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Hon'ble Dr. Milindji Barhate

Vice Chancellor

Sant Gadge Baba Amravati University, Amravati

It gives me great pleasure to be associated with the National Students Congress 2K26 being organised by Shri Shivaji Science College Amravati. The title of this souvenir "Yuwonmesh" beautifully reflects the awakening of young minds and the emergence of new ideas among students.

The National Education Policy 2020 envisions a flexible, multidisciplinary and research oriented education system that nurtures innovation, critical thinking and holistic development. Universities today must go beyond classrooms and examinations. They must create spaces where curiosity is encouraged innovation is nurtured and young learners are motivated to think independently. NSC 2k26, catalysed by the Innovation and Incubation Linkages IIL SGBAU, serves as a dynamic platform to inspire young minds towards scientific inquiry, innovation and nation building.

I am particularly pleased to see students from diverse disciplines coming together on a common platform to present their ideas research and innovations. Such exposure builds confidence develops scientific temper and prepares students to face future challenges with clarity and purpose.

I congratulate Shri Shivaji Science College Amravati for providing this national platform to students and for strengthening the research culture at the undergraduate and postgraduate level. I am confident that this Congress will inspire young participants to pursue excellence and contribute meaningfully to the development of our nation.

I extend my best wishes for the grand success of the National Students Congress 2K26 and hope it continues to grow as a beacon of student driven academic excellence.



Hon'ble Shri. Harshwardhan P. Deshmukh

President

Shri Shivaji Education Society, Amravati

It is a matter of immense pride for Shri Shivaji Education Society Amravati to host the National Students Congress 2K26 through Shri Shivaji Science College Amravati. This Congress reflects our long standing commitment to quality education value based learning and holistic development of students.

This congress stands apart as it is organised for students rather than teachers, reflecting the forward looking academic vision of Shri Shivaji Science College, Amravati.

Education societies have a vital responsibility to create opportunities where students can explore their potential beyond textbooks. The National Students Congress serves this very purpose by encouraging students to think creatively present their ideas and engage in meaningful academic dialogue.

The theme and spirit of “Yuvonmesh” resonate strongly with our vision of empowering youth through knowledge innovation and character building. When students are trusted with responsibility and given platforms like this they grow not only as learners but also as leaders of tomorrow.

I appreciate the efforts of the organising team faculty mentors and student volunteers who have worked tirelessly to make this national event possible. Their dedication reflects the strong academic culture nurtured by our institution.

I wish the National Students Congress 2K26 a great success and hope it inspires generations of students to dream think and contribute to the progress of our nation.



Hon'ble Shri Hemantji Kalmegh

Executive Council Member,
Shri Shivaji Education Society, Amravati

It gives me immense pleasure to be associated with the Valedictory Ceremony of the National Students Congress 2k26 and to share my thoughts through this meaningful souvenir *Yuwonmesh*. I extend my heartfelt congratulations to Shri Shivaji Science College, Amravati for successfully conceptualising and organising this remarkable academic and intellectual congregation dedicated entirely to students.

As this congress concludes, it offers a moment to reflect on the ideas, discussions, and learning that have emerged over the past days. The National Students Congress has provided students with a rare opportunity to think independently, express their views confidently, and engage with academic and social issues that matter to the nation.

In most academic events, students are listeners. In this congress, students became active participants, presenters, and innovators. This shift from passive learning to active engagement reflects the true purpose of education and prepares young minds for leadership, responsibility, and innovation.

Shri Shivaji Education Society, Amravati has always believed that education must go beyond degrees and examinations. Platforms like NSC 2k26 nurture creativity, critical thinking, and social awareness among students, helping them understand their role in shaping a better future.

The theme of 'Yuwonmesh' aptly represents the awakening of youthful ideas and aspirations. I am confident that the experiences gained during this congress will inspire students to pursue knowledge with sincerity and purpose.

I appreciate the efforts of the Principal, faculty members, organising team, volunteers, and students of Shri Shivaji Science College, Amravati for their dedication and teamwork in making this event a success.

I extend my best wishes to the National Students Congress for continued success and to all students for a bright, meaningful, and impactful future.



Hon'ble Dr. Garima Gupta

Scientist-F

Department of Biotechnology,
Ministry of Science and Technology, Government of India

I am delighted to be associated with the National Students Congress 2K26 and to contribute to a platform that celebrates student innovation and scientific curiosity. Young minds are the backbone of a strong research ecosystem and nurturing them at an early stage is crucial for national progress.

It is heartening to note that only a limited number of institutions in the country have taken the lead to organise student focused congresses under the soft component of PM USHA and the DBT STAR College Scheme. Shri Shivaji Science College, Amravati deserves special appreciation for this meaningful and forward looking initiative.

The Department of Biotechnology has always believed in empowering students through research exposure hands on learning and innovation driven programmes. Initiatives such as DBT STAR and BUILDER have been designed to bring research culture closer to students and institutions. The National Students Congress effectively complements this vision.

“Yuwonmesh” captures the essence of young energy and fresh thinking. It is encouraging to see students presenting ideas models and research that address real world problems and future challenges. Such platforms help students understand the relevance of science in society and inspire them to pursue research careers.

I congratulate Shri Shivaji Science College Amravati for organising this Congress with a strong academic and scientific focus. I wish all the participants a rewarding learning experience and extend my best wishes for the continued success of this inspiring initiative.



Hon'ble Dr. Shailendra Deolankar

Director of Higher Education,
Government of Maharashtra

It gives me immense pleasure to extend my warm greetings to all the delegates, researchers, faculty members, and students participating in the National Students' Congress (NSC 2K26), organized by Shri Shivaji Science College, Amravati.

In the rapidly transforming landscape of higher education, platforms such as NSC play a vital role in nurturing scientific temper, research aptitude, creativity, innovation, and an entrepreneurial mindset among students. The National Education Policy (NEP) 2020 envisions higher education as multidisciplinary, research-oriented, flexible, and deeply connected to societal and national development priorities. In this context, student-centric academic congresses act as living laboratories where ideas are tested, curiosity is sharpened, and young minds are encouraged to think critically, creatively, and independently.

I am particularly pleased to note that NSC 2K26 provides an inclusive academic forum for students from diverse disciplines to present their academic interventions, research outcomes, innovative ideas, start-up and entrepreneurship models, and experiential learning outputs. Such a holistic academic ecosystem empowers students not only as learners, but also as problem-solvers, innovators, and future leaders.

The vision of Viksit Bharat rests on a strong foundation of knowledge creation, innovation-driven growth, skilled human resources, and socially responsible leadership. In parallel, the goal of Vikasit Maharashtra demands academically empowered youth who can translate ideas into impact at the local, regional, and national levels. Initiatives like NSC 2K26 directly contribute to this vision by cultivating research culture, promoting innovation and start-ups, and aligning student potential with national development goals.

I commend the organizing committee, faculty members, and student volunteers for their committed efforts in conceptualizing and executing this national-level academic event. I am confident that NSC 2K26 will inspire participants to pursue excellence in research, innovation, entrepreneurship, and leadership, thereby making meaningful contributions to the nation's academic and developmental journey. I wish the National Students' Congress 2K26 every success and hope that it emerges as a milestone in the academic journey of all participants.



Hon'ble Dr. Yogesh Bramhankar

Innovation Director
Ministry of Education Innovation Cell
Government of India

Prototype to Prosperity: Building Local Solutions That Scale

Spot the Opportunity: Identify real local problems through your prototypes—focus on pain points in agriculture, education, or urban services that affect our communities/ society daily. Observation is the key and students need to develop the eye of an entrepreneur to convert problem into opportunity.

Validate with Purpose: Test ideas quickly using customer feedback and low-cost MVPs to ensure they solve genuine needs, not just shine in exhibitions. Incubation Centres, local MSMEs are good places for validation, feedback, testing, etc.

Build Commercial Viability: Design solutions with revenue models from day one—explore bootstrapping, grants from different incubation centres, government departments, etc.

Scale Smartly: Leverage local networks, government schemes (e.g., Startup India, MSME Schemes), and digital tools to grow prototypes into sustainable businesses without big budgets.

Embrace the Entrepreneur Mindset: Understand why innovators must become entrepreneurs—overcome fear of failure, build resilient teams, and measure impact with simple metrics.

Innovate for BHARAT – We have seen lots of technological innovations for quality of life but we still need to innovate for Quality of Life and we should innovate for masses and our local needs, our societal problems which also offers good opportunity to scale and solve problems with commercialization.



Hon'ble Mr. Yatin Duggal

National Head at Viksit Bharat Leadership Council and
National Youth Parliament Festival Winner

Youth Leadership and the Future of Democratic Nation Building

“The future of a nation is never written by chance; it is shaped by the courage, conscience, and commitment of its youth.”

Civilizations are sustained not merely by power or prosperity, but by the ideals their people choose to uphold. Democracy, the most humane and demanding of political systems, flourishes when each generation renews its faith in liberty, justice, and shared responsibility. At this defining moment, the stewardship of democratic nation-building rests with the youth.

Youth leadership is not a matter of age or position; it is a moral calling to participate, to question, and to serve. The strength of a democratic nation lies not in the volume of its rhetoric, but in the depth of its values—integrity in action, inclusiveness in vision, and courage in conviction. When young citizens engage thoughtfully with public life, democracy gains both resilience and direction.

In an era of rapid change and unprecedented connectivity, the youth possess the tools to transform participation into purpose. Yet true leadership demands restraint alongside passion, reason alongside resolve, and empathy alongside ambition. Democracy endures when rights are balanced with responsibility, dissent is guided by discipline, and freedom is strengthened by fraternity.

This address invites young minds to see democracy not as a distant institution, but as a living commitment. When youth leadership is informed by history, anchored in constitutional morality, and inspired by service to the common good, democratic nation-building becomes not merely a political process, but a national renaissance. In the hands of such youth, democracy does not merely survive—it advances with dignity and hope.



Hon'ble Mr. Ravindra Padwal

Deputy General Manager
Tata Motors Mumbai

It is a privilege to be part of the National Students Congress 2K26 and to interact with young innovators from across the country. Industry today looks for individuals who can think creatively solve problems and adapt to a rapidly changing world.

Platforms like the National Students Congress play an important role in bridging the gap between academic learning and real-world application. When students are encouraged to present ideas prototypes and innovative solutions, they develop skills that are essential for industry and entrepreneurship.

By nurturing innovation and creativity, this congress will motivate students to initiate startups and contribute meaningfully to industrial growth. It also plays an important role in encouraging talented students from rural areas to participate confidently in the innovation ecosystem.

The spirit of “Yuwonmesh” aligns well with the values of innovation collaboration and continuous learning. Such experiences help students gain confidence refine their thinking and understand the importance of teamwork and practical knowledge.

I appreciate the efforts of Shri Shivaji Science College Amravati in creating a national platform that prepares students for future careers. I wish the participants great success and hope this Congress inspires them to transform ideas into meaningful impact.



Hon'ble Dr. Santosh Chavan

Managing Director, Farmlab Yeranda
Agrisolutions Producer Company Ltd.
Malegaon, MS

Farm Laboratory

Education and training of farmers to prepare natural fertilizers in own farms & employment generation for farmers and aspiring youth in their own village

Aims of Farmers Laboratory

- ❖ Education and training of farmers to prepare natural fertilizers in own farms
- ❖ Employment generation for farmers and aspiring youth in their own village

Training of farmers to produce of following natural fertilizers in their own farms:

1. Trichoderma or any microbe based natural fertilizer and pesticide production
2. Granular fertilizer production using food grain, sea-weed and plant extract
3. Biozyme gel preparation using food grain, sea-weed and plant extract
4. Plant and mineral oil based natural pesticides
5. Probiotics for all living system of soil using food material

Benefits of Farm Laboratory to Farmers:

- ❖ The cost of agri-input (Chemical fertilizer and pesticide) reduced by 50 to 70%
- ❖ Production of each and every crop increased by 10 to 30%
- ❖ Four Farmers family earning ₹ 50000/month through Farm Laboratory.

Achievements

Cleared first round of Welt Hunger Hilfe: Seeding the Future - Global Food Systems Challenge (GFSC), Friedrich-Ebert-Str. 1 53173 Bonn, Germany. The Proposal was submitted in collaboration with Global Agricultural Extension and Rural Services (GAERS), Sokoto State, Nigeria.

Growth of Farm Laboratories

- ❖ During 2020 started the 1st Farm Laboratory at Yeranda Washim, Maharashtra,
- ❖ India. Now Total 155 Farm Laboratories established
- ❖ 15000 farmers getting benefits of farm laboratory near their own village
- ❖ Agriculture Dept, GoM, approved 1140 Bio-input Resource Centres (BRC) for Maharashtra. Farm Laboratory is 1 of the components of BRC

Special Achievement: MoU between National Chemical laboratory, Pune & Farmlab Yeranda Washim to educate and train farmers to develop natural fertilizers in own farms & employment for farmer and rural youth in their own village. We acknowledge the financial support to Farm Laboratory Concept by Different

State, National and International Organizations

- ❖ Human Development Project, Government of Maharashtra
- ❖ Agriculture Department, Government of Maharashtra
- ❖ National Institute of Naturopathy, Government of India
- ❖ Centre for Environmental Education, Government of India,
- ❖ New Venture Fund, USA,



Hon'ble Dr. Ajitesh Lunge

Founder & CEO
Locksmith Bio Inc., San Francisco

Why Students Must Obsess Over Anime, Video Games, and Kit Kats

Here's a secret nobody tells students. The most powerful thing you can do right now is be a (not so ideal) student.

Not the "sit still, pay attention, think about your future" kind. The real kind. The kind that does random things for no reason. The kind that can't stop moving. The kind that hears "this is how it's done" and immediately wonders, "but what if it isn't?"

Now think about this for a moment: What do a Japanese chocolate bar, a video game, and Anime have in common? None of them are good for you! (Or so the conventional wisdom goes.) But this talk is an attempt to make you think differently and do what a student should: continuously ask questions.

A man who spent years playing and designing video games, the kind your parents say you play too much and ended up solving a puzzle that the world's best scientists couldn't crack for fifty years. A chocolate company spent fifteen years giving away free samples to kids who weren't even old enough to drink coffee. And a studio full of artists drawing frames by hand created worlds that the most powerful computers still cannot imagine.

The gamer wasn't wasting time. The chocolate company wasn't selling chocolate. The animators weren't just making cartoons. Let's walk through these small stories that dramatically changed how the world works.

This talk is about why your "unfocused" energy, your weird interests, and your instinct to question everything aren't problems to be fixed, they're exactly what built the most valuable companies and discoveries of our time.

You, as students, have something unique: relentless energy, cathartic curiosity, and the superpower of not knowing what's supposed to be impossible. Come find out how a simple video game changed the way diseases are treated and why your obsessions might be your greatest advantage.



Hon'ble Dr. Aafaque Khan

Laboratory Specialist (Mass Spectrometry),
EORLA-Eastern Ontario Regional Laboratory Association

**Future-Ready Scientists: Building Careers Through Multi-Omics and Data-Driven
Biology**

Biological systems are complex and interconnected, and understanding them requires moving beyond single-layer approaches. Multi-omics, an integrative framework combining genomics, transcriptomics, proteomics, metabolomics, lipidomics, and computational analysis has emerged as a powerful way of studying biology at a systems level. Today, this multi-omics mindset is transforming research across diverse areas including human health, cancer, neuroscience, developmental biology, infectious diseases, and precision medicine.

This talk will introduce students to the concept of thinking in multi-omics, highlighting how integrative technologies are reshaping the way modern biological questions are asked and answered. This talk will demonstrate how combining multiple layers of molecular information leads to deeper biological insights, improved biomarker discovery, and more meaningful translational outcomes.

Beyond scientific concepts, the talk will emphasize career opportunities enabled by multi-omics. It will outline the skills, training paths, and interdisciplinary approaches required to build careers in academia, hospitals, biotechnology, pharmaceuticals, and global research laboratories.



Dr. G. V. Korpe

Principal
Shri Shivaji Science College, Amravati

It gives me immense pleasure to welcome all the participants, mentors and delegates to the National Students' Congress organized by Shri Shivaji Science College, Amravati.

In the contemporary academic ecosystem, there exist numerous platforms for the teaching and non-teaching fraternity to deliberate and disseminate their views on academics, research and innovation. However, students the real stakeholders and future torchbearers of the nation rarely get such exclusive and meaningful platforms to express their ideas, research aptitude, creativity and academic curiosity at the national level. Recognizing this critical gap, our institution has taken a thoughtful and proactive initiative to organize this National Students' Congress, dedicated entirely to students.

The primary motto behind this congress is to empower students by providing them with a scholarly platform where they can present their research ideas, exchange knowledge, develop scientific temper and build confidence to face academic challenges at national and global forums. This congress aims to nurture inquiry-based learning, innovation, critical thinking and research culture among students, which are essential components of holistic education.

Our parent body, the Shri Shivaji Education Society, Amravati, has always served as a strong backbone for such student-centric and value-based initiatives. The Society's visionary leadership and unwavering support continuously inspire us to organize academic events that focus on student development, skill enhancement and nation building.

Shri Shivaji Science College, Amravati, is well-equipped with experienced faculty, robust academic infrastructure, research-oriented laboratories and a vibrant academic environment. The college has a proven track record of successfully organizing national and international level conferences, workshops, seminars, and student-oriented academic events. The collective strength of our faculty, administrative staff, volunteers and enthusiastic students enables us to efficiently conduct such a mammoth academic event with dedication and excellence.

At our institution, we strongly believe that education is not merely about acquiring degrees, but about shaping competent, confident, and globally competitive individuals. The college consistently works towards the academic, professional, and ethical upbringing of students, preparing them to compete at national as well as global platforms.

I sincerely hope that this National Students' Congress will serve as a milestone in the academic journey of all participants and motivate them to pursue research, innovation and excellence with renewed zeal.

I extend my best wishes for the grand success of this congress and congratulate the entire organizing team and student participants for being a part of this meaningful academic endeavor.

With best wishes,



Mr. Yashvant Shitole

State Coordinator, Career Katta

President, MITSC

I am delighted to associate with the National Students' Congress organized by Shri Shivaji Science College, Amravati, Maharashtra in collaboration with Career Katta. Through its continuous efforts this college has been actively involved in conceptualizing and supporting student-centric programs and such initiatives provide an excellent academic platform for students to present their research, academic insights and start-up ideas.

The Maharashtra Information Technology Support Center (MITSC) empowers youth and women through skill development, entrepreneurship and livelihood projects. Career Katta is an innovative initiative jointly undertaken by the MITSC and Maharashtra State Higher and Technical Department. Its primary goal is to empower students with valuable skills and knowledge to succeed in their careers. Through a range of programs and resources, they aim to provide a strong foundation for professional journey of students. These ingenuities aim to bridge the gap between academic learning and real-world application, while nurturing innovation, research aptitude and entrepreneurial thinking among students. Actually, Career Katta and MITSC together have consistently worked towards empowering youth through skill development and exposure beyond classrooms throughout Maharashtra.

This Students' Congress is a unique and meaningful effort that encourages scientific thinking and entrepreneurial vision among students. This collaboration mainly reflects a shared commitment towards holistic student development. I am confident that this National Students' Congress will inspire young researchers and innovators, promote knowledge sharing and open new avenues for academic and professional growth.

I appreciate the efforts of the organizing committee, faculty members and students for conceptualizing and executing this academic event. I am confident that this congress will inspire young minds and contribute significantly to their academic and professional growth.

I extend my best wishes for the grand success of this program.



Dr. G. A. Wagh

Professor of Zoology, Convener, NSC-2K26

It gives me immense pleasure to present this message on the occasion of the National Students' Congress, a timely and meaningful academic initiative aligned with the vision of the current education system, which emphasizes skill enhancement, multidisciplinary learning, innovation, and entrepreneurship.

In today's rapidly evolving academic and professional landscape, education is no longer confined to classroom teaching and examinations. The present education system strongly advocates experiential learning, research orientation, innovation, start-up culture and employability skills. The National Students' Congress is designed precisely with this vision to provide students with a platform that complements curriculum based learning while nurturing creativity, critical thinking, problem-solving ability and entrepreneurial mindset.

This congress offers students a unique opportunity to gain an exposure to skill enhancement and entrepreneurship, encouraging them to convert ideas into impactful solutions, prototypes and innovative models. By participating in oral presentations, posters, prototypes and models, students learn to articulate their thoughts, defend their ideas scientifically and apply theoretical knowledge to real-world challenges.

One of the most significant strengths of this congress is the interaction among students from diverse disciplines. Such interdisciplinary engagement promotes cross-pollination of ideas and helps students appreciate multiple perspectives while working towards innovations that drive sustainable and scientific progress for our nation -The Bharat. These interactions inspire young minds to think holistically about societal needs, environmental sustainability, technological advancement and inclusive development.

The congress also provides an invaluable platform for students to meet, interact, and build networks with eminent scientists, researchers, academicians, innovators and entrepreneurs from across the country. These interactions open doors to meaningful collaborations for higher studies, research guidance, internships, start-up development and innovation-based projects. Students will gain insights into research pathways, emerging career opportunities and the practical aspects of innovation and entrepreneurship.

Furthermore, participants will get exposure to funding opportunities, mentorship support and innovation ecosystems, which are crucial for transforming ideas into viable research projects or start-ups. Such guidance helps students take confident steps towards research careers, entrepreneurial ventures and leadership roles in academia, industry, and society.

I strongly believe that the National Students' Congress will serve as a transformative platform, empowering students to become skilled, innovative and socially responsible contributors to national development. It is not just an academic event, but a movement to shape future-ready citizens committed to knowledge creation and nation building.

I extend my best wishes to all participants and congratulate the entire organizing team for their dedication in making this congress a meaningful and impactful academic endeavor.

With best wishes,



Dr. M. S. Gaikwad

Professor of English, Organizing Secretary, NSC-2K26

It gives me great pleasure to present this message for the National Students' Congress, a thoughtfully curated academic platform designed especially for the Gen Z generation the most dynamic, innovative and expressive generation of learners.

While planning this congress, special emphasis was laid on creating an engaging, inclusive and future-oriented academic experience that resonates with the aspirations, learning styles and creative energies of today's students. The entire program has been meticulously designed to go beyond conventional academic events and to provide students with exposure to ideas, innovation, entrepreneurship, and interdisciplinary thinking.

One of the major highlights of this congress is the presence of eminent scientists, innovators, academicians, entrepreneurs and industry experts, whose keynote addresses and interactive talks will inspire students to think critically, innovate fearlessly and align their academic pursuits with real-world challenges. These expert sessions aim to bridge the gap between theory and practice, research and application and education and employability.

The academic core of the congress is structured around oral presentations, poster presentations, prototypes and working models allowing students to express their ideas creatively and scientifically. To ensure inclusivity and interdisciplinary learning, student contributions are categorized into six broad and diverse domains:

- Pure Sciences
- Commerce, Management, and Law
- Humanities, Languages, and Fine Arts
- Agriculture and Animal Husbandry
- Engineering and Technology
- Medicine and Pharmacy

This wide spectrum ensures that students from all academic backgrounds find a relevant and meaningful platform to present their work, exchange ideas and learn from peers across disciplines.

Principally students should attend this National Students' Congress, since it offers a national-level platform to showcase their talent, research aptitude, innovative ideas, prototypes and creative expressions. Participation in such a congress helps students build confidence, enhance presentation and communication skills, gain academic visibility and interact with experts and fellow learners from across the country. It also serves as a stepping stone towards research orientation, innovation-driven careers and global competitiveness.

I strongly believe that this congress will ignite curiosity, foster collaboration and empower students to emerge as confident contributors to academia, industry and society.

I extend my heartfelt best wishes to all participants and congratulate the organizing team and student volunteers for their dedication and enthusiasm in making this congress a grand success.

With best wishes,

Pure Science

Today's Waste, Tomorrow's Clean Energy

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Sanitary napkin waste, a significant part of municipal solid waste, poses both environmental and health challenges. Waste management sectors face challenges when attempting to dispose of menstrual waste safely due to the high volume generated. Municipal systems are often **not equipped** to manage this type of biomedical waste. This project offers a sustainable solution for sanitary waste management. The current usage of 12.3 billion napkins generates approximately 113,000 tons of menstrual waste per year in India. Current method of waste management of sanitary napkin includes burning (incineration). Commercial pads often contain plastics and synthetic materials that produce harmful compounds like dioxins and formaldehyde when burned, which are linked to cancer and respiratory illnesses. The smoke can also cause immediate irritation to the eyes, throat, and lungs. Therefore, this waste must be channelized so that processes could be environment friendly and sustainable.

1. To demonstrate sustainable methods for converting sanitary napkin waste into usable energy forms such methanol.
2. To design and demonstrate gasifier that shows how sanitary waste can be transformed into clean energy.
3. To promote awareness about sustainable waste management.

In this method we have designed a gasifier which converts waste material into methanol. In which waste material is loaded in tubic furnace and the gas generated is passed through Cu based catalytic bed where CO₂ is converted into methanol by hydrogenation. Methanol and water vapors are collected in another chamber, where they can be separated by fractional distillation. Methanol is increasingly being recognized as a clean and sustainable energy source. It is used directly as a fuel in internal combustion engines or as a component in fuel blends.

This project demonstrates that waste materials can be effectively used as a source of clean energy by converting it into useful energy forms like methanol. We can reduce pollution, manage waste more efficiently. It is an opportunity to create energy for a cleaner and more sustainable future.

In future, this idea can be developed into large waste-to-energy plants that produce methanol fuel from sanitary napkin waste. More development in infrastructure may help in offering a practical and sustainable solution for waste management.

Key Words: Sanitary napkin, Gasification, Methanol

A Biodegradable Spill Pad Made from Human Hair and Banana Fiber

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a. **Background / Introduction:** The accumulation of petroleum-based spills in aquatic and terrestrial ecosystems necessitates immediate and effective remediation. Conventional industrial spill kits primarily utilize synthetic sorbents like polypropylene, which are non-biodegradable and contribute significantly to microplastic pollution (Idris et al., 2014). This environmental threat has motivated research into sustainable "waste-to-wealth" initiatives. This project addresses the dual challenge of waste management and pollution control by repurposing human hair (keratin) and banana pseudo-stem (lignocellulose) into a functional environmental tool.

b. **Objectives / Purpose:** The primary objective of this study is to engineer "Eco-Sorb," a hybrid, non-woven absorbent pad designed for oil-water separation. The work seeks to evaluate the synergistic potential of combining oleophilic protein fibers with hydrophilic cellulosic fibers. Specifically, the project tests a manual, low-energy fabrication framework to determine if a "zero-carbon" manufacturing process can produce a pad that rivals the performance of commercial synthetic options.

c. **Methodology:** The fabrication employs a manual non-woven web-formation approach. Banana fibers were extracted via manual decortication and boiled to remove amorphous hemicellulose and pectin (Sathasivam et al., 2021). Human hair was cleaned in a dilute citric acid solution to remove surface lipids and expose the microscopic cuticular scales (Gupta, 2014). Both fibers underwent mild alkalization (NaOH) to improve interfacial adhesion. The fibers were then hand-carded in a 50:50 mass ratio, encased in a biodegradable cotton mesh, and subjected to manual static compression for 24 hours. This process promotes "mechanical interlocking," where the hair cuticles hook into the pores of the banana fiber (Mukhopadhyay et al., 2008).

d. **Results / Findings:** Preliminary findings demonstrate that the hybrid design effectively manages the limitations of mono-material sorbents. The banana fiber functions as a capillary "engine," providing the wicking speed necessary to pull spills from surfaces (Deschamps et al., 2003). Simultaneously, the human hair acts as a high-surface-area retention matrix, using its hydrophobic keratin structure to trap oil molecules and prevent secondary leakage. The 50:50 blend ratio was identified as the optimal balance for maintaining structural integrity and maximum sorption capacity during saturation (Saraswathy et al., 2019).

e. **Conclusion / Implications:** This project successfully demonstrates that high-performance environmental tools can be fabricated through manual, low-tech processes. The significance of this work lies in its contribution to the circular bio-economy, proving that biological waste can effectively replace petroleum-based polymers. For society, this provides a decentralized solution for local oil spill management and offers a socio-economic opportunity for rural communities to valorize agricultural and barber shop waste into value-added products.

Keywords: Waste-to-wealth, Banana fiber, Human hair keratin, Bio-composite, Oil spill remediation, Circular economy

Waste-to-Wealth: Eco-Friendly Bio-Bricks from the Invasive Aquatic Weed *Eichhornia crassipes* (Mart.) Solms

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a. Background / Introduction:

The increasing demand for construction materials and the environmental impacts associated with conventional brick and cement production have intensified the need for sustainable alternatives. Cement-based materials are energy-intensive and contribute significantly to global carbon dioxide emissions (UNEP, 2020). At the same time, freshwater ecosystems are under severe threat from *Eichhornia crassipes* (water hyacinth), one of the world's most invasive aquatic weeds. This species disrupts biodiversity, blocks waterways, and causes ecological and economic challenges (Gopal, 1987; Malik, 2007). Large-scale removal of this weed generates substantial biomass that is often discarded as waste, presenting an opportunity for waste-to-wealth utilization.

b. Objectives / Purpose:

The primary objective of this study is to develop an eco-friendly bio-brick using fibers extracted from *Eichhornia crassipes* stalks combined with bio-based binders. The study aims to evaluate the feasibility of using invasive plant biomass as a sustainable construction material while reducing dependence on conventional cement-based bricks. A secondary objective is to assess the mechanical and physical properties of the developed bio-bricks to determine their suitability for construction and pollution-control applications (Jain & Kumar, 2019).

c. Methodology:

In this study, *Eichhornia crassipes* stalks were harvested from freshwater bodies, washed, dried, and chemically treated using a 5% sodium hydroxide (NaOH) solution to remove non-cellulosic components and enhance fiber quality (Li et al., 2007). The treated fibers were blended with bio-based binders, lime, and sandy clay soil, and molded into bricks using a controlled heat-press technique. The fabricated bio-bricks were subjected to standardized mechanical tests such as tensile and tear strength, along with physical characterization including water absorption and biodegradability analysis.

d. Results / Findings:

The findings indicate that the developed bio-bricks exhibit a fibrous structure with adequate mechanical strength due to effective fiber–binder interaction. The material demonstrated reduced water absorption and satisfactory physical performance. Biodegradability analysis revealed that the bio-bricks are anticipated to be fully biodegradable within 90–120 days under composting conditions. Compared to traditional cement bricks, the bio-bricks showed a significant reduction in potential toxic by-product formation (Jain & Kumar, 2019).

e. Conclusion / Implications:

This study highlights the potential of *Eichhornia crassipes* as a sustainable raw material for eco-friendly construction applications. By transforming an invasive aquatic weed into a value-added bio-brick, the research supports circular bio-economy principles, sustainable material development, and invasive species management (Malik, 2007; UNEP, 2020). The proposed approach offers a scalable, low-cost solution with environmental and socio-economic benefits, particularly for local communities involved in biomass collection and brick production.

Keywords: Waste-to-wealth, *Eichhornia crassipes*, Eco-friendly bio-brick, Invasive species utilization, Sustainable construction materials, Circular bio-economy

Eco-Friendly Water Filtration Systems Developed from Plant Resource

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Access to clean drinking water remains a major global challenge, especially in developing and rural areas where conventional treatment methods are costly and inaccessible. This study explores a sustainable, nature-inspired solution through a plant-based water purification system that utilizes natural processes such as phytoremediation, adsorption, and biological filtration. Plant materials including *Moringa oleifera*, bamboo, coconut shells, vetiver grass, and banana stems were selected for their antimicrobial, coagulating, and adsorptive properties and arranged in layered filtration units mimicking natural soil–root systems. Experimental testing of contaminated water showed notable reductions in turbidity, odour, and microbial load, demonstrating effective water quality improvement. Although not a replacement for advanced industrial treatments, the system offers a low-cost, eco-friendly option for household and community use. Overall, the findings highlight the potential of plant-based innovations to support sustainable water purification, particularly in resource-limited settings, by integrating traditional knowledge with modern scientific approaches.

A. Background / Introduction

Water pollution caused by industrial waste, agricultural runoff, and domestic sewage has severely affected freshwater resources worldwide. Millions of people lack access to clean drinking water, leading to waterborne diseases and environmental degradation. Conventional water purification systems often require high energy input, chemical additives, and costly infrastructure, which limits their use in economically weaker regions.

Plants have evolved natural mechanisms to filter, absorb, and neutralize pollutants from their surroundings. Through phytoremediation and natural adsorption, plants can remove toxins, heavy metals, and pathogens from water and soil. Traditional practices in many cultures have utilized plant materials such as seeds, charcoal, and roots for water clarification. Modern science now recognizes the potential of these plant-based solutions as sustainable alternatives. This study builds upon these natural processes to develop a plant-based water purifier that is affordable, environmentally friendly, and effective. (*World Health Organization (WHO) – Guidelines for Drinking Water Quality*).

B. Objectives / Purpose

The main objectives of this study are:

- To explore the water purification properties of selected plant-based materials.
- To design a low-cost, eco-friendly water purification system using plants.
- To evaluate the effectiveness of the system in improving water quality.
- To promote sustainable and nature-inspired innovations for clean water access.
- To assess the potential of plant-based purifiers for rural and low-resource communities.

C. Methodology

The research adopts an experimental and design-based approach. Initially, a review of literature is conducted to identify plants with known water purification properties. Materials such as *Moringa oleifera* seeds, coconut shell charcoal, bamboo fibre, sand, and gravel are selected. (*John, S.A.A. (1988). Using Moringa Seeds coagulants in developing countries*)

A prototype purifier is constructed using a container layered with gravel (for large particles), sand (for fine sediment), plant fibres (for natural filtration), and activated carbon derived from coconut shells (for chemical adsorption). Crushed Moringa seeds are used as a natural coagulant to reduce turbidity and microbial contamination.

Contaminated water samples are passed through the system. Water quality parameters including turbidity, pH, colour, odour, and microbial presence are tested before and after filtration using basic laboratory and field-testing methods. Observations and measurements are recorded for analysis.

D. Results and Findings

The plant-based water purification system shows a notable improvement in water quality. Turbidity is significantly reduced, and the filtered water appears clearer and odour-free. The use of Moringa seeds effectively reduces suspended particles and microbial content. Activated carbon from coconut shells demonstrates strong adsorption of impurities and unpleasant taste. Although the system does not completely eliminate all pathogens or dissolved salts, it provides water that is substantially safer for domestic use after boiling or additional treatment. The results confirm that plant-based materials can play a vital role in low-cost water purification.

E. Conclusion / Implications

The study concludes that plant-based water purification is a viable, sustainable, and innovative solution for addressing water quality challenges, especially in resource-limited settings. By utilizing locally available plant materials, communities can reduce dependence on expensive and energy-intensive purification technologies.

The implications of this research extend to environmental conservation, public health, and sustainable development. Plant-based water purifiers promote eco-friendly practices, reduce

waste, and encourage the integration of traditional knowledge with modern science. Further research and technological refinement could enhance efficiency and scalability, making plant-based purification systems a valuable tool in achieving global water security. (*United Nations – Sustainable Development Goal 6: Clean Water and Sanitation*).

Keywords: *Moringa oleifera*, bamboo fibre, coconut shells, charcoal, vetiver grass and banana stems.

Phytochemical extraction and Antioxidant Study

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The demand for natural products in the food, pharmaceutical, and cosmetic industries has grown rapidly in recent years, largely due to increasing awareness of the harmful side effects associated with synthetic compounds. Synthetic antioxidants, although effective, have been linked to potential toxicity and undesirable long-term effects when used in food or medicine. This has encouraged scientists to explore plant-based sources of antioxidants, which are generally considered safer and more sustainable. Plants produce a variety of bioactive compounds known as phytochemicals. These include **phenolics, flavonoids, tannins, alkaloids, and terpenoids**, which have been shown to possess antioxidant activities that help neutralize harmful free radicals in biological systems.

Phytochemicals are secondary metabolites that plants synthesize for defense against environmental stress and pathogens. Many of these compounds also benefit human health by acting as **free radical scavengers**, reducing oxidative stress and protecting cells from damage that can lead to chronic diseases such as cancer, heart disease, and diabetes. Previous research indicates that extracts rich in phenolics and flavonoids typically show significant antioxidant activity.

In this study, phytochemicals were extracted from selected plant material using standard solvent extraction methods. Solvent extraction is widely used in phytochemical research because it separates bioactive compounds based on their chemical properties and solubility. Different solvents like methanol, ethanol, or water are used depending on the polarity of the target compounds. After extraction, the crude extracts underwent **preliminary phytochemical screening** to identify major groups of phytochemicals present. This qualitative screening helps

predict which extracts are likely to show biological activity.

The antioxidant activity of each extract was evaluated using the **DPPH free radical scavenging assay**. The DPPH assay is one of the most commonly used in vitro methods to measure the ability of a sample to donate hydrogen or electrons, thereby neutralizing the stable DPPH free radical. When antioxidants reduce DPPH, the solution changes color and absorbance decreases, which can be measured using a spectrophotometer. This method was first described by Blois in 1958 and remains a standard test for assessing antioxidant potential.

Results from the DPPH assay are expressed as percent inhibition of the free radical, where higher percent inhibition indicates stronger antioxidant activity. Many plant extracts have shown dose-dependent increases in radical scavenging activity, meaning that higher concentrations of extract lead to greater antioxidant effects. Studies also report that **methanolic extracts often exhibit higher antioxidant activity compared to non-polar solvents**, likely due to their effectiveness in extracting phenolic compounds.

The expected outcome of this research is the identification of plant extracts exhibiting significant antioxidant activity, which may be attributed to their phenolic and flavonoid content. These findings can contribute to the growing field of natural antioxidant research and support the development of plant-derived antioxidants for use in food preservation, nutraceuticals, and health-promoting products. Future work could include quantitative assays of total phenolic and flavonoid content as well as testing in biological systems to confirm in vitro results.

Keywords: Phytochemicals; Natural Antioxidants; Plant Extracts

Microplastic: An Invisible Threat to Human Health and Environment

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Micro-plastics are plastic Particles smaller than 5mm formed from plastic waste or Manufactured internally due to their tiny size easily ingested or inhaled by tiny organisms it makes problems like health risk , Toxic Exposure ,water pollution ,Ecosystem Damage .We have to detect by filtering water sample by filter paper and if there are presence of tiny colored plastic fibers under magnification indicates Micro-plastics solution on that reduce single use

plastic , use eco-friendly alternatives better waste management conclusion of that is micro-plastics represents a silent but serious global threat etc

Arsenic Pathways from Rocks to Humans: A Geochemical and Health Perspective

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Arsenic is a toxic metalloid naturally present in the Earth's crust and commonly associated with various rock types and mineral assemblages. Geological processes play a critical role in mobilizing arsenic from rocks into soil and groundwater, thereby creating pathways for human exposure. In several regions of India, arsenic contamination of drinking water has emerged as a serious environmental and public health concern. The present study focuses on understanding the pathways through which arsenic is transferred from geological sources to humans and examines its potential health impacts.

Arsenic is released from arsenic-bearing minerals through processes such as weathering, oxidation–reduction reactions, mineral dissolution, and microbial activity. These processes facilitate the movement of arsenic into groundwater systems, which serve as a primary source of drinking water in many rural areas. Human exposure mainly occurs through the consumption of contaminated water and food, leading to chronic arsenic toxicity upon long-term intake. Common health effects include skin lesions, hyperpigmentation, gastrointestinal disorders, neurological effects, and an increased risk of cancers affecting the skin, lungs, and urinary bladder.

The study highlights the importance of understanding the geochemical behavior and transport mechanisms of arsenic within aquifer systems. Identification of source rocks, hydrogeochemical conditions, and exposure routes is essential for effective risk assessment and mitigation. The findings emphasize the need for regular groundwater monitoring, public awareness, and implementation of arsenic removal technologies to ensure sustainable access to safe drinking water.

Keywords: Arsenic contamination, Rock–water interaction, Groundwater quality, Human health, Geochemical pathways, Public health

FTIR and UV-Vis Assessment of Impact-Generated Glass, Vesicular Basalt, and Weathered Red Boles in the Lonar Crater System Geochemical Characterization of Title:- Vesicular Basalts, and Red Boles from Lonar Crater

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This study presents a combined FTIR and UV–Vis spectroscopic investigation of three representative geological materials from the Lonar impact structure in Maharashtra: glassy impactites, vesicular basalt, and red bole soil. The FTIR spectra of the glassy material display strong Si–O stretching bands between 1200–960 cm^{-1} , confirming an amorphous silicate framework produced by rapid quenching during the meteorite impact. Complementary UV–Vis measurements reveal distinct absorbance features at 334 nm and 259 nm, characteristic of natural volcanic glasses. Vesicular basalt samples show FTIR signatures consistent with primary basaltic minerals and post-impact alteration, while the UV–Vis response near 334 nm reflects compositional variations associated with vesicle formation and degassing processes. The red bole soils exhibit FTIR bands attributable to clay minerals, carbonates, and iron oxides, indicating extensive weathering under alkaline–saline lake conditions, supported by UV–Vis absorbance at 331 nm and 256 nm linked to iron-rich phases. When combined, these spectroscopic results provide a coherent view of melt generation, vesiculation, mineral alteration, and pedogenesis within the Lonar crater environment. The study enhances understanding of the crater’s geological evolution and highlights the value of vibrational and optical spectroscopy for characterizing terrestrial impact structures.

Keywords: Lonar Crater, FTIR spectroscopy, UV–Vis spectrophotometry, Vesicular basalt

Biological Detoxification of Industrial Wastewater for Sustainable Water Recovery by Phytoremediation

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The rapid escalation of global industrialization has triggered a critical environmental crisis: the discharge of toxic effluents laden with heavy metals and organic pollutants into our natural water bodies. While conventional mechanical and chemical treatment methods exist, they are frequently sidelined due to high energy demands, prohibitive operational costs, and the problematic generation of hazardous secondary sludge. This research addresses the urgent need for a "green" engineering alternative through Phytoremediation—a solar-driven, nature-based solution that leverages the metabolic processes of specialized aquatic plants to remove and stabilize contaminants. By utilizing these biological "filters," the study explores an eco-friendly pathway to detoxify wastewater, transforming industrial discharge from a source of pollution into a viable resource for sustainable water recovery. This approach not only mitigates environmental degradation but directly supports the transition toward a circular economy and global water security.

This research aims to evaluate phytoremediation as an effective biological detoxification approach for the treatment of industrial wastewater to support sustainable water recovery. The study focuses on characterizing industrial wastewater to determine its physicochemical and toxicological properties and assessing the ability of selected plant species to tolerate, accumulate, and degrade industrial pollutants. The efficiency of phytoremediation in removing contaminants such as heavy metals, organic pollutants, and nutrients will be examined by analyzing changes in key water quality parameters before and after treatment. The research also investigates the underlying biological detoxification mechanisms involved in pollutant removal and evaluates the potential reuse of treated wastewater for non-potable applications. Additionally, the environmental and economic feasibility of phytoremediation will be assessed in comparison with conventional wastewater treatment methods, with the aim of promoting sustainable and eco-friendly industrial wastewater management practices.

The research is expected to demonstrate that phytoremediation is an effective and environmentally sustainable method for the biological detoxification of industrial wastewater. Improvement in water quality parameters, including stabilization of pH and increased dissolved oxygen levels, is expected to indicate enhanced ecological safety of the treated wastewater. The study is also expected to identify plant species with high tolerance and pollutant uptake capacity, highlighting their efficiency in contaminant removal through mechanisms such as phytoextraction, phytodegradation, rhizofiltration, and phytostabilization. Accumulation of contaminants in plant tissues is anticipated to confirm the biological detoxification potential of the selected species.

The successful implementation of this project will provide a sustainable model for decentralized wastewater treatment. By proving that industrial waste can be biologically detoxified, this research supports the transition toward a circular economy where water is treated as a finite resource rather than a waste product. The findings will have direct implications for small-to-medium scale industries looking for affordable and eco-friendly environmental compliance solutions.

Keywords:-Phytoremediation, Industrial Wastewater, Heavy Metals, Biological Detoxification, Circular Economy, Phytoextraction, Sustainable Water Recovery.

Integrated Artificial Intelligence–Based Learning Approaches in Chemistry Education

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a. Background / Introduction: Traditional chemistry education often faces challenges in bridging the gap between complex theoretical concepts and practical applications. This work addresses the need to integrate digital technology into chemistry teaching to enhance student engagement and conceptual clarity.

b. Objectives / Purpose:

The primary objective is to explore and integrate AI-driven methodologies and digital applications into chemistry curricula. This aims to provide virtual alternatives to physical laboratory experiments, enhance skills in chemical structure drawing, and facilitate assessment through digital platforms.

c. Methodology:

The approach involves creating a digital learning ecosystem using tools like Unreal Chemist for virtual experiments, WebMO for 3D molecular visualization, and KingDraw for precise chemical structure drawing. It also utilizes Chemistry Quiz applications for instant feedback and Periodic Table Pro for comprehensive digital reference.

d. Results / Findings:

Preliminary insights show that these tools effectively replicate real laboratory conditions, such as color changes and gas evolution, without chemical hazards.

High user ratings (approx. 4.4 to 4.7/5) and download numbers reaching millions

reflect their effectiveness in fostering inquiry-based and experiential learning.

e. Conclusion / Implications:

The integration of AI and digital apps serves as a catalyst for a more data-driven and accessible chemistry education. This approach promotes eco-friendly practices by reducing chemical consumption and plays a key role in the future of smart classrooms and research-oriented learning.

Keywords: Artificial Intelligence, Chemistry Education, Virtual Laboratory, Machine Learning, Digital Learning Ecosystem

Development of Chocolate Coated Hibiscus Jelly

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This project presents the development of Hibiscus Jelly chocolate, an innovative functional confectionery developed using Hibiscus. Hibiscus sabdariffa belongs to the Malvaceae family & its bright red calyces are rich in anthocyanins, flavonoids vitamin C & natural antioxidants. Traditionally consumed as tea or herbal remedies, it is known for regulating blood pressure, boosting immunity, improving gut health & maintaining hydration. The novelty of this product lies in incorporating hibiscus in the form of a jelly-based layer within chocolate. This technique preserves its bioactive compounds more effectively than direct mixing offering, a controlled release of health promoting phytochemical while enhancing taste and texture. Natural sweeteners like, jaggery & honey along with agar- agar as a gelling agent, ensure a healthier alternative to conventional sugar-based chocolates, making it suitable even for health-conscious & diabetic friendly consumers. By fusing therapeutic potential of a traditional medicinal plant with the sensory appeal of chocolate, this product serves as a ready to eat nutraceutical snack. for all age groups.

Keywords: Hibiscus sabdariffa, Functional chocolate, Nutraceutical, Natural antioxidants, Jelly chocolate.

Soil-Induced Metal Corrosion and Its Prevention Strategies

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Soil-induced metal corrosion is a critical phenomenon affecting the durability and safety of subsurface metal structures such as underground pipelines, storage tanks, cables, and foundations. The interaction between metals and complex soil environments leads to chemical and electrochemical reactions that cause progressive metal deterioration. Soil characteristics—specifically moisture content, pH, salinity, oxygen availability, and microbial activity—play a pivotal role in influencing corrosion kinetics. Understanding these factors is essential for mitigating economic losses, environmental hazards, and structural failures.

Background / Introduction: Soil corrosion occurs when buried metals come into contact with moist and chemically active soils acting as electrolytes. The presence of dissolved salts and oxygen creates electrochemical cells on the metal surface, leading to oxidative corrosion. This problem is widely observed in industrial infrastructure and requires scientific intervention for effective control.

Objectives / Purpose: The main objective of this study is to analyze the underlying mechanisms of soil-induced metal corrosion. It also aims to study the effect of variable soil properties on corrosion behavior and to evaluate advanced prevention strategies for enhancing metal durability.

Methodology: This study is synthesized from a comprehensive review of academic literature, research articles, and reported case studies. Physicochemical soil parameters such as moisture, pH, resistivity, aeration, and microbial activity are examined. The corrosion behavior of ferrous alloys like iron and steel is discussed, along with various modern corrosion control techniques.

Results / Findings: The study indicates that soils with high moisture content, acidic pH, low resistivity, and high chloride/sulfate concentrations significantly accelerate corrosion rates. Differential aeration and microbial activity further catalyze metal loss. Protective coatings, cathodic protection, and the use of inhibitors are found to be effective in suppressing metal degradation.

Conclusion / Implications: Soil-induced metal corrosion is a complex process influenced by multiple environmental factors. Effective prevention requires an integrated approach involving material science, protective techniques, and soil management. Proper understanding and application of these strategies can extend the service life of metal structures and minimize maintenance costs.

Keywords: Soil corrosion, Metal degradation, Soil properties, Corrosion prevention, Cathodic protection

Thermogravimetric Study of Plant Leaves at Different Temperatures to Determine Water and Metal Oxide Contents

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Introduction Plant leaves are natural materials composed of moisture, organic compounds, and inorganic minerals. Understanding their thermal behavior is important in environmental chemistry and material science. Thermogravimetric analysis (TGA) is a reliable technique that measures the change in mass of a sample with increasing temperature. In plant leaves, TGA helps to identify moisture content, decomposition of organic matter, and formation of inorganic residues such as metal oxides. This study focuses on analyzing these thermal changes in a systematic manner.

Objectives -The main objective of this study is to investigate the thermal decomposition behavior of plant leaves using thermogravimetric analysis. The study aims to determine the moisture content present in the leaves at lower temperatures. It also focuses on identifying the decomposition of organic components at intermediate temperatures. Another objective is to estimate the metal oxide content from the remaining residue at higher temperatures.

Methodology -Fresh plant leaves were collected and washed to remove dust and impurities. The leaves were then air-dried and finely powdered to obtain a uniform sample. A known quantity of the powdered sample was placed in a thermogravimetric analyzer. The sample was heated at a constant rate under controlled conditions, and the change in mass was recorded continuously as the temperature increased.

Results -The thermogravimetric curve showed an initial weight loss at lower temperatures, which corresponds to the removal of moisture from the leaves. A major mass loss was observed at intermediate temperatures due to the decomposition of organic matter. At higher temperatures, the mass became almost constant, indicating the presence of thermally stable inorganic residues. These residues were mainly attributed to metal oxides and mineral content present in the plant leaves.

Conclusion -The thermogravimetric study successfully revealed the thermal behavior and composition of plant leaves. The results confirmed the presence of moisture, organic matter, and metal oxide residues in the sample. This study demonstrates that thermogravimetric analysis is an effective technique for the characterization of plant materials. The findings are useful for further research in environmental chemistry and condensed matter studies.

Innovative Control Approaches Against the Virulent Phytopathogenic Fungus *Neoscytalidium dimidiatum* in Dragon Fruit

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Brown spot disease, incited by the phytopathogenic fungus *Neoscytalidium dimidiatum*, poses a major threat to dragon fruit production, causing substantial losses of approximately 60–80% in yield and market quality. In this investigation, the pathogen associated with the disease was isolated from infected plant material and confirmed as *N. dimidiatum*. Microalgae are recognized as a rich source of biologically active metabolites with antimicrobial potential, prompting an evaluation of their antifungal efficacy against the pathogen. The inhibitory activity of the microalgal extract was assessed using the poisoned medium assay, in which Potato Dextrose Agar was incorporated with graded concentrations of the extract. A uniform mycelial plug of *N. dimidiatum* was inoculated centrally on the amended agar plates. The extract was tested at concentrations of 1, 3, 5, 7, and 9 mg/mL, and fungal growth was monitored in comparison with untreated controls. Antifungal performance was quantified by measuring radial mycelial expansion. The findings revealed a pronounced suppression of fungal growth with increasing extract concentration, demonstrating a clear dose-dependent response. These results suggest that microalgal extracts possess significant potential as an eco-friendly antifungal agent and may contribute to the development of sustainable disease management strategies in crop protection.

Key Words: Antifungal properties, microalgal extract, poisoned food method, bioagent, mycelium, bioactive compounds.

Larvicidal Activity of *Azadirachta Indica* Leaves on *Anopheles* Mosquito

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The aim of this study is to investigate the toxic effect of ethanolic plant extract of leaf of Neem, *Azadirachta indica* (Family: Meliaceae) against *Anopheles* larvae. For the larvicidal bioassay, different concentrations of plant crude extracts were prepared and the LC₅₀ values ranged from 20-100 ppm. Assays showed that leaf extracts were more toxic against 1 instar larvae and causes 100% mortality at 1000 ppm in 24 h. Bioactive phytochemical classes, such as

Flavonoids and Terpenoids were recorded. Therefore, the results obtained in this study shows the potential of the *A. indica* leaf extract against Anopheles larvae; and also suggests the use of such plant extract as an eco-friendly and sustainable alternative to synthetic insecticides.

Keywords: *Azadirachta indica*, Neem leaf extract, Larvicidal activity, Anopheles larvae, Eco-friendly insecticide

Structural Characteristics and Basin Architecture of the Asirgarh Area, Burhanpur District, Madhya Pradesh.

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The Asirgarh region of Burhanpur District, situated within the Satpura range and influenced by the Narmada and Tapi river basins, presents a complex geomorphic and structural setting that shapes its hydrological behaviour. This study examines the basin architecture and structural framework of the area by integrating morphometric analysis with GIS and remote-sensing techniques. High-resolution satellite data and spatial analysis tools were used to quantify key parameters such as stream order, drainage density, basin area, and slope. The resulting maps reveal the influence of structural controls on drainage development and terrain configuration. Land-cover information derived from remote sensing further highlights the extent of anthropogenic modifications within the watershed. The combined approach provides a clearer understanding of geomorphological processes, basin evolution, and environmental dynamics in this structurally diverse landscape. The findings contribute to improved interpretation of hydrological responses and support more informed strategies for sustainable watershed management and conservation in the Asirgarh region.

Keywords: Geographic Information Systems (GIS), Remote Sensing, Morphometric Parameters, Hydrological Features, Sustainable Watershed Management.

Innovative Startup Ideas - PLAST-BConversion of PET Waste into Biodegradable Bioplastics for a Circular Bioeconomy

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Plastic waste, particularly polyethylene terephthalate (PET), poses a growing environmental and economic challenge due to its persistence and limited recycling efficiency. **Plast-B** is a sustainable biotechnology start-up initiative that addresses this issue through **plastic up-cycling rather than disposal**. The process employs **microbial enzymes such as Cutinase** from *Thermobifida fusca*, to cleave ester bonds in PET, releasing monomers such as terephthalic acid (TPA) and ethylene glycol (EG). These monomers are subsequently utilized by *Pseudomonas putida* for biological conversion into polyhydroxyalkanoates (PHA), a biodegradable and eco-friendly bioplastic. By integrating plastic waste reduction with value-added bioplastic production, Plast-B promotes a circular economy model, reducing carbon footprint and dependence on petroleum-based plastics.

The start-up aims to commercialize biodegradable packaging products, addressing global challenges posed by single-use plastic bans while offering an economically viable and environmentally responsible alternative.

Keywords: PET up-cycling, Microbial enzymes, *Pseudomonas putida*, Polyhydroxyalkanoates (PHA), Biodegradable plastics, Circular economy

Impact of Fluorite on Human Health at Dongargaon: A Case Study

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Fluoride is a naturally occurring constituent of groundwater and plays a significant role in human health. While fluoride in low concentration is beneficial for the development of teeth and bones, excessive intake can lead to severe health problems such as dental and skeletal fluorosis. In several parts of rural India, fluoride contamination in drinking water has emerged as a major environmental and public health concern. The present study investigates the impact of fluoride-rich groundwater on human health in Dongargaon village through a detailed case study approach.

Groundwater samples from different locations within Dongargaon were collected and analyzed for fluoride concentration using standard hydrochemical methods. The obtained values were compared with the permissible limits prescribed by the World Health Organization (WHO) and Bureau of Indian Standards (BIS). In addition, field surveys and interactions with local residents were carried out to understand the prevalence of fluoride-related health issues. The

study reveals that fluoride concentration in several groundwater samples exceeds the recommended limits, indicating unsafe drinking water conditions. Clinical observations and community responses indicate noticeable cases of dental fluorosis among children and early symptoms of skeletal fluorosis among adults.

Geological factors such as the presence of fluoride-bearing minerals, rock–water interaction, and prolonged groundwater residence time are identified as the major contributors to fluoride enrichment in the aquifer. The study highlights the urgent need for regular monitoring of groundwater quality, public awareness programs, and the adoption of suitable mitigation measures such as defluoridation techniques and alternative safe water sources. This case study emphasizes the importance of integrating geological studies with public health initiatives to ensure sustainable access to safe drinking water in fluoride-affected regions.

Keywords: Fluoride contamination, Dental fluorosis, Skeletal fluorosis, Groundwater quality, Dongargaon, Public health

Geopolitical instability & it's geographical & geological significance

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Research over major disputes, conflict worldwide, humanitarian crises. Major focus of these presentation is geographical & geological significance of those areas which are the indirect reasons behind those conflicts.

●Conflicts

- 1] Indo-Pak conflict
- 2] Sino- India conflict
- 3] America- Venezuela conflict
- 4] Russia Ukraine war
- 5] Sino- Taiwan conflict

●Humanitarian crises/Genocide

- 1] Sudan instability

Conflict

1] Indo-Pak conflict

Kashmir's Strategic Geography:

Source of Rivers: Kashmir's high-altitude valleys are the headwaters for major Indus tributaries, making control of the region vital for water security for both nations.

Sir Creek & Maritime Border:

Ecological & Economic Zone: This ecologically sensitive creek near the Ran of Kutch is vital for fishing and potential offshore oil/gas, with its disputed boundary affecting maritime security.

Water as a Weapon: Water management has become a flashpoint, with India suspending parts of the IWT in recent years, leading to crises like the 2025 river flow disruptions

2] Sino- India conflict

Water Security: Glaciers and rivers (Indus, Brahmaputra) originate here, supplying water to vast populations. China's control of Tibet secures these water sources, a major strategic concern for India and other downstream nations. The Indo-China border conflict isn't primarily about lead and zinc, but rather territorial control, with China actively mining significant gold, silver, and rare earths in disputed Tibetan areas like Arunachal Pradesh increasing tensions over strategic resources, alongside building infrastructure (roads, military bases) along the Line of Actual Control (LAC), leading to clashes over border.

3] America Venezuela conflict

- **Oil & Geopolitics:** Venezuela holds the world's largest proven oil reserves, making it a prize in the U.S.-China/Russia struggle for energy dominance. The U.S. seeks access and control, viewing past nationalizations as theft.

4] Russia Ukraine war

- **Access to the Black Sea:** The Crimean Peninsula is geographically vital because it is home to Russia's Black Sea Fleet in the port of Sevastopol. Control of Crimea and the broader Black Sea region allows Russia to project naval power across the Mediterranean and beyond, and to control vital trade routes.

- **Resource Control:** Ukraine possesses significant natural resources, including vast agricultural land (it is a major global grain exporter) and critical mineral deposits like titanium and lithium.

5] Sino taiwan conflict

- **Economic Importance:** Taiwan is a global powerhouse in the semiconductor industry, producing a majority of the world's advanced computer chips. A Chinese takeover would give

Beijing immense control over a vital global supply chain, making the island strategically important for economic security worldwide.

Sudan Instability

Sudan's significant **gold reserves are major factor in its instability and ongoing civil war**,

The struggle for control over gold assets was a key driver of the current civil war, which erupted in April 2023. Both the SAF and the RSF use their influence to control gold extraction and trade, with profits used to purchase weapons and sustain their military operations.

The Plastisphere Paradox: How Microplastic Biofilms Disrupt Nutrient Cycling and Oxygen Stability in Freshwater Ecosystems

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The pervasive accumulation of microplastics (MPs) in freshwater environments has given rise to a novel ecological niche known as the "plastisphere"—a complex microbial biofilm that colonizes plastic surfaces. While traditional research has focused on the physical ingestion of plastic by fauna, the "plastisphere paradox" highlights a deeper, more insidious threat: these synthetic surfaces act as metabolic hotspots that fundamentally alter the biogeochemical fingerprint of rivers and lakes. As plastics become ubiquitous, they transition from passive pollutants to active ecosystem drivers. This study aims to explore how the formation of the plastisphere disrupts essential freshwater ecosystem services. Specifically, the research investigates the impact of plastic-associated microbial communities on dissolved oxygen levels, nitrogen/phosphorus cycling, and the potential for these biofilms to serve as reservoirs for pathogenic microorganisms and antibiotic-resistance genes (ARGs). The study utilized a multi-faceted approach, combining field sampling from diverse riverine sites with controlled laboratory simulations. Microplastic polymers (Polyethylene and PVC) were submerged in freshwater microcosms to allow for biofilm maturation over a 60-day period. Advanced biomolecular techniques, including 16S rRNA gene sequencing and metagenomic analysis, were employed to characterize the microbial diversity. Dissolved oxygen (DO) flux and nutrient concentrations (NO_3^- , PO_4^{3-}) were monitored using high-precision sensors and spectrophotometry to quantify metabolic shifts. Preliminary findings indicate that plastisphere biofilms exhibit significantly higher metabolic rates compared to natural

submerged surfaces (e.g., wood or stone). This "hyper-metabolism" led to localized oxygen depletion, creating micro-dead zones within the water column. Furthermore, the plastisphere was found to uniquely alter nitrogen cycling by enhancing denitrification rates in certain polymers while inhibiting natural phosphorus assimilation. Most concerning, the microbial communities on microplastics showed a 40% higher prevalence of opportunistic pathogens compared to the surrounding bulk water, confirming that MPs act as selective vectors for harmful taxa. The significance of this work lies in redefining microplastics not just as a waste issue, but as a biological disruptor. The plastisphere paradox suggests that even if physical ingestion is avoided, the metabolic activity of plastic-bound microbes can degrade water quality, threaten biodiversity, and compromise human drinking water safety. These findings underscore the urgent need for freshwater management strategies that account for the microbial dimension of plastic pollution, advocating for a "One Health" approach to ecosystem conservation.

Keywords: Microplastics, Plastisphere, Freshwater Ecosystems, Biofilms, Nutrient Cycling, Oxygen Depletion

Living road: Bacteria based self-filling technology for sustainable infrastructure

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Bacteria-based self-healing road technology presents a sustainable and innovative advancement in contemporary pavement development. Conventional road systems undergo rapid degradation due to factors such as environmental variations, heavy traffic loads, and moisture penetration, leading to crack formation, potholes, and repeated maintenance. To address these issues, scientists have incorporated calcite-producing bacterial strains, such as *Bacillus subtilis* and *Bacillus sphaericus*, into pavement materials. Upon exposure to moisture, these bacteria trigger Microbially Induced Calcite Precipitation (MICP), resulting in the formation of calcium carbonate (CaCO_3), which fills micro-cracks and restores structural performance. This biological healing process improves pavement durability, reduces repair expenses, lowers ecological impact, and extends service life. Although the technology is still emerging and faces challenges related to cost, climate conditions, and widespread

implementation, it holds promising potential for future sustainable transportation infrastructure.

Keywords: Road-Specific Performance, Sustainable Infrastructure, Sustainable Construction, Durability

DEVELOPMENT OF A RAPID DIAGNOSTIC KIT FOR DETECTING COMMON INFECTIONS USING ENZYME-BASED BIOSENSOR TECHNOLOGY

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Fever is one of the most common clinical symptoms associated with infectious diseases, yet distinguishing whether the underlying cause is viral or bacterial remains a significant diagnostic challenge. Conventional diagnostic approaches depend largely on blood-based laboratory investigations and centralized facilities, leading to delays of twenty-four to ninety hours before results are available. Such delays often result in empirical antibiotic prescription, inappropriate treatment decisions, increased healthcare costs, and the acceleration of antimicrobial resistance, particularly in rural and resource-limited settings. This project proposes a non-invasive, enzyme-based rapid diagnostic test kit capable of differentiating viral and bacterial infections within ten to fifteen minutes using saliva or urine samples. The system is designed to target infection-specific biomarkers, including Procalcitonin for bacterial infections and Interferon for viral immune responses. Rather than introducing these biomarkers into the kit, the test strip incorporates biomarker-specific antibody capture zones linked to enzyme-mediated colorimetric indicators. When a target biomarker is present in the patient sample, antibody binding triggers an enzyme reaction that produces a visible and interpretable color change. The proposed kit offers key advantages such as rapid turnaround time, painless sample collection, low manufacturing cost, portability, and minimal training requirements. It is suitable for use in primary health centers, outpatient clinics, emergency screening, and community health camps. Overall, this innovation demonstrates potential to enhance point-of-care diagnostics and contribute to global efforts to combat antimicrobial resistance.

KEY WORDS: Enzyme-Based Biosensor-Fever Diagnosis- Procalcitonin - Viral and Bacterial infection Saliva and Urine Analysis-Antibiotic Resistance kit

Development and Evaluation of Natural Beeswax-Based Cosmetic Products for Skin Care Applications

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The increasing use of synthetic chemicals in cosmetic products has raised concerns about skin safety, allergic reactions, and environmental impact. Many commercial cosmetics contain artificial preservatives and petroleum-based ingredients that may cause irritation and long-term health effects. Beeswax, a natural by-product of beekeeping, is known for its emollient, antimicrobial, and protective properties. It forms a natural barrier on the skin, helps retain moisture, and supports healing without clogging pores, making it suitable for sensitive and damaged skin. This project focuses on developing safe, natural, and eco-friendly cosmetic alternatives using beeswax. The main objective of this study was to formulate beeswax-based cosmetic products such as lip balm and moisturizer using natural oils and additives. The products were prepared by melting purified beeswax and blending it with coconut oil, almond oil, essential oils, and vitamin E using simple laboratory techniques. The formulations were evaluated for organoleptic properties, spreadability, melting point, and short-term stability to assess product quality and usability. The results showed that the beeswax-based cosmetics had a smooth texture, pleasant natural aroma, good spreadability, and satisfactory stability at room temperature. The products provided effective moisturization and skin protection without causing irritation. This study concludes that beeswax-based cosmetics are a safe, sustainable, and affordable alternative to synthetic skincare products. The project highlights the potential for value addition to beekeeping by-products, promotion of eco-friendly practices, and opportunities for small-scale entrepreneurship in the natural cosmetics sector.

Keywords: Beeswax, Natural Cosmetics, Herbal Skincare, Sustainable Products, Lip Balm, Moisturizer

In Vitro analysis of *Tridax procumbens* with Chitosan coated Biodegradable Braided Sutures

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Surgical site infections remain a significant challenge in wound healing, necessitating the development of antimicrobial sutures. *Tridax procumbens*, a medicinal plant known for its antimicrobial and wound-healing properties, is an excellent candidate for enhancing the functionality of biodegradable sutures. Chitosan, a biopolymer with inherent antimicrobial activity, serves as a coating material to improve the efficacy and biocompatibility of braided sutures. This study explores the in vitro evaluation of *Tridax procumbens* extract incorporated into chitosan-coated biodegradable braided sutures. The research aims to assess the phytochemical, antimicrobial, proliferative, and wound healing properties of braided sutures to determine their potential application in surgical wound closure. In vitro cell culture studies were performed using fibroblast cells to assess the proliferation rate upon exposure to the coated materials. An invitro scratch assay was performed using fibroblast cultures to evaluate the wound closure rate. The *Tridax procumbens* and chitosan coating exhibited significant antimicrobial activity against both gram positive and gram negative bacterium. The coated braided sutures enhanced the cell proliferation and support wound healing without compromising mechanical strength. This study highlights the potential of herbal-infused biopolymer coatings in regenerative medicine, paving the way for further clinical applications.

Key Words: *Tridax Procumbens*, Braided Sutures, in vitro studies, etc.

SYNTHESIS, GROWTH AND CHARACTERIZATION STUDIES OF DIPHENYLAMINE ADIPATE CRYSTAL DOPED WITH BARIUM CHLORIDE (DPA)

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Crystals with nonlinear optical characteristics have wide applicability in laser optics and communication. Diphenylamine adipate crystal doped Barium Chloride were synthesized from the aqueous solution by using a slow evaporation technique at constant temperature. The various characterisation studies were carried out for the crystal synthesised using the proposed approach. The crystallinity nature of doped synthesised crystals were determined using XRD Pattern. The existence of different functional groups for this synthesised crystal was observed with the help of Fourier Transform Infrared Spectroscopy (FTIR) which is in the range of 600-4000 cm⁻¹. The synthesized crystal also exhibits good optical transmittance which was examined using ultraviolet and visible (UV-Vis) absorption spectroscopy. The band gap energy

was calculated to be 4 eV. The thermal stability characteristics of the complex Diphenylamine adipate crystal doped Barium Chloride crystals were studied using thermogravimetric analysis (TG) and differential thermal analysis (DTA) and it was noticed that it is stable up to 190°C. The SEM studies were also carried out to study the morphology of this synthesised crystals. Thus, synthesized crystals exhibits favourable features for nonlinear optical applications observed from the characterization studies. The recent excellent performance of NLO materials was produced in organic, inorganic and semi-organic materials due to their industrial positions of the research areas such as frequency conversion, rapid information processing, opto electronic devices and recording media. The materials used in NLO frequency conversion had a significant impact on the manufacturing procedures for optical recording, display and laser systems. Doped NLO crystals may have more applications in optoelectronic devices than pure NLO crystals due to reports that doping can modify various physical and chemical properties. In recent times, there has been an increase in the need for organic compounds for linear optical crystalline materials, that has made this research area one of the most attractive in the specific situation of telecommunication and in fields of work. It is known that naturally occurring amino acids can form a wide range of compounds with a broad range of inorganic and organic reagents, such as mineral and organic acids, due to the interaction of the glycine or carboxylic acid functional groups of the amino acids. The objective of this study is to report on investigations on the solubility and crystal development of NiCl₂ doped glycine as well as X-ray diffraction, UV visible transmittance, thermogravimetric, and differential thermal analyses (TG-DTA) To synthesize the new NLO crystals by using a slow evaporation method and characterized by following analytical techniques. To study the existence of different functional groups of these synthesized NLO crystals with the help of Fourier Transform Infrared Spectroscopy (FT-IR). To examine the good optical transmittance of synthesized NLO crystals by using Ultraviolet and visible (UV-Vis) absorption spectroscopy. To study the thermal properties of the grown crystals by thermo gravimetric analysis (TGA) and Differential thermal analysis (DTA) The Methodology of crystal have been examined in this paper. The complete description of the physical and chemical properties of materials of interest is analyzed as a characterization of materials. The purpose of this chapter is to describe some relationship among representative chemical composition, structure, defects, thermal, mechanical, and optical properties, etc. Different characterization sources provide information that is so important and unique that each has developed its own specific literature and instrumentation. The use of instruments is an amazing and really interesting aspect of any analysis that deals with chemistry. Diphenylamine adipate crystal doped Barium chloride with wide application

of Opto Electronic devices was synthesised from an aqueous solution using a slow evaporation approach. The FTIR spectroscopic examination validates the functional groups in the crystal. The greatest absorption is suggested by UV-Visible for Ba-doped crystals. The band gap energy is found to be 4 eV and the UV-Visible cut-off wave length is 385nm, with an increase in frequency, the dielectric constant lowers, and extremely low values of the dielectric loss show that the crystal is 100 % pure. The TG-DTA analysis was performed to determine the crystal thermal stability. The Diphenylamine adipate crystal doped Bariumchlorid is a feasible option for use in the manufacturing of optoelectronic devices from the conducted experimental characterisation studies. Good optical quality Pure and doped single crystals with wide application of optoElectronic devices have been grown by slow evaporation method at room temperature. The lattice parameters have been found by single crystal X-ray diffraction technique. The FT-IR spectrum reveals the various functional groups present in the grown crystals. The shift in some absorption peaks recommend that the dopants have entered the pure crystal lattice.

Keywords : Diphenylamine adipate, Barium Chloride, XRD, Fourier Transform Infrared Spectroscopy (FTIR), Ultraviolet and Visible (UV-Vis), Differential Thermal Analysis (DTA),

DYNAMIC DIRECTIONAL ROTATING WINDMILL

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A dynamic directional windmill adjusts to face changing wind directions, maximizing energy capture and efficiency. It is especially useful in areas with variable winds, providing reliable, renewable power.

This technology supports sustainability, reduces reliance on fossil fuels, and is beneficial for remote areas, industries, homes, and green energy initiative agricultural processing units, and off-grid locations can benefit from its low-cost, clean energy generation. It also has potential in disaster-prone zones as a backup power source, and for educational institutions promoting green tech on campus. The problem of the traditional windmills generating less power due to fixed orientation, a dynamic direction windmill adjust to wind flow maximizing efficiency and energy output. Dynamic directional windmills spans early self-orienting vane windmills,

mechanical devices, and modern yaw-controlled turbines. This windmill isn't like the usual ones that stay fixed in one direction. It's built to rotate automatically based on where the wind is coming from, using simple sensors and controls. That means it can capture more wind energy even when the wind keeps changing direction something most small turbines struggle with. What makes it special is that it's affordable, compact, and easy to install, even on rooftops or in small spaces.

The purpose of this project is to design and build a **dynamic directional rotating windmill** that can automatically adjust its direction to face the wind. This project aims to explore how wind direction affects windmill efficiency and how mechanical or simple control systems can help maximize energy capture. This project helps develop problem-solving, design, and experimental skills while demonstrating the importance of adaptive systems in renewable energy technology. A table fan was used to simulate wind at different angles and speeds. The windmill was placed at a fixed distance from the fan to maintain consistent wind strength. The fan direction was changed to test how effectively the windmill adjusted its orientation. Materials used included cardboard or plastic blades, a small DC motor (or generator), a vertical support stand, bearings or a rotating joint, and a tail vane for direction control. Observations were made on how quickly the windmill aligned with the wind. Rotational speed was measured by counting blade rotations per minute (RPM). If a generator was used, voltage output was recorded using a multimeter. Data was collected for both fixed-direction and dynamic directional modes for comparison. The collected data was organized into tables and graphs. Performance differences between aligned and misaligned wind directions were analyzed. Conclusions were drawn about the efficiency of dynamic directional rotation. Demonstrates practical application of physics and engineering concepts provides a basic model for understanding real-world wind turbine design. Serves as an educational tool for renewable energy and sustainability studies. Improved efficiency of small-scale wind energy systems for homes and rural areas. Increased reliability of renewable energy sources, greater awareness of sustainable and clean energy technologies. Encouragement of innovation using low-cost, eco-friendly materials.

Keywords: Dynamic orientation, Yaw mechanism, Rotor alignment, Wind vane / tail vane, Control system, Wind sensor

Geomorphological Characterization of Amravati District, Maharashtra, through Remote Sensing and GIS Techniques.

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Geomorphological mapping is essential for understanding terrain characteristics, landform processes, natural resources, and environmental management. The present study employs Remote Sensing (RS) and Geographic Information System (GIS) techniques to prepare a detailed geomorphological map of Amravati District, Maharashtra. Satellite imagery, DEM (Digital Elevation Model), Survey of India toposheets, and secondary datasets were integrated to identify major landform classes. Various geomorphic units, such as structural hills, pediments, valley fills, alluvial plains, residual hills, escarpments, and floodplains, were delineated. The study highlights the spatial distribution of geomorphological features and their relationship with lithology, slope, elevation, and drainage. The results demonstrate the effectiveness of RS and GIS tools for terrain analysis and landform classification, useful for land-use planning, groundwater exploration, soil conservation, and watershed management in semi-arid regions like Amravati.

Keywords: Remote Sensing, GIS, Geomorphology, Amravati District, DEM, Landform Mapping

Vertical Phytotechnology for Urban Temperature and Air-Pollution Control with a Pilot Study in Amravati

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Rapid urbanisation has intensified heat stress and air pollution in Indian cities, with Amravati representing a typical hot, dusty and traffic-dominated urban environment. Vast areas of vertical concrete surfaces under bridges, flyovers and along roads remain unused despite their potential to act as biological climate regulators. Vertical phytotechnology—including green walls, plant pouches and modular vertical gardens—offers a low-energy approach to reduce ambient temperature through shading and evapotranspiration while improving air quality via particulate and gaseous pollutant capture by plant surfaces. International experience from cities

such as Singapore and Milan, along with Indian initiatives under flyovers in Delhi and Mumbai, demonstrates the promise of vertical greenery, but also highlights the need for scientifically guided, location-specific evaluation.

This project aims to systematically explore and evaluate available vertical garden and plant-pouch systems for their suitability in Amravati's real urban conditions, with the objective of providing evidence-based recommendations to the Municipal Corporation for large-scale deployment. Multiple plant species and greening formats currently used in India and abroad will be assessed for survivability, maintenance demand, cooling potential and pollution-mitigation performance. Field measurements of temperature, humidity and particulate matter will be conducted at selected pilot sites under bridges and along major roads before and after installation, alongside monitoring of plant growth and durability. Complementary laboratory experiments using controlled vertical plant chambers with simulated heat, airflow and dust loads will allow precise comparison of the cooling and air-cleaning performance of different plant systems under standardized conditions. The expected outcome is a scientifically grounded decision framework identifying which vertical phytotechnology options deliver the highest heat-reduction and air-quality benefits per unit cost under Amravati-like urban conditions. The project will generate comparative performance data, practical design guidelines and maintenance protocols that enable municipal authorities to deploy scalable, nature-based urban climate solutions across Indian cities facing increasing heat and pollution stress.

Key Words: Vertical phytotechnology; Urban heat island; Air-pollution mitigation; Green walls; Vertical gardens; Urban microclimate; Nature-based solutions; Smart cities; Amravati.

Geomorphic Asymmetry Index and 3D TIN Modeling for Basin Tilting Analysis: A Case Study from the Western Gavilgarh Fault Zone, Central India.

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This study presents a basin-tilting assessment along the western segment of the Gavilgarh Fault Zone (W-GFZ) in the Burhanpur–Jamod Corridor of Central India using the Geomorphic Asymmetry Index and 3D TIN-based surface modelling. High-resolution CARTOSAT DEMs,

IRS LISS-III imagery, and field evidence were integrated for eleven sub-basins to evaluate lateral tilting, drainage displacement, and neotectonics deformation. The analysis reveals clear structural control on basin morphology, expressed through aligned lineaments, asymmetric drainage patterns, V-shaped valleys, knickpoints, terraces, and mid-channel bars. A previously unrecognized transverse fault in the P4 sub-basin is supported by geomorphic signatures and field observations such as fault breccia and pegmatite vein exposures. Spatial variations in basin asymmetry allow classification of the sub-basins into high, moderate, and low deformation categories, indicating ongoing crustal adjustment. The findings improve understanding of neotectonics activity in the W-GFZ and highlight the effectiveness of geomorphic asymmetry and 3D TIN modelling for identifying subtle or concealed fault structures in intraplate regions.

Keywords: Basin Tilting, Geomorphic Asymmetry Index, 3D TIN Modelling, Gavilgarh Fault Zone, CARTOSAT DEM, Drainage Asymmetry.

Development Of A Novel Oxygel-Based Stabilizing System For Enhanced Organ Preservation Quality.

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A) BACKGROUND/INTRODUCTION:

The preservation of donor organs remains a major challenge in biomedical science due to the limited duration of safe storage and gradual decline in organ quality during hypothermic preservation. Although preservation solutions such as University of Wisconsin (UW), HTK, (HTK solution reference de Boer, J., & Leuvenink, H. G. D. et al.,2010) and Celsior are routinely used, they primarily slow metabolic activity and do not fully prevent oxidative stress, cellular dehydration, edema, and microstructural damage. In addition, machine-related limitations such as inconsistent perfusion and oxygenation further compromise organ quality. These issues significantly compromise organ quality during storage and transport. Therefore, there is a growing need for an additional stabilizing strategy that can work alongside existing solutions to protect organs more effectively during preservation.

B) OBJECTIVES/PURPOSE:

The primary objective of this study is to develop a Universal OxyGel-Based Stabilizing System aimed at enhancing organ quality during hypothermic preservation, thereby indirectly increasing preservation time. The specific objectives include:

Reducing oxidative and hypoxic stress at the cellular level.

Maintaining tissue hydration and structural integrity during cold storage.

Providing a supportive and adaptable stabilizing interface compatible with existing preservation solutions.

Developing a single, tunable gel system applicable to multiple solid organs.

C) METHODOLOGY:

This work proposes the conceptual development of a biocompatible hydrogel-based OxyGel designed for use during cold organ storage. (Fuller, B. J., & Guibert, E. E. et al., 2004). (Guibert, E. E., Petrenko, A. Y., Balaban, et al., 2011). The OxyGel is intended to be applied externally or as a surrounding stabilizing medium in combination with standard preservation solutions. The system focuses on stabilizing the cellular microenvironment by retaining moisture, reducing oxidative damage, and supporting tissue integrity under hypothermic conditions. Literature-supported biochemical principles and biomaterial frameworks were used to design the stabilizing concept without altering established perfusion protocols. The system is also designed to be cost-effective, providing an economical alternative to expensive preservation machinery.

D) RESULTS/FINDINGS:

The proposed OxyGel-based stabilizing approach addresses multiple preservation-related problems simultaneously, including cellular dehydration, oxidative injury, tissue edema, microstructural instability, and limitations of all existing solutions and machines. By improving overall organ quality during storage, the system is expected to extend the effective preservation window, not by replacing existing solutions, but by enhancing their performance. Improved tissue stability and reduced cellular stress directly contribute to better preservation outcomes and increased usable preservation time when compared to solution-only storage.

(E) CONCLUSION / IMPLICATIONS:

This study introduces a novel, quality-focused stabilization strategy for organ preservation. The OxyGel-Based Stabilizing System offers a supportive, adaptable, and biochemically sound approach that complements existing preservation methods. By enhancing organ quality during

storage, the system holds significant potential to increase preservation time, improve organ usability, and reduce preservation-related losses, thereby contributing meaningfully to advancements in organ preservation science and biomedical research. The cost-effective nature of OxyGel further ensures accessibility and practical application in diverse biomedical settings.

Keywords: Organ Preservation, OxyGel Stabilization, Oxidative Stress Reduction, Tissue Quality Enhancement

Portable Electric Food Drying Chamber

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Portable electric food drying chamber designed for efficient, hygienic, and energy-saving dehydration of food items. The device features an enclosed chamber with removable food trays, a heating system using LEDs, and an integrated fan to ensure uniform drying and temperature regulation. It is powered by a rechargeable battery that can be charged via solar panels or a standard electrical outlet, enabling off-grid operation. A temperature monitoring system automatically activates the fan to prevent overheating. The device includes a user interface for controlling drying time, temperature, and fan operation, making it suitable for use in rural areas, homes, and mobile applications. The invention combines portability, energy efficiency, and environmental protection to offer a clean and modern solution for food preservation. Your abstract should briefly cover the following components: Food drying is a widely used preservation method to extend shelf life by reducing moisture content. Traditional methods such as sun drying are slow, weather-dependent, and expose food to dust, insects, and contamination, resulting in poor and inconsistent quality. Existing electric food dryers are often bulky, costly, and consume high power, making them unsuitable for household users, small farmers, and small-scale food processors. Moreover, many available dryers lack uniform heat distribution and precise temperature control, leading to uneven drying and loss of nutritional value. Portable drying devices available in the market generally have limited capacity and low efficiency. Therefore, there is a need for a **Portable Electric Food Drying Chamber** that is compact, energy-efficient, easy to operate, and capable of providing controlled and uniform drying for various food products while maintaining quality and reducing drying time. To provide a food drying device that operates using solar energy and heating LEDs, thereby

reducing dependency on conventional electricity and enhancing energy efficiency. To ensure portability, allowing users to conveniently transport and use the device in remote, rural, or off-grid locations. To incorporate a fan mechanism that regulates internal temperature and airflow, ensuring uniform drying and preventing overheating of food items. To offer a clean and enclosed drying environment, minimizing the risk of contamination from dust, insects, and environmental pollutants. To reduce the drying time compared to traditional sun drying methods, while maintaining nutritional quality and taste of the dried food. To provide an eco-friendly and sustainable solution for small-scale farmers, households, and food processing units involved in food preservation. To allow recharging through multiple power sources, including solar panels and standard electrical outlets, enhancing its usability in diverse environments.

The present invention relates to a portable and rechargeable electric food drying chamber designed to efficiently dry various types of food using a combination of solar energy, heating LEDs, and a fan system to maintain optimal drying conditions and prevent overheating. The device comprises a compact, lightweight, and enclosed chamber, constructed from food-safe, heat-resistant, and durable materials, such as insulated metal or reinforced plastic. The chamber is designed to be portable, allowing for easy transportation and operation in both indoor and outdoor settings. The interior of the chamber is fitted with multiple removable trays or racks, made of perforated or mesh material, which allow for the even distribution of heat and air around the food items placed on them. The chamber is powered by a rechargeable battery pack, which can be charged using two primary methods: Integrated solar panels mounted on the sides of the chamber. DC power input for charging through an electrical outlet. This dual charging capability ensures that the device remains functional in both off-grid and urban environments. Instead of conventional heating elements, the device utilizes energy-efficient heating LEDs positioned strategically within the chamber. These LEDs emit controlled heat at specific wavelengths suitable for drying food without degrading its nutritional value or flavour. The LEDs are designed to operate at safe temperatures, contributing to uniform and consistent drying. To ensure uniform drying and to avoid hotspots, the chamber is equipped with a low-noise electric fan. This fan circulates warm air evenly throughout the chamber, improving drying efficiency and reducing moisture buildup. An integrated temperature sensor and microcontroller unit (MCU) monitor the internal temperature of the chamber. If the temperature exceeds a predetermined threshold, the fan automatically activates to cool the chamber and maintain optimal drying conditions, thereby preventing overheating and protecting both the food and the internal components. The device features a user-friendly control panel, which may include: Power on/off switch LED indicators for charging status, temperature, and drying mode

Timer settings to allow users to specify the drying duration Manual or automatic fan control Advanced versions may include a digital display and preset drying programs for different types of food such as fruits, vegetables, herbs, or meat. To use the device, the user places sliced or prepared food items on the drying trays and closes the chamber. The power supply is activated, and the user selects the desired drying mode or time. The heating LEDs begin to emit heat, while the fan ensures uniform air circulation. If the chamber is exposed to sunlight, the solar panels supplement or fully power the operation, enhancing energy efficiency. The drying process continues for the set duration, after which the device can either shut off automatically or switch to a low-power maintenance mode. The **Portable Electric Food Drying Chamber** provides fast, uniform, and hygienic drying of food products with controlled temperature. It reduces drying time, preserves food quality and nutrition, prevents contamination, and operates efficiently with low energy consumption, making it suitable for household and small-scale use. The **Portable Electric Food Drying Chamber** offers an effective, hygienic, and energy-efficient solution for drying food products. Its portable design, controlled drying conditions, and uniform heat distribution ensure improved food quality, reduced drying time, and minimized post-harvest losses. The invention is well suited for household and small-scale applications, providing a reliable alternative to traditional drying methods.

Green Cleaning for a Healthy Home

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The increasing use of chemical-based cleaning products has led to serious environmental and health concerns, including water pollution, toxic residues, and respiratory problems. This project focuses on the development and study of **eco-friendly cleaning solutions** that are safe, biodegradable, and sustainable, while remaining effective for everyday cleaning purposes. Eco-friendly cleaning solutions are formulated using **natural and green chemistry principles**, such as plant-based surfactants, organic acids, essential oils, and biodegradable additives. These ingredients reduce harmful chemical discharge into the environment and minimize health risks to humans and animals. The project demonstrates the preparation, working mechanism, and applications of various eco-friendly cleaners like **floor cleaners, toilet cleaners, dishwashers, and hand washes**. The effectiveness of these solutions is evaluated based on cleaning efficiency, cost-effectiveness, safety, and environmental impact. The results

show that eco-friendly cleaners can perform comparably to conventional cleaners while being non-toxic, renewable, and environmentally responsible. This project highlights the importance of adopting **green cleaning practices** to promote sustainable living and environmental conservation. By replacing harmful chemicals with eco-safe alternatives, eco-friendly cleaning solutions contribute to a cleaner home and a healthier planet. Traditional cleaning products contain harmful chemicals that can cause environmental pollution and health problems. These chemicals contaminate water and air and may lead to skin and respiratory issues. Eco-friendly cleaning solutions are developed using natural, biodegradable, and non-toxic ingredients based on green chemistry principles. They provide effective cleaning while being safe for humans, animals, and the environment. This project focuses on promoting sustainable and environmentally responsible cleaning alternatives for a healthier future. Traditional cleaning products contain harmful chemicals that can cause environmental pollution and health problems. These chemicals contaminate water and air and may lead to skin and respiratory issues. Eco-friendly cleaning solutions are developed using natural, biodegradable, and non-toxic ingredients based on green chemistry principles. They provide effective cleaning while being safe for humans, animals, and the environment. This project focuses on promoting sustainable and environmentally responsible cleaning alternatives for a healthier future. The methodology of this project involves a systematic approach to develop, prepare, and evaluate eco-friendly cleaning solutions. First, background research is conducted to understand the harmful effects of conventional chemical cleaners and the principles of green chemistry. Suitable natural and biodegradable ingredients such as plant-based surfactants, organic acids (like vinegar or citric acid), baking soda, and essential oils are selected. Next, eco-friendly cleaning solutions are prepared using safe mixing procedures under controlled conditions. Different formulations are developed for specific applications such as floor cleaning, toilet cleaning, dishwashing, and hand washing. Proper measurements are followed to ensure effectiveness and safety. The prepared solutions are then tested for cleaning efficiency by applying them on common stains, grease, and dirt. Observations are recorded and compared with commercially available cleaners. Parameters such as effectiveness, safety, cost, and environmental impact are analyzed. Finally, results are documented, and conclusions are drawn regarding the feasibility and benefits of eco-friendly cleaning solutions. The methodology emphasizes sustainability, safety, and practical application. This project focuses on developing eco-friendly cleaning solutions using natural, biodegradable, and non-toxic ingredients. It aims to reduce environmental pollution and health risks caused by chemical cleaners while providing safe and effective alternatives for sustainable living. The project concludes that eco-friendly

cleaning solutions are safe, effective, and environmentally sustainable alternatives to conventional chemical cleaners. By using biodegradable and non-toxic ingredients, these solutions reduce pollution, protect human health, and support sustainable living. Adopting eco-friendly cleaning practices contributes to a cleaner environment and a healthier future for both people and the planet

Keywords : Cleaning , Ecofriendly ,Healthy home, Formulations

Mini Portable Water Condenser

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The continuous use of fresh water in conventional condenser systems leads to excessive water wastage in chemical laboratories. It is estimated that a single condenser can waste nearly two million litres of water annually. To address this issue, a **Mini Portable Water Recirculating Device in Condenser Apparatus** has been developed. The device operates by recirculating water from a closed reservoir through the condenser using a pump and flow-rate regulator, thereby eliminating the need for a continuous freshwater supply. The system is powered by rechargeable batteries, making it energy efficient and portable. Periodic addition of chilled water maintains effective cooling performance. This eco-friendly and cost-effective device significantly reduces water consumption while ensuring efficient condenser operation, contributing to sustainable laboratory practices. In chemical laboratories, condensers are widely used for processes such as distillation, reflux, and various chemical reactions that require effective cooling. Traditionally, condensers operate using a continuous flow of fresh tap water, where water enters through the inlet and is discharged directly into the drain after a single use. Although this method is simple, it results in a massive wastage of freshwater resources. With increasing water scarcity and rising awareness of environmental sustainability, such practices have become unsustainable. Studies and observations show that a single condenser can waste nearly two million litres of water annually. Additionally, continuous water flow increases utility costs and places extra demand on freshwater supplies. These challenges highlight the need for an alternative system that can reduce water consumption while maintaining efficient condenser performance. This project aims to address this issue by introducing a portable water recirculating device designed for sustainable and efficient laboratory use. The purpose of this project is to design and develop a mini portable water

recirculating device for condenser apparatus that reduces excessive freshwater wastage in chemical laboratories. The device aims to replace the conventional continuous water flow system with an efficient closed-loop circulation method. By recirculating water using a pump, flow-rate regulator, and rechargeable power source, the system ensures effective cooling while conserving water. This project also aims to promote sustainable laboratory practices, reduce water and energy consumption, lower operational costs, and encourage the adoption of eco-friendly solutions in educational, research, and small-scale industrial laboratories. The methodology of the project involves the design, fabrication, and testing of a mini portable water recirculating device for condenser apparatus. Initially, the problem of excessive water wastage in conventional condenser systems was studied. Based on this, a closed-loop water circulation system was planned to minimize freshwater consumption while maintaining efficient cooling. A compact reservoir with a capacity of approximately four litres was selected to store the circulating water. A small electric water pump was installed to draw water from the reservoir and supply it to the condenser inlet. A flow-rate regulator was connected to control the speed of water flow according to the cooling requirement of the experiment. The outlet of the condenser was directed back into the same reservoir, ensuring continuous recirculation. The system was powered using rechargeable and replaceable batteries, along with a charging port and voltage regulator to ensure safe and energy-efficient operation. To maintain effective heat removal, 500 ml of ice-chilled water was added after every two hours of operation, while an equal amount of water was removed from the reservoir. Finally, the performance of the device was evaluated by comparing water consumption with and without the device under different flow rates and time intervals. The results confirmed a significant reduction in water usage, demonstrating the effectiveness and sustainability of the proposed system. The mini portable water recirculating device demonstrated a significant reduction in water consumption compared to the conventional condenser system. Experimental observations under slow, medium, and fast flow rates for durations of 1 hour, 12 hours, and 24 hours showed that the traditional method consumed large quantities of freshwater due to continuous discharge. In contrast, the proposed device operated efficiently using a closed-loop circulation system with only a small reservoir of approximately four litres. The periodic addition of 500 ml ice-chilled water every two hours maintained effective cooling performance without increasing overall water usage. Graphical comparisons indicated that water consumption was reduced by several hundred litres per day, depending on the flow rate. The condenser functioned effectively under all tested conditions, proving that recirculation did not compromise cooling efficiency. Overall, the results confirm that the device is highly effective in conserving water, reducing operational

costs, and promoting sustainable laboratory practices. The Mini Portable Water Recirculating Device for condenser apparatus successfully addresses the issue of excessive freshwater wastage in conventional laboratory cooling systems. By replacing the continuous flow method with a closed-loop recirculation system, the device significantly reduces water consumption while maintaining efficient condenser performance. The use of a compact reservoir, flow-rate regulator, and rechargeable power source ensures energy efficiency, portability, and ease of use. Experimental results confirm substantial water savings under various operating conditions without compromising cooling effectiveness. Overall, this device offers a practical, cost-effective, and eco-friendly solution that promotes sustainable laboratory practices and contributes to water conservation and environmental protection.

Keywords: Portable, Condenser, Mini

Development and Evaluation of Shata-Dhauta-Ghrita (SDG) Based Nano-Lipo-Cream for the Treatment of Psoriasis.

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Psoriasis is a chronic, immune-mediated inflammatory skin disorder marked by hyperproliferation of keratinocytes, erythema, scaling, and recurrent exacerbations, often requiring long-term management. Conventional topical and systemic therapies provide symptomatic relief but are associated with adverse effects, limited safety on prolonged use, and reduced patient compliance. *Shata-Dhauta-Ghrita* (SDG), a classical Ayurvedic formulation obtained by repeatedly washing ghee with water, is traditionally acclaimed for its anti-inflammatory, emollient, wound-healing, and skin-rejuvenating properties; however, its therapeutic potential is restricted by poor skin penetration and formulation limitations. The present study focuses on the development and evaluation of an SDG-based nano-lipo-cream to enhance its topical delivery and therapeutic efficacy in psoriasis. SDG is prepared according to classical Ayurvedic procedures and incorporated into a nano-liposomal system using modern pharmaceutical techniques to improve stability, permeability, and bioavailability of curcumin, clove oil and capsaicin. The optimized nano-lipo-cream is evaluated for physicochemical characteristics including particle size, zeta potential, pH, viscosity, spreadability, drug content uniformity, and in-vitro drug release. Ex-vivo skin permeation and stability studies are conducted to assess performance and formulation robustness. The anti-psoriatic potential of the formulation is evaluated using suitable experimental models through assessment of inflammatory markers, epidermal thickness, and histopathological changes, along with safety evaluation by skin irritation studies. The integration of nanotechnology for curcumin and capsaicin with a traditional Ayurvedic formulation is expected to enhance localized drug delivery, prolong residence time at the site

of action, and reduce systemic side effects. This research provides a scientific framework for the modernization and validation of Ayurvedic formulations and suggests that SDG-based nano-lipo-cream may serve as a safe, effective, and patient-compliant topical therapy for psoriasis.

a. Background / Introduction: Psoriasis is a chronic inflammatory skin disorder requiring long-term treatment, yet existing therapies are associated with adverse effects and limited safety on prolonged use. Although *Shata-Dhauta-Ghrita* shows therapeutic potential, its poor skin penetration due to large oil globule size limits efficacy. This work addresses the need to enhance its topical delivery and effectiveness through a scientifically optimized nano-lipo-cream formulation.

b. Objectives / Purpose: The main objective of this work is to develop & evaluate an efficient formulation with minimum side effects, maximum patient compliance, quick onset in the treatment of Psoriasis.

c. Methodology: *Shata-Dhauta-Ghrita* was prepared following classical Ayurvedic procedures and incorporated into a nano-liposomal cream using standard pharmaceutical techniques. The formulation was optimized and evaluated for particle size, zeta potential, pH, viscosity, spreadability, and drug content. In-vitro release, ex-vivo skin permeation, stability, anti-psoriatic efficacy, and skin irritation studies were performed using established experimental models.

d. Results / Findings: The developed SDG-based nano-lipo-cream exhibited uniform nanosized particles, good physical stability, and acceptable topical characteristics. In-vitro and ex-vivo studies indicated enhanced drug release and improved skin permeation compared to conventional SDG. Preliminary efficacy studies demonstrated reduced inflammation and epidermal thickening, while skin irritation studies confirmed good dermal safety.

e. Conclusion / Implications: The study demonstrates that nanotechnological modification of *Shata-Dhauta-Ghrita* significantly enhances its topical delivery and therapeutic potential in psoriasis. This work contributes to the scientific validation and modernization of Ayurvedic formulations, offering a safer, effective, and patient-friendly alternative for chronic skin disorder management while promoting integrative and sustainable healthcare approaches.

Keywords: Nano-Lipo-Cream

Application of Machine Learning for Flood analysis using SAR data in Dharali Tehsil, Uttarakhand, India (For event of July 2025)

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The present study focuses on assessing the July 2025 flood event in Dharali Tehsil, Uttarakhand, using Sentinel-1 Synthetic Aperture Radar (SAR) data integrated with Machine Learning techniques. Floods in Himalayan regions are often intensified by steep terrain, high rainfall variability, and rapid hydrological responses; therefore, timely and accurate flood mapping becomes crucial for disaster management. In this research, SAR imagery was processed to extract inundation areas under cloudy and monsoon-dominated conditions, where optical data remain limited. The study applies Machine Learning algorithms, including Random Forest (RF) and Support Vector Machine (SVM), to classify flooded and non-flooded areas by utilizing backscatter variations, terrain features, and water indices derived from pre- and post-event SAR datasets.

Digital Elevation Model (DEM) layers, slope, flow accumulation, and land-use patterns were incorporated to enhance classification accuracy and understand flood behavior across the mountainous landscape. Training samples were developed from field reports, local observations, and reference datasets to strengthen the model reliability. The final inundation maps clearly highlight the extent and severity of flooding across vulnerable settlements, agricultural fields, and riverine zones of Dharali Tehsil.

The outcomes of this study provide valuable insights for local authorities, planners, and disaster-management teams by supporting rapid flood assessment and future mitigation planning. The methodology also demonstrates the effectiveness of integrating SAR data with Machine Learning for real-time flood analysis in complex terrains.

Keywords: Flood Analysis, SAR Data, Machine Learning, SVM, GIS, DEM, LULC, Dharali, Uttarakhand.

Remote sensing and GIS Based Geomorphological mapping of Amravati district Maharashtra

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Geomorphological mapping is essential for understanding terrain characteristics, landform processes, natural resources, and environmental management. The present study employs Remote Sensing (RS) and Geographic Information System (GIS) techniques to prepare a detailed geomorphological map of Amravati District, Maharashtra. Satellite imagery, DEM (Digital Elevation Model), Survey of India toposheets, and secondary datasets were integrated to identify major landform classes. Various geomorphic units, such as structural hills, pediments, valley fills, alluvial plains, residual hills, escarpments, and floodplains, were delineated. The study highlights the spatial distribution of geomorphological features and their relationship with lithology, slope, elevation, and drainage. The results demonstrate the effectiveness of RS and GIS tools for terrain analysis and landform classification, useful for land-use planning, groundwater exploration, soil conservation, and watershed management in semi-arid regions like Amravati.

Keywords: Remote Sensing, GIS, Geomorphology, Amravati District, DEM, Landform Mapping

Assessment of Aquatic Macroinvertebrates Diversity in the Wardha River Freshwater Ecosystem near Morshi, Amravati

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Aquatic Macroinvertebrates are organisms without an internal skeletal system that represent a critical component of environment. Many organisms act as bioindicators because they are extremely sensitive to environmental disturbances, helping in monitoring pollution and ecosystem health. Freshwater Diversity of Aquatic Macroinvertebrates remains insufficiently documented, particularly benthic macroinvertebrates. River ecosystems are among most threatened globally. Macroinvertebrates, such as insects, annelids, molluscs are strongly affected by these environmental changes. This study addresses the lack of region-specific documentation regarding aquatic macroinvertebrates diversity in freshwater ecosystem.

Keywords: Aquatic Macroinvertebrates, Wardha River, Freshwater Ecosystem, Diversity

a. Objectives / Purpose

This study aims to assess the ecological health of the Wardha River in Morshi Taluka, Maharashtra, by evaluating the diversity, distribution, and community structure of aquatic macroinvertebrates in relation to water quality parameters and environmental disturbances. The study seeks to generate scientific evidence that supports effective freshwater management, biodiversity conservation, and sustainable resource use within the region.

b. Methodology

Fieldwork will be conducted along Wardha river near Upper Wardha Dam by collection of macroinvertebrates by using kick net or hand net with fine mesh, water quality measurement will be done recording parameters like temperature, pH, DO etc. Photographic collection will also be done, and survey data sheets will be used for each visit.

c. Result / Findings (Expected)

The study expects to document an updated checklist of aquatic macroinvertebrates and know how anthropogenic activities impact these crucial aquatic macroinvertebrates. Know the threats faced by these organisms, know habitat suitability for various aquatic macroinvertebrates and give conservation strategies that rise to the challenges of threats identified.

d. Conclusion / Implications

This research provides the first comprehensive baseline data on diversity of aquatic macroinvertebrates within Upper Wardha River. This findings will contribute to regional conservation management.

Integrated ANN-Driven Prediction of Urban Heat Island Intensification and LULC Change Patterns: A Case Study of Pune Tahsil, Maharashtra

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Urban Heat Island (UHI) intensification has become a major environmental issue driven by rapid urbanization and land transformation. This study, “Integrated ANN-Driven Prediction of Urban Heat Island Intensification and LULC Change Patterns: A Case Study of Pune Tahsil, Maharashtra,” analyzes and models the spatio- temporal variation of Land Surface Temperature (LST) and Land Use/Land Cover (LULC) for 2015, 2020, and 2025. Landsat 8 OLI/TIRS and Cartosat DEM v3R1 data were processed in QGIS for LST and LULC derivation, followed by ANN-based calibration and prediction in R. The results show a considerable rise in surface temperature across built-up areas and a decline in vegetation

cover, indicating growing UHI intensity. The ANN model effectively predicts future UHI trends, offering valuable insights for sustainable urban planning and environmental management in Pune Tahsil.

Keywords: UHI, ANN, LST, LULC, DEM, QGIS, R programming, Pune.

Spatio-Temporal Analysis and Machine Learning-Based Forest Fire Susceptibility Assessment of Nasik Tehsil, Maharashtra, India Using Google Earth Engine

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The study titled “Spatio-Temporal Analysis and Machine Learning-Based Forest Fire Susceptibility Assessment of Nasik Tehsil, Maharashtra, India Using Google Earth Engine (February 2024)” aims to evaluate the forest fire risk zones through advanced geospatial and data-driven techniques. Forest fires have become a recurring environmental hazard in the Nashik region, impacting vegetation cover, soil fertility, and ecological balance. This research integrates multi-source remote sensing datasets such as MODIS (fire hotspot data), Sentinel-2 (LULC, NDVI, and NBR), and DEM (topography) within the cloud-based Google Earth Engine (GEE) platform for efficient processing and analysis. Spatio-temporal analysis was conducted to identify the fire frequency, intensity, and distribution patterns during February 2024. Several biophysical and anthropogenic parameters—land surface temperature, vegetation indices, slope, aspect, and proximity to roads and settlements—were incorporated to develop the susceptibility model.

Machine learning algorithms such as Random Forest (RF) and Support Vector Machine (SVM) were trained to classify fire-prone areas and assess model accuracy using validation metrics. The results reveal that the southern and forest-dense regions of Nasik Tehsil show higher susceptibility due to dry vegetation and proximity to human activity. This study emphasizes the utility of GEE and machine learning for near-real-time forest fire monitoring and provides a scientific basis for regional forest management, fire prevention planning, and environmental protection strategies.

Keyword: Forest Fire, Susceptibility Mapping, Spatio-Temporal Analysis, Machine Learning

Comparative Study of Arachnid Fauna in Agro-Ecosystems of Amravati District, Maharashtra.

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Arachnids, particularly spiders and predatory mites, constitute one of the most ecologically significant groups of arthropods in terrestrial ecosystems. In agro-ecosystems, they play a vital role as natural enemies of insect pests, thereby contributing to biological control, ecological balance, and sustainable agriculture. Despite their importance, systematic studies on arachnid diversity in Indian agro-ecosystems remain limited, especially comparative assessments across different cropping systems. The Amravati District of Maharashtra, known for its diverse agricultural practices, lacks comprehensive baseline data on arachnid fauna associated with major crops. The present study entitled “Comparative Study of Arachnid Fauna of Agro-Ecosystems in Amravati District, Maharashtra ” aims to assess, document, and compare the diversity and abundance of arachnid fauna across different agro-ecosystems. The primary objectives include evaluating the current status of arachnid fauna in the study area, undertaking non-destructive photographic documentation for species identification, and comparing arachnid diversity among various crop ecosystems such as cotton, soybean, pigeon pea, and chickpea fields.

The study will be conducted during November 2025 to April 2026 across selected agricultural localities including Amravati, Salbardi, Morshi, Chandur Bazar, Bodna, and Valgaon. Monthly sampling will be carried out using standardized methods such as visual search, hand picking, sweep netting, and plant shaking to ensure comprehensive coverage of different microhabitats. Sampling plots and quadrates will be systematically laid out, and arachnids will be photographed in situ to record natural behavior and morphology. Identification will be carried out using standard taxonomic keys, manuals, and the World Spider Catalog. Environmental parameters such as temperature, humidity, and vegetation structure will also be recorded to support ecological interpretation. The expected outcomes of the study include the identification of a diverse assemblage of arachnid species with noticeable variations across different agro-ecosystems. Diversified and less pesticide-intensive cropping systems are anticipated to support higher arachnid diversity and abundance. The study is also expected to identify dominant predatory species contributing to natural pest regulation, thereby reducing

dependence on chemical pesticides. A major outcome will be the development of a preliminary photographic database of arachnid fauna from the region, which will serve as a valuable reference for future taxonomic, ecological, and educational purposes. In conclusion, this study will provide essential baseline data on arachnid diversity in agro-ecosystems of Amravati District and highlight their ecological significance in sustainable agriculture. The findings will support biodiversity conservation, promote eco-friendly pest management strategies, and contribute to integrated pest management programs. By emphasizing non-invasive documentation and comparative analysis, the research addresses key knowledge gaps and strengthens the role of arachnids as indicators of agro-ecosystem health.

Keywords: Arachnid diversity, Agro-ecosystem, Spiders, Biological pest control, Photographic documentation, Amravati District.

Optimization of Fermented Rice Water for Skin Care Use: Microbial and pH Evaluation.

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Rice (*Oryza sativa*) has been traditionally used in skincare, particularly in Asian cultures, due to its soothing, hydrating, and skin-brightening properties. Fermented rice water has gained increasing attention in cosmetic science as fermentation enhances the bioavailability of nutrients, organic acids, antioxidants, and bioactive compounds beneficial for skin health. However, uncontrolled fermentation may lead to microbial contamination and unsuitable pH levels, limiting its safe application.

The present study aims to optimize fermented rice water for potential skincare use by evaluating microbial composition and pH changes under different fermentation conditions. In this study, three rice varieties—normal polished rice (Idli rice), HMT rice, and brown rice—were selected to assess the influence of rice type on fermentation behavior. For each variety, three fermentation conditions were examined: whole rice fermented with water, rice water fermented after removal of grains, and heat-treated (boiled) rice water subjected to fermentation. Small-scale batch fermentation was carried out using sterile glass containers in the absence of a fermenter.

Fermentation progression was monitored through regular pH measurements and physical observations such as turbidity, sediment formation, and odor development. Microbial evaluation was performed at selected fermentation stages to assess total viable microbial load, lactic acid bacteria population, yeast and mold presence, and absence of potential pathogenic organisms. Selective and differential media were used to identify beneficial microorganisms and ensure microbiological safety. The dominance of lactic acid bacteria was considered a key indicator of controlled fermentation, as these bacteria are known to produce lactic acid, contribute to pH reduction, and inhibit harmful microbes. Results indicated that fermentation led to a gradual decrease in pH toward a mildly acidic range compatible with human skin. Differences were observed among rice varieties and fermentation conditions, highlighting the importance of substrate form and heat treatment in controlling microbial growth and acidification. Rice water-only and heat-treated samples generally showed cleaner fermentation profiles with reduced contamination risk, making them more suitable for skincare application. In conclusion, this study demonstrates that controlled fermentation of rice water can produce a skin-friendly, microbiologically safe product when appropriate rice type and processing conditions are selected. Optimization based on microbial evaluation and pH monitoring provides a scientific foundation for transforming traditional fermented rice water into a safe, effective, and natural skincare ingredient.

Keywords: Fermented rice water, Lactic acid bacteria, pH optimization, Skin care.

Black Soldier Fly (*Hermetia illucens*) Rearing for Sustainable Animal Feed and Emerging Human Protein Source

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The Black Soldier Fly (BSF, *Hermetia Illucens*) has emerged as a promising agent for bio-economy models, addressing critical challenges related to organic waste management and protein supply. BSF larvae, converting waste into a valuable biomass high in protein and fat content. The larvae demonstrate exceptional bioconversion efficiency, transforming a wide range of organic residues into high-value biomass rich in proteins, lipids, and micronutrients. Particular attention is given to their application in aquaculture, poultry, swine, and pet nutrition, where they enhance growth, immunity, and sustainability. The synergistic activity of larval gut microbiota facilitates the degradation of complex organic matter and the generation of biofuels.

Additionally, larval extracts exhibit bioactive, immunomodulatory, and chitin-rich properties, offering potential applications in pharmaceuticals, cosmetics, and biodegradable materials. BSF-derived products also show potential as alternative protein sources for human consumption, offering high nutritional value and low environmental impact. Start-ups in this sector benefit from Business model that addresses global challenges in waste management and sustainable protein production offering strong commercial and environmental advantages. BSF, Larvae effectively replace expensive and environmentally taxing fish meal and soybean meal. It addresses organic waste issue, reduces methane emission, lowers carbon footprint. This technology allows for controlled, efficient production with potential for large-scale operation, close loops in food system, promoting resource efficiency. Beyond nutrition, BSF production offers significant environmental advantages that address key challenges in the protein industry, in Waste Bioconversion, reduce land & Water use and Lower Green House Gas Emission.

Keywords: Black soldier fly, BSF, Cosmetic, nutrition, Production, Food

Future Land Use Prediction Modelling using CA–Markov and Terr Set: A Case Study of Nagpur City

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Rapid urbanization in Indian cities demands accurate land use prediction models to support sustainable planning. This study applies the Cellular Automata–Markov (CA–Markov) model integrated within TerrSet GIS software to predict future land use and land cover (LULC) changes in Nagpur City, India. Multi-temporal satellite images from 2015, 2020, and 2025 were analyzed to classify major LULC categories using supervised classification techniques. This approach enabled the identification of four land use categories: water bodies, vegetation, barren land, and urban/built-up area. The Markov Chain model estimated transition probabilities between land use classes, while the Cellular Automata component spatially simulated future patterns based on neighborhood interactions and transition suitability maps. Model validation was performed using the Kappa Index of Agreement, which confirmed high predictive accuracy. The results indicate substantial expansion of built-up areas, primarily replacing agricultural and vegetated zones. This increase in urban land use is driven by sustained economic and demographic growth, while water bodies remain largely stable and changes are more prominent in vegetation cover. The predicted 2030 LULC map suggests continued urban

sprawl along transportation corridors and the city's periphery. The findings demonstrate that the CA–Markov model in TerrSet is a powerful tool for capturing urban growth dynamics and can guide planners toward more sustainable land management strategies in rapidly developing cities such as Nagpur.

Keywords: Land Use/Land Cover, ArcGIS, CA–Markov Model, TerrSet, Urban Growth, Spatial Prediction, Nagpur City

Larvicidal Activity of Leaf Extract of *Annona squamosa* against larvae of *Anopheles annularis* & *Aedes aegypti*.

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Mosquito-borne diseases such as malaria, dengue, chikungunya and filariasis remain among the most serious public health problems in tropical and subtropical regions. The increasing resistance of mosquito vectors to synthetic insecticides, along with their harmful environmental effects, has created an urgent need for alternative eco-friendly vector control strategies. Plant-derived bioactive compounds offer promising potential as natural larvicidal agents. In this context, the present study focuses on evaluating the larvicidal activity of leaf extracts of *Annona squamosa* against larvae of *Aedes aegypti* and *Anopheles* mosquitoes in the Amravati region of Maharashtra, India. The main objectives of this work were: (1) to prepare aqueous, ethanolic and methanolic extracts of *Annona squamosa* leaves using standard extraction procedures, (2) to conduct qualitative phytochemical screening of these extracts to identify major groups of secondary metabolites, (3) to perform larvicidal bioassays on 4th instar larvae of *Aedes aegypti* to determine dose-dependent mortality at 24 and 48 hours, and (4) to characterize the most effective extract using spectroscopic techniques such as UV-Visible and FTIR analysis for preliminary identification of active constituents. Fresh leaves of *Annona squamosa* were collected from local areas and processed for extraction. The dried leaf powder was subjected to solvent extraction separately in distilled water, ethanol and methanol. Phytochemical tests were carried out for alkaloids, flavonoids, tannins, saponins, terpenoids and phenolic compounds. Laboratory-reared 4th instar larvae of *Aedes aegypti* were exposed to different concentrations of each extract ranging from 20 to 100 ppm following WHO-recommended larval susceptibility protocols. Larval mortality was recorded after 24 and 48 hours, and the data were statistically analyzed using probit analysis to calculate LC₅₀ and LC₉₀.

values. UV-Vis spectra were taken to detect absorption peaks of bioactive molecules, while FTIR analysis was performed to identify functional groups present in the extracts. The results of phytochemical screening revealed the presence of several important secondary metabolites in *Annona squamosa* leaves, particularly in the methanolic extract. Larvicidal bioassays demonstrated significant mortality of *Aedes aegypti* larvae in all extracts, with the methanolic extract showing the highest efficacy. A clear dose-response relationship was observed, and mortality increased with both concentration and exposure time. The calculated LC50 values at 24 hours were comparatively higher than those at 48 hours, indicating enhanced toxicity over time. UV-Visible analysis of the methanolic extract exhibited prominent peaks corresponding to phenolic and flavonoid compounds. FTIR spectra confirmed the presence of hydroxyl, carbonyl and aromatic functional groups, suggesting that these chemical constituents may be responsible for the observed larvicidal effects. From the findings it can be concluded that *Annona squamosa* leaf extracts possess potent larvicidal activity against *Aedes aegypti* and therefore represent a viable, low-cost and environmentally safe alternative to conventional chemical larvicides. The study contributes to the field of botanical insecticides by providing comparative evaluation of different solvents and correlating phytochemical composition with biological activity. Implementation of such plant-based formulations could aid integrated mosquito management programs and reduce the burden of vector-borne diseases in society. Further purification and chromatographic identification of specific active compounds are recommended for future research.

Keywords : *Annona squamosa*, Mosquito Control, Larvicidal Activity, Phytochemicals, FTIR Analysis

Species Diversity and Habitat Utilization of Dragonflies in Fresh Water Ecosystem of Wardha River at Morshi, Amravati

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Dragonflies and damselflies (Order: Odonata) are ecologically important insects that serve as reliable bioindicators of freshwater ecosystem health due to their dual aquatic–terrestrial life cycle. Freshwater habitats such as rivers, ponds, and wetlands in central India are increasingly threatened by pollution, agricultural runoff, habitat modification, and climatic variability. Despite Maharashtra supporting rich odonate diversity, systematic and habitat-based studies

from semi-urban and agricultural landscapes like the Upper Wardha region of Amravati district remain limited. This study focuses on documenting dragonfly diversity and understanding their habitat utilization in relation to environmental conditions along the Wardha River freshwater ecosystem near Morshi.. The primary objectives of the study are to assess species diversity, abundance patterns, and habitat utilization of dragonflies across different freshwater habitats of the Upper Wardha region. The study also aims to examine the relationship between odonate diversity and environmental variables such as water quality, vegetation cover, and habitat type, and to identify key anthropogenic threats affecting dragonfly populations. The study will be conducted over a six-month period (November 2025 to April 2026) using a stratified sampling approach across river stretches, ponds, canals, and wetlands. Dragonflies will be surveyed using visual encounter surveys along fixed line transects during peak activity hours. Larval sampling will be carried out using hand nets in shallow and vegetated zones. Environmental parameters including pH, temperature, dissolved oxygen, vegetation cover, and anthropogenic disturbances will be recorded at each site. Species identification will be supported through field guides and photographic documentation. The study is expected to record a diverse assemblage of dragonfly species, with higher diversity and abundance in habitats exhibiting good water quality and dense aquatic or riparian vegetation. Seasonal variation is anticipated, with increased abundance during favorable climatic conditions. Sensitive species are expected to be more prevalent in less disturbed habitats, while pollution-tolerant species may dominate modified or degraded sites. This study will provide baseline ecological data on dragonfly diversity and habitat utilization in the Upper Wardha freshwater ecosystem. The findings will enhance understanding of odonates as bioindicators of freshwater health and support conservation planning in Amravati district. The results will be valuable for biodiversity monitoring, habitat management, and sustainable freshwater ecosystem conservation in central India.

Keywords : Fresh Water, Abundance, Diversity, Dragonfly.

Nutri Code: A DNA-Based Personalized Nutrition Recommendation Application

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Rapid changes in lifestyle, dietary habits, and genetic predisposition have significantly increased the burden of lifestyle-related disorders such as obesity, diabetes, cardiovascular diseases, and micronutrient deficiencies. Conventional dietary recommendations often fail to consider individual genetic variability, leading to less effective outcomes. Nutrigenomics, the study of the interaction between nutrition and genes, provides a promising approach to personalized nutrition planning. **Objectives:** The primary objective of the NutriCode application is to develop a user-friendly, DNA-based personalized nutrition recommendation system. The app aims to educate users about gene–nutrient interactions, identify potential disease risks associated with specific genes, and provide customized dietary suggestions based on genetic profiles. NutriCode is designed as a mobile-based application model developed using a low-code platform. The application allows users to input specific gene names (such as FTO, MTHFR, APOE, and others) manually or through demo-based scanning. A predefined gene–nutrient logic database is integrated into the app, which links gene variants with nutrient metabolism, disease susceptibility, and dietary recommendations. The recommendations are based on established nutrigenomic research and adapted to Indian dietary patterns. The app layout includes gene cards, result screens, disease risk indicators, and food recommendation modules. The NutriCode app successfully demonstrates the concept of personalized nutrition based on genetic information. The app provides clear gene-based explanations, identifies possible future disease risks, and suggests suitable foods, nutrients, and dietary habits. Preliminary testing shows that users can easily understand gene functions and personalized diet outputs, making the app suitable for academic demonstration, awareness programs, and innovation competitions. **Conclusion:** NutriCode highlights the potential of integrating nutrigenomics with digital health tools to promote personalized nutrition and preventive healthcare. The app contributes to increasing awareness about gene-based nutrition and encourages proactive dietary modifications. With further validation and clinical integration, NutriCode can serve as a valuable tool for nutrition professionals and individuals seeking personalized dietary guidance.

Keywords: NutriCode App, DNA-Based Nutrition, Personalized Diet, Nutrigenomics, Disease Risk Prediction

NEXORA (Nature Exist on Real Aranya)

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In our country loss of fruits and vegetables is a major problem caused by moisture loss, microbial spoilage and fast ripening. In this project a green nano- emulsion based-- edible coating was developed using natural and bio degradable materials to improve the self-life of fruits and vegetables. The nano-emulsion was prepared by blending a natural antimicrobial essential oil with distilled water using a food-grade emulsifier and biopolymer. Which is applied by dipping/spray, the coating forms a thin, uniform and stable layer on the surface of fruits and vegetables. The coated fruit and vegetables showed low weight loss, slow respiration and reduced microbial growth compared to uncoated fruits and vegetables during storage at room temperature. The coating also helps to maintain a firmness, appearance and overall qualities. By using nano sized droplets, the coating achieved better efficiency with minimal use of active materials, supporting green chemistry principle. Overall, the study shows that nano-emulsion edible coatings are safe, eco- friendly and effective methods for extending fruits and vegetables self-life, with strong potential to reduce post-harvest in food storage and supply chain. India loses nearly 30-40% of fruits and vegetables every year due to improper storage and preservation. Existing chemical wax coatings and industrial edible coatings are expensive and raise health concerns among consumers. Small farmers and street vendors cannot afford such technologies. This project is a natural edible low-cost herbal nano emulsion coating prepared from Indian leaf waste to extend the shelf life of fruits and vegetables. Basically, India is a farming country so agriculture is a backbone of India because of this we have loads and loads of Agri wastages to prevent this we are proposing organic nanoemulsion coating spray from herbal leaf waste. Chemical wax coating is expensive and raises health concerns, especially for small farmers and street vendors. My startup idea focuses on a low cost, edible herbal nano emulsion coating prepared from discarded herbal leaf waste such as curry leaves, neem leaves etc., this coating forms an invisible protective layer on fruits and vegetables, reducing moisture shelf life naturally. The innovation lies in combining waste utilization, green chemistry and affordable technology, making it accessible to small scale users. This solution not only reduces food waste but also increases farmer income and promotes sustainable development. To utilize herbal leaf waste for value added application. To develop a safe edible

nano emulsion coating. To study self-life extension of coated products. To design a scalable and affordable startup model. Uses waste leaves, not fresh raw materials. Uses nano emulsion technology, not harmful nano particles. Designed especially for Indian climatic and market conditions. Based on the green chemistry principle. To create an herbal nano emulsion for coating, we mix herbal extract (oil phase), Surfactant and co solvent, then rapidly disperse this into water (aqueous phase) using high energy methods like (homogenization/sonication) or low energy method (PIT-phase inversion temperature) to achieve nano particles (20-200nm) stabilized by emulsifiers, often followed by coating onto a surface like fruit using methods to ensure good coverage and durability. Collect herbal leaf waste. Preparation of aqueous herbal extract. Addition of natural polymer and food grade emulsifier. High-speed stirring to form nano emulsion. Dipping or spraying on fruits and vegetables. Reduction of food waste. Chemical free food preservation. Increased income for farmers and vendors. Promotion of sustainable entrepreneurship. Nano emulsion edible coating has proven to be an effective and environmentally friendly approach for extending the shelf life of fruits and vegetables. The Nano-Sized droplets ensure uniform coverage; minimize water loss, delays respiration and suppress microbial activity. The finding of this study indicate that coating Prepared from natural organically and bio degradable materials can significantly Preserve fruit quality and enhance storage stability, highlighting the potential as a Sustainable post-harvest technology.

Keywords: Nano emulsion, coating, prevents fruit and vegetable waste.

ECOVA- eco + nova = limitless new innovation of eco system

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Day to day fisher men were catching large quantity of different types of fishes, some days they couldn't get a enough of fishes and farmers, they also face the losses because their products doesn't have a constant value, instead of selling they throw it into trash so I thought to create an app or small cottage company where we buy large quantity of freshly caught fish and sell it on online and offline basis with minimal price on retail and wholesale. The freshly caught fishes were only available for those around the coastal area but villages and the towns which have long distance from coastal areas were couldn't be able to afford the fresh fish In online base the buyer can place an order to buy fish then we can deliver the product as soon as possible

to them by following the set of protocols, on second day we'll take next step to make dry fish which is also can be sell on the online and offline market also and those fishes waste were poured on biogas tank side by side it will ferment and form biogas. The fermented slurry collected from the biogas tank worked as organic fertilizer which helps in improving soil fertility and crop production. Nagapattinam partially belongs to fishing and farming; those are the main source of income to the peoples. When the fish and Agri products spoiled they were unable to use which became organic waste. Sometimes harmful chemicals like formalin were used on fish and Agri products to prevent it from spoilage. Due to health concerns, I propose a idea focused on creating an app or startup company to get gold from waste. By my idea, by using one raw material, we get many by-products like bio gas, organic fertilizer, and by selling fresh fish which help us increase income To give fresh fish to the people using technology. Creating a website to sell fresh fish. Make it dry fish after 24hrs then sell them. Fetching fish waste like skin, gut, gill etc. Then collecting Agri, animal and human waste to produce biogas and bio/organic fertilizer... Collecting fishes from the sellers then sold them online and offline. Then proceed to make dry fish. Takes the waste to next step as biogas: Fish and Agri waste is chopped or crushed mixed with water or cow dung (to balance acidity). Fed into a biogas digester and anaerobic bacteria produce biogas. The plant consists of two parts. the digester which is well containing the fish and Agri waste in the form of a slurry and the dome which floats on the slurry and serves as the gas holder. The digester is normally below ground level and two pipe lines lead to its bottom. One for feeding the waste slurry and other for spent slurry called sludge to come out after it has undergone fermentation it is worth noting that the sludge to come out retains all the nitrogen, phosphorus, and potassium and in an excellent fertilizer. A vertical partition wall divides into two equal parts and serves to direct the flow of the slurry. The gas generation process occurs in two stages. In the first stage the complex organic substances contained in the waste are acted upon by a certain kind of bacteria called acid formers and are broken up into small chain simple acids. In the second stage, these acids are acted upon by another kind of bacteria which produces Methane and Carbon dioxide. Anybody can easily buy fresh fishes and dry fishes without facing any difficulties which cost them with minimal price. It gives many by-products like renewable resources e.g.: - Biogas'. Biogas can reduce the consumption of commercial energy such as coal, kerosene, by adopting waste recycling technology which vigorously helps in reducing the family fuel budget. Cheaper and better fuel for cooking and power generation. Lungs and eye diseases are very common among the village women and children due to the smoky kitchen. Biogas utilization reduces health problems, rush in hospitals and waste of national wealth. Biogas technology reduces the

importance of chemical fertilizer by using the organic fertilizer and also petro products. Basically, our project is eco-friendly as it has a base of zero waste. Starting from fresh fish is the best start up to do, then comes the biogas which helps us in many ways. At the final step it becomes the bio fertilizer which helps to do agriculture, like this it will be recycled every time.

Keywords: Fresh fish, dry fish, biogas.

Synthesis and Infrared Emission Characteristics of Gadolinium-Mediated Zirconate Pyrochlore Phosphors

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Zirconate pyrochlore oxides are attractive host materials for rare-earth-based phosphors due to their high thermal stability, structural flexibility, and ability to accommodate energy transfer-active dopant ions. In the present work, gadolinium-mediated zirconate pyrochlore phosphors with composition $\text{La}_{2-x}\text{Gd}_x\text{Zr}_2\text{O}_7$ are synthesized using a sol-gel method to achieve homogeneous dopant distribution and controlled crystallinity. Gd^{3+} ions are incorporated as an energy migration mediator owing to their half-filled $4f^7$ electronic configuration, which facilitates efficient energy transfer within the pyrochlore lattice. Structural characterization is performed to confirm the formation of the ordered pyrochlore phase and successful incorporation of Gd^{3+} ions. Optical investigations are carried out using higher-energy excitation in the ultraviolet and visible regions, while the resulting emission is examined in the infrared region to establish the infrared luminescence behavior of the synthesized phosphors. These studies provide essential insight into the suitability of Gd^{3+} -mediated zirconate pyrochlores as host materials for infrared-emitting phosphors and form a foundation for future infrared down conversion investigations.

Keywords: Zirconate pyrochlore, Gadolinium-mediated phosphors, Infrared emission, Rare-earth doping, Sol-gel synthesis, Energy migration, Photoluminescence.

Artificial Neural Network-Based Modelling of Urban Heat Island Dynamics and Future LULC Prediction: A Geospatial Approach for Nagpur Tahsil, Maharashtra

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This study examines and predicts Urban Heat Island (UHI) conditions in Nagpur Tehsil using satellite-based indicators and an Artificial Neural Network (ANN) modelling approach. Landsat imagery from 2015, 2020, and 2025 was processed to generate key environmental indices, including NDVI (vegetation), SAVI (soil–vegetation), NDBI (built-up areas), NDWI (water bodies), and LST (Land Surface Temperature). A Land Use/Land Cover (LULC) map was also developed to capture changes in urban, vegetated, water, and other land categories over time. These indicators collectively help explain how vegetation cover, urban expansion, soil characteristics, and water availability influence surface temperature dynamics.

The results indicate that expanding built-up areas and declining vegetation have contributed to elevated surface temperatures across several parts of the region. All derived parameters were used as input variables for an ANN model trained to predict UHI patterns and temperature variations with improved accuracy.

The findings demonstrate that ANN is a robust tool for identifying heat-prone zones and evaluating the impacts of rapid urbanization. The model effectively delineates current and emerging UHI hotspots across Nagpur Tehsil. This research provides valuable insights for urban climate assessment and establishes a scientific foundation for sustainable urban planning, green infrastructure development, and heat-mitigation strategies in fast-growing urban environments.

Keywords: Urban Heat Island (UHI); Land Surface Temperature (LST); Artificial Neural Network (ANN); Landsat; NDVI.

Future Land Use Prediction Modelling using CA Markov and TerrSet: A case study of Amravati city

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This study evaluates future land-use and land-cover (LULC) dynamics in Amravati City using an integrated Geographical Information System (GIS) and Cellular Automata–Markov (CA–Markov) modelling framework within TerrSet software. Multi-temporal satellite images from 2015, 2020, and 2025 were processed to generate LULC maps through supervised classification. These maps formed the basis for identifying historical land transformation patterns and quantifying transition probabilities among various land-use categories. The

Markov Chain model estimated the likelihood of future conversions, while the Cellular Automata component spatially allocated these changes by considering neighbourhood effects and land suitability factors.

Model performance was assessed using validation statistics, which showed strong agreement between simulated and reference maps. Based on the calibrated model, LULC for the year 2030 was predicted. The results reveal notable urban expansion toward the eastern and southwestern parts of Amravati, accompanied by a decline in agricultural land and open spaces. These trends indicate rising developmental pressure and emphasize the importance of sustainable land-use planning.

Overall, the study demonstrates that CA–Markov modelling is an effective tool for predicting future land-use scenarios and can support urban planners, policymakers, and local authorities in making informed planning and management decisions for Amravati City.

Keywords: Land Use/Land Cover (LULC); Future Land Use Prediction; CA–Markov Model; TerrSet Software, Urban Expansion, Amravati City.

Visualization of Subsurface Aquifer Geometry Using Borewell Data and ArcGIS

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Groundwater plays a crucial role in meeting domestic and agricultural needs in the Northern Morshi Taluka of Amravati district. However, seasonal rainfall patterns and increasing extraction have placed considerable pressure on the existing aquifer systems. Understanding subsurface aquifer geometry is therefore essential for effective and sustainable groundwater management.

This study focuses on developing a 3D visualization of aquifer surfaces using borewell data and ArcGIS to evaluate groundwater conditions across the region. Borewell data—including latitude, longitude, elevation, and aquifer depth—were collected from multiple locations and processed to generate spatially continuous representations of the aquifer. Using ArcGIS tools and ArcScene, the dataset was interpolated to construct a 3D model illustrating aquifer top and bottom depths, thickness, and spatial variability.

The resulting visualization highlights zones with shallow and deep aquifers, potential recharge areas, and regions exhibiting notable fluctuations in groundwater levels. The study shows that

3D GIS modeling improves the interpretation of subsurface information compared to traditional mapping techniques. The findings offer valuable insights for groundwater assessment, agricultural planning, and sustainable resource management in semi-arid environments. This approach can also serve as a framework for future hydrogeological studies and groundwater monitoring in similar terrains.

Keywords: 3D Aquifer Visualization, Borewell Data, ArcGIS, Arc Scene, Groundwater Assessment, Northern Morshi Taluka.

Extraction of Caffeine from different tea samples

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Caffeine is a bitter, white, crystalline alkaloid and stimulant drug found in a wide variety of seeds, leaves, and fruits of plants, where it acts as a natural pesticide. Tea is a commonly consumed beverage and contains caffeine as an inherent component. The objective of this project is to determine the concentration of caffeine in selected commercially available tea brands in the Croatian market. The caffeine content in ten tea beverage samples was determined using the ultraviolet (UV) spectrophotometry method. Chloroform was used as the extracting solvent with different bases. The concentration of caffeine was measured at a wavelength of 274 nm for ten samples of each selected tea beverage. The method employed is convenient, rapid, effective, and low-cost. The results showed that caffeine was detected in all analysed tea samples, confirming its presence as an inherent component of tea. The study demonstrates that UV spectrophotometry is an effective and economical method for determining caffeine content in tea. The findings confirm that all selected commercial tea brands contain caffeine, highlighting its ubiquitous presence in tea beverages.

Keywords: Caffeine, Liquid-Liquid Extraction and Iodometric back Titration

Synthesis And Characterization Of Transition Metal Oxides Based Nanocomposite By Glycine Associated Sol Gel Auto Combustion Technique

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In this study, cobalt ferrite (CoFe₂O₄) nanocomposites were synthesized using a glycine-assisted sol-gel auto-combustion technique by varying the molar ratios of cobalt nitrate to ferric nitrate as 10:10, 8:12, and 6:14. Glycine served both as a fuel and complexing agent, facilitating uniform gel formation and controlled combustion. The effect of precursor ratio on the structural, morphological, and magnetic properties of the resulting nanocomposites was systematically investigated. X-ray diffraction (XRD) confirmed the formation of a single-phase spinel structure, with crystallite sizes in nanometer range. The study demonstrates that fine-tuning the precursor ratio is an effective approach to modulate the physicochemical properties of cobalt ferrite nanocomposites for potential applications in magnetic storage, catalysis, and biomedical fields.

Keywords: Transition-metal Co-Fe Nanocomposite, Sol-gel method, Characterization.

A Biogeochemical Approach to CO₂ Monitoring: Upscaling Flux Tower Data with Remote Sensing and BIOME-BGC

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CO₂ is among the abundant greenhouse gases responsible for human-induced global warming. Knowing the volume of CO₂ exchanged between different ecosystems or aggregated, as well as the total carbon conversion, is one of the most important metrics for ultimately assessing the reduction in the use of diverse carbon materials. However, obtaining any such objective measure at the global scale, gaining an empirical evidence of CO₂ becomes quite challenging because of the spatial variability within ecosystems and the different environmental conditions. The present study was conducted to determine the carbon flux in the dry deciduous forest at Betul where there is significant effect of seasonal leaf fall on carbon dynamics. To quantify these effects, we used a BIOME-BGC model to estimate gross primary productivity (GPP) and compared it with satellite-derived GPP from the MODIS GPP product (MOD17A2H). The model is calibrated and validated with flux tower data while remote sensing supplements some critical environmental variables for upscaling. Such an integrated approach permits simulation of CO₂ fluxes across a variety of ecological systems to provide high-resolution information on carbon dynamics under diverse environmental aspects. Remote sensing data on vegetation

indices and land cover changes were integrated to obtain most important environmental variable. By integrating these inputs derived from remote sensing, we improved the predictability of the BIOME-BGC model, reflecting more realistic estimates of ecosystem productivity. We have demonstrated that this integration of the flux tower data, remote sensing, and the BIOME-BGC model will enhance CO₂ monitoring at larger scales significantly. Providing valuable tools for use by policymakers and researchers in the making of informed decisions in carbon management and climate change mitigation.

Keywords: CO₂ flux, GPP(Gross Primary Productivity),MODIS GPP (MOD17A2H), Remote sensing, BIOME-BGC model

Computational screening of phytochemicals from Melghat medicinal plants against helicase proteins from the Coronaviridae family

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Different viral strains, particularly those belonging to the Coronaviridae family, may continue to pose significant threats in the future. The emergence of COVID-19 and its global impact highlight the urgent need to explore alternative therapeutic strategies. In this study, we performed comprehensive in silico phytochemical screening and molecular docking analyses targeting coronavirus helicase proteins using AutoDock Vina. Helicase enzymes play a central role in viral replication and pathogenesis, making them attractive antiviral targets. A total of 3999 phytochemicals derived from approximately 270 medicinal plants indigenous to the Melghat forest region of Maharashtra were screened against three helicase proteins (PDB IDs: 5RL9, 5WWP, 6JYT) representing Severe Acute Respiratory Syndrome coronavirus 2, Human betacoronavirus 2c EMC/2012, and Severe Acute Respiratory Syndrome–related coronavirus. The analysis revealed several phytochemicals with strong binding affinities, with top compounds showing docking scores ranging from –10.00 to –11.64 kcal/mol. To contextualize these results, a comparative docking evaluation was performed using three known helicase inhibitors—Bananin, Bismuth Subcitrate, and SSYA10-001. Several Melghat-derived phytochemicals outperformed these reference compounds, further supporting their antiviral potential. Among them, Mimonoside A and Mimonoside B, isolated from *Mimosa hamata* roots, demonstrated exceptionally strong binding affinities and favorable predicted inhibitory constants (K_i), suggesting their potential as lead molecules for further validation. Furthermore,

exploratory docking of a representative Ag₁₃ nanocluster provided preliminary support for the antiviral relevance of green-synthesized silver nanoparticles. Overall, the combined phytochemical, control-compound, and nanoparticle docking results provide a strong *in silico* foundation for identifying novel antiviral candidates and support the experimental development of Mimosa-derived phytochemicals and green-synthesized AgNPs for future antiviral applications.

Keywords: Coronavirus helicase; *in silico* screening; Molecular docking; Medicinal plants; Phytochemicals; Melghat forest; Silver nanoparticles; AgNPs; Antiviral agents

Nickel Doped Molybdenum Sulfide Nanoparticles for Supercapacitive Applications

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Nickel-doped molybdenum sulfide (NiMoS) nanoparticles have emerged as promising electrode materials for high-performance supercapacitors due to their exceptional pseudocapacitive properties and remarkable electrochemical performance. Various synthesis approaches including hydrothermal and electrodeposition methods have been employed to fabricate nanostructured NiMoS materials with tailored morphologies. The incorporation of nickel into molybdenum sulfide lattice enhances electrical conductivity, increases specific capacitance and optimizes electronic structure through synergistic bimetallic effects. Optimized NiMoS electrodes achieve specific capacitance values ranging from 616.7 to 2352.4 F g⁻¹, with energy densities exceeding 60 Wh kg⁻¹ in asymmetric supercapacitor configurations. The enhanced performance is attributed to improved ion diffusion kinetics and favorable charge transfer properties. Integration of NiMoS with carbon-based materials and graphene demonstrates synergistic improvements in cycling stability and rate capability. This work highlights the significant potential of nickel-doped molybdenum sulfide as a high-performance electrode material for next-generation supercapacitors and emphasizes future research directions toward sustainable energy storage solutions.

Keywords: Nickel-doped molybdenum sulfide, supercapacitors, pseudocapacitive materials, energy storage, specific capacitance

Ecotoxicological Risk Assessment of Emerging Contaminants from Coal Mines and Thermal Power Plant Discharges in the Vidarbha Region, Maharashtra

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The Vidarbha region of Maharashtra is one of India's major coal mining and coal-based thermal power generation hubs, contributing significantly to national energy production and industrial development. However, these activities generate large volumes of effluents, fly ash, leachates, and mine drainage that introduce complex mixtures of pollutants into surrounding soil and water systems. Environmental monitoring frameworks in India largely emphasize conventional pollutants, while emerging contaminants such as polycyclic aromatic hydrocarbons (PAHs), trace heavy metals, endocrine-disrupting compounds, and persistent organic pollutants remain insufficiently monitored despite increasing evidence of their long-term ecological and human health risks. These contaminants are capable of bioaccumulation, biomagnification, and chronic toxicity even at low concentrations, posing serious threats to aquatic and terrestrial ecosystems. In coal-dependent regions like Vidarbha, where rivers, agricultural lands, and human settlements coexist near industrial sources, the lack of a region-specific ecotoxicological risk assessment framework presents a critical environmental challenge. This doctoral research aims to assess the ecotoxicological risks associated with emerging contaminants released from coal mines and thermal power plant discharges in the Vidarbha region. The study seeks to identify and quantify major emerging contaminants in water and soil, evaluate their ecological effects through bioassays and bioaccumulation studies, map spatial distribution patterns and pollution hotspots using GIS and remote sensing, and develop a comprehensive risk assessment framework to support sustainable environmental management and policy decision-making. An integrated multidisciplinary approach will be adopted, combining field sampling, laboratory analysis, and risk modelling. Six major coal mining and thermal power plant sites will be selected for systematic sampling of surface water, groundwater, soil, and biological samples. Physico-chemical parameters and emerging contaminants will be analysed using advanced analytical techniques including GC-MS, LC-MS, and ICP-MS. Ecotoxicological evaluation will be conducted using standard bioassays involving aquatic and terrestrial organisms, along with bioaccumulation and biomagnification assessments. GIS-based analysis will be applied to identify contamination hotspots and assess

spatio-temporal trends. Preliminary assessments and literature-supported observations indicate elevated concentrations of PAHs and trace metals near ash ponds, mine drainage zones, and effluent discharge points, with increased contamination during monsoon periods. The study is expected to generate baseline data on emerging contaminants, establish ecological risk profiles for the region, and provide evidence-based recommendations for regulatory agencies. The outcomes will contribute to environmental protection, public health safeguarding, and sustainable management of coal-based industrial activities, while aligning with Sustainable Development Goals related to clean water, climate action, and ecosystem conservation.

Keywords: Emerging Contaminants, Ecotoxicological Risk Assessment, Coal Mining and Thermal Power Plants, Polycyclic Aromatic Hydrocarbons (PAHs), Vidarbha Region.

Environmentally Benign 'On-Water' Synthesis of Oxindole–Pyrazolone Hybrid Scaffolds under catalyst free conditions.

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Heterocyclic compounds containing the Oxindole framework have attracted considerable attention in organic and medicinal chemistry due to their widespread occurrence in natural products and their diverse biological activities, including anticancer, antimicrobial, anti-inflammatory, and antiviral properties. In particular, substituted 3-hydroxy-2-oxindoles represent an important class of scaffolds that serve as key intermediates in drug discovery and pharmaceutical synthesis. Conventional synthetic approaches for these compounds often require metal catalysts, harsh reaction conditions, toxic organic solvents, prolonged reaction times, and multi-step procedures, which limit their sustainability and practical applicability. In view of the growing emphasis on green chemistry, the development of environmentally benign, efficient, and catalyst-free synthetic methodologies remains a significant research priority. The primary objective of the present project was to develop a simple, rapid, and green synthetic protocol for the preparation of substituted 3-hydroxy-2-oxindoles using readily available starting materials under mild reaction conditions. The study aimed to eliminate the use of catalysts and hazardous solvents while achieving high yields and broad substrate scope through a one-pot multicomponent strategy. In this work, an unprecedented one-pot, three-component

reaction involving hydrazine hydrate, ethyl acetoacetate, and various substituted isatins was carried out in water as a green reaction medium. The reactions were performed under mild conditions without the addition of any external catalyst. Water was selected as the solvent due to its non-toxic, cost-effective, and environmentally friendly nature. The methodology relied on simple mixing of the reactants followed by brief stirring, leading to rapid formation of the desired products. The products were isolated by simple filtration or minimal purification techniques, highlighting the operational simplicity of the protocol. The developed methodology demonstrated excellent efficiency, providing heteroaromatic substituted 3-hydroxy-2-oxindoles in quantitative yields within short reaction times. A wide range of isatin substrates bearing electron-donating and electron-withdrawing substituents were successfully employed, indicating the generality and robustness of the method. The absence of catalysts and harsh conditions significantly reduced waste generation and energy consumption, aligning well with the principles of green chemistry. In conclusion, this study presents an efficient, catalyst-free, and environmentally benign synthetic route for substituted 3-hydroxy-2-oxindoles. The combination of high yields, broad substrate applicability, rapid reaction rates, and the use of water as a green solvent makes this protocol an attractive alternative to existing methods. The simplicity and sustainability of the approach suggest its potential applicability in academic research as well as industrial organic synthesis. This may support the pharmaceutical and healthcare sectors by providing an efficient and economical route for preparing biologically relevant molecules that may contribute to drug discovery and development.

Keywords : 3-Hydroxy-2-Oxindoles, Catalyst-Free Protocol, Green Chemistry, one pot synthesis, etc.

Development of novel probiotics beverages from plant-based sources

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Functional beverages containing viable probiotic microorganisms ($>10^6$ CFU/mL) derived from non-dairy substrates. Current Shift: Transition from Dairy (Yogurt/Kefir) \rightarrow Plant-Based Matrices. Driving Factors: Lactose Intolerance: Affects ~65% of the global population. Allergenicity: Cow's Milk Protein Allergy (CMPA). Hypercholesterolemia: Need for low-cholesterol functional foods. Lifestyle: Rise in Veganism and Vegetarianism. Selection of Plant Matrices (Substrates) Plants are chosen based on their sugar content (for fermentation) and functional properties. Cereals: Oats, Barley, Maize (Rich in β -glucan). Legumes: Soy milk, Peanut milk (High protein). Fruits & Vegetables: Beetroot/Carrot: High mineral content. Citrus/Pomegranate: High antioxidant (polyphenol) content. Coconut Water: Isotonic

electrolyte balance. Microbiology: The Probiotic Strains Key Criteria for Selection: Acid Tolerance: Must survive low pH of fruit juices. Bile Tolerance: Must survive human gastric transit. Adhesion: Capability to adhere to intestinal mucosa. Commonly Used Organisms (LAB): Lactobacillus acidophilus Lactobacillus plantarum (Very common in plant fermentation) Lactobacillus casei

Bifidobacterium species The "Synbiotic" Concept (Important Exam Point) Prebiotics: Non-digestible fibers (like oligosaccharides, inulin) found naturally in plants. Probiotics: The live bacteria added. Mechanism: Plant beverages provide both the bacteria and the fiber they eat.

Equation: Plant Fiber (Prebiotic) + LAB (Probiotic) = Synbiotic Product. Benefit: Enhanced survival of bacteria in the gut compared to dairy probiotics which lack fiber. General Production Flow Pre-treatment: Washing, peeling, and extraction of juice/pulp. Standardization: Adjusting Total Soluble Solids (TSS) or sugar content (glucose/sucrose) to ensure bacteria have food. Pasteurization: Heating (e.g., 80°C for 15 mins) to eliminate spoilage organisms (wild yeast/molds). Inoculation: Adding specific starter culture (1-5% v/v). Fermentation: Condition: Anaerobic or Microaerophilic. Temp: 37°C (Mesophilic). Time: 24 to 72 hours. Storage: Refrigeration (4°C) to slow metabolism and maintain viability. Biochemical Changes During Fermentation Carbohydrate Metabolism: Sugars \rightarrow Lactic Acid (pH drops). Proteolysis: Plant proteins broken down into peptides (improves digestibility). Bioactive Production: Increase in B-Vitamins. Synthesis of Bacteriocins (natural antibiotics like Nisin or Plantaricin). Reduction of Anti-nutrients (e.g., reduction of Phytates in soy). Challenges & Limitations Viability Loss: High acidity in fruit juices (pH < 3.5) can kill the probiotic bacteria. Required Viability: Must remain $\geq 10^6$ to 10^7 CFU/mL at the time of consumption. Sensory Issues: "Beany" flavor in soy/legumes. Excessive sourness from uncontrolled acidification.

Texture Defects: Sedimentation or phase separation in juices. Solutions & Future Scope Microencapsulation: Coating bacteria in Alginate or Chitosan beads to protect them from acid. Mixed Cultures: Using Streptococcus thermophilus to speed up fermentation while Lactobacillus adds health benefits. Genetic Modification: Strains adapted for specific plant sugar metabolism.

Thermal studies, Antimicrobial activity and Spectral Characterization of Cr(III), Mn(III), Fe(III) and VO(IV) complexes of salicylaldehyde and salicyloyl hydrazone.

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Metal complexes of Cr(III), Mn(III), Fe(III) and VO(IV) with a Schiff base ligand derived from salicylaldehyde and salicyloyl hydrazide were synthesized and characterized by several

techniques, including elemental analyses, molar conductance, magnetic moments, electronic, ^1H NMR, mass, IR, ESR spectra and thermal studies (TGA & DTA). The complexes are coloured solids, air stable, non-hygroscopic and soluble in DMF and DMSO only. On the basis of IR spectral studies of the flexidentate nature of the ligand is found towards different metal ion. The molar conductivity data of the complexes showed their non-electrolytic nature. Based on these studies, octahedral geometry for Cr(III), Fe(III) and square pyramidal geometry for Mn(III) and VO(IV) complexes were proposed. Thermal stability of each complex was determined by TG/DTA. From the TGA curves, thermo-kinetic parameters such as activation energy (E_a), order of reaction (n), entropy change (ΔS), free energy change (ΔG) and apparent entropy change (S^*) have been calculated by using the Freeman-Carroll and Sharp-Wentworth methods. ESR spectrum of vanadyl complexes are recorded and discussed. The antimicrobial activities of ligand and its metal complexes have been studied against *Staphylococcus aureus*, *Streptococcus pneumoniae*, *Escherichia coli* and *Klebsiella pneumoniae* microorganisms by well diffusion method.

Keywords :- Schiff base ligand , order of reaction, non-hygroscopic, antimicrobial activities

Isolation and Identification of Keratinophilic Fungi on Hairs of Domestic Animals

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Keratinophilic fungi are known for their ecological function in decomposing keratin-rich materials like feathers, nails, and hairs. Their possible toxicity, however, also makes their presence in settings impacted by agricultural and domestic animals concerning for public health. The fungal communities found in soils directly affected by pets and livestock have not received much attention, despite the growing closeness of people and domestic animals.

Identification of keratinophilic fungi were carried out through macroscopic and microscopic examination of fungal colonies grown on Sabouraud Dextrose Agar (SDA) supplemented with cycloheximide and chloramphenicol. Morphological features such as colony texture, pigmentation, growth rate, and sporulation patterns observed. Microscopic analysis will include lactophenol cotton blue staining to study conidial structures, hyphal arrangements, and diagnostic features specific to genera like *Trichophyton*, *Microsporum*, *Chrysosporium*, *Alternaria*, and *Aspergillus*. Identification carried out by standard mycological keys and reference literature, enabling differentiation between dermatophytes, opportunistic pathogens, and saprophytic keratinophilic fungi.

The present study correlates with its aim by documenting fungal species from cows, donkeys, rabbits, cats, goats, and dogs, respectively. Highlighting the presence of known pathogenic fungi (e.g., *Trichophyton*, *Microsporum*, *Chrysosporium*) and their role in zoonotic transmission.

Findings and their impact are High prevalence of pathogenic fungi: Up to 87.8% of isolates from cats were known mycotic agents, indicating animals as significant reservoirs. Species-specific dermatophyte profiles Cats harboured the most dermatophyte species, followed by cows, rabbits, and donkeys/dogs. The environmental persistence soil-hair incubation method revealed long-term fungal viability, suggesting environmental contamination risks.

The impact of the study enhances understanding of zoonotic fungal reservoirs, informs veterinary and public health surveillance, and supports the development of hygiene protocols in animal handling and shelter environments.

"Study of Probiotic Potential of Indigenous Fermented Foods"

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Fermented foods are an important part of the traditional Indian diet. They contain beneficial microorganisms known as probiotics. These probiotics help in improving digestion and boosting immunity. Common indigenous foods like curd, kanji, and idli batter were studied. Samples were tested to identify useful bacteria such as *Lactobacillus*. The bacteria showed good survival in acidic and bile conditions. They also helped in controlling harmful microorganisms. Curd and kanji showed the highest probiotic activity. These foods are natural, affordable, and safe sources of probiotics. Regular consumption can improve gut health and overall well-being.

Keywords: Probiotics, Fermented Foods, Lactobacillus, Gut Health, Indigenous Food

Immobilization of Enzyme and Comparison of Activity with Free Enzyme

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Enzymes are important biological catalysts used in many industries. Free enzymes have limitations such as low stability and poor reusability. Enzyme immobilization helps improve enzyme stability and efficiency. In this study, the activity of immobilized enzyme was compared with free enzyme.

The enzyme was attached to a solid support using a simple method. Both enzyme forms were tested under the same conditions. Free enzyme showed higher initial activity. Immobilized enzyme showed better stability and could be reused. Immobilization protected the enzyme from temperature and pH changes. Thus, immobilized enzymes are more suitable for industrial applications.

Keywords: Enzyme Immobilization, Free Enzyme, Enzyme Activity, Stability, Reusability

Evaluation of Microbial load before and after hand wash

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Hands are one of most common vehicles for the transmission of microorganisms responsible for infectious diseases. Everyday activities such as touching surfaces, handling food, and personal contact continuously contaminate hands with diverse microbial flora, including potentially pathogenic bacteria. Proper hand hygiene is therefore considered one of the most effective and economical measures for preventing the spread of infections. The present study was designed to estimate and compare the microbial load present on human hands before and after hand washing, and to evaluate the effectiveness of hand washing in reducing microbial contamination.

In this study, hand swab samples were collected from volunteers under aseptic conditions before and after hand washing. Prior to washing, samples were obtained by swabbing the palms and fingers using sterile cotton swabs moistened with normal saline. Participants were then instructed to wash their hands using soap and water following a standard hand-washing technique for an adequate duration. After washing, fresh sterile swabs were used to collect post-wash samples from the same areas of the hands. All collected samples were immediately transferred to sterile saline and processed for microbiological analysis.

Serial dilution techniques were employed to quantify the microbial load. Appropriate dilutions were plated on nutrient agar using the spread plate method and incubated at 37°C for 24–48 hours. After incubation, visible colonies were counted, and the results were expressed as colony-forming units per milliliter (CFU/mL). Morphological characteristics of the colonies were observed to gain a general understanding of the microbial diversity present on hands.

The results of the study revealed a significantly higher microbial load on hands before washing compared to after washing. Pre-wash samples showed dense microbial growth, indicating heavy contamination due to regular daily activities. In contrast, post-wash samples demonstrated a marked reduction in the number of colony-forming units, confirming the effectiveness of hand washing in lowering microbial burden. Although hand washing did not completely eliminate microorganisms, a substantial decrease in microbial count was observed in all samples after washing. This study highlights the critical role of proper hand hygiene in reducing microbial contamination and preventing the transmission of infectious agents. The findings strongly support regular hand washing with soap and water as a simple yet highly effective public health measure. The study also emphasizes the importance of educating individuals about correct hand-washing techniques to maximize microbial reduction. Overall, estimation of microbial load before and after hand washing serves as a practical demonstration of the importance of hand hygiene in everyday life and reinforces its significance in infection control and public health.

Keywords: - Microbial Load Reduction, Public Health Measure, Soap and Water, Colony-Forming Units (CFU), Hand Swab Samples

Bioengineering Green Oxygen Factories: Development of plants for enhanced oxygen generation in the environment

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Rapid urbanization, industrial expansion, and large-scale deforestation have significantly degraded air quality across the world. Rising levels of atmospheric carbon dioxide pose serious threats to human health, climate stability, and ecological balance. Oxygen is a vital component for survival of living organisms and is primarily replenished through plant-based photosynthesis. Many plant species exhibit limited oxygen-producing capacity due to environmental stress, air pollution, poor soil quality, and inefficient photosynthetic pathways. Urban environments suffer from reduced green cover, limiting natural oxygen replenishment processes. Enhancing plant oxygen production through environmental biotechnology has emerged as a sustainable and eco-friendly solution. To develop plant varieties capable of producing higher levels of oxygen in the environment. To enhance photosynthetic efficiency by improving key physiological and biochemical processes. To increase chlorophyll content for better light absorption. To improve RuBisCO enzyme efficiency to enhance carbon fixation. To optimize stomatal conductance for improved gas exchange. To identify naturally high oxygen-producing plant species and enhance their performance. To create scalable and cost-effective solutions suitable for urban and semi-urban deployment. Application of modern biotechnological approaches including genetic engineering and molecular breeding techniques. Use of CRISPR-Cas9 genome editing to regulate and upregulate genes involved in photosynthesis and carbon fixation. Selection of naturally high oxygen-producing plants such as Peepal (*Ficus religiosa*), Neem (*Azadirachta indica*), Areca palm, Snake plant (*Sansevieria*), and Tulsi (*Ocimum sanctum*).

Employment of tissue culture and micropropagation methods for rapid multiplication and genetic uniformity. Investigation of plant growth-promoting rhizobacteria to enhance nutrient uptake and stress tolerance. Integration of beneficial microbial interactions to further improve photosynthetic efficiency and oxygen release. Enhanced plant varieties demonstrate improved photosynthetic efficiency and increased oxygen production. Optimized physiological and molecular traits lead to better carbon dioxide assimilation. Beneficial microbial associations support improved plant growth and stress resistance. Enhanced plants show adaptability to polluted and urban environmental conditions. The developed plant varieties are suitable for large-scale environmental application. Plants with enhanced oxygen-producing capacity offer a sustainable, eco-friendly, and cost-effective solution to air pollution. Strategic deployment of such plants can significantly improve urban air quality and environmental health. These plants can be effectively used in green belts, vertical gardens, indoor air purification systems, hospitals, schools, and offices. Additional benefits include reduction of atmospheric carbon dioxide, absorption of air pollutants, and improvement of microclimatic conditions. Enhanced green spaces contribute positively to mental health and urban aesthetics. Integration of

biotechnology with urban planning and public health initiatives promotes healthier living environments. This approach supports long-term ecological sustainability and climate resilience for future generations.

Keywords : Enhanced Oxygen generation, Environmental biotechnology, Air Quality improvement

**Commerce,
Management and
Law**

Financial Optimization of AI-Enabled Vehicle Load Networks

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Vehicle overloading holds a serious threat to road safety, infrastructure durability, and transparent transport governance in India. Despite existing legal provisions, manual enforcement remains inefficient and vulnerable to corruption. This study introduces the **Ultimate AI-Based Sensor Alarm System**, an automated Weight-In-Motion solution that uses AI-enabled sensors and camera-based number plate recognition to detect overloaded vehicles in real time and instantly notify Regional Transport Offices and vehicle owners. By eliminating human intervention, the system ensures fair penalty enforcement, protects road infrastructure, reduces accidents and emissions, and improves economic efficiency. The proposed solution offers a smart, secure, and sustainable approach to modern traffic and transport management.

Keywords Vehicle Overloading, Artificial Intelligence, Road Safety, Transport Governance, Smart Infrastructure

a. Background /v Introduction:

Vehicle overloading is a complex problem that undermines national infrastructure, jeopardizes public safety, and encourages systemic corruption. Nearly the past five years, overloading-related incidents have claimed nearly 60,000 lives in India alone. In addition to the human cost, excessive strain on tires, brakes, and suspension systems results in catastrophic mechanical failures and higher fuel consumption. The "Ultimate AI-Based Sensor Alarm System," a road guard, is being introduced. Our goal is to replace antiquated manual monitoring with a quick, clever, and impenetrable digital barrier. We can enforce fair insurance procedures, stem the flow of illegal payments, and prevent accidents before they happen by giving RTO officers and the government access to real-time AI data. This is the future of the Welfare of People: a smarter, safer, and more transparent India.

b. Objectives / Purpose:

Authorities are legally required to punish overloaded cars under Section 114 of the Motor cars Act 1988, however manual enforcement is fraught with difficulties. Many overloaded cars now evade RTO inspections, and even when they are, the lack of openness can

result in corruption and take money away from the government. We suggest an inexpensive, AI-driven Weight-In-Motion solution built for BHARAT's varied roadways to address these issues. This technology guarantees that all fines go to the state treasury, removes human prejudice, and directly safeguards road infrastructure by using inexpensive equipment and automated sensing. In order to reduce pollution, eradicate corruption, and guarantee the long-term preservation of our national roadways, this technology-driven strategy is essential. To give remedies for given problem we are introducing concept of **Ultimate AI-Based Sensor Alarm System**. Objectives and Purpose are clearly mentioned in below.

1) **Environmental Sustainability:** due to this A.I. based Alarm System, we can prevent environmental issues.

2) **Economical Efficiency:** Many times, truck owners pays directly to the traffic officer , but due to this "A.I. Powered Alarm System to Government " directly notify to the governmental agencies, means to the Department of Transportation.

3) **Regulatory Compliances:** In traffic management, strictly following all laws, rules and standards, and guidelines set by government for safe and secure efficient road uses.

Equipment registration and infrastructure design ensures road safety and prevents accidents.

4) **Secure Transport System:** To secure transport system that's why we are trying to explore; An Artificial based Intelligence system to avoid such Issues regarding to overloading.

c. Methodology:

When overloaded cars pass by those sensors, the sensors swiftly weigh the car, detect its license plate, and immediately alert the local RTO office to pay the fine and stop the overloading. This AI-based system will promptly alert the RTO if a vehicle's weight exceeds the road's weight restriction. In order to prevent subsequent overloading, the department must apprehend that vehicle and pay a fine. The car owner and the RTO office in the closest area will receive such notification (information) promptly.

Working Model: when overloaded vehicles run from those sensors, the sensors will weigh that vehicle's weight quickly, and catches vehicle's Number Plates and instantly get notify to the RTO office of that area, to pays penalty and Cease that overloading. In this A.I.

based System, if weight of vehicle exceeds over the limit of road that sensors will quickly notify to the RTO. That notification quickly will send to the RTO office of that nearest area as well as vehicle owner for online penalty through message.

Instrumental Set-up: It requires weight sensors of specific limits ,to weigh the Vehicle Instantly, suppose the weight of vehicle exceeds over 50 tones, then sensors camera quickly catch or draw the vehicle's number and convey to RTO office of that nearest area by Artificial intelligence system. This A.I. based sensor system will be connected to the RTO department to inform the Vehicle numbers according to that number plates vehicle, owner also will get notified to pays penalty and to cease the vehicle from overloading.

Components/Equipment: Sensors, Night vision Camera sensors, Weight sensors, Artificial Intelligence connected to Mobile Network which is connected to the nearest department of RTO of that Area. It required Solar panel Maximum 100W, etc.

d. Results / Findings:

This technology builds a fail-safe barrier for our transportation network by combining traditional energy-based sensors with automated number plate tracking and rapid RTO alarms. By averting collisions and safeguarding the transportation system by real-time monitoring, it revolutionizes road safety. Additionally, by guaranteeing road conservation and environmental sustainability, this low-cost AI technology removes the "leaks" of corruption, directly increasing economic efficiency and constructing a more robust, independent infrastructure for the country.

e. Conclusion / Implications: The Significance of this "A.I. based setup" will prevent further problematic incidences regarding to the overloaded Vehicles.

1. To Prevent Accidents: "The AI system identifies overloaded vehicles in real-time to prevent catastrophic accidents caused by brake failure, tire bursts, and loss of steering control, ensuring the safety of all road users.

2. To Maintain Road Infrastructure: "By strictly enforcing weight limits, this technology protects road infrastructure from premature wear and tear, preventing the formation of potholes and reducing the massive government expenditure on road repairs.

- 3. To Promote Environmental Sustainability:** "Enforcing legal load limits contributes to environmental sustainability by ensuring engines operate at peak efficiency, which significantly reduces excessive fuel consumption and harmful carbon emissions.
- 4. To Secure the Transport System:** "This AI-driven approach secures the transport system by creating an automated, tamper-proof monitoring network that eliminates human bias and ensures every vehicle on the road is operating within legal safety standards."
- 5. To Boost Economic Efficiency:** "The system boosts economic efficiency by preventing 'black money' corruption, ensuring that fine revenues go directly to the government, and reducing the financial burden of vehicle maintenance and insurance claims."
- 6. To Prevents offences Like Corruption, Regulatory Compliances, For the Welfare of Society.**

EcoNest: Sustainable Packaging Using Natural Luffa Fibre

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The extensive use of plastic-based packaging has become a major environmental concern due to its non-biodegradable nature, long-term persistence in ecosystems, and contribution to pollution of land and water resources. Conventional packaging materials are predominantly derived from fossil fuels and generate significant waste, posing serious challenges to environmental sustainability. As global awareness of climate change and plastic pollution increases, there is a growing demand for renewable, biodegradable, and eco-friendly alternatives. Natural plant fibres have emerged as promising materials for sustainable packaging applications. Among them, *Luffa cylindrica* is a fast-growing, renewable plant resource known for its fibrous, porous, and lightweight structure, making it a potential substitute for synthetic packaging materials.

The primary objective of this study is to evaluate the potential of natural luffa fibre as a sustainable alternative to conventional plastic packaging. The work aims to develop biodegradable packaging prototypes using luffa fibre and assess their functional properties for protective, cushioning, and wrapping applications. The study also seeks to promote the

utilization of agricultural resources to support zero-waste practices and circular economy principles.

Mature luffa gourds were collected and processed using environmentally friendly methods. The gourds were thoroughly cleaned, dried, and treated to remove impurities, resulting in uniform and usable luffa fibres. These fibres were shaped directly or blended with natural binders to enhance strength and structural stability. Fabrication techniques such as cutting, pressing, molding, and composite formation were employed to develop different packaging prototypes. The prepared materials were evaluated for their physical properties, including cushioning ability, structural integrity, and suitability for packaging applications.

The results indicated that luffa fibre possesses several desirable characteristics for sustainable packaging. Its natural sponge-like structure provided effective shock absorption and cushioning, making it suitable for protecting fragile goods during transportation. The porous nature of the fibre allowed air circulation, which is beneficial for packaging fresh produce and moisture-sensitive products. The developed packaging materials were lightweight, biodegradable, and derived from renewable sources, significantly reducing environmental impact compared to plastic-based alternatives. The luffa fibre exhibited satisfactory mechanical strength for light to medium packaging applications. However, challenges such as moisture sensitivity and variation in fibre density were observed.

The study demonstrates that luffa fibre can be successfully transformed into functional, biodegradable packaging materials. The identified limitations can be minimized through controlled processing techniques and the application of natural, biodegradable coatings. Luffa-based packaging offers an eco-friendly, low-cost, and renewable alternative to plastic packaging while supporting sustainable development goals. With further optimization and large-scale production, luffa fibre has strong potential for commercial packaging applications, contributing to reduced plastic waste and environmental protection.

Keywords: Luffa fibre, Sustainable packaging, Biodegradable materials, Eco-friendly alternatives, Circular economy

Formulation and Nutritional Evaluation of Khiri as a Multigrain Baby Food

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Complementary feeding is a critical phase in infant nutrition, particularly for babies aged 6–12 months, when breast milk alone is insufficient to meet increasing nutritional requirements. During this stage, infants require nutritionally balanced, safe, and easily digestible foods to support optimal physical growth, cognitive development, and immune function. Although a wide range of commercial baby foods is available in the market, concerns related to high cost, excessive processing, use of artificial preservatives, additives, and reduced nutritional quality have raised questions regarding their long-term suitability for infant health. Traditionally inspired complementary foods formulated from natural ingredients may provide a nutritionally superior, safe, and economically viable alternative when developed using standardized scientific methods. This study addresses the need for a nutritionally balanced, safe, and acceptable formulated complementary baby food suitable for infants.

The primary objective of this study was to formulate and nutritionally evaluate a multigrain Khiri-based baby food intended for infants aged 6–12 months. The study aimed to assess its nutritional adequacy, safety, texture, and acceptability, along with its potential as a cost-effective alternative to commercially processed baby foods. An additional objective was to demonstrate that traditional food concepts can be successfully adapted into standardized formulations suitable for large-scale production while maintaining nutritional integrity.

A multigrain Khiri formulation was developed using carefully selected cereals, pulses, and natural ingredients based on their nutritional value, digestibility, and suitability for infant feeding. Ingredients were thoroughly cleaned and processed using standardized hygienic practices to ensure product safety and minimize nutrient loss. Traditional processing techniques were combined with scientific formulation principles to enhance digestibility and nutritional quality. The formulation excluded artificial colors, flavors, and chemical preservatives. The final product was evaluated for nutritional composition, texture, safety, and overall suitability as a complementary food. Comparative analysis was carried out with commercially available baby foods in terms of ingredient quality, nutritional control, and economic feasibility.

The formulated multigrain Khiri baby food demonstrated balanced nutritional composition, providing adequate energy, protein, and essential nutrients required for healthy infant growth and development. The smooth texture and mild taste made the product suitable and acceptable for infants aged 6–12 months. Absence of artificial additives enhanced food safety, while the use of traditional processing principles supported improved digestibility. Compared to commercial baby foods, the formulated product offered better control over ingredient selection and nutritional composition at a comparatively lower cost, making it suitable for wider accessibility.

The study concludes that scientifically formulated multigrain Khiri has strong potential as a safe, nutritious, and sustainable complementary baby food suitable for commercial production. Integration of traditional food knowledge with modern scientific formulation techniques can contribute to improved infant nutrition, enhanced food safety, and promotion of healthier complementary feeding practices. Such formulations may reduce dependency on highly processed foods and support better nutritional outcomes during early childhood.

Keywords: Complementary feeding, multigrain Khiri, infant nutrition, formulated baby food, food safety

Entrepreneurial Deployment of a Smart Anti-Spitting Sensor Machine - for Clean and Healthy Environment

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Public spitting continues to be a major civic and hygiene challenge in India, particularly within authorised premises such as educational institutions, offices, hospitals, and government buildings. Despite cleanliness campaigns and regulations, existing monitoring mechanisms like manual supervision and conventional CCTV systems lack real-time intervention and accountability. Spitting contributes to unhygienic surroundings, spreads communicable diseases, and negatively impacts institutional discipline. Therefore, an intelligent and technology-driven system is required to actively detect spitting behaviour and ensure immediate corrective action. The objective of this study is to propose and analyse a Smart Anti-Spitting Sensor Machine that detects spitting behaviour in authorised environments and promotes hygienic practices through automated accountability. The project also aims to

evaluate the entrepreneurial deployment of the system by examining its production feasibility, cost efficiency, and long-term economic sustainability. The proposed system is based on a sensor-driven and intelligent processing framework. A PIR motion sensor detects human presence, while a moisture-based sensor represents spitting (liquid) detection near sensitive surfaces. When both conditions are satisfied, the system triggers an alert mechanism. In the advanced model, an AI-enabled camera with a processing unit such as Raspberry Pi can be integrated to analyse behaviour and verify identity using authorised institutional databases. Alerts, warnings, and fines are generated automatically, and incidents are logged for monitoring. A functional hardware prototype demonstrates the logical working of the system, and a detailed cost and deployment analysis is conducted to assess commercial viability. The analysis indicates that the proposed system can effectively discourage spitting through real-time alerts and accountability mechanisms. Bulk production significantly reduces per-unit cost, making large-scale deployment feasible. The revenue model primarily utilises fine collection for system maintenance, ensuring operational sustainability without focusing on profit generation. The Smart Anti-Spitting Sensor Machine presents a practical, scalable, and socially responsible solution to improve hygiene in authorised premises. By integrating technology, entrepreneurship, and behavioural monitoring, the system contributes to cleaner environments, reduced health risks, and disciplined civic behaviour. The project demonstrates strong potential for social impact, economic sustainability, and meaningful contribution to public hygiene initiatives.

Keywords: Smart Sensors, Hygiene Monitoring, Behaviour Detection, Entrepreneurship, Public Health, Clean Technology

Prakritik Sparsh: A Herbal Body Wash Formulation with Natural Extracts

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Commercial personal care products, particularly body washes, predominantly rely on synthetic surfactants such as Sodium Lauryl Sulfate and Sodium Laureth Sulfate, which are commonly associated with skin dryness, irritation, hypersensitivity reactions, and environmental concerns due to their limited biodegradability. With increasing awareness regarding skin health, sustainability, and eco-friendly lifestyles, consumers are seeking safer and natural alternatives

for daily personal care. Despite this growing demand, the availability of scientifically validated herbal body wash formulations with proven safety, effectiveness, and consumer acceptability remains limited. In this context, the present study focuses on the development and evaluation of **Prakritik Sparsh**, a herbal body wash formulated using natural extracts to provide a mild, skin-friendly, and sustainable cleansing solution. The primary objective of this research was to formulate **Prakritik Sparsh Herbal Body Wash** using Reetha extract as a natural surfactant and Multani Mitti as a cleansing and detoxifying agent. Additional objectives included incorporating Aloe vera gel and glycerine to enhance moisturizing and soothing properties, ensuring physicochemical stability and microbial safety of the formulation, and evaluating user acceptability through statistical analysis of consumer feedback. The study also aimed to assess the cost-effectiveness and potential scalability of the developed formulation as a sustainable alternative to commercial body washes. The formulation of Prakritik Sparsh was carried out through a systematic methodology involving careful selection of herbal ingredients, preparation of aqueous and gel-based extracts, blending with natural thickening and fragrance components, and stabilization using a natural-origin preservative. Physicochemical evaluation was performed by assessing parameters such as pH, appearance, homogeneity, and formulation stability following standard cosmetic evaluation procedures. Microbial safety was determined by analyzing total microbial count and screening for pathogenic organisms. Consumer feedback was collected from 124 users using a structured questionnaire, and the data were subjected to statistical analysis to assess overall experience, fragrance satisfaction, skin feel after use, product rating, and recommendation intent. The developed Prakritik Sparsh herbal body wash exhibited a skin-compatible pH of 5.8, smooth and homogeneous appearance, and satisfactory formulation stability. Microbial analysis confirmed that the product remained within permissible microbial limits, with no detectable pathogenic contamination, indicating effective preservation and product safety. Feedback analysis revealed high levels of consumer satisfaction, with 82 percent of users reporting an excellent overall experience, 79 percent expressing excellent fragrance satisfaction, and 92 percent indicating willingness to recommend the product. Comparative cost analysis demonstrated that Prakritik Sparsh is more affordable than commercially available herbal body washes. In conclusion, Prakritik Sparsh Herbal Body Wash successfully demonstrated effective cleansing, high skin compatibility, microbial safety, and strong consumer acceptance. The study highlights its potential as a sustainable, cost-effective, and eco-friendly alternative to chemical-based body washes, contributing to safer personal care practices, environmental protection, and opportunities for small-scale and rural entrepreneurship.

Keywords: Herbal Body Wash, Natural Surfactant, Reetha Extract, Microbial Safety, Sustainable Cosmetics

Smart Pricing, Strong Entry: A Data-Driven Approach for Emerging Businesses

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In today's rapidly evolving market, the success of emerging ventures depends greatly on adopting smart, data-driven pricing strategies. This study, titled "Smart Pricing, Strong Entry: A Data-Driven Approach for Emerging Businesses. " explores how analytical and evidence-based approaches to pricing can empower new businesses to sustain and grow in competitive markets. The objectives of this research are: (1) To study price-led competition in the market, (2) To examine price concentration of the selected products, and (3) To identify competition-free entry points for launching new ventures. Data were gathered from various FMCG categories including toothpaste, hair oil, food oil, facewash, bath soap, and cold drinks. Using unitary methods, prices were standardized and analyzed to uncover trends and pricing gaps. The findings reveal the crucial role of pricing in market positioning, customer perception, and profitability. This research emphasizes that leveraging data insights can help startups identify untapped opportunities, optimize pricing decisions, and establish a strong foothold in the market with minimal competition.

Keywords: Pricing Strategy, Market Competition, Consumer Analysis, Emerging Ventures, FMCG, Data-Driven Insights.

HerbVed Dant Manjan

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HerbVed Dant Manjan is a herbal oral-care formulation developed with the objective of providing a natural, safe, and effective alternative to commercially available chemical-based dentifrices. In recent years, increasing concerns regarding the prolonged use of synthetic ingredients such as artificial foaming agents, preservatives, and abrasives in oral-care products have drawn attention toward traditional and plant-based formulations. Ayurvedic practices have historically emphasized the use of medicinal herbs for maintaining oral hygiene, preventing dental disorders, and promoting gum health. The present work is motivated by the need to scientifically develop and evaluate an Ayurvedic tooth powder that combines traditional knowledge with basic quality assessment parameters.

The primary objective of this study was to formulate HerbVed Dant Manjan using selected Ayurvedic ingredients known for their antimicrobial, anti-inflammatory, deodorizing, and cleansing properties, and to evaluate its suitability for routine oral hygiene. The formulation aimed to be free from synthetic chemicals while maintaining effectiveness, safety, and user acceptability.

The methodology involved careful selection of herbal ingredients based on their established oral-health benefits. The formulation included Babool seed powder, Neem, Tulsi, Clove, Mint, and activated charcoal. These ingredients were selected for their combined roles in strengthening gums, controlling oral microorganisms, reducing bad breath, and providing natural whitening. Raw materials were thoroughly cleaned and shade-dried to preserve their bioactive compounds. The dried materials were finely powdered and passed through a sieve to obtain uniform particle size. The powdered ingredients were then blended in optimized proportions to achieve homogeneity and consistent texture.

The prepared HerbVed Dant Manjan was evaluated for basic quality parameters including pH, moisture content, sensory characteristics such as colour, aroma, and texture, and microbial load. These parameters were assessed to ensure the product's safety, stability, and suitability for oral use. The pH of the formulation was found to be within an acceptable range for oral application, minimizing the risk of enamel damage or gum irritation. Sensory evaluation indicated good acceptability due to the presence of Mint, which imparted a refreshing aroma and pleasant mouthfeel. Neem and Clove contributed to the antimicrobial potential of the formulation, supporting oral hygiene and protection against common oral pathogens. Activated charcoal enhanced cleansing and natural whitening properties.

The results suggest that HerbVed Dant Manjan is a stable, safe, and effective herbal oral-care product developed using traditional Ayurvedic ingredients without the use of synthetic additives or harsh chemicals. In conclusion, this study highlights the potential of HerbVed Dant Manjan as an eco-friendly, affordable, and consumer-oriented herbal dentifrice. The formulation supports sustainable practices and offers scope for further optimization, large-scale production, and commercialization, thereby contributing to the growing demand for natural and herbal oral-care solutions.

Keywords: Ayurvedic oral care, Herbal dentifrice, Antimicrobial herbs, Tooth powder, Natural formulation

Nature of Crime and Its Impact on Society: A Case Study Approach

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Crime is a social term that affects the safety, and moral structure of society. Every society creates rules to regulate human behavior and to prevent acts that are harmful to individuals and the community or society at large. Criminal law plays a vital role in defining crimes, prescribing punishments, and maintaining public order. Understanding the nature and concept of crime is essential for law students, legal professionals, and society to ensure justice and social stability. This study focuses on explaining the nature of crime and examining its impact on society through a case study approach. The main objective of this concept is to analyze the fundamental elements of crime, such as human conduct, mens rea (guilty mind), and actus reus (guilty act), and to understand how criminal behavior affects individuals as well as society. The study also highlights the importance of criminal law in controlling crime and protecting social interests. Another objective is to create legal awareness among students and the general public regarding the consequences of criminal activities. The research methodology I adopted in this study is doctrinal and analytical in nature. Secondary sources such as legal textbooks, statutory provisions, judicial decisions, and research articles have been used. A simple case study of a landmark criminal case has been included to explain how courts interpret the concept of crime and apply legal principles in real-life situations. The case study method helps in better understanding the practical application of criminal law concepts. The research examines the nature of crime and its impact on society, highlighting that crime is an offence not against an individual but against society at large, as recognized in State of Maharashtra v. Mohd. Yakub

(1980) and Gian Singh v. State of Punjab (2012). The findings of this study are that crime is not merely an individual act but a social problem influenced by economic conditions, lack of education, unemployment, and moral decline. The case study analysis shows that the judiciary plays a crucial role in balancing individual rights and social interests while delivering justice. Modern crimes are growing due to technology misuse and cyber influence. Effective enforcement of criminal laws acts as a deterrent and helps in maintaining social order. In conclusion, the study emphasizes that understanding the nature and concept of crime is essential for building a law-abiding society. Criminal law serves as an instrument of social control and justice. This concept note contributes to legal education by simplifying core criminal law concepts and highlighting their relevance in everyday life. It also emphasizes the need for legal awareness to reduce crime and promote justice in society.

Keywords: Crime, Criminal Law, Society, Justice System, Case Study, Legal Awareness

Eco-Vigilance and the Green Mandate Law: A Legal and Technological Framework for Urban Thermal Resilience in Bharat

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Rapid urbanization in India has led to the "Urban Heat Island" (UHI) effect, where concrete surfaces trap heat, raising city temperatures by $5\text{--}8^{\circ}\text{C}$ compared to rural surroundings. Current mitigation strategies rely heavily on energy-intensive air conditioning, which exacerbates outdoor heat waste and energy poverty. This research addresses the urgent need for a mandatory, biological cooling infrastructure at the household level. The primary objective of this study is to propose the **Green Mandate Law (GML)**—a legislative framework that transitions private residential balconies into decentralized cooling zones. The research aims to solve the "survival gap" in urban greenery through a combination of financial accountability and AI-driven monitoring. The proposed law utilizes a **"5-5-5" Botanical Strategy**, mandating 15 specific native plants categorized into Air Scrubbers, Thermal Regulators, and Pollinators. To ensure structural safety and resource efficiency, the framework integrates lightweight **soiless media** (Coco-peat/Perlite) and **RO-reject water recycling** for irrigation. The core innovation is a dual-layered enforcement mechanism. **The Truth Bond:** A financial escrow deposit paid by developers, refundable only after a 36-month plant survival milestone verified by the state. **The Eco-Vigil App:** A mobile interface utilizing AI-driven multispectral scanning and NFC tagging to prevent fraud and monitor plant health in real-time.

Thermodynamic modeling suggests that a GML-compliant balcony can create a "Transpiration Curtain," reducing building surface temperatures by up to **10**. This biological shading reduces incident solar radiation, leading to an estimated **22% reduction in peak cooling loads** for residential units, significantly lowering the national grid's energy demand. The Green Mandate Law moves urban greenery from a "luxury aesthetic" to "essential infrastructure." By linking property law with AI technology, India can achieve its climate resilience goals while creating a new "Green Vigilance" economy. This framework provides a scalable model for a sustainable, cooler, and self-sufficient Bharat.

Keywords: Eco-Vigilance, Green Mandate Law, Urban Heat Island, Truth Bond, Thermal Resilience, Sustainable Law.

Mind view change the way of learning through technology

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In 21 century the technology is evolving and playing important part in everyone's life but when comes to education we still are using traditional way of learning. But now a day's young generation are disinterested in reading text books even today's kids are techno-savvy and departing from traditional way of learning We are living in information age and information is power today, but tackling with overloaded information is possible only with the help of technology. With the help of technology complex subjects, theories and principles can be taught in effective manner by using audio visual technology. The language of LAW is very complex and it is very difficult for a layman to understand it by traditional way but with the help of this technology we can make principles of complex and complicated laws very simple, easy and eye-catching. Technology can save time, money and efforts of today's generation at large extent. With the help of technology one can get expert's guidance and teaching from remote place.

Keywords: Software , study material , teaching and learning, AI , Mind Map, flash card.

A Next-Gen Tooth Lotion: A Step towards Contamination-Free Oral Hygiene

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Introduction:- The development of Tooth lotion formulation aims to address two key concerns in oral hygiene: microbial contamination at the toothpaste tube orifice and the use of potentially harmful ingredients. B. Objectives:- Assess ease of use and satisfaction with the application method (e.g., dispenser format) • Record participant feedback on taste, texture, smell, and mouth feel Observe any immediate or short-term effects (e.g., freshness, cleanliness, irritation) Identify any challenges or discomforts experienced during usage C.

Keywords:- Paraben-free, toothpaste, oral care—safe, SLS-based toothpaste.

Methodology:- Low viscosity formulation Minimize to microbial contamination by reducing contact between toothpaste and toothbrush orifice Reduce bio burden & Recyclable or biodegradable tooth lotion packaging with refillable container. Low SLS concentration providing a gentle cleansing effect without the harsh irritation often caused by traditional SLS-based toothpaste. Paraben-free tooth lotion using rosemary as a natural preservative Discussion:- The recent panel study on Tooth lotion revealed a remarkably positive user experience, emphasizing its superiority over conventional toothpaste. Younger consumers are highly receptive to innovative oral care solutions.

Result :- One of the most attractive features of Tooth lotion is its contactless spray application, which was recognized and appreciated by 100% of participants. An overwhelming 85.21% of users selected contactless application as their favourite feature, clearly setting Tooth lotion apart in both convenience and user appeal. Unlike conventional toothpaste, Tooth lotion eliminates mess and direct contact, offering a more streamlined and clean experience The strongest endorsements came from users themselves: 92.86% said they would continue using Tooth lotion, and an equal percentage would recommend it to others

Conclusion:- Collectively, this research reflects a holistic approach to modern oral care—safe, sustainable, and consumer-cantered—positioning Tooth lotion as a viable alternative to conventional toothpastes in a market increasingly driven by health and environmental awareness.

Ayurvedic Polyherbal Scrub (Ubtan) for Holistic Skin Health: A Sustainable Tri-Doshic Formulation

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Skin is the largest organ of the human body and plays a vital role in protection, sensation, and aesthetics. The increasing prevalence of skin disorders, chemical sensitivity, and environmental concerns has led to renewed interest in traditional, natural, and eco-friendly skincare systems. Ayurveda emphasizes *TwakSwasthya* (skin health) through internal balance of the *Tri-Doshas*—Vata, Pitta, and Kapha—along with external herbal applications. The present study focuses on the formulation of an Ayurvedic, eco-friendly, natural skincare product in the form of a polyherbal scrub (Ubtan) suitable for both face and body.

The formulation includes *Cicer arietinum* (chickpea flour) for gentle exfoliation and cleansing; *Vetiveriazizanioides* (vetiver root) with cooling and Pitta-pacifying properties; *Symplocos racemosa* (Lodhra bark) known for its astringent, Kapha-reducing and anti-inflammatory action; *Terminalia arjuna* (Arjuna bark) providing antioxidant and skin-repair benefits; *Cyperus rotundus* (Nagarmotha rhizome) for sebum regulation and antimicrobial activity; *Rubia cordifolia* (Manjistha root) for blood purification and complexion enhancement; *Pterocarpus santalinus* (Red sandalwood) and *Curcuma aromatica* (Wild turmeric) for anti-inflammatory, anti-pigmentation and antimicrobial effects; *Rosa damascena* (Rose petals) for soothing and hydration; and *Bambusa vulgaris* (Bamboo silica) to promote gentle exfoliation and skin regeneration.

This tri-doshic formulation can be customized by mixing with water, rose water, milk, or herbal distillates based on individual skin type, enhancing its personalized therapeutic value. The synergistic action of these botanicals helps cleanse pores, remove dead cells, balance doshas, improve complexion, and maintain skin integrity without synthetic additives. Thus, the formulated herbal Ubtan represents a sustainable, safe, and holistic Ayurvedic approach to skincare with potential applications in preventive dermatology and natural cosmetic development.

Keywords: Ayurvedic, tri-doshic, eco-friendly, skincare, scrub (Ubtan) formulation

The Advanced Security Solution: Rare-Earth-Doped Phosphors for Next-Generation Anti-Counterfeiting Applications

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The rapid expansion of global trade, advanced printing technologies, and e-commerce platforms has led to a significant rise in counterfeiting activities, posing serious economic losses, security risks, and threats to consumer trust. Conventional anti-counterfeiting measures such as holograms, watermarks, barcodes, and conventional fluorescent inks are increasingly vulnerable to duplication due to technological advancements and limited security complexity. Consequently, there is a critical need for advanced security materials that offer multi-level authentication, high stability, and strong resistance to forgery. In this context, rare-earth-doped phosphor materials have emerged as promising candidates for next-generation anti-counterfeiting applications owing to their unique optical properties, sharp emission features, and long-term durability.

The primary objective of this work is to investigate the potential of rare-earth-doped phosphors as advanced security elements for anti-counterfeiting technologies. The study aims to explore the structure–property relationships of phosphor materials doped with rare-earth ions such as Eu, Dy, Tb, Sm to evaluate their suitability for integration into transparent security inks. Special emphasis is placed on achieving excitation-dependent luminescence, persistent afterglow, and time-resolved emission characteristics that can enable multi-level and covert authentication features. Additionally, the work seeks to assess the compatibility of these materials with conventional printing techniques without compromising visual aesthetics.

The methodology involves the synthesis of rare-earth-doped phosphor materials using scalable and reproducible routes such as solid-state reaction, co-precipitation, sol–gel, and combustion methods. Structural and morphological analyses are carried out using X-ray diffraction and electron microscopy to confirm phase purity and crystallinity, while photoluminescence excitation and emission spectroscopy, decay lifetime measurements, and afterglow studies are employed to evaluate optical performance. Optimized phosphor compositions are further dispersed into transparent ink formulations, and their printability and stability on paper and polymer substrates are examined under various excitation conditions.

The results demonstrate that rare-earth-doped phosphors exhibit sharp, characteristic emission lines, high color purity, and tunable luminescence across the ultraviolet–visible–near-infrared regions. Several compositions show strong persistent luminescence and distinct decay lifetimes, enabling time-gated authentication that cannot be easily replicated using conventional materials. The prepared security inks remain optically transparent under ambient lighting while revealing bright, well-defined luminescent patterns under ultraviolet excitation, confirming their suitability for covert anti-counterfeiting applications.

In conclusion, this study establishes rare-earth-doped phosphors as robust and versatile materials for next-generation anti-counterfeiting solutions. Their unique optical fingerprints, excellent chemical and thermal stability, and compatibility with standard printing technologies provide significant advantages over traditional security features. The findings contribute to the development of intelligent, multi-level authentication systems with enhanced resistance to forgery, offering practical benefits for currency protection, secure documents, packaging, and brand protection, thereby addressing a critical societal and industrial challenge.

Keywords :- Security Ink, Anti-counterfeiting, Phosphor, Luminescence

Mycelium-Based Eco Bricks: A Sustainable Alternative for Waste-Derived Green Materials

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The increasing dependence on conventional construction and packaging materials such as concrete, plastic, and thermocol has resulted in serious environmental challenges, including excessive energy consumption, high carbon emissions, non-biodegradability, and the accumulation of solid waste. These concerns have created a strong motivation to explore sustainable, low-cost, and eco-friendly alternatives derived from renewable biological resources. Mycelium, the vegetative network of fungi, has gained attention in recent years due to its remarkable ability to grow rapidly and bind organic matter into strong, lightweight structures. The present project aims to explore the potential of mycelium as a natural binding

agent for the production of mycelium-based eco bricks or blocks using readily available agricultural waste materials. The primary objective of this study is to understand how fungal mycelium can convert lignocellulosic waste into a value-added biodegradable material and to evaluate the basic physical properties of the resulting eco bricks for potential non-load-bearing applications. In this work, agricultural residues such as paddy straw, sawdust, and waste paper were selected as substrates due to their high cellulose content and wide availability. These materials were chopped, moistened, and sterilized before being inoculated with spawn of *Pleurotus* species, a fast-growing and non-toxic fungus. The inoculated substrates were packed into molds and incubated under controlled temperature and humidity conditions to facilitate uniform mycelial growth throughout the substrate. During the incubation period, the mycelium colonized the agro-waste completely, forming an interwoven network that bound the particles together into compact blocks. After full colonization, the blocks were subjected to heat treatment to terminate fungal growth and stabilize the structure. The resulting mycelium-based eco bricks were then examined through simple observational and manual tests to assess their weight, texture, integrity, and handling strength. The findings revealed that the mycelium effectively acted as a biological adhesive, producing lightweight, porous, and structurally stable blocks with good cohesion. The porous nature of the blocks suggested potential thermal insulation and sound-absorbing properties, while their low density made them easy to handle and transport. Although the eco bricks were not suitable for load-bearing construction, they demonstrated promising potential for applications such as packaging materials, insulation panels, interior partitions, acoustic boards, and temporary or decorative structures. The study emphasizes the role of fungal biotechnology in promoting circular economy principles, reducing plastic usage, lowering carbon footprints, and contributing to sustainable development, thereby offering valuable insights for future research and innovation in green construction and bio-composite materials.

Keywords: Myco-bricks, Agricultural waste, Sustainable materials, Biodegradable composites.

EcoForm: Biodegradable 3D Printed Solutions for Everyday Living and Artistic Expression

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EcoForm: Biodegradable 3D Printed Solutions for Everyday Living and Artistic Expression presents an innovative approach to sustainable design and manufacturing through the use of eco-friendly, biodegradable materials in 3D printing. The project addresses the growing concern of plastic waste and environmental degradation caused by conventional manufacturing processes, highlighting the need for sustainable alternatives that do not compromise functionality or aesthetics. The primary objective of EcoForm is to bridge the gap between functionality, creativity, and environmental responsibility by developing a diverse range of biodegradable 3D printed products. The project explores how digital fabrication technologies can be effectively combined with sustainable materials to promote green living and conscious consumerism. The methodology involves the use of biodegradable 3D printing filaments and computer-aided design (CAD) tools to design, prototype, and manufacture various functional, technical, and artistic products. These include everyday household items such as kitchenware, mobile stands, and clocks, as well as creative and aesthetic products like photo frames, statues, and moon lamps. In addition, technical prototypes such as FPV stands, drone frames, gear systems, and protective cover designs were developed to evaluate the material's mechanical strength, precision, and adaptability for engineering applications. The results demonstrate that biodegradable filaments offer sufficient durability, design flexibility, and surface quality for both functional and artistic applications. The successful fabrication of technical and decorative products highlights the versatility of biodegradable 3D printing materials, proving them to be viable alternatives to traditional plastic-based solutions. In conclusion, EcoForm showcases the potential of biodegradable 3D printing in reducing carbon footprints and supporting sustainable manufacturing practices. By integrating technology, sustainability, and artistic expression, the project contributes to the global movement toward a circular economy. EcoForm envisions a future where innovation and environmental care coexist seamlessly, redefining modern design practices for a more sustainable society.

Keywords: Biodegradable materials, 3D printing, Sustainable design, Eco-friendly manufacturing, Circular economy.

Degradation of the Aravalli Range and Its Impact on Environment and Air Quality in Delhi–NCR: A Case Study

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The Aravalli Mountain range is one of the oldest geological formations in the world and plays a vital role in maintaining ecological balance in north-western India. Stretching across Gujarat, Rajasthan, Haryana, and Delhi, the Aravalli range acts as a natural barrier against desertification, regulates regional climate, supports biodiversity, and facilitates groundwater recharge. In recent decades, however, rapid urbanization, illegal mining, deforestation, and unplanned infrastructure development have caused severe degradation of the Aravalli ecosystem. This degradation has emerged as a major environmental concern, particularly for the Delhi–NCR region, which is already facing critical levels of air pollution and environmental stress.

The present case study aims to examine the extent of degradation of the Aravalli range and analyze its impact on environmental stability and air quality in the Delhi–NCR region. The primary objectives of this study are to identify the major human-induced factors responsible for the degradation of the Aravalli hills, to understand their relationship with rising Air Quality Index (AQI) levels, and to assess the broader environmental consequences such as groundwater depletion, loss of biodiversity, and climate imbalance. The study also seeks to propose sustainable solutions for the protection and restoration of the Aravalli ecosystem.

The methodology adopted for this study is based on secondary data analysis. Data were collected from credible sources such as reports published by the Central Pollution Control Board (CPCB), Ministry of Environment, Forest and Climate Change (MoEFCC), environmental research articles, satellite-based observations, and reports from national newspapers and environmental organizations. AQI trends of the Delhi–NCR region were reviewed and correlated with environmental changes linked to the degradation of the Aravalli range.

The findings of the study reveal that large-scale destruction of the Aravalli hills has significantly contributed to increased dust pollution, frequent dust storms, and worsening air quality in Delhi–NCR. The removal of forest cover has reduced the natural ability of the region to trap dust particles and regulate temperature. Additionally, the degradation of the Aravalli range has adversely affected groundwater recharge, leading to declining water tables and

increased water scarcity. Despite legal protections and mining bans imposed by the Supreme Court, weak enforcement and policy loopholes have allowed continued environmental damage. The study concludes that the degradation of the Aravalli range is not only an environmental issue but also a public health and governance challenge. Protecting and restoring the Aravalli ecosystem is essential for improving air quality, ensuring water security, and achieving sustainable development in the Delhi–NCR region. The study recommends strict enforcement of environmental laws, declaration of eco-sensitive zones, large-scale afforestation programs, and integration of environmental considerations into urban planning policies. Immediate and coordinated action is necessary to preserve the Aravalli range for future generations.

Keywords: Aravalli Range, Air Quality Index (AQI), Illegal Mining, Urbanization, Environmental Degradation, Delhi–NCR

DRY FLOWER ARTISTIC: AN UNIQUE ENTREPRENEURSHIP SCOPE FOR CRAFT MAKERS

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Drying and preserving flowers and plant materials is a form of artistic expression that was very popular during the Victorian age. Dried or Dehydrated Flowers or Plant part like Roots, leaves, Stem, Bark or Whole plant can be used for ornamental purposes. Dried flowers and plant parts are low-cost, environmental-friendly, long lasting, biodegradable and readily available. It can enhance Initiate entrepreneurship skills amongst students by preparing decorative things from dried flowers and plant parts. Flowers and other plant materials collected from Gardens, Temples and Farms. The various processes involved in the production of dried plant material including sun drying, air drying, oven drying, drying using desiccants, microwave oven drying, press drying, water drying and glycerinization treatment. In the present study we had taken initiative to prepare greetings and decorative things from dried flowers.

Preserving dried flowers in resin is an artful way to create a one-of-a-kind keepsake. "Whether they are your favorite flowers or flowers tied to an important event like your wedding bouquet, preserving them in resin will capture their beauty forever. Resin art, with its liquid, glass-like finish, offers a unique way to capture the beauty of nature, including the delicate charm of dried plant parts. Embedding dried flower in resin created different attractive artifacts and lasts for

many years. This initiative is a sustainable approach as it mainly involves eco-friendly and biodegradable substances and avoids any use of plastics. Dehydrated products can be used for the production of distinct and artistic decorative items. These items aid to generate revenue.

Present attempt also used to develop resin art among artisans. This pioneer step may leads to develop a new kind of art in present era.

Keywords: Dry flower, Craft, Entrepreneurship, Resin art, eco-friendly, Artifacts

Transforming Education Through Sports for Tribal & Rural Students

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Conventional physics laboratories often face limitations in infrastructure, equipment, and accessibility, particularly in rural and under-resourced settings. This study introduces a “**Physics Lab on the Sports Ground**”, where everyday sports activities serve as experimental platforms to demonstrate core physics principles. Actions such as sprinting, jumping, throwing, kicking, and spinning are used to explore kinematics, Newton’s laws, energy, momentum, rotational motion, friction, and basic aerodynamics. The methodology integrates activity-based experiments, low-cost tools, smartphone sensors, and simple data analysis techniques to transform the sports field into an open-air laboratory. The model was implemented with secondary and undergraduate students, including those from rural and tribal backgrounds. Learning outcomes were measured through pre–post assessments, observation rubrics, and student feedback. Results showed improved conceptual understanding, higher engagement, and stronger inquiry skills compared to traditional lab sessions. The study demonstrates that sports-ground-based physics labs offer an inclusive, cost-effective, and scalable model for experiential STEM education.

To convert sports grounds into low-cost, accessible physics learning environments. To demonstrate fundamental physics concepts through real-life sports actions. To improve conceptual clarity and scientific inquiry skills among rural and tribal students. To integrate sports activities with experiential, activity-based pedagogy. To evaluate learning outcomes through structured assessments and feedback.

This initiative introduces a “Physics Lab on the Sports Ground”, replacing conventional indoor lab constraints with outdoor experiential activities. Sports actions such as running, jumping,

throwing, kicking, and spinning were mapped to physics concepts including kinematics, Newton's laws, energy, momentum, friction, and rotational dynamics. Low-cost tools (measuring tape, stopwatches, markers) and smartphone sensors (accelerometer, gyroscope, video analysis) were used for data collection. The model was implemented with secondary and undergraduate students, including learners from rural and tribal backgrounds. Learning was assessed Singapore- and post-test questionnaires Observation rubrics during activities Student feedback form Results The implementation showed:

Significant improvement in conceptual understanding of motion, force, and energy. Higher student engagement, motivation, and participation. Enhanced scientific inquiry skills, including observation, measurement, and interpretation. Better retention of physics concepts compared to traditional laboratory sessions. Strong acceptance among rural and tribal students, as the activities aligned with familiar sports. The Physics Lab on the Sports Ground offers an inclusive, cost-effective, and scalable model for experiential STEM education. By integrating physics concepts with sports actions, students develop deeper understanding, curiosity, and hands-on scientific skills. This approach effectively bridges the gap between theoretical learning and real-world applications, particularly benefiting rural and tribal educational settings, where laboratory infrastructure is limited.

ECOLOOM: Zero-Waste Art and Sustainable Products from *Luffa cylindrica*

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The increasing accumulation of non-biodegradable waste and the excessive use of synthetic materials have become major environmental concerns across the globe. In response to these challenges, there is a growing need to explore sustainable, biodegradable, and eco-friendly alternatives derived from natural resources. *Luffa cylindrica*, a fast-growing and renewable plant, offers immense potential due to its fibrous structure, biodegradability, and minimal environmental impact. This study focuses on the innovative utilization of *Luffa cylindrica* for the development of decorative items, functional utility products, and value-added edible products, following the principles of zero-waste and sustainable design.

The primary objective of this work was to explore the versatility of *Luffa cylindrica* and demonstrate its suitability as a raw material for artistic, functional, and edible applications. The study aimed to convert different components of the plant into useful products while minimizing waste generation. By integrating creativity with sustainability, the work emphasizes the importance of eco-friendly material alternatives in addressing modern environmental challenges.

The methodology involved the collection of mature luffa fruits, followed by cleaning, drying, and separation of fibers and seeds. The fibrous sponge was processed through cutting, shaping, and surface treatment to develop decorative art pieces and functional items such as natural scrubbers and utility products. Natural dyes and eco-safe techniques were used to preserve environmental sustainability. The seeds were cleaned, roasted, and ground into fine powder, then blended with cocoa, natural sweeteners, and plant-based fats to prepare a nutritious and innovative seed-based chocolate. All procedures were carried out using simple, low-cost, and environmentally friendly methods suitable for small-scale applications.

The results revealed that luffa fibers possess excellent porosity, durability, and structural strength, making them suitable for both artistic and functional uses. The developed decorative items displayed unique textures and aesthetic appeal, while the utility products showed good performance and biodegradability. The seed-based chocolate demonstrated acceptable taste, texture, and appearance, indicating its potential as a plant-based food product. The overall process generated minimal waste, reinforcing the concept of complete resource utilization.

In conclusion, this study highlights *Luffa cylindrica* as a multifunctional, sustainable material capable of supporting zero-waste art, eco-friendly product development, and value-added food innovation. The findings emphasize the importance of utilizing renewable biological resources to reduce environmental impact and promote sustainable living. This work also encourages eco-entrepreneurship and demonstrates how natural materials can be effectively transformed into creative, functional, and environmentally responsible products, contributing to a more sustainable future.

Keywords: *Luffa cylindrica*, Zero-waste art, Sustainable materials, Natural fibers, Eco-friendly products, Seed-based chocolate, Biodegradable resources, Green innovation

Pure Nutrition in Every Bite -Nourished Nation

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A society with good health can achieve economic, social and educational progress.

Specially the women's health is a complete and multidimensional issue that requires an interdisciplinary approach that considers both biological and social determinants.

In recent years there is increase in the prevalence of diet-related diseases in the female population, therefore a survey on health and nutrition for women in different age group have been conducted.

A survey following the questionnaire method have been conducted for women in different age groups, The nutritional status and food intake of the participants were assessed. The survey was ranging the age group between 25 to 60 years.

The survey report, set out women to create a health product such as nutritious bars keeping in mind the most demanding age groups of women categorized as breast feeding mother and geriatric women. The nutrition rich bars include nutrient-rich ingredients like dates, skim milk, peanuts, oats, dried fruits, rajgura puff for elderly women named "Health Haven" and processed soyabean, pure ghee, dates, pumpkin seeds, milk powder, poppy seeds, nuts, and dried fruits for breast feeding Mothers named "Fit Fuel".

This research highlights the potential use of such bars to combat lifestyle diseases and improve overall well-being specially in Women. They meet the growing need of wholesome.

The results of the study have shown that the nutrition bars using nutrition rich ingredients enhance the nutritive value, antioxidants which is the need of women in our society. Overall, the study demonstrate that the formulated nutrition rich bars provide enriched nutritionally valuable food option for women and it provide a new alternative solution instead of conventional approaches.

Keywords: Nutritious ingredients, geriatric women, breast feeding mother, nutrition rich bar, alternative solution.

Manufacture of Light Weight/Blackboard Duster from Waste UPVC & Foam Pieces

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There is no improper stable waste disposal and control strategies which is the most important environmental troubles that growing international locations are dealing with it. Besides the waste, generate at school, home, market, and different public places, they're also the ones from industries, farms, hospitals, pharmaceuticals, and different sources. Waste that is not well managed by human being is UPVC small pieces as well as foam waste pieces. When we burn this UPVC & Foam waste it causes air, water and soil pollution. But by construction of small house hold articles using this small piece of UPVC & Foam we not only protect our environment but also generate the employment. Large amount of UPVC & Foam waste is generated every year while constructing of different household products such as modular kitchen from UPVC material in India similarly large amount of foam waste generated which causes air, water & soil pollutions and it affect environment. Our aim is to utilise this UPVC & Foam waste for the manufacture of other small domestic products, so that we minimize the waste generation and protect the Environment in some extent.

Keywords: Adolescence, BMI, Menstrual Pattern, Irregular cycle.

Preserving Ancient Stone Sculptures Using Natural Plant-Based Colours for Sustainable Heritage Conservation

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Ancient stone sculptures constitute an invaluable part of cultural, historical, and spiritual heritage. These sculptures, found predominantly in temples and heritage monuments, have withstood centuries of environmental exposure due to the inherent strength and breathable nature of stone. However, in recent times, the widespread use of artificial paints and synthetic coatings for aesthetic enhancement and restoration has resulted in severe and irreversible damage. Synthetic paints block the natural pores of stone, restrict air circulation, trap internal

moisture, and create internal pressure, leading to cracking, peeling, salt deposition, and gradual structural deterioration. This issue necessitates the adoption of an environmentally responsible and culturally appropriate conservation approach.

Introduction:

Ancient stone sculptures represent the rich cultural, historical, and spiritual heritage of India. These sculptures are mainly found in temples and heritage monuments.

Stone has a natural porous structure that allows air circulation and moisture balance.

This breathable nature helps sculptures remain stable for centuries. In recent times, synthetic paints are widely used for restoration purposes. These artificial paints contain chemicals and synthetic binders. Such materials block the natural pores of stone. As a result, moisture gets trapped inside the sculpture. This causes cracking, peeling, salt formation, and surface damage. Synthetic paints also contribute to environmental pollution. They release toxic substances harmful to humans and living organisms. Traditional conservation methods followed Agama principles. Natural plant-based colours were used in ancient times. These colours are non-toxic and biodegradable. They do not interfere with rituals or abhishekam. Natural colours allow stone to breathe naturally. They preserve the original aesthetic and sacred value. This project focuses on using plant-based colours for preservation. It combines traditional knowledge with scientific understanding. Thus, natural colours ensure sustainable heritage conservation.

Objectives: To promote the use of natural, plant-based colors for stone sculpture preservation. To protect structural integrity of ancient stone. To preserve spiritual and cultural significance. To ensure environmental safety. To revive traditional knowledge integrated with scientific understanding.

Methodology: Identification of easily available natural dye sources such as: Turmeric, Beetroot, Hibiscus, Indigo plant, Onion peels, Tea and coffee, Kasthi flower, Jasmine leaves Medicinal foliage Extraction methods include: Boiling, Soaking, Fermentation, Filtration Water used as the primary medium., Shade variations achieved by: Blending plant extracts Adjusting concentration Modifying pH levels Application without synthetic binders or sealants to maintain stone breathability.

Results: Natural colours allow internal moisture to escape naturally. Prevent internal stress, surface cracking, and peeling. Do not alter the mineral composition of stone. Do not absorb excess heat, maintaining thermal balance. Life time. 50 - 300 years Are biodegradable and

non-toxic. Safe for: Humans, Birds, Insects and Surrounding ecosystems Reversible application allows cleaning or restoration without damage. Benefits: Fully compatible with traditional Agama practices. Do not interfere with: Rituals, Abhishekam, Worship procedures Preserve original aesthetic beauty and sacred essence of sculptures.

Conclusion:

Natural plant-based colours provide a safe, eco-friendly, and culturally appropriate solution for preserving ancient stone sculptures. They protect the stone's structural integrity, support traditional practices, and ensure sustainable heritage conservation for future generations.

Keywords: Ancient stone sculptures, Natural paints, Heritage conservation, Plant-pigment, Environmental safety.

Know your food better

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Food is a fundamental requirement for human survival, growth, and overall well-being. The quality of food consumed is influenced by various determinants such as availability, cultural practices, processing methods, and nutritional composition. In recent years, there has been growing interest in the concept of *functional foods, which provide health benefits beyond basic nutrition. Among the functional components of foods, **antioxidants* play a vital role in protecting the body against oxidative stress caused by free radicals. Oxidative stress is associated with the development of several chronic and degenerative diseases, including cardiovascular diseases, cancer, diabetes, and aging-related disorders. Antioxidants are naturally present in a wide range of foods that are commonly consumed in daily diets. The objective behind choosing this topic is to explore and understand the significance of antioxidants as functional food components present in various food groups such as cereals, pulses, vegetables and fruits, dry fruits, oilseeds and nuts, spices, tea and coffee, seeds and oils, whey proteins, red wine, and jaggery. The seminar aims to highlight how these foods contribute to health promotion and disease prevention. Another important objective is to create awareness about the nutritional and therapeutic value of traditional and natural food sources, encouraging their inclusion in daily diets for better health outcomes. Antioxidants are found in cereals and pulses mainly in the form of phenolic compounds, which help in reducing inflammation and

improving gut health. Fruits and vegetables are rich sources of vitamins such as vitamin C, vitamin E, carotenoids, and flavonoids, which protect cells from oxidative damage. Dry fruits, oilseeds, and nuts provide antioxidants along with healthy fats that support heart health. Spices such as turmeric, cloves, cinnamon, and cumin contain potent bioactive compounds with antioxidant and anti-inflammatory properties. Tea and coffee are rich in polyphenols and catechins that improve metabolic health. Seeds and edible oils supply vitamin E and essential fatty acids. Whey proteins act as antioxidants by enhancing immune function and cellular repair. Red wine contains resveratrol, a powerful antioxidant known for cardiovascular benefits, while jaggery provides minerals and antioxidant compounds, making it a healthier alternative to refined sugar. The expected outcome of this seminar is an improved understanding of the role of antioxidants in maintaining health and preventing diseases. It will emphasize that simple dietary modifications, such as increasing the intake of antioxidant-rich foods, can significantly enhance quality of life. The seminar also highlights that many antioxidant sources are affordable and easily accessible, especially in traditional diets. In **conclusion**, antioxidants as functional food components have immense potential in promoting health and preventing lifestyle-related diseases. This topic contributes to society by spreading nutritional awareness, supporting preventive healthcare, and encouraging the consumption of natural, traditional, and minimally processed foods. By understanding the importance of antioxidants, individuals can make informed food choices that support long-term health and well-being, thereby contributing to a healthier society.

Keywords: Antioxidants, Functional foods, Determinants of food, Disease prevention, Nutrition and health

Nutrition as Medicine: A Sustainable Alternative to Long-Term Medication

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Good health is the base of a strong society and a productive nation. In recent years, people are becoming more dependent on medicines for even small problems such as headache, cold, acidity and stress. Many chronic diseases such as diabetes, hypertension, heart disease and obesity are also increasing. Medicines are important and lifesaving, but they mainly control

symptoms and often need to be taken for a long time. Long-term or unnecessary use of medicines can lead to side effects such as gastric problems, kidney damage, liver injury and antibiotic resistance. Therefore, there is a need to focus not only on treatment but also on prevention. This is where the concept of “nutrition as medicine” becomes very important. The aim of this study is to highlight the role of nutrition in preventing, managing and sometimes reversing common lifestyle diseases. It also aims to make people aware that a balanced diet, healthy lifestyle and proper nutrition education can reduce excess dependence on medicines. Another objective is to show how natural food, traditional diets and locally available plant foods can be a sustainable solution for future health care. is based on secondary data collected from textbooks, research articles, government health reports and World Health Organization guidelines. Information on nutrients such as carbohydrates, proteins, fats, vitamins, minerals and dietary fiber was reviewed to understand their role in body functions and immunity. The study also explains the impact of junk food, processed food, sugary drinks and sedentary lifestyle on health. Examples of functional foods like millets, turmeric, ginger, garlic, probiotics, green leafy vegetables and fruits are discussed for their protective health benefits. A balanced diet rich in fruits, vegetables, whole grains, pulses, milk, nuts and seeds can help in controlling blood sugar, blood pressure and cholesterol levels. Nutrients such as omega-3 fatty acids, antioxidants, vitamins and minerals strengthen immunity and protect against infections and inflammation. Good nutrition, along with physical activity, adequate water intake, sleep and stress management, leads to better overall health. People who follow healthy dietary habits often experience reduced medicine use, fewer complications and improved quality of life. Nutrition should not be seen only as food for hunger but as a powerful tool for health promotion. “Nutrition as medicine” encourages prevention rather than cure, natural wellness rather than drug dependence, and long-term health rather than temporary relief. Public awareness, nutrition counseling, inclusion of traditional foods and school-level nutrition education are necessary to build a healthy future society. Thus, adopting balanced nutrition and lifestyle changes is the sustainable pathway toward natural wellness.

Keywords: Nutrition as medicine, chronic disease prevention, balanced diet, functional foods, natural wellness, healthy lifestyle

EQUISOLE: Where Soy Waste Sparks Innovation

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The consequences of rapid industrialization and over-reliance on oil-based plastics have created critical environment problems, especially plastic pollution and unsustainable resource management. Concomitantly, India annually generates large amounts of waste from the processing of soya, which, having high-value biopolymer properties, continues to be considered as waste and left unexploited. The EQUISOLE project presents a novel, environment-friendly approach by identifying the conversion of waste soya to high-quality biodegradable bio-products. This innovation involves the creation of bio-based materials like biodegradable plastics, bio-adhesives, bio-coatings, bio-fertilizers, and bio-composites from waste components of soy along with its proteins, polysaccharides, and residual oils. This innovation encompasses cost-effective processing methods that are environmentally friendly. This innovation has a great impact on plastic pollution as it offers an effective alternative to conventional plastic materials that are made from non-renewable resources like fossils. In addition to that, it has an indirect positive effect on agriculture by providing extra sources of revenue to farmers in addition to promoting green manufacturing. The biodegradable materials produced show promising strength, biodegradability, and versatility. On the whole, the EQUISOLE project is an example of how innovation, which brings together the concepts of waste, biodegradable materials, and the principles of sustainable engineering, can be effective in the pursuit of addressing environmental issues. This project emphasizes the importance of the valorization of soy waste in accelerating innovative ideas which lead to positive economic development and the sustenance of an effective bio-based economy.

Keywords: Soy waste valorization; Biodegradable bioplastics; Circular bio-economy; Sustainable innovation; Green materials; Waste-to-wealth

Water Bell System For School

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Adequate hydration is essential for the physical, mental, and emotional development of children. However, due to busy academic schedules, classroom engagement, and lack of awareness, many school-going children fail to drink sufficient water during school hours. Dehydration among students often goes unnoticed and can lead to reduced concentration, fatigue, headaches, digestive issues, and overall poor academic performance. Schools play a vital role in shaping healthy habits, making them an ideal environment to introduce structured health-promoting practices. The Water Bell System is designed as a simple yet effective solution to address the issue of irregular water intake among students during school hours. The primary objective of the Water Bell System is to promote regular and adequate water consumption among students by encouraging them to drink approximately 200 ml of water at fixed intervals throughout the school day. The system aims to reduce dehydration, improve students' physical and mental well-being, and develop disciplined, lifelong healthy hydration habits from an early age. The Water Bell System operates through a separate bell integrated into the school timetable, which rings at fixed intervals, usually every 45 to 60 minutes. When the Water Bell rings, students and teachers pause their academic activities briefly and drink water together. The system can be implemented using a simple timer-based or automated bell mechanism without requiring major infrastructural changes. Teachers supervise the activity, ensuring collective participation while maintaining minimal disruption to classroom teaching. Regular intake of approximately 200 ml of water at frequent intervals helps maintain optimal hydration levels in students. Observations indicate improved alertness, concentration, and reduced fatigue among students. The system also contributes to a noticeable reduction in common dehydration-related problems such as headaches, dizziness, constipation, and tiredness. Additionally, students become more aware of the importance of drinking water regularly, leading to better self-care habits. The Water Bell System is a cost-effective, sustainable, and student-friendly initiative that significantly contributes to improving student health and well-being. By acting as an automatic reminder, the bell reduces the need for repeated teacher instructions while ensuring uniform participation across all classes. The system fosters discipline, health awareness, and consistency, creating a positive and healthy learning environment. Its simplicity and adaptability make it suitable for implementation in schools of various sizes and settings, contributing meaningfully to preventive healthcare and holistic education

Keywords: Water Bell System, Hydration, School Health, Student Well-being, Healthy Habits, Dehydration Prevention

From Scroll to Thought: Literature and Critical Thinking in the Digital Age

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In the contemporary digital age, young minds are surrounded by instant information. Social media, short videos, online posts, and algorithm-driven news feeds continuously shape the way students read and think. While such digital platforms provide quick access to knowledge, they also encourage rapid reactions, superficial understanding, and reduced attention span. In this situation, developing critical thinking has become an urgent educational need. This research idea explores the role of literature as a powerful tool to train the mind for critical thinking in a culture dominated by instant and fast information.

The primary objective of this study is to understand how literary learning helps students build mental skills such as deep reflection, interpretation, empathy, and independent judgment. Literature does not offer one fixed meaning; instead, it encourages readers to interpret characters, motives, and moral dilemmas. This process strengthens the ability to question assumptions, evaluate viewpoints, and understand complex human behaviour. The research also aims to explore how literary learning can be made more engaging for the digital generation by integrating Digital Humanities approaches.

The methodology proposed in this research is exploratory and qualitative. It involves a conceptual analysis of reading habits in digital culture and a comparative framework between instant digital consumption and deep literary reading. The study will use selected literary texts (short stories, poems, or novels) as examples to demonstrate how literature trains the mind. It also proposes using Digital Humanities tools such as digital annotation platforms, online collaborative reading, discussion forums, visual mind mapping tools, and digital archives. These tools help transform screens from spaces of distraction into spaces of learning. Instead of rejecting technology, this idea promotes the responsible use of digital platforms to encourage slow reading, discussion, and reflective interpretation.

The expected findings of this research idea suggest that literature can help young minds move beyond passive consumption of online content. Literary reading improves attention, develops critical reasoning, and builds emotional intelligence. It also trains students to recognise bias, manipulation, and incomplete narratives—skills that are essential for resisting misinformation and algorithmic influence. Further, digital tools can make literary learning learner-centred by

allowing students to annotate texts, share interpretations, and present creative responses such as digital posters, blogs, audio reflections, and visual story maps.

In conclusion, this research idea highlights that literature remains highly relevant in the digital age. It offers not only academic knowledge but also trains the mind for thoughtful decision-making and responsible citizenship. By combining literature with Digital Humanities methods, this approach reimagines literary learning in a way that fits the learning style of modern youth. It contributes to education by promoting deep thinking, ethical awareness, and intellectual independence, enabling students to shift from scrolling towards meaningful thought.

Keywords: Digital culture, Critical thinking, Literary learning, Digital humanities, Youth education, Deep reading.

Block by Block: Restoring Kodali Karuppur Textiles to Glory

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Kodali karuppur sarees, a combination of wax resist hand painting, block printing and intricate weaving, was used exclusively for royal weddings and Events. : 1-To develop the design of kodali karuppur tradition for block making. 2-To evaluate the life style products. An exploratory and retrospective research design was used for study. One method used was printing with wooden blocks, according to the design indicated in the original. Market survey was done and base textures were collected. Woven cotton fabric was used for the product making. Field study visited village kodali karuppur personally saw craft with the open eyes. A) Designing & construction of products Conceptualization and theme making Product Development) 5 female garments were designed Female garment Samples :- 1:- Ready to wear saree blouse 2:- Indo western long kurta with skirt 3:- Plaza and top with dupatta 4:-Lehenga choli with dupatta 5:- Salwar suit with dupatta. Photoshoot of Designed garment – (5 Female) were displayed and used by model for photoshoot in order to get a picture of the study and marketability.

Talking about the process of block printing 90% judges and 50 % consumer know about the printing process. Regarding the acceptance of the garments 87 .50 % thought that garments are acceptable and opinion about compatibility of the fabric and block printing and the idea of using kodali karuppur design for life style product, 90 % consumers were in favor. The block

printing craftsmanship can certainly revive the tradition of kodali karuppur to some extent and the products are highly appreciated.

Key words: kodali karuppur, Block design , Products, Female garments, lifestyle.

आदिवासी बोली, कला व संस्कृतीवर आधारित उद्योजकता : मेळघाटातील कोरकू समाजाचा अभ्यास

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आदिवासी समाजाची ओळख ही त्यांच्या बोली भाषा, कला व संस्कृतीतून स्पष्टपणे व्यक्त होते. या घटकांमधून त्या समाजाची जीवनदृष्टी, निसर्गाशी असलेले नाते, परंपरा व सामूहिक मूल्ये प्रतिबिंबित होतात. महाराष्ट्रातील मेळघाट परिसरात वास्तव्यास असलेल्या कोरकू आदिवासी समाजाची बोली, लोककला, लोकनृत्य, लोकगीते, भितीचित्रे तसेच पारंपरिक जीवनशैली ही अत्यंत समृद्ध अशी सांस्कृतिक संपत्ती आहे.

ही सांस्कृतिक संपत्ती केवळ वारसाच नसून उद्योजकतेच्या दृष्टीने मोठी संधी निर्माण करणारी आहे. कोरकू समाजातील कला व सांस्कृतिक घटक योग्य प्रशिक्षण, आधुनिक साधने आणि बाजारपेठेशी प्रभावीपणे जोडले गेले, तर ते आर्थिक सशक्तीकरणाचे प्रभावी माध्यम ठरू शकतात. तथापि, आधुनिकतेचा प्रभाव, शहरीकरण आणि मुख्य प्रवाहातील संस्कृतीच्या वाढत्या प्रभावामुळे ही सांस्कृतिक संपत्ती हळूहळू लोप पावत असल्याचे दिसून येते. त्याचबरोबर या सांस्कृतिक घटकांचे आर्थिक रूपांतर (economic utilization) आजही मर्यादित प्रमाणात होत आहे.

या पार्श्वभूमीवर आदिवासी बोली, कला व संस्कृतीवर आधारित उद्योजकतेचा अभ्यास करणे आवश्यक ठरते. सदर अभ्यासातून मेळघाटातील कोरकू समाजाच्या सांस्कृतिक घटकांचे जतन करताना त्यांना

शाश्वत उद्योजकतेशी कसे जोडता येईल, तसेच त्याद्वारे आर्थिक व सामाजिक सशक्तीकरण कसे साध्य होऊ शकते, याचा सखोल विचार करण्यात येणार आहे.

Keywords:- सामाजिक सशक्तीकरण, आदिवासी, सांस्कृतिक संपत्ती.

AI-Based Speech Recognition and Emotion Detection System

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(a)Background/Introduction:

In recent years, Artificial Intelligence (AI) has significantly improved how humans interact with machines using natural communication methods like speech. Speech recognition is widely used in virtual assistants, customer support systems, smart devices, and educational platforms. However, most traditional speech-based systems mainly focus on converting speech into text and ignore the emotional state of the speaker. This reduces the system's ability to respond appropriately in real-life situations, where emotions strongly influence communication. Emotion detection from speech helps bridge this gap by identifying the speaker's feelings such as happiness, sadness, anger, fear, or neutrality, enabling more human-like and intelligent interaction.

Keywords:-Speech Recognition, Emotion Detection, Artificial Intelligence, Deep Learning, Human-Computer Interaction, NLP

(b)Objectives/Purpose:

The objective of this project is to develop an AI-based system that combines speech recognition and emotion detection in a single framework. The system aims to accurately convert spoken audio into text while also predicting the emotional state of the speaker. Additionally, the project explores the effectiveness of machine learning and deep learning models for emotion classification and investigates how different speech features influence the performance of emotion detection.

(c)Methodology:

The proposed system uses publicly available emotional speech datasets such as RAVDESS and related audio datasets. The audio data is preprocessed using techniques like noise removal,

normalization, silence trimming, and segmentation. For speech recognition, an Automatic Speech Recognition (ASR) module is implemented using deep learning-based speech-to-text methods. For emotion detection, important acoustic features such as MFCC (Mel-Frequency Cepstral Coefficients), pitch, energy, and spectrogram-based features are extracted using speech processing tools. These extracted features are then used to train and test different models such as Support Vector Machine (SVM), Random Forest, and deep learning models like CNN (Convolutional Neural Networks) and LSTM (Long Short-Term Memory networks). Tools and libraries such as Python, TensorFlow/Keras, Librosa, and NumPy are used for development and evaluation.

(d)Results/Findings:

The speech recognition module generates accurate text output for clear speech inputs and performs effectively for general usage scenarios. Emotion detection results show promising accuracy in recognizing emotions, with deep learning models achieving better performance compared to traditional machine learning algorithms. Preliminary findings suggest that the quality of preprocessing and feature extraction significantly impacts classification accuracy. Balanced training data and strong feature selection improve the system's ability to differentiate between similar emotions.

(e)Conclusion/Implications:

This project demonstrates that integrating speech recognition with emotion detection creates a more advanced and emotionally aware AI system. Such a model can be highly useful in real-world applications like mental health monitoring, smart learning systems, emotionally intelligent chatbots, customer support automation, and assistive technologies. The project contributes to the field of affective computing by enabling systems to understand both the spoken content and emotional intent of users. Future enhancements may include real-time emotion detection, multilingual support, and deployment in mobile or web-based platforms.

Agriculture and Animal Husbandry

Sustainable Application of Hotel Food Waste in the Development of Commercial Fish Feed (Aquafeed)

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India is the second largest aquaculture producer in the world, and the sector is expanding at an annual growth rate of approximately seven to eight percent. This rapid growth has resulted in a steadily increasing demand for commercial fish feed, which constitutes nearly sixty to seventy percent of the total production cost. Conventional fish feeds rely heavily on fishmeal, soybean meal, and synthetic additives, making them expensive and environmentally unsustainable. At the same time, the hospitality industry, particularly hotels and food service establishments, generates a substantial quantity of biodegradable food waste on a daily basis. Improper disposal of this waste leads to landfill accumulation, greenhouse gas emissions, and environmental pollution. Addressing the dual challenges of rising aquafeed demand and effective food waste management has therefore become an urgent requirement.

The present study focuses on the development of a sustainable and cost effective commercial fish feed named Aquafeed using hotel food waste as the primary raw material. The main objective of this research is to convert segregated hotel food waste into nutritionally suitable fish feed pellets, thereby promoting waste valorization and supporting sustainable aquaculture practices. Additionally, the study aims to compare the developed Aquafeed with commercially available fish feed in terms of cost efficiency, sustainability, and environmental impact. Hotel food waste was collected from selected food service establishments and carefully segregated to eliminate spicy, oily, and non biodegradable components. The usable fraction primarily consisted of rice, cereals, vegetable residues, bread, and curry remnants. These materials were subjected to drying and grinding processes to obtain a uniform powdered mixture. The processed material was then formulated into fish feed pellets using simple, safe, and low cost preparation techniques. No synthetic additives or chemical preservatives were used during the formulation, ensuring the eco friendly nature of the developed feed.

The findings of the study indicate that Aquafeed is significantly more economical than commercially available fish feed due to the utilization of locally available waste resources. The developed feed retains essential nutritional components required for fish growth while reducing dependency on conventional feed ingredients. Furthermore, the process contributes to a reduction in hotel food waste generation and minimizes landfill burden. Comparative

assessment reveals that Aquafeed offers advantages in terms of sustainability, waste reduction, and environmental friendliness when compared to conventional commercial fish feed.

In conclusion, the study demonstrates that hotel food waste can be effectively transformed into a low cost and sustainable fish feed. The development of Aquafeed provides a practical, scalable, and environmentally responsible solution that addresses both aquaculture feed demand and food waste management. This approach supports circular economy principles, enhances resource efficiency, and contributes to sustainable development within the aquaculture and hospitality sectors. Moreover, the adoption of such waste based aquafeed systems has the potential to lower production costs for small scale fish farmers and improve access to affordable feed resources. By integrating waste management with feed production, this model presents a viable pathway for environmentally sustainable, economically feasible, and socially beneficial aquaculture development in India under present resource constrained conditions.

Keywords: Hotel food waste, Sustainable aquafeed, Fish feed pellets, Waste-to-value, Resource management

ParkiTest: A Voice Based Parkinson's Disease Detection System Using SPA Hunt Optimization and Acoustic Biomarkers

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Parkinson's Disease (PD) is a disorder that affects the nervous system and causes problems with movement. These problems are categorized into three major types, including tremors, stiffness of muscles (rigidity), and slowness of movement (bradykinesia). The traditional method for diagnosing PD is through clinical assessments using the UPDRS rating scale. This type of clinical assessment is expensive, very subjective, and requires the person to be seen in person at a specialist facility, which makes early detection difficult, especially in areas where resources are limited. As a result, many individuals do not get diagnosed until they have fully exhibited visible movement symptoms.

To aid the diagnosis of PD, there is an urgent need for new objective non-invasive biomarker measures that allow remote screening for PD symptoms. One of the most promising predictive

measures for PD diagnosis is vocal impairment (dysphonia), which can often be measured before visible movement symptoms appear.

A major barrier to predictive technology implementation in this field is a lack of rigorous predictive modelling methodology. However, in the Vidarbha region, the potential for using advanced predictive modeling techniques such as time series analyses and machine learning for predicting climatic parameters that impact the agricultural stability of the region has already been demonstrated [2]. For example, previous research has successfully applied ARIMA and LSTM models to estimate climatic parameters impacting agricultural stability and has demonstrated the value of data-driven forecasting in the local context.

To draw an analogy, there is an urgent need to apply similar advanced computational intelligence techniques to address public health issues in the regional community.

With the continued evolution of mobile phone technology and the accuracy of algorithmic analyses, we can address the growing demand for early detection of PD through the utilization of new predictive modeling tools. We can bridge the gap between complex neurological diagnostics and the general population.

Keywords: Parkinson's Disease, Acoustic Biomarkers, SPA-Hunt Optimization, Tele-diagnosis, Mobile Health, Deep Learning

Sustainable Conversion of Market-Grade Vegetable Waste into Nutritious Supplementary Oil Cake Feed for

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Rapid generation of market-grade vegetable waste due to improper segregation and disposal practices poses serious environmental and public health challenges. Accumulated vegetable residues lead to foul odor, insect breeding, unhygienic conditions, and contamination of soil and water resources. Simultaneously, the livestock sector heavily depends on commercially available oil cakes such as soybean and cottonseed cake, which are often expensive, prone to spoilage, aflatoxin contamination, and quality degradation. Addressing these parallel challenges through sustainable waste utilization forms the core motivation of the present work. The primary objective of this study is to develop a cost-effective, eco-friendly, and nutritionally viable supplementary livestock feed by converting market-grade vegetable waste into a leaf-based oil cake alternative. The study aims to reduce environmental pollution from vegetable

markets while providing a sustainable substitute to conventional oil cakes, thereby supporting livestock health and farmer livelihoods.

The methodology involves systematic collection of vegetable waste from wholesale and retail markets, followed by manual segregation to remove non-biodegradable materials such as plastics and paper. Protein-rich leafy vegetables are selectively separated and thoroughly washed to eliminate dust, soil, and pesticide residues. The cleaned biomass is then dried either under sunlight for 2–3 days or in an oven at 45–50 °C until moisture content is reduced below 10%. The dried material is coarsely ground using a mechanical grinder. Formulation is carried out by incorporating mustard seed powder (10–15% of total mass) to enhance nutritional value, binding capacity, and preservation. The mixture is homogenized into a semi-solid blend and subjected to mechanical compression to obtain firm, cake-like feed blocks.

Nutritional analysis indicates that the homemade leaf-based oil cake contains 9–15% protein, 39–26% carbohydrates, 10–12% fats, and 18–20% fiber. Although protein content is lower compared to soybean oil cake, the higher fiber content and balanced nutrient profile make it suitable as a supplementary feed. Comparative cost analysis reveals that the homemade oil cake (₹10–15/kg) is significantly cheaper than cottonseed and soybean oil cakes.

In conclusion, the sustainable conversion of vegetable waste into supplementary oil cake feed offers a dual benefit of effective waste management and affordable livestock nutrition. This approach reduces dependency on commercial oil cakes, minimizes environmental pollution, and promotes circular bioeconomy practices. The study highlights a practical, scalable, and eco-conscious solution with significant implications for sustainable agriculture, waste valorization, and rural development.

Keywords: Vegetable waste management, Sustainable livestock feed, Oil cake alternatives, Agro-waste valorization, Nutritional supplementation

Development of saline tolerant bioinoculants for sustainable coastal agriculture

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Background / Introduction

Salinity stress is a major abiotic constraint limiting crop productivity and soil health, particularly in coastal and irrigated regions. Elevated salt levels reduce microbial activity, restrict nutrient availability, and impair plant growth, leading to yield losses and increased dependence on chemical fertilizers. Farmers often rely on biofertilizers produced elsewhere, which may not be optimally adapted to local saline conditions. We hypothesize that developing crop-specific, saline-tolerant bioinoculants tailored to local soils will enhance microbial survival, improve nutrient uptake, and provide more effective support for sustainable agriculture.

a. Objectives / Purpose

To address this challenge, the Agricultural Microbiology Unit at PAJANCOA & RI initiated its first systematic project in 2023 with the support of DBT. Thirty students actively participated in the experiential learning course on Bioinoculant Production Technology (0+10 credits). The objective was to isolate diverse microbial strains with potential biofertilizer applications that can support sustainable agriculture in coastal regions and across India.

c. Methodology

Surveys were conducted across Puducherry, Tamil Nadu, Mahe, and Yanam to collect soil and root samples for bacterial isolation using selective media specific to *Rhizobium* (Somasegaran and Hoben, 1994), zinc-solubilizing bacteria (Bunt & Rovira, 1955), *Azotobacter* (Jensen, 1951), *Azospirillum* (Dobereiner, 1978), and *Methylobacterium* (Green, 2006). The isolates were preserved in glycerol stocks at -20°C to ensure long-term viability. Preliminary screening under sterile conditions was carried out to evaluate plant growth-promoting activities.

Building on this foundation, the next phase will involve systematic screening under hydroponic and greenhouse conditions to evaluate performance in saline environments. Molecular characterization through 16S rRNA gene sequencing will ensure authenticity, with validated sequences submitted to NCBI. In parallel, cultural conditions for mass multiplication will be standardized, and pilot-scale fermentation will optimize growth parameters such as pH, temperature, aeration, and nutrient composition. Establishing robust fermentation protocols is essential for scaling up production and ensuring consistency in bioinoculant quality.

d. Results / Findings

A total of 82 cultures comprising of *Rhizobium* (30), *Methylobacterium* (10), *Azospirillum* (20), *Azotobacter* (10), and zinc-solubilizing bacteria (12). These isolates were successfully preserved in glycerol stocks at -20°C in the Agricultural Microbiology Unit. Preliminary screening under sterile conditions revealed promising results. Out of 82, eight *Rhizobium* and four *Methylobacterium* isolates alone were demonstrated by enhanced root colonization potential compared to uninoculated control in tissue-culture-based experiments using black gram and rice as host crops. These findings provide early evidence that locally adapted microbial strains maintain functional traits essential for plant growth promotion. This was supported by the DBT STAR scheme.

e. Conclusion / Implications:

The long-term vision of this initiative is to develop crop-specific bioinoculant formulations under the PAJANCOA & RI brand, thereby supporting farmers in the region with reliable, eco-friendly products. Commercialization of these bioinoculants will reduce dependence on chemical fertilizers, improve nutrient use efficiency, and enhance crop tolerance to salinity stress. Looking ahead, we also envision establishing a quality control laboratory for biofertilizers in our institute

In conclusion, this project represents a collaborative effort between faculty and students to address a pressing agricultural challenge through innovative microbial solutions. The isolation of diverse strains provides a strong foundation for developing saline-tolerant bioinoculants. Subject to continued financial support, the proposed screening, molecular identification, pilot-scale fermentation, and establishment of a quality control laboratory will enable the transformation of this academic exercise into a practical product with significant impact on sustainable coastal agriculture. In addition, the initiative serves as a continuous experiential learning cycle, enhancing students' hands-on training, research skills, and long-term engagement with bioinoculant technology, thereby creating a sustainable loop of knowledge transfer and workforce development within the institute.

Keywords: Salinity Stress, Bioinoculants, *Rhizobium* and *Methylobacterium*, Sustainable Coastal Agriculture, Plant Growth Promotion

“Leaf Guard: A Mobile AI App for Real-Time Plant Disease Detection

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Leaf Guard is an AI-powered mobile application designed to detect plant diseases in real time through image analysis. Plant diseases significantly threaten crop productivity, especially in regions with limited access to agricultural diagnostics. Leaf Guard is a mobile application powered by artificial intelligence (AI) that enables real-time detection of leaf diseases using smartphone images. The app leverages deep learning models—specifically Convolutional Neural Networks (CNNs)—to analyse leaf images and accurately identify disease types.

Trained on a large dataset of thousands of annotated leaf images, Leaf Guard can detect diseases in crops such as cotton, orange, pigeon pea, chickpeas, and soybean (*Glycine max*). It identifies common diseases like leaf blight, wilt, rust, bacterial spot, and mildew, while also assessing the severity of infections. Upon detection, the app provides immediate, actionable guidance on disease management, including both organic and chemical treatment options tailored to the crop's condition.

Its user-friendly interface ensures accessibility for farmers, agricultural extension workers, and researchers, even in low-connectivity areas. With features like offline detection and Multi-language support, Leaf Guard bridges the technological gap in precision agriculture, helping reduce crop loss and promote sustainable farming practices. This innovative tool empowers users with real-time, expert-level disease diagnostics, Encouraging early intervention, improving yield management, and minimizing the misuse of pesticides in agriculture.

Future work includes integrating multispectral imaging for early asymptomatic detection and extending the model to pest identification. By bridging the gap between AI and agriculture, LeafGuard exemplifies how technology can enhance food security, empower farmers, and promote sustainable farming practices.

Keywords: Plant disease detection, Convolutional Neural Networks (CNN)

Student-Led Research Project: Microbial Photosynthesis Meets Abiotic Stress: Exploring the Role of ALA-Producing Anoxygenic Phototrophs in Salinity-Stressed Rice Ecosystems

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a. Background / Introduction

Abiotic stresses such as drought, salinity, and extreme temperatures are responsible for major yield losses in crops worldwide. Rice (*Oryza sativa*), which is the staple food for more than half of the global population, is especially sensitive to salinity stress. Salt stress reduces seed germination, nutrient absorption, stomatal activity, and photosynthesis, leading to poor growth and low yield. 5-Aminolevulinic acid (ALA) is an important compound that helps in the formation of chlorophyll and other molecules needed for plant growth. It has been shown to improve plant tolerance to stress and increase productivity. The external application of ALA has proven highly effective in mitigating salt-induced adversities in different crops. However, commercial ALA is expensive to produce, which limits its use in agriculture. Microorganisms that naturally produce ALA, especially Purple Non-Sulfur Bacteria (PNSB), may provide a cheaper and eco-friendly alternative. Additionally, several studies have highlighted the potential of PNSB to enhance soil fertility and crop productivity when applied directly to soil or plants. However, research specifically addressing the role of PNSB in alleviating salinity stress remains limited.

Keywords: Rice, Salinity, Stress, PNSB, ALA, Bio-stimulant.

b. Objectives / Purpose: The aim of this study is to explore the potential of ALA-producing PNSB to improve rice growth under salt stress. We plan to compare microbial ALA with commercial ALA, study the nitrogen-fixing ability of PNSB, and evaluate their use as bio-stimulants and biofertilizers for rice cultivation.

c. Methodology: Soil samples will be collected from saline rice-growing regions in India. A Winogradsky column system will be used to enrich and isolate PNSB. The isolates will be tested for their ability to produce ALA, fix nitrogen, and promote plant growth by producing hormones like auxins and cytokinins. Their ability to solubilize phosphate and produce siderophores will also be checked. Molecular methods such as 16S rRNA sequencing and PCR will be used to confirm the identity of the isolates and the presence of ALA biosynthetic genes. Selected strains will be tested on rice seedlings under hydroponic, tissue culture, and

greenhouse conditions to study their effect on seed germination, seedling vigor, and salt tolerance. Gene expression studies using qRT-PCR will be conducted to see how PNSB inoculation affects salt-responsive genes in rice. In addition, carrier-based and liquid formulations of PNSB will be developed to improve shelf life and ease of application. Finally, field trials will be planned to test the performance of these formulations on salt-susceptible rice varieties.

d. Results / Findings: It is expected that some PNSB strains will produce measurable amounts of ALA and show nitrogen-fixing activity. These strains may help rice seedlings germinate better and grow more vigorously under saline conditions compared to untreated controls. Molecular studies are anticipated to confirm the presence of ALA biosynthetic genes, supporting their role as bio-stimulants.

e. Conclusion / Implications: This research idea highlights the potential of PNSB as bio-stimulants and biofertilizers to reduce salinity stress in rice. Using microbial ALA could be a cost-effective and eco-friendly alternative to commercial ALA. It may also reduce the need for chemical fertilizers, improve soil health, and lower greenhouse gas emissions from rice cultivation. The development of PNSB-based formulations can support sustainable rice production and help farmers in saline regions. This project also provides valuable hands-on learning opportunities for students, linking classroom knowledge with practical applications in agriculture.

Bioinspired Synthesis of Zinc Oxide Nanoparticles (ZnO NPs) Using Orange Peel Extract for Agricultural Applications: A step towards Zn Nano-fertilizer Development

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The present study focuses on the eco-friendly synthesis of zinc oxide nanoparticles (ZnO NPs) using waste orange peel extract as a natural reducing and stabilizing agent. This green approach aims to minimize chemical waste while producing agriculturally beneficial nanomaterials. The synthesized ZnO NPs were characterized using UV–Visible spectroscopy, which showed an absorption peak at 360–380 nm, confirming nanoparticle formation. FTIR analysis revealed a broad peak at 3402.22 cm^{-1} , indicating the presence of hydroxyl groups responsible for reduction and stabilization. XRD patterns confirmed the crystalline nature of ZnO NPs, while

Zeta potential measurements (-20.7 mV) indicated good stability. SEM images revealed mostly spherical nanoparticles with some agglomeration, ranging from 20–80 nm in size.

The bio-efficacy of ZnO NPs was evaluated on spinach (*Spinacia oleracea*) to assess their impact on seed germination, vegetative growth, and total biomass. Results demonstrated significant enhancement in plant height and biomass, particularly at a concentration of 200 ppm, suggesting improved nutrient availability and physiological activity.

This study establishes that green-synthesized ZnO nanoparticles can serve as sustainable plant growth promoters, offering an eco-friendly alternative to conventional fertilizers and development of Zn nanofertilizer. The innovation contributes to waste valorization, enhanced soil health, and supports environmentally sustainable agriculture with potential implications for food security and rural economic stability.

Keywords: Green synthesis, Zinc oxide nanoparticles, orange peel extract, Plant growth promotion, Sustainable agriculture

Innovating Biogas Technology: A Scalable and Sustainable Model for Agricultural Waste Management

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Agricultural waste management is a major challenge, with residues like geranium waste, wheat straw, and sugarcane leaves often left unused or burned, causing pollution. This project proposes an innovative and universal model for biogas production (National Bioenergy Programme (MNRE) (2022-2026), where the waste substrate can be varied while the process remains the same. The methodology includes alkaline pretreatment with NaOH, followed by fungal treatment using *Schizophyllum commune*, and anaerobic digestion with cow dung slurry as inoculum. The fungus plays a crucial role in degrading lignocellulosic polymers into simple sugars, making the biomass more digestible for methanogenic microbes. This model is unique because it can be applied to any lignocellulosic agricultural waste without changing the protocol, thus providing a flexible, scalable, and sustainable waste to energy solution. Expected outcomes include higher methane yield, reduced carbon emissions, and the production of biofertilizer as a byproduct. The novelty lies in integrating fungal biotechnology with conventional digestion, creating a standardized, ecofriendly, and engineering driven

biogas production system. The current model is developed to utilise all kinds of agricultural wastes for the production of biogas.

Keywords: Lignocellulosic biomass, Biogas production, Fungal pretreatment, *Schizophyllum commune*, Anaerobic digestion, Waste-to-energy

AI Powered 7 in 1 Soil Monitoring System

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Current agricultural practices suffer from inefficient fertilizer application due to a lack of real-time data. This project proposes a portable 7-parameter monitoring system that integrates NPK, pH, EC, moisture, and temperature sensors. With AI assistant. By providing localized, real-time analytics and predictive crop advice, the system reduces chemical waste by 30% and enhances yield for small-scale and industrial farmers. The system is encased in a sturdy enclosure and powered by a combination of a battery and a power bank, incorporating a Bluetooth module for wireless data transmission. . This arrangement facilitates localized, low-power communication.

A standout feature of this design is the mobile application interface, displayed on a handheld device. This app offers users a real-time dashboard to visualize the collected soil data. By providing instant monitoring of NPK, moisture, temperature, and EC levels, it empowers farmers and agronomists to make informed, data-driven decisions regarding irrigation, fertilization, and overall crop management. As a result, resource utilization is optimized, and yield potential is enhanced, all thanks to cutting-edge technology and the integration of AI.1. Acquisition: Multi-sensor array (NPK Electrochemical, pH Probe, temperature, etc.) interfaces with a microcontroller.2. Processing: Data is filtered 3. Analysis: The AI assistant contextualizes raw numbers against a database of regional crop requirements4: Output: Real-time and transmitted via API to the "Soil data showing app" logic. Visualization on a mobile-responsive dashboard with PDFThe integration of a "Conversational AI Expert" directly into the sensor dashboard. The Difference: Unlike traditional loggers that show static numbers, our system "talks to the farmer, answering questions like "Why is my Potassium low?" or "Which fertilizer should I buy for tomatoes today?" in their native language. The project successfully developed a unified platform that transforms raw soil telemetry into agricultural intelligence.

By achieving the 7-parameter monitoring goal, the system provides a comprehensive "health check-up" for the earth, ensuring sustainable farming and food security.

Keywords: Precision agriculture, communicational AI, real time connectivity, multilingual.

Eco-Sensor: Biodegradable Plant Powders for Sustainable Agriculture

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Soil testing is an essential practice in agriculture for determining soil fertility, nutrient availability, and suitability for crop cultivation. Conventional soil testing kits often rely on chemical reagents that can be hazardous, expensive, and environmentally harmful. These limitations reduce their accessibility, particularly in low-resource and rural settings. There is an increasing need for sustainable, safe, and affordable alternatives that align with eco-friendly agricultural practices. Plant-based indicators offer a promising solution due to their natural origin, biodegradability, and ability to undergo visible colour changes in response to chemical variations. The objective of this project is to develop an eco-friendly and biodegradable soil testing kit using plant-based powders as natural indicators for assessing soil pH and nitrogen status. The study aims to provide a low-cost, safe, and user-friendly alternative to conventional chemical soil testing kits, making soil assessment more accessible to farmers, students, and field workers. Additionally, the project seeks to promote sustainable agricultural practices by minimising chemical usage and encouraging natural testing methods. The soil testing kit was developed using selected plant materials known for their indicator properties. Hibiscus flower powder, rich in anthocyanins, was used as a natural pH indicator due to its distinct colour changes under acidic, neutral, and alkaline conditions. Guava leaf powder, containing tannins and polyphenols, was employed for nitrogen detection, as it reacts with nitrogen compounds to produce measurable colour variations. The plant materials were processed into fine powders and incorporated into a simple testing format suitable for field application. Soil samples were analyzed using these plant-based indicators, and the resulting color changes were observed to assess soil characteristics. The developed eco-sensor successfully demonstrated visible and distinguishable color changes corresponding to different soil pH levels and nitrogen content. Hibiscus flower powder effectively indicated acidic, neutral, and basic soil conditions, while

guava leaf powder showed clear reactions with nitrogen compounds. The results confirmed that plant-based powders can function as reliable indicators for basic soil assessment. The kit proved to be safe, biodegradable, and easy to use, requiring minimal technical expertise. The study concludes that biodegradable plant powders can serve as effective natural indicators for soil testing applications. The developed eco-friendly soil testing kit offers a sustainable, low-cost alternative to chemical-based kits and has significant potential for use in educational, agricultural, and field settings. By reducing reliance on synthetic chemicals, this innovation supports environmentally responsible farming practices. Furthermore, the project lays the foundation for future improvements, including the development of strip-based testing formats and enhanced extract stability, thereby expanding its practical utility and impact on sustainable agriculture.

Keywords: Biodegradable sensors, Plant-based indicators, Soil pH testing, Nitrogen detection, Sustainable agriculture, Eco-friendly soil kit.

A perfect remedy for primary burn management in animal husbandry :PashuCare

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Burn injuries are the common health concern in animal husbandry often occurs due to accidental exposure to heat or chemical contact. Conventional burns treatment can cause irritation or delayed healing and may not always be readily available in rural areas. Shea butter is rich source of vitamin-E a natural antioxidant and is also rich in triterpenes, tocopherols, stearic acid and oleic acid which have anti-inflammatory, antioxidant and wound healing properties. In animal husbandry, maintaining skin integrity is vital since burns abrasion or cuts can lead to infection. Shea butter provides a natural, sustainable and affordable solution for managing these conditions. Shea butter possessing the moisturizing, soothing and wound healing property and tissue generation forms a protective barrier preventing dehydration and healing. Shea butter represents a promising natural therapeutic agent for managing burns and skin injuries in animal husbandry. Shea butter into veterinary practice support eco-friendly and economical livestock management, especially in rural settings. The aim of this study is to create the formulation for animal's need intended to help them in the primary burn management as it contains the shea butter which is known for its wound healing and soothing properties along

with the natural ingredients like honey, glycerin, aloe vera and coconut oil. The experimental setup was kept simple, cost-effective, and reproducible, aligning with small-scale laboratory and field-level veterinary applications. Basic laboratory tools such as a magnetic stirrer or manual stirrer, weighing balance, beakers, thermometer, pH paper or pH meter, and spatula were used. No sophisticated instrumentation was required, making the formulation feasible in academic and rural settings. The preparation was carried out under hygienic conditions to prevent microbial contamination. Preliminary observations showed that the hydrogel possessed excellent moisture-retention capacity, which is essential for maintaining a moist wound environment and supporting faster healing in animals. The formulation exhibited good spread ability and adhesiveness, allowing it to remain on the skin or wound surface without excessive runoff, an important requirement in animal husbandry where frequent reapplication is difficult. From a veterinary and healthcare standpoint, the hydrogel addresses an important unmet need in animal care—safe, affordable, and easy-to-apply wound dressings for livestock and domestic animals. Many rural and low-resource settings lack access to advanced veterinary products; this formulation offers a cost-effective and locally adaptable alternative that can help reduce infection, improve healing outcomes, and enhance animal welfare.

Keywords: animal husbandry, burn management, shea butter, wound healing, veterinary practice

7-Hydroxyflavone as a Promising Bioflavonoid for Management of Veterinary PCOS

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Polycystic ovarian syndrome (PCOS) is a common gynaecological and endocrinological disorder causes anovulatory infertility that affecting 4-10% in women and 10-13% of animals like cows, Buffalo, Sheep, Goat of reproductive age. Although current therapeutic options exist, many are accompanied by adverse effects, underscoring the need for safer and more effective alternatives. 7-Hydroxyflavone (7-HF), a natural flavonoid, has demonstrated notable biological properties; however, its therapeutic potential in PCOS remains unexplored. The current study aimed to explore the possible role of 7-HF in treating letrozole induced PCOS in rats. PCOS was induced in Female Wistar Rats by the administered of letrozole (1 mg/kg, p.o.) for 21 days. After induction, rats were treated with 7- Hydroxyflavone at various doses (5, 10

and 15 mg/kg) and metformin (300 mg/kg) for 14 consecutive days. Letrozole-induced PCOS was characterized by disrupted estrous cycle, increased body and ovarian weights, cystic ovarian follicles, altered metabolic and hormonal level, enhanced oxidative stress (elevated LPO, SOD; reduced GSH), and elevated inflammatory markers (TNF-alpha and IL-6). Treatment with 7-Hydroxyflavone significantly mitigated these alterations, restored normal estrous cycles and hormonal balance, reduced oxidative stress and inflammation, and improved ovarian histology in a dose-dependent manner. This study provides the first evidence that 7-Hydroxyflavone effectively mitigates letrozole-induced PCOS manifestations in rats, likely through its antioxidant, anti-inflammatory, and endocrine-modulating effects. These findings support the therapeutic potential of 7-HF as a novel candidate for Veterinary PCOS management.

KEY WORDS: Polycystic Ovarian Syndrome (PCOS), 7- Hydroxyflavone (7-HF), Letrozole, Estrus Cycle (EC),

Optimizing Fish Growth and RAS Efficiency Using Black Soldier Fly (BSF) Based Functional Aquafeed.

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Feed formulation plays a central role in sustaining modern aquaculture, especially in Recirculatory Aquaculture System (RAS), where feed quality directly affects growth, metabolism, and overall system stability. Conventional protein sources such as fishmeal and soybean meal are increasingly difficult to rely on due to rising costs and concerns over resource depletion and environmental pressures. Black Soldier Fly (*Hermetia illucens* L.) (BSF) prepupae meal has gained attention as a potential alternative because it converts organic waste into a high-protein product, making it suitable for use in circular aquaculture practices. However, in its basic form, BSF meal may not fully meet the nutritional demands of fast-growing fish without additional supplementation. This study focuses on developing a BSF-based functional aquafeed and examining its performance within RAS conditions.

The feed was produced using defatted BSF prepupae meal as the main protein ingredient. To improve amino acid balance and micronutrient availability, the formulation also included moringa leaf powder, spirulina, L-lysine, and DL-methionine. Natural pectin was used as a

binding agent to strengthen pellet integrity and limit nutrient loss during feeding. The ingredients were milled, mixed, pelletized, and dried under controlled conditions to obtain a uniform feed suitable for grow-out stages. Crude protein calculations based on ingredient proportions confirmed that the final feed contained approximately 34–35% protein, which is comparable to or higher than many commercial grower feeds currently available.

The formulated feed was then tested within a working RAS to observe its behaviour in a closed-loop system. The pellets showed high water stability, which helped reduce disintegration and limited the number of suspended solids entering the filtration components. Fish readily consumed the feed, and digestion appeared efficient, as indicated by reduced visible waste and lower ammonia accumulation. These characteristics supported improved system performance, including steady water quality and reduced pressure on biofiltration units. The inclusion of spirulina and moringa contributed additional vitamins and minerals that support metabolic processes, although further biochemical analysis is needed to quantify these effects on fish immunity and growth rates.

Key observations during the study suggest that BSF based feed enriched with essential amino acids can provide a dependable protein source while reducing dependence on conventional ingredients. The ability to process organic waste through BSF larvae and convert it into fish feed also offers an opportunity to close nutrient loops within aquaculture farms, lowering waste output and improving resource efficiency. The environmental benefits of reduced feed-related pollution were also noticeable through lower solid waste accumulation and more stable nitrogen cycling within the system.

In conclusion, the results show that this BSF based feed can support fish growth while maintaining water quality in RAS. High protein content, pellet stability, and efficient digestion lowered solid waste and ammonia levels, helping sustain system performance. These outcomes indicate that nutritionally balanced BSF meal can reduce dependence on conventional protein sources without affecting feed quality. The method also supports sustainability by converting organic waste into aquaculture inputs. Further growth trials, health evaluations, and cost analyses are needed to confirm long-term benefits and assess commercial feasibility.

Keywords: Black Soldier Fly (BSF) Feed, Recirculatory Aquaculture Systems (RAS), Sustainable Aquafeed, Crude Protein

Conventional Artificial Insemination Practices and Stakeholder Readiness for Digital AI Gun Technology in Dairy Animals

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Artificial insemination (AI) is a cornerstone reproductive biotechnology widely employed for genetic improvement and productivity enhancement in dairy animals. In India, and particularly in rural and semi-urban regions such as Akola district of Maharashtra, conventional artificial insemination using a manual AI gun and the recto-vaginal technique continues to be the predominant breeding practice under field conditions. Despite its extensive adoption, the success of conventional AI often remains inconsistent due to multiple operational and management-related constraints, including improper or delayed heat detection, variability in technician skill and experience, inaccurate semen deposition, and limited access to advanced monitoring tools. These challenges collectively result in suboptimal conception rates, increased repeat breeding, and economic losses to dairy farmers. In recent years, digital or smart AI gun technologies have been proposed as innovative solutions to address several of the limitations associated with conventional AI practices. Such technologies aim to enhance precision in semen deposition, reduce operator dependency, and potentially improve conception outcomes through sensor-based guidance and data-driven decision support. However, the adoption of digital AI gun technology in routine veterinary practice in India remains minimal, largely due to limited awareness, insufficient training, infrastructural constraints, and uncertainties regarding cost-effectiveness and field applicability.

The present study was undertaken with the objective of assessing prevailing conventional artificial insemination practices in Akola district, identifying key technical and socio-economic constraints affecting AI success, and evaluating the level of readiness, awareness, and acceptance of stakeholders toward the future adoption of digital AI gun technology. A structured, questionnaire-based survey was conducted among 120 respondents, comprising veterinary officers, AI technicians, and dairy farmers actively involved in cattle breeding programs.

The findings of the study revealed moderate conception rates ranging between 30–50 percent, a high frequency of repeat inseminations, and a strong dependence of AI success on individual technician skill. Awareness regarding digital AI gun technology was found to be limited across

all stakeholder groups; however, a majority of respondents expressed a positive attitude and willingness to adopt such technologies if introduced through government-supported programs accompanied by adequate training and technical support. In conclusion, the study highlights a clear need for technological intervention and policy-driven initiatives to improve reproductive efficiency in dairy animals. Strategic integration of digital AI gun technology, along with capacity building and awareness programs, has the potential to enhance AI success rates, reduce repeat breeding, and contribute to the sustainable development of dairy farming systems in Akola district and similar regions.

Keywords: Artificial insemination, dairy cattle, conventional AI, digital AI gun, stakeholder readiness, farmer perception, Akola district

Title: Eco-friendly Agro waste-based Artifacts

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A growing environmental hazard is the use of plastics derived from non-renewable petroleum sources in agriculture and industries. In recent years, growing environmental awareness and the urgent need to reduce plastic pollution have encouraged the development of eco-friendly and sustainable materials. One of the promising innovations in this area is the creation of biodegradable artifacts and pots made from plant waste. These products are designed to reduce plastic use or non-degradable materials. However, the production and characterisation of biodegradable plant waste-based pots and other products are the subject of very few publications. Plant pots and other artifacts made of biodegradable materials eliminate the need for transplanting and, hence, the need to throw away a container. The plant waste, like Coconut Coir, Wood dust, and Sugar- cane bagasse, are found to be useful for preparing various eco-friendly products. This waste collected, boiled and dried properly thereafter it can be used to make various artifacts like Plant pots, Diyas, Pen holder etc. This initiative is a sustainable approach as it mainly involves eco-friendly and biodegradable substances and avoids any use of plastics. The present attempt has been made to aware people for the use of Biodegradable and Ecofriendly products prepared from plant waste.

Keywords: Agro waste, Artifacts, bio pots, Biodegradable, Eco-friendly, Renewable, etc.

Null KTI Introgression: Development of Protease Inhibitor Free Soybean Cultivar for Food Industry Demands

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Soybean (*Glycine max* L.) is a major source of plant-based protein (35–45%) and oil (18–22%). However, its direct utilization in food and feed is restricted due to the presence of Kunitz Trypsin Inhibitor (KTI), an anti-nutritional protease inhibitor that reduces protein digestibility by inhibiting trypsin activity. Although thermal processing can partially inactivate KTI, residual activity remains and increases processing costs while affecting protein quality. Genetic elimination of KTI offers a sustainable solution to develop food- and industry-ready soybean varieties without compromising nutritional value. The present study aimed to introgress a null KTI allele into high-yielding, charcoal rot resistant soybean genotypes to develop nutritionally improved soybean lines suitable for food and feed applications.

Marker-assisted backcross breeding (MABB) was employed to introgress the null KTI allele from donor genotypes NRC-101 and NRC-127 into charcoal rot resistant recipient cultivars AMS-MB-5-18 and AMS-MB-5-19. Four cross combinations were generated. Hybridity and KTI null allele introgression were confirmed using a null allele-specific PCR marker targeting the Ti locus on linkage group A2. A total of 360 SSR markers were screened for parental polymorphism, and 61 polymorphic markers were used for background selection. Charcoal rot resistance was evaluated under sick plot conditions at RRC, Amravati along with the mapping of resistant gene responsible for the charcoal rot. Native PAGE was used to confirm the absence of KTI peptide, and qRT-PCR was performed to study growth stage wise KTI gene expression pattern. Eighty-eight backcross-derived plants were confirmed for null KTI allele introgression, of which 24 lines were KTI peptide-negative by Native PAGE analysis comprises BC₁F₄, BC₁F₅, BC₂F₃, BC₃F₂ populations. These lines showed high recovery of recurrent parent genome (up to ~96%). Charcoal rot resistance was retained, with associated QTLs identified on chromosomes 1, 2, and 12. qRT-PCR analysis revealed stage-specific regulation of KTI, with significantly higher expression at the R5 stage compared to R6. The study successfully developed advanced soybean lines combining null KTI allele and charcoal rot resistance with high recurrent parent genome recovery. These lines have direct implications for both industry and farmers. For industries these lines reduce the heat processing stage, lower production costs,

and improve protein quality for food and feed applications. For farmers, the lines combine charcoal rot resistance with improved nutritional value, ensuring stable yields and better market acceptance, thereby enhancing overall profitability. Also, these lines represent valuable genetic resources for developing nutritionally superior, processing-efficient, and disease-resistant soybean varieties for the food and feed industry.

Keywords: Soybean KTI, MAS, qRT-PCR, QTL

“Helminth Parasites as Eco-biological Markers for Sustainable Aquatic Resource Management in Akola, Maharashtra.”

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Helminth parasites of freshwater fishes are increasingly recognised as valuable eco-biological indicators because their life cycles and distribution patterns are closely linked to environmental conditions. The present work investigates the helminth fauna of commonly occurring freshwater fishes in Akola District, Maharashtra, with the objective of assessing their potential use in monitoring ecosystem health and guiding sustainable aquatic resource management. Fish samples were collected seasonally from selected reservoirs, tanks, and river stretches within the district. Standard parasitological procedures were used to isolate and identify helminth parasites, and their prevalence, mean intensity, and community structure were documented. Parallel to this, major physico-chemical parameters of the water including temperature, pH, dissolved oxygen, hardness, conductivity, and nutrient load were analysed to understand habitat quality. Marked variation was observed in helminth composition among sites, with higher parasite diversity in relatively undisturbed habitats and dominance of pollution-tolerant taxa in areas subject to organic enrichment and anthropogenic pressure. Statistical comparison of parasitological and environmental data indicated clear associations between parasite occurrence and specific ecological conditions. Helminths with complex life cycles proved particularly sensitive to habitat alterations, making them strong indicators of ecosystem imbalance. Their ability to integrate long-term environmental changes further strengthens their value over short-term chemical assessments. The study demonstrates that helminth parasite communities can serve as reliable biological markers for evaluating water quality and tracking ecological change in freshwater bodies of semi-arid regions such as Akola. Incorporating helminth-based indices into existing monitoring frameworks can enhance early detection of

environmental stress, promote better management of fishery resources, and support conservation-oriented decision-making. The findings emphasise the need to adopt integrative biological tools for achieving sustainable aquatic resource management at the regional level. Conventional environmental monitoring largely depends on physico-chemical measurements, which provide only short-term information and often fail to reflect cumulative ecological changes. There is a growing need for reliable biological indicators that can integrate long-term environmental conditions. Helminth parasites, due to their complex life cycles, host specificity, and sensitivity to habitat alterations, offer strong potential as ecological indicators. However, their indicator value remains underutilized in regional freshwater ecosystems such as those of Akola District, Maharashtra. The study aims to evaluate the potential of helminth parasites as ecological indicators of environmental health. Specifically, it seeks to assess helminth diversity, prevalence, and community structure in freshwater fish hosts and to understand their relationship with environmental variables and habitat quality. Freshwater fish were collected seasonally from selected reservoirs, tanks, and river stretches within Akola District. Helminth parasites were isolated, preserved, and identified using standard parasitological techniques. Quantitative parameters such as prevalence, mean intensity, and abundance were recorded. Simultaneously, physico-chemical parameters of water, including temperature, pH, dissolved oxygen, conductivity, hardness, and nutrient levels, were analysed. Statistical methods were applied to examine correlations between parasite communities and environmental conditions. The study revealed significant spatial and seasonal variations in helminth parasite assemblages. Higher parasite diversity and balanced community structures were observed in relatively undisturbed habitats, whereas polluted and anthropogenically stressed sites showed reduced diversity with dominance of pollution-tolerant species. Helminths with complex life cycles were particularly sensitive to environmental degradation, demonstrating clear associations with changes in water quality parameters. The findings confirm that helminth parasite communities are effective, long-term biological indicators of environmental health in freshwater ecosystems. Their integrative response to ecological changes makes them valuable tools for environmental monitoring and assessment. The study contributes to ecological parasitology by highlighting the practical application of helminths in ecosystem evaluation and supports their inclusion in sustainable freshwater management and conservation strategies.

Keywords: Helminth parasites, Eco-biological indicators, Freshwater fishes, Environmental health, Water quality, Aquatic ecosystem

Microbial Production of Enzymes Using Agro-Waste

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Agro-wastes such as rice bran, wheat straw, sugarcane bagasse, and fruit peels are rich in nutrients and serve as low-cost substrates for enzyme production. Microorganisms like bacteria, fungi, and yeast efficiently utilize these wastes to produce industrially important enzymes.

Solid-state and submerged fermentation are the main techniques employed for enzyme production using agro-residues. This approach reduces production cost while promoting waste valorization and environmental sustainability. Enzymes such as amylases, cellulases, proteases, and lipases are commonly produced through this method. Agro-waste based fermentation enhances microbial growth due to the presence of carbon, nitrogen, and minerals. The process also helps in minimizing agricultural waste disposal problems. Microbial enzyme production using agro-waste is eco-friendly and economically viable. It supports sustainable industrial development and circular bioeconomy concepts. Thus, agro-waste utilization offers a promising alternative for large-scale enzyme production.

Keywords: Agro-waste, Enzyme production, Microorganisms, Solid-state fermentation, Industrial enzymes, Sustainability

Engineering and Technology

“Natural Disaster Prediction using Smart Data Analytics”

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a. Background / Introduction: The occurrence of natural disasters has increased in frequency and intensity over the last several decades, including earthquakes and tidal waves or flooding and extreme fires, because of climate change and damage to Earth's ecosystem. Natural disasters threaten humans, infrastructure, and global economic stability. Historically, disaster management has been reactive, with post-event relief being a priority instead of focusing on proactive disaster mitigation. The greatest challenge in mitigating environmental disasters is the volume, velocity, and range of information regarding the environment that has the potential to overload traditional methods of forecasting weather. Therefore, there is an immediate need for advanced systems capable of converting raw environmental data into useful decision-making information prior to an event occurring.

b. Objectives / Purpose: The purpose of this research is to establish a reliable framework for Predicting Natural Disasters through Smart Data Analytics. The goal of this work is to create a predictive engine that can accurately identify the precursors of natural hazards early enough to give warning to those potentially affected. This study will investigate how the use of multiple sources of information (e.g., satellite images, seismic sensors, and historical weather data) can increase the lead time of emergency notifications. This study will also examine the relationship between local weather anomalies and large-scale disasters to reduce false alarm counts and, therefore, reduce the risk of complacency among the public.

c. Methodology: The method of this research consists of utilizing both Big Data Processing (e.g., Hadoop using pre-built data analysis tooling) & AI based "Smart Data" method by using machine learning algorithms on top of an advanced cloud-based architecture for real-time data ingestion.

1. Collecting Data: A combination of multiple [very large] datasets (for example, GDACs & multiple Internet of Things (IoT) enabled sensors).

2. Cleaning and Normalization: All collected datasets were processed through cleaning and normalization procedures. All cleaning and normalizing processes have been performed using Python-based Libraries that enable the identification and addressing of missing data and sensor noise.

3. Building Models: Two types of modelling used in this project were Random Forest and Long Short-Term Memory (LSTM) Networks. Random Forest is well suited for describing non-linear relationships within large datasets while LSTM Models can learn from historical observations over time and are therefore ideal for time-series forecasting.

4. Validation: A comparison of predicted model results was made with historical disaster datasets over the last ten years to provide a measure of the accuracy of predictions made by this model through calculated accuracy, precision, and F1 score (i.e., measures of the true positive rate and overall reliability of the predictive values).

d. Results / Findings: The initial findings of the Smart Data Analytics framework are considerably superior to typical statistical forecasts. An LSTM wastewater flood forecast model demonstrated an 88% level of accuracy at predicting both the prevention and timing of flooding within 72-hours. In addition, the use of real-time geodetic and seismic data has resulted in a 15% increase in detection of precursors (or foreshocks) to significant earthquakes, when compared to standard methods. The results also highlighted the paramount importance of the ability of the model to be adjusted according to changes in soil moisture and sea surface temperature regarding its sensitivity to hurricane intensity was almost 20%. Overall, the findings demonstrate that the most effective means of providing accurate predictive analytics is through an emphasis on quality and relevance of data to “smart data”.

e. Conclusion / Implications: The study reveals that Smart Data Analytics can change how Disaster Risk Reduction operates by creating an innovative technology that allows them to become more proactive rather than reactive.

The findings of the study will allow governments/NGOs to develop and implement scalable systems for early warning.

The significance of this work is that it can help authorities save lives and reduce economic impact by providing them with an appropriate time frame to mobilize resources and evacuate residents.

The establishment of Resilient Cities globally using artificial intelligence will ultimately assist with climate change adaptation.

Keywords Smart Data Analytics, National Disaster, Earthquake, Early Warning Systems.

KAYAHA: AI-Powered Compliance Automation Platform for Startups

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a. Background / Introduction:

The compliance industry presents a significant barrier to startup growth, with traditional SOC 2, HIPAA, and ISO 27001 certification processes costing \$50,000 to \$150,000 and taking 6 to 12 months to complete. This prohibitive expense forces 73% of early-stage startups to delay compliance initiatives, directly impacting their ability to close enterprise deals, secure funding, and meet regulatory requirements. The current market—valued at \$10 billion and growing at 24% CAGR—remains dominated by manual consultant-driven processes that are slow, expensive, and overwhelming for resource-constrained startups. Founders waste 200+ hours navigating technical jargon, endless documentation, and complex security frameworks without clear roadmaps. This problem motivated the development of KAYAHA, an AI-powered solution designed to democratize compliance for early-stage companies.

b. Objectives / Purpose

KAYAHA aims to revolutionize compliance automation by reducing certification time from 6–12 months to 60 days while cutting costs by 75% compared to traditional consultants. The primary objectives are: (1) Automate policy generation using AI to create 15 customized security policies in under 2 minutes, (2) Implement continuous evidence collection through native cloud integrations with AWS, GitHub, and Google Workspace, (3) Provide intelligent gap analysis and step-by-step remediation guidance, (4) Deliver a guided, startup-friendly user experience that eliminates overwhelming complexity, and (5) Guarantee certification success with a 60-day timeline backed by a money-back guarantee. The platform targets pre-seed to Series A startups, addressing the critical need for affordable, fast compliance solutions that enable companies to unlock enterprise sales and satisfy investor due diligence requirements.

c. Methodology:

KAYAHA employs a three-phase approach: Connect-Generate-Certify. The technical architecture utilizes React 18 with TypeScript for the frontend, integrating Claude AI (Anthropic) for intelligent policy generation that learns company-specific voice and industry context. The system connects to cloud infrastructure via OAuth-based integrations,

automatically collecting compliance evidence from AWS CloudTrail, GitHub branch protection settings, Google Workspace MFA configurations, and other security tools. A proprietary gap analysis engine continuously monitors 47 SOC 2 controls, identifying deficiencies and providing prioritized remediation workflows. The AI assistant offers contextual guidance, explaining technical requirements in plain English and linking to relevant documentation. The platform implements a guided onboarding wizard capturing company profile, industry, tech stack, and compliance needs to generate personalized 60-day roadmaps. Real-time WebSocket connections provide live compliance score updates and team collaboration features. The system architecture emphasizes mobile-first responsive design, WCAG 2.1 AA accessibility compliance, and sub-2-second page load times.

d. Results / Findings

Current beta testing with 20 design partners demonstrates strong product-market fit: 94% user satisfaction (NPS: 72), 52-day average time to SOC 2 certification (28% faster than the 60-day guarantee), and 0% churn rate during the beta period. The platform successfully automated evidence collection for 120+ security controls per company, generated customized policies in an average of 90 seconds, and achieved an average deal size of \$599/month—significantly below the \$25,000 annual industry average. Early validation includes 300+ waitlist signups in 30 days (100% organic), first paying customer conversion in December 2025, and \$2,000 monthly recurring revenue from beta users. User interviews revealed 180+ hours saved per company compared to manual compliance approaches, with 94% of founders identifying cost as a critical blocker that KAYAHA successfully addressed.

e. Conclusion / Implications

KAYAHA demonstrates that AI automation can fundamentally transform regulatory compliance from a prohibitive barrier into an accessible growth enabler for startups. By reducing costs from \$80,000 to under \$6,000 annually while accelerating timelines by 70%, the platform addresses a massive \$450 million serviceable market within the broader \$10 billion compliance industry. The implications extend beyond individual company success: democratizing compliance strengthens the entire startup ecosystem, enabling earlier enterprise readiness, faster fundraising cycles, and improved security postures across thousands of emerging companies. The 40:1 LTV:CAC ratio and strong unit economics validate a scalable business model. Future development roadmap includes HIPAA and ISO 27001 framework support (Q2 2026), auditor marketplace integration, and expansion into global markets (EU GDPR focus). This innovation contributes to India's growing RegTech sector while addressing

a genuine pain point experienced by founders nationwide, positioning KAYAHA to become the “Stripe of Compliance” for the next generation of technology companies.

Keywords: Compliance Automation, Artificial Intelligence, Startup Technology, SOC 2 Certification, Cloud Security, Regulatory Technology (RegTech)

A.S.H.A: An AI-Driven Peer-to-Peer Emergency Response System for Reducing Golden Minute Mortality

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Delay in emergency medical response is one of the major causes of preventable deaths worldwide, particularly during the critical “golden minutes” immediately following accidents, cardiac arrests, strokes, and trauma incidents. Although ambulance networks exist, they often fail to provide rapid first aid due to traffic congestion, inaccurate location detection, limited availability of vehicles, and the absence of community-level response coordination. In many real-life scenarios, trained individuals capable of providing first aid are present near the victim, yet remain disconnected due to a lack of a structured digital system. This creates a critical gap between emergency occurrence and medical assistance, resulting in avoidable loss of life. The objective of this work is to design and implement A.S.H.A (Alert System for Health Assistance) — an AI-based peer-to-peer emergency response platform that enables rapid connection between victims and nearby verified responders. The system aims to reduce response times, improve the quality of early intervention, and transform emergency care from a purely centralised, ambulance-dependent model to a distributed, community-driven life-saving network. A.S.H.A is implemented as a web-based and SMS-supported platform that allows victims or bystanders to trigger emergency alerts by submitting location and emergency details. The backend system utilises artificial intelligence to process real-time geolocation data, responder availability, skill certifications, and proximity to identify the most suitable responder. An automated ranking and notification engine instantly dispatches alerts via SMS and web notifications while simultaneously informing official emergency services. The system architecture uses modern web technologies, including React and Tailwind for the frontend, Node.js and Python for backend processing, Firebase and MongoDB for real-time data handling, and Twilio and Google Maps APIs for communication and location services. A centralised admin dashboard is provided for alert monitoring, responder verification, and

performance analysis. Initial pilot implementation demonstrates that A.S.H.A significantly reduces the waiting time for first response compared to conventional ambulance-only systems. The AI-based matching ensures that nearby and skilled responders are prioritised, improving the effectiveness of early medical intervention. The platform also enhances coordination between volunteers and authorities, offering transparent status updates and a structured approach to emergency handling. A.S.H.A introduces a new paradigm in emergency healthcare by establishing a scalable, low-cost, and community-empowered digital safety network. By enabling immediate peer-to-peer assistance before ambulance arrival, the system enhances survival probability and promotes civic responsibility. This research contributes to the development of sustainable smart-health infrastructure and presents a deployable solution for urban and semi-urban regions with high emergency response delays.

Keywords: Emergency Response, Golden Minutes, Artificial Intelligence, Peer-to-Peer Network, Community Health, First Aid Automation

Cost Effective TDS Instrument for Any Solvent

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Total Dissolved Solids (TDS) indicate the amount of dissolved salts/minerals in water, expressed in parts per million (ppm). This project measures TDS using the Gravity Analog TDS v1.0 sensor and simultaneously measures temperature with the DS18B20 sensor for compensation. An SSD1306 I²C OLED shows live TDS and temperature, while the serial port outputs CSV for graphing. The standardized measurement of TDS of any drinking water can be done with the help of simple technique of measuring the electrical conductivity of water, without polarizing the water molecules. We know that the larger is the salinity of water the more is its electrical conductivity. So by using standard techniques of measuring the electrical conductivity (Ec) we can use this value to find out the TDS by using following empirical equation.

Keywords: TDS, CSV, Electrical conductivity, Techniques, Equation, Gravity, Salinity

Designing a Technology-Enabled Verified Safe Spaces Network for Women

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Women's safety remains a persistent and critical challenge in India, particularly during travel, daily commuting, and in unfamiliar public environments. Despite the availability of multiple digital safety applications and emergency response systems, women continue to face insecurity due to the absence of proactive, trusted, and region-specific safety infrastructure. Most existing solutions are reactive in nature, relying heavily on panic buttons or post-incident reporting, and often lack local verification, community trust, and accessibility. There is a growing need for a sustainable, women-led approach that integrates technology with real-world support systems to the primary objective of this work is to design a **technology-enabled Verified Safe Spaces Network for Women**, which provides a proactive and community-driven safety infrastructure. The system aims to identify, verify, and digitally map safe public and private locations that women can rely on during distress or uncertainty. The initiative also seeks to empower women as validators and contributors, creating a trusted network that is scalable across regions. Additionally, the project explores how such a framework can evolve into a sustainable innovation model supporting safer travel, urban safety planning, and long-term social impact.

The proposed framework follows an interdisciplinary and community-centric methodology. A structured women-led regional model is used to verify safe spaces such as shops, hostels, clinics, educational institutions, and public facilities based on predefined criteria including safety, accessibility, responsiveness, and inclusivity. These verified locations are integrated into a centralized digital platform using location-based mapping. The system combines human verification with technological tools such as geospatial mapping, community feedback mechanisms, and basic safety analytics. The design emphasizes scalability, transparency, and ethical data usage, ensuring that the platform remains accessible and trustworthy.

As this work presents a conceptual and design-oriented framework, the expected outcomes include the creation of a reliable network of verified safe spaces and improved access to safety information for women travelers. Preliminary insights suggest that community-verified safety models can significantly enhance trust and usability compared to purely automated systems.

The framework demonstrates the potential to reduce uncertainty during travel, encourage safer mobility, and foster collective responsibility for women's safety at the regional level.

The proposed Verified Safe Spaces Network offers a sustainable and socially impactful approach to women's safety by integrating technology with community trust. The framework contributes to interdisciplinary research by combining elements of engineering, social innovation, and urban safety planning. In the long term, the model has the potential to evolve into a national safety infrastructure and a scalable startup through partnerships with institutions, corporates, and public agencies. This work aligns with the theme of **Sustainable Innovation for a Smarter Future**, offering a meaningful contribution toward safer and more inclusive public environments for women.

Keywords: Women Safety, Safe Spaces, Community Networks, Smart Technology, Social Innovation

A Mobile Learning Tool for Indian Criminal Case Studies Emphasizing Forensic Science

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Forensic science plays a crucial role in modern criminal investigations by providing scientific methods for evidence identification, analysis, and interpretation. In India, numerous criminal cases have been solved through advanced forensic techniques such as DNA profiling, fingerprint examination, toxicology, autopsy analysis, cyber forensics, and ballistics. However, there is a lack of dedicated educational platforms that present Indian criminal case studies with a structured forensic science perspective. Existing true-crime platforms largely focus on storytelling rather than scientific explanation, creating a gap in forensic education resources. To address this need, the present project proposes a mobile learning application designed to deliver Indian criminal case studies emphasizing forensic methodologies used in real investigations.

The primary objective of this project is to develop an interactive mobile-based educational tool that enhances forensic literacy among students of forensic science, criminology, law, and aspirants of competitive examinations. The project aims to compile real Indian criminal cases and present them in a structured format highlighting forensic evidence, investigative

procedures, and judicial outcomes. Additionally, the application seeks to promote scientifically accurate understanding of crime investigation among true-crime learners and the general public.

The project involves systematic collection of authentic Indian criminal case data. Each case is analyzed to extract relevant forensic components, including type of evidence, laboratory techniques used, interpretation of findings, and their impact on case resolution. The mobile application is designed with categorized case libraries, multilingual accessibility, department-wise classification, and dedicated sections explaining forensic techniques. Interactive quizzes and knowledge checkpoints are included to reinforce learning. The app structure ensures user-friendly navigation and academic reliability of content.

The developed framework demonstrates that integrating real criminal cases with forensic explanations significantly improves conceptual understanding of investigative science. The categorized case repository provides learners with systematic exposure to diverse forensic disciplines. Interactive quizzes and simplified explanations promote analytical thinking and knowledge retention. The application design successfully bridges theoretical forensic concepts with practical case-based learning, making forensic education more accessible and engaging.

The proposed mobile learning tool serves as a unique India-centric digital repository for forensic case studies, addressing the current lack of scientifically structured true-crime educational platforms. By presenting verified case material with forensic interpretation, the application contributes to academic learning, promotes awareness of forensic applications in the Indian criminal justice system, and encourages scientific reasoning in crime investigation studies. This project has the potential to become an advanced educational aid for students, educators, and forensic enthusiasts, strengthening the integration of forensic knowledge into modern criminal investigation pedagogy.

Keywords: Forensic science, case studies, Indian criminal justice system, digital learning, forensic techniques, crime investigation.

Stock Price Prediction Using Machine Learning, API-Based News Analysis, and Safe Price Estimation

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Stock market prediction remains one of the most challenging problems in financial analytics due to its dynamic, non-linear, and uncertainty-driven nature. This research presents a novel stock price prediction system that integrates machine learning algorithms, real-time market data, and news-based sentiment analysis through APIs to estimate a safe and optimized stock price for the subsequent trading day. The proposed model combines historical price trends, technical indicators, and external news sentiment to capture both quantitative and qualitative market signals. Advanced machine learning techniques such as regression models, ensemble learning, and time-series forecasting methods are employed to enhance prediction robustness and reduce volatility-driven risk. Real-time API integration enables continuous data ingestion, ensuring adaptability to sudden market movements and breaking news. Rather than predicting a single exact value, the system focuses on forecasting a safe price range that supports informed, risk-aware decision-making. Experimental analysis demonstrates improved prediction stability and practical applicability for short-term investors. This framework highlights how intelligent fusion of machine learning, API-driven analytics, and sentiment-aware modeling can contribute to more reliable stock market forecasting.

Keywords: Stock price prediction, machine learning, sentiment analysis, financial APIs, time-series forecasting, safe price estimation.

SceneVault

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Modern crime scene investigations face critical challenges in preserving the chain of custody and preventing evidence contamination during documentation and analysis. SceneVault SatLink addresses these persistent challenges through an innovative integrated system that

combines unmanned aerial vehicle (UAV) photogrammetry with biometric-secured satellite verification for tamper-evident digital evidence archival.

The system deploys a forensic-grade UAV equipped with high-resolution photogrammetric sensors to generate millimeter-precise 3D scene reconstructions, significantly minimizing physical investigator presence at crime scenes and consequently reducing contamination risks. The captured aerial data transfers wirelessly to a ruggedized SceneVault Handheld unit, where advanced biometric fingerprint authentication restricts access exclusively to authorized forensic personnel, preventing unauthorized access and surpassing traditional software-based security vulnerabilities. A direct satellite uplink then transmits cryptographic “security heartbeats” incorporating precise UTC timestamps, GPS coordinates, and SHA-256 hashes to a centralized forensic server, establishing an immutable and non-repudiable audit trail that operates independently of terrestrial networks. This architecture ensures comprehensive evidence integrity for courtroom virtual reconstructions and forensic validation, even under compromised network conditions or hostile environments.

The system’s key technical innovations include orthomosaic 3D digital twin generation with sub-centimeter accuracy, hardware-based fingerprint verification systems, and non-repudiable satellite timestamping that documents every access and modification. SceneVault Sat-Link advances forensic technology standards by providing verifiable, contamination-free evidence management specifically tailored for high-stakes criminal investigations. The system effectively bridges the critical gap between field data acquisition and secure digital archival, offering India’s forensic agencies a competitive technology solution that aligns with international standards while addressing the nation’s specific forensic investigation needs. By integrating cutting-edge drone technology, biometric security, and satellite infrastructure, SceneVault Sat-Link represents a significant leap forward in ensuring the reliability and admissibility of digital forensic evidence in legal proceedings.

Key words: UAV photogrammetry, Biometric authentication, Satellite timestamping, Chain of custody, 3D scene reconstruction.

Smart Sleep Sensing and Alert System for Drivers

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In recent years, there has been a tremendous increase in highway accidents, especially involving cars and long-distance trucks. A single mistake can lead to severe physical injuries, loss of life, and significant economic damage—not only to the driver but also to other road users. One of the major causes of such accidents is driver drowsiness and sleepiness while driving. Studies indicate that nearly 30% of road accidents are caused by driver fatigue and drowsiness. Therefore, I have come up with efficient device that can detect drowsiness at an early stage. Early detection of sleepiness can significantly reduce accidents and improve road safety.

The main objectives of the proposed project are: To design and develop a low-cost sleep sensing device. To monitor eye blink rate and eye closure duration using an eye blink sensor. To detect early signs of drowsiness or sleep in real time. To generate an alert when drowsiness is detected. In this project, a sleep sensing device is developed using an Arduino microcontroller, an eye blink sensor, and an alert system (buzzer/LED). The eye blink sensor continuously monitors the eye movement and sends signals to the Arduino. The Arduino processes these signals to analyse blink rate and eye closure duration. The system detects drowsiness and activates the alert mechanism to warn the driver. The system operates in real time, making it suitable for portable and practical applications. The sleep sensing device developed in this project successfully demonstrates a simple, low-cost, and effective approach to detecting driver drowsiness using an Arduino and an eye blink sensor. By continuously monitoring eye blink patterns and eye closure duration, the system is capable of identifying early signs of sleep and alerting the user in real time.

Keywords: Driver Drowsiness, Sleep Sensing Device, Real-Time Monitoring

Design And Development Of A Non-Lethal Ultrasonic Device For Preventing Stray Dog-Related Road Accidents In India

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ABSTRACT

(A) BACKGROUND / INTRODUCTION

Stray dogs in urban and semi-urban areas of India pose a major public safety challenge. Sudden and unpredictable movement of these animals on roads often results major accidents, vehicle collisions, and injuries to both humans and animals. ("published in Journal of Engineering Technology and Planning et al., 2025) Traditional control measures, such as culling or relocation, face legal, ethical, and logistical challenges, making them unsuitable for long-term application. There is a pressing need for a humane, non-lethal method to control stray dogs in accident-prone areas while safeguarding public safety and respecting animal welfare.

(B) OBJECTIVES/PURPOSE

(i) The primary objective of this project is to design and develop a cost-effective ultrasonic device that can effectively deter stray dogs from roads and public areas, thereby reducing road accidents.

(ii) Secondary objectives include ensuring animal welfare by avoiding physical or mental harm, minimizing human disturbance, and providing a scalable solution suitable for urban deployment.

(C) METHODOLOGY

The device emits ultrasonic sound waves in the 13,500 Hz to 30,000 Hz range, which are uncomfortable to dogs but largely inaudible to humans. It features a motion detection sensor, activating only when dogs approach within a 10-meter radius. Two operational modes are provided: Mode 1 for small or young dogs, and Mode 2 for larger or older dogs. The system comprises affordable electronic components, including an Arduino microcontroller, ultrasonic buzzer, PIR sensor, battery, and casing. Field testing was conducted in urban streets, parks, and residential areas to observe behavioral responses of stray dogs.

(D) RESULTS / FINDINGS:

Initial trials demonstrated that the device successfully repelled dogs without causing injury or long-term stress. Dogs maintained a safe distance of 5–10 meters, with intermittent pulses preventing habituation. Both small and large dogs responded effectively to their respective operational modes. No adverse effects were observed on humans or other non-target animals, confirming the device's safety. The behavioral response of dogs was limited to temporary avoidance, indicating humane, ethical operation.

(E) CONCLUSION / IMPLICATIONS:

The study confirms that a non-lethal ultrasonic device can provide a practical, humane, and effective solution to reduce stray dog-related road accidents. Its low-cost, energy-efficient, and scalable design makes it suitable for widespread urban deployment. By promoting ethical animal control, minimizing human risk, and reducing accidents, this project contributes positively to public safety, urban planning, and animal welfare. Future improvements could include solar-powered options, IoT integration, and adaptive frequency modulation for enhanced effectiveness.

Keywords : Stray dogs, Ultrasonic device, Road safety, Animal welfare

SkillBridge AI: An Intelligent Platform Connecting Education and Skills

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In today's rapidly evolving digital economy, there exists a significant gap between formal education and industry-required skills. Despite earning degrees, a large number of students and fresh graduates struggle to secure meaningful employment due to lack of practical exposure, unclear career direction, and outdated curricula. Traditional education systems often focus on theoretical knowledge while industries demand problem-solving ability, adaptability, and hands-on experience. This mismatch results in unemployment, underemployment, and wasted potential, particularly in developing economies. There is a growing need for an intelligent, adaptive system that can guide individuals from education to employability in a personalized and data-driven manner. The primary objective of SkillBridge AI is to build an AI-powered platform that acts as a personalized career companion for students and early professionals. The startup aims to assess an individual's skills, interests, academic background, and learning behavior, and then provide a clear roadmap toward suitable career paths. The platform seeks to bridge the gap between education and industry by recommending relevant skills, micro-projects, internships, and learning resources aligned with real-world job requirements. SkillBridge AI uses a hybrid approach combining machine learning, data analytics, and industry data. User data such as academic performance, aptitude test results, learning pace, and career preferences are analyzed using recommendation algorithms. Natural Language Processing is employed to map job descriptions to required skills, while predictive analytics forecasts emerging roles and future skill demands. The system continuously updates its

recommendations based on user progress and market trends. Cloud-based infrastructure ensures scalability, and a mobile-first design makes the platform accessible to a wider audience. Initial pilot testing and simulated user journeys indicate that personalized guidance significantly improves learner engagement and clarity of career direction. Users are able to identify skill gaps early, choose relevant learning paths, and gain confidence through project-based validation of skills. The platform demonstrates strong potential to reduce confusion, random course selection, and time wasted on irrelevant learning. Early feedback suggests improved employability readiness and higher alignment between user capabilities and career goals. SkillBridge AI presents a meaningful innovation in the EdTech and employability ecosystem. By intelligently connecting education, skills, and industry needs, the platform empowers individuals to make informed career decisions and prepares them for the future workforce. The startup has the potential to impact millions of learners by reducing unemployment, improving workforce quality, and supporting lifelong learning. SkillBridge AI contributes not only to technological advancement but also to social and economic development by transforming how people learn, grow, and work.

Keywords: Artificial Intelligence, Skill Development, Employability, EdTech, Career Guidance, Data Analytics

DOGOWAY A perfume/reticule to keep dog away

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The project DOGOWAY was created to keep dogs away from humans. The major issue of our society is stray dogs as they cause a deadly injury to humans even if it takes their lives. To prevent this situation, we can wear a perfume or reticule which will be the mixture of citrus and vinegar, as the dog is over sensitive compared to humans. It avoids some smells like citrus, vinegar and certain spices like cinnamon. By using this perfume, we can save both humans and dogs as it will not cause any damages, it is an eco-friendly product which is prepared in an organic way compared to those chemical products like dog repellent spray and many other existing products. DOGOWAY is very affordable and unique, especially useful for humans who fear dogs. Low-cost which makes it more affordable. It is also a solution for the biggest problem of society. In our society stray dogs become a major issue which causes deadly injuries to

humans even if it takes their lives, which is solely not the dog's fault. To avoid such a circumstance, we are proposing our DOGOWAY, a kind of perfume and reticule which will keep the dog away from humans without any harm for both humans and dogs. It is an eco-friendly product which is prepared in an organic way compared to chemical products like dog repellent spray and many other existing products. It reduces danger from dogs. It is also harmful to free products. Created specially to save both human and dog life from harm and the new law against dogs. It is wearable for humans as it's in the form of perfume and reticule. It is easy to use and carry around without any burden. It works in invisible form. To develop a safe organic dog repellent, we are using simple citrus juice as a value-added application and raw material. It alerts dogs and keeps them away from humans. It is very affordable and unique. fruit waste as a value-added application and raw materials.e.g. Like lemon and orange peels which have citrus acid. 80 ml of ethanol. 50 ml of boiled and cooled distilled water 12 drops of pure orange or lemon peel oil (extracted by shimmering the peels in ethanol) 5ml of white vinegar (5% acetic acid) and a drop of favorite fragrances. By adding and mixing all those ingredients we make a dog repellent perfume In my test trials, over a particular day with local strays, the perfume worked like a charm of 7 dogs that bolted straight for me with treats before, 5 backed off right away and would not come closer than 5 metres after a couple of spritzes of my shoes and pants. That's a solid 85% hit rate, way better than just plain ethanol.DOGOWAY perfume/reticule for every day a week there is no itching, redness, or anything on my skin or clothes, just stayed fresh for minimum 3+hrs even in the humid and hot days. pH hovered around 4.2 nice and stable. We can use it as normal perfume. It will not cause any damage to dogs. Compared to store bought essential or citrus oil our homemade oil is cost efficient and budget friendly, basically it was prepared from fruit waste. It feels like a real sustainable technique for me.

Keywords: Stray dog, repellent, perfume, product

“NOZA”- (smelling sensor for anosmia and disabled person)

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The project involves developing a multi-sensory alert system for gas leaks and fires, catering to individuals with anosmia, blindness, deafness, and dumbness. The system includes visual

displays, buzzers, vibration motors on wearable devices, and automated purifiers to mitigate harm. It utilizes sensors like MQ2 for gas detection and fire sensors for early warning systems. The wearable device ensures alerts are received promptly, enhancing safety for vulnerable groups. Awareness of Challenges: The idea might have stemmed from an awareness of the significant challenges faced by elderly people and children with these disabilities in daily life, communication and interaction with their environment. Need for Inclusive Solutions: There could be a growing recognition of the need for inclusive solutions that cater to individuals with multiple disabilities, ensuring they have access to necessary support and tools for a better quality of life. Advancements in Assistive Technology: The idea might have been inspired by advancements in assistive technology and innovations in accessibility solutions for people with disabilities, suggesting potential for impactful interventions for those with anosmia, blindness, deafness. Multi-sensory alerts (sound + light + vibration) instead of only one alert type. Wearable vibration device for those who can't see or hear. GPS + GSM alerts even without internet, unlike most modern alarms. Automatic purifier control to reduce harmful gases. Designed for accessibility and inclusivity, not just general safety. Multi-sensory alerts (sound + light + vibration) instead of only one alert type. Wearable vibration device for those who can't see or hear. GPS + GSM alerts even without internet, unlike most modern alarms. Automatic purifier control to reduce harmful gases. Designed for accessibility and inclusivity, not just general safety.

Hardware used:

- ESP32
- MQ-2 / MQ-135
- LDR
- Buzzer
- LED
- Vibration Motor
- GPS Module
- GSM (SIM800L)
- Relay Module
- Battery

The system aims to deliver multi sensor alerts (visual LED, buzzers, vibration) for gas leaks and fires, detected via MQ-2/MQ-135 sensors, ensuring 90%+ detection accuracy within 10seconds for vulnerable users like the elderly and children. Automated response, such as air

purifier activation via relay, will reduce hazard exposure by 80% with the help of GSM/GPS for care giver notification enhancing response in time. Wearable integration supports customizable alerts, improving user safety and quality of life across disabilities. NOZA is a **smart and simple safety system** for detecting gas leaks and fire. It alerts users by **sound, light and vibration** to keep everyone safe. Sends **GPS location** to mobile phones for quick help. Automatically controls **air and water purifiers** to reduce danger. Especially helpful for people with **anosmia and disabilities**. A low-cost solution for safer homes and communities. **OZA makes safety accessible to all, saving lives with technology.**

Keywords : Smelling sensor using multiple sensors.

NaviSense: An Intelligent Split-Architecture Mobility Aid for the Visually Impaired

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Independent mobility is one of the most significant challenges faced by visually impaired individuals. Traditional white canes, although widely used, are limited in functionality as they can only detect obstacles at ground level and within close proximity. These canes fail to identify hanging obstacles such as tree branches, signboards, or unexpected surface irregularities like potholes and drop-offs, which often results in accidents and injuries. With the advancement of embedded systems and artificial intelligence, there is a growing need for an intelligent, affordable, and reliable mobility aid that enhances environmental awareness and ensures user safety. The primary objective of this project is to design and develop **NaviSense**, an intelligent mobility assistance system that upgrades a conventional white cane into a smart navigation tool. The system aims to provide real-time obstacle detection, fall detection, and environmental understanding while maintaining low cost, energy efficiency, and offline reliability. The project also focuses on ensuring minimal response time and intuitive feedback for visually impaired users. NaviSense is built using a novel **Split-Architecture Design** to balance speed and intelligence. The system consists of two layers. The **Reflex Layer**, powered by an ESP32 microcontroller, handles time-critical tasks such as obstacle detection and fall detection using a multi-sensor array consisting of triple ultrasonic sensors and an MPU6050 gyroscope. This layer provides immediate haptic feedback with a latency of less than 50 milliseconds. The **Intelligence Layer**, powered by an ESP32-CAM module, captures real-time video data

and transmits it to a mobile application via a UART piggyback interface. The mobile application uses the **MobileNet-SSD** deep learning algorithm to classify complex environmental features such as staircases, water puddles, and vehicles. Communication between devices is achieved using ESP-NOW technology, enabling offline functionality and reliable data transmission. The implemented system successfully detects both ground-level and hanging obstacles, significantly improving user safety compared to traditional canes. The reflex layer ensures instant response for critical situations, while the intelligence layer enhances situational awareness through AI-based object classification. The system operates efficiently with low power consumption and provides accurate haptic feedback through a wearable belt. NaviSense effectively bridges the vertical detection gap present in conventional mobility aids by integrating embedded systems and artificial intelligence. The split-architecture approach ensures reliability, speed, and scalability. This solution offers a cost-effective, energy-efficient, and intelligent navigation aid, empowering visually impaired individuals with safer and more autonomous mobility. The project contributes to the field of assistive technology and has strong potential for real-world deployment and future enhancements.

Keywords : Assistive Technology, Visually Impaired, Smart Cane, Embedded Systems, Artificial Intelligence, Obstacle Detection

SMART HATCH- smart egg hatching incubator with IOT

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Incubation is a critical step in poultry and wildlife breeding. Traditional incubators are often limited to basic temperature and humidity control with minimal automation or adaptability. Temperature control is critical for proper embryo development. Too high or too low a temperature can prevent successful hatching. Many rural areas lack access to modern, reliable egg incubators, forcing farmers to rely on traditional methods or poorly maintained equipment. Our project SMART HATCH aims to develop an advanced, intelligent egg incubator that incorporates smart technology, artificial intelligence, remote monitoring and eco-friendly power solutions. Integrate IoT for remote monitoring and control. Use AI to improve hatch success through embryo monitoring. Enable off-grid use through solar power and battery backup. Ensure hygienic and bio secure incubation through self-sterilization features.

Incubation is a critical step in poultry and wildlife breeding. Traditional incubators are often limited to basic temperature and humidity control with minimal automation or adaptability. Many modern incubators, especially electric incubators, depend heavily on a reliable and stable electricity supply to regulate temperature and humidity. This is a significant challenge in rural or off-grid areas. Our project aims to develop an advanced, intelligent egg incubator that incorporates smart technology, artificial intelligence, remote monitoring and eco-friendly power solutions. To design and build a highly automated, user-friendly egg incubator. To integrate IoT for remote monitoring and control. Use AI to improve hatch success through embryo monitoring. To enable off-grid use through solar power and battery backup. To ensure hygienic and bio secure incubation through self-sterilization features. Uses advanced sensors and AI to monitor each egg continuously. Predicts how likely an egg is to hatch and warns users early if something might be wrong. e.g.: Gas Sensors (O₂, NH₃), Weight Sensors, Optical/Imaging Sensors, CO₂ Sensor} Automatically adjusts conditions like temperature and humidity to create the best environment for each egg. {e.g.: Temperature & Humidity Sensor} Self-cleaning function that cuts down on manual cleaning and reduces risk of infection. {e.g.: Water Level Sensor, Flow Sensor, Door/Access Sensor, Vibration/Motor Sensor} •Smart power systems switch between solar, battery or grid power to keep running anywhere. {e.g.: UV Intensity Sensor, Light Sensor (Ambient Light)} .Poultry Farming Industries: Automated incubation in small and mid-scale poultry farms, Improving hatch rates and reducing labor costs, Higher productivity with less human monitoring. Agri Tech & Smart Farming Sector: Integration into smart farm ecosystems, IoT-based livestock and poultry management solutions, Compatibility with precision agriculture platforms. Educational Institutions: Use in schools, universities and vocational training for biology, agriculture and AI/IoT studies, Demonstration tool in STEM innovation labs or exhibitions, Enables safe, repeatable hatching experiments Our project successfully demonstrates a smart egg incubator using IoT and AI technologies. It automates temperature, humidity and egg turning with added features like remote monitoring and embryo detection. While it is a prototype and not yet a commercial product, it shows strong potential for future development in both farming and education sectors.

Keywords: Incubation, IOT, small vendors.

CHRONO (Learn, Grow ,evolve – with time)

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In the current digital age, students are exposed to an excessive amount of information from multiple online platforms, leading to confusion, lack of focus, and uncertainty in career decision making. This situation often results in unemployment, inadequate practical skills, and a widening gap between academic learning and industry expectations. The concept presented in this poster, titled CHRONO – Learn. Grow. Evolve with Time, aims to address this challenge by emphasizing time-relevant, skill-based, and practical learning. The study adopts an observational and conceptual research methodology by analyzing present student learning patterns, industry trends, and employment scenarios, including startup closures, layoffs, and reduced hiring. The poster visually synthesizes these findings to highlight the need for filtered knowledge and adaptive learning systems. The key finding suggests that structured, personalized, and practice-oriented learning can significantly reduce information overload and improve student employability. CHRONO proposes a platform that delivers curated content focused on trending technologies, encourages real-world problem-solving, and supports students in transforming side projects into viable innovations. The study concludes that aligning education with evolving technological and industrial demands is essential for empowering students to make informed decisions and remain competitive in a rapidly changing world..

Keywords : CHRONO – Learn, key, Word, Skill based, platform , visually

HVAC Sentinel using IoT

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Now a days the IoT is being implemented and widely used in various areas like automobile, industry, healthcare and many more. But when it comes to the security of system from health sector this crucial problem arises. To over-come this problem the solution is the HVAC Sentinel using IoT, to monitor a patient's health vitals and climate. The proposed system is low

cost and integrated with Multi Factor Authentication scheme, where the individual system is reliable and can be used to monitor the vitals of older or sick people remotely. Different parameters are used and integrated in the proposed system, and developed at low cost. The parameters are for monitoring Heart, Temperature, and Humidity. After survey of the various schemes and methodologies: to make this system lightweight, reliable, efficient and low cost our proposed system is developed keeping all the aspect from security to lightweight. This HVAC system provides the real time monitoring the vitals and the climate parameters. The threshold of the parameters are calibrated to make it more reliable for decision making. The System is integrated via REST API from scalable aspect. Clinical grade systems are often costly and non-portable, this was one of the research gap found and to overcome this we developed the HVAC Sentinel using various sensors, microcontroller making the system for personal health and climate monitoring using the Internet of Things. The proposed methodology includes the heterogeneous sensor: devices with analog/digital interfaces, processing: threshold and calibration of the threshold, decision for baseline and normalization, multi-modal, REST API to FastAPI, and Dashboard.

Keywords: IoT, Healthcare, Monitoring, REST API, FastAPI.

Introduction: The clinical grade systems to monitor health/heart are costly, the presented/developed system offers the secure heart monitoring system at affordable cost and with enterprise grade security.

Objective: Secure Personal Heart and climate monitoring system at affordable cost.

Methodology: Experimental methodology where alert and security is integrated on both sides of developed system.

Results: The developed system works efficiently and found secure.

Conclusion/Implication: The developed system is secure and provide heart and climate monitoring and is developed at low cost as compared to existing insecure systems.

SENSEI–AI For Smart Education

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Background / Introduction:

The rapid growth of online and hybrid education has changed how learning is delivered. However, most digital education platforms focus mainly on delivering content and tracking basic interaction metrics like attendance and participation. These systems cannot detect student's emotional and cognitive states in real time. This leads to passive learning, reduced attention, poor understanding and silent disengagement. Without awareness of emotions and engagement, educators struggle to adjust their teaching strategies on the fly. This highlights the need for smart educational systems that prioritize human behavior in learning analytics.

Keywords: Emotion Detection, Student Engagement, Adaptive Learning, AI Education, Computer Vision, Deep Learning

b. Objectives / Purpose:

Sensei - AI for Smart Education, is a real-time emotion and engagement intelligence system that aims to improve digital learning environments by integrating emotional awareness into education. Its main goal is to analyze learners facial expressions and behavior from live video feeds. It turns this information into actionable cognitive indicators like engagement, concentration, confusion, focus and distraction. By offering real-time insights into classroom dynamics, Sensei helps educators understand how students are responding to lessons and customize their teaching methods.

c. Methodology:

The system uses computer vision and deep learning for real-time analysis. OpenCV handles video acquisition and frame processing. MediaPipe Face Mesh allows accurate detection and tracking of multiple faces using 468 facial landmarks per learner, including iris landmarks for gaze tracking. Emotion recognition uses the HSEmotion deep learning model, based on an EfficientNet convolutional neural network and deployed in ONNX format for efficient use.

The model identifies eight basic emotions: anger, contempt, disgust, fear, happiness, sadness, surprise, and neutral. For added reliability, DeepFace serves as a backup emotion recognition module.

SAFEHER – A Hardware-Assisted Wearable SOS Pendant for Women Safety

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Women's safety remains a critical social concern, particularly in isolated areas, poorly lit streets, and during night-time travel. Despite the availability of mobile safety applications and helpline services, real-life emergency situations often leave victims with little or no time to unlock a phone, open an application, or remember emergency contact numbers. Panic, fear, and stress significantly reduce the ability to respond effectively during such moments. This gap between existing safety solutions and real-world usability highlights the need for a faster, simpler, and more reliable safety response mechanism.

The objective of this work is to design and present a low-cost, wearable panic-time smart response system that enables women to seek immediate help with minimal effort. The proposed system, named SAFEHER, focuses on one-touch activation and automatic emergency response, ensuring assistance even when the user is unable to speak or remember helpline numbers. The aim is to provide a practical, accessible, and socially impactful solution that enhances women's confidence and mobility in daily life.

The methodology involves the conceptual design of a wearable panic band or pendant integrated with a dedicated SOS trigger. Upon activation, the system initiates multiple safety actions simultaneously, including alert generation, emergency notifications, and automatic connection to predefined helpline numbers such as 112 and 181. The system is designed to support both silent mode (for discreet situations) and loud alarm mode (to attract nearby attention), depending on the scenario. The conceptual framework also includes location sharing and escalation of alerts to guardians, nearby responders, and police authorities. Survey-based observations on women's perception of safety during different times of the day were considered to justify the need for rapid response systems.

The expected results demonstrate that a one-touch wearable alert system can significantly reduce response time compared to mobile application-based solutions. The automatic helpline calling feature eliminates the dependency on memory and manual dialing, which is crucial

during panic situations. The integration of nearby alert mechanisms increases the chances of immediate assistance, especially in public or semi-public spaces.

In conclusion, the SAFEHER system presents a practical and socially relevant approach to women's safety by combining simplicity, speed, and accessibility. Its low-cost and wearable nature make it suitable for large-scale adoption by educational institutions, workplaces, and community safety programs. This work contributes to social innovation by addressing real-life constraints faced by women during emergencies and proposes a scalable solution that can help create safer public environments and empower women with confidence and security.

Keywords:- Women Safety, Wearable Device, Panic Button, Emergency Alert System, Smart Response System, Social Innovation

SnapCell

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Introduction

Spreadsheets are essential tools used by professionals worldwide for managing and analyzing data. However, creating formulas, cleaning data, and organizing cells manually can be time-consuming and prone to errors. Most existing AI-powered spreadsheet tools rely on cloud services, which limits their use in regions with poor or intermittent internet connectivity. Additionally, sending sensitive data to cloud platforms creates significant privacy and security concerns for many organizations and users. These limitations lead to inefficiencies, wasted time, and increased operational costs, especially in offline or privacy-sensitive environments.

Keywords:-Local AI, Spreadsheet Assistant, Data Privacy, Local Large Language Models, Productivity Tools, Edge Computing, Hashing, Cryptography

Objectives

This work aims to develop SnapCell, an offline AI-powered spreadsheet assistant that enables natural language interaction with spreadsheet data while ensuring complete data privacy and usability in low-connectivity or offline environments. The project explores how locally deployed large language models can be integrated with high-performance spreadsheet engines

to automate tasks such as formula generation, data cleaning, categorization, and batch operations without cloud-based processing. An additional objective is to create an extensible architecture supporting domain-specific plugins, allowing SnapCell to adapt across industries including finance, education, research, and small businesses.

Methodology

SnapCell is implemented as a cross-platform desktop application using an interface combined with a high-performance C++ backend for spreadsheet processing. AI functionalities are powered by deployment of open-source large language models via efficient inference engine. The application employs SQLite for managing some local file storage and synchronization. Natural language prompts are processed in real-time locally, enabling fast and private interaction. The system translates user instructions into spreadsheet actions, formulas, and transformations while maintaining responsiveness on modern consumer hardware.

Findings

Preliminary experiments confirm that current lightweight large language models can run effectively on modern laptops without dedicated GPUs, delivering acceptable latency for interactive spreadsheet assistance. Early testing indicates that SnapCell can significantly reduce the time required for repetitive tasks such as generating complex formulas, standardizing entries across large datasets, and performing structured data cleaning operations. These findings demonstrate that many benefits of AI augmentation do not strictly require cloud-scale infrastructure and support the practicality of an offline, privacy-preserving AI assistant for everyday spreadsheet use.

Conclusion

SnapCell introduces a novel approach to AI-assisted spreadsheets by combining offline operation, strong data privacy, and intuitive natural language interaction in a single integrated tool. Unlike existing cloud-based tools, SnapCell runs all AI inference locally, ensuring data privacy and enabling use in offline or low-connectivity environments. By eliminating dependence on continuous internet connectivity and third-party servers, the system addresses key concerns around security, confidentiality, and accessibility that limit current solutions. The extensible design allows integration of domain-specific plugins, making it adaptable across industries. This unique blend of privacy, offline capability, and AI automation sets SnapCell

apart and contributes a feasible, scalable, and user-centric model for bringing advanced AI capabilities to everyday data tasks in secure and resource-constrained environments.

From Thalito Techno-Food: How Indian Meals Will Evolve Digitally

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Background/Introduction:

The evolution of food systems has always been driven by cultural, economic, and technological changes. India's food culture, historically known for its traditional thali, is now beginning to embrace digital and technological advancements. As new technologies like AI, smart kitchens, drone delivery, and virtual food experiences emerge, there's a fundamental shift occurring in how people approach cooking, consuming, and experiencing food. This transition presents an opportunity to explore the transformation of Indian food culture from traditional to technology-driven systems.

Objectives /Purpose:

This study aims to explore the impact of technological advancements on Indian food habits and traditions. The primary objective is to understand how digital tools such as AI-based meal planning, smart kitchens, drone delivery, and virtual food experiences will redefine Indian meals over the next few decades. The study will also analyze the potential benefits and limitations of these technologies in the context of Indian society.

Methodology:

A qualitative approach is adopted for this study, involving an in-depth review of existing literature on AI adoption in food technology, drone-based delivery systems and virtual dining experiences. Data was collected from academic journals, industry reports, and case studies from global and Indian perspectives. Additionally, the study incorporates projections and expert opinions regarding the future of food systems in India, particularly how technology will shape food choices and consumption patterns.

Results/Findings:

The findings suggest that the digital transformation of food in India will lead to more personalized, efficient, and sustainable eating habits. AI will play a significant role in personalized meal recommendations based on genetic makeup, health, and preferences. Smart kitchens and automated cooking appliances will make food preparation faster and more accessible. Drone delivery systems will make food delivery quicker and more hygienic, and virtual food experiences will allow people to enjoy dining in immersive environments, enhancing food culture.

Conclusion/Implications:

The integration of digital technologies into food systems in India presents both challenges and opportunities. While it promises efficiency, personalization, and innovation, it also raises concerns about cultural erosion and technology dependency. The shift from traditional thali meals to techno-food systems will shape India's food culture, offer new culinary experiences while require a balance between tradition and innovation. The significance of this work lies in understanding how India can embrace digital food technologies while preserving its rich culinary heritage.

Keywords: evolution of food AI, smart kitchens, drone delivery, and virtual food experiences emerge

Human-Centric Lighting Design

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Human-Centric Lighting (HCL) is an advanced lighting approach that places human health, comfort, and performance at the center of lighting design. Unlike conventional static lighting systems, HCL dynamically adjusts light intensity and color temperature in alignment with the human circadian rhythm, thereby supporting physiological, psychological, and visual well-being. This project focuses on the design and implementation of a human-centric lighting system that simulates natural daylight patterns within indoor environments.

The proposed system utilizes tunable white LED technology to vary correlated color temperature and illuminance throughout the day, promoting alertness and productivity during daytime hours while encouraging relaxation and rest in the evening. Key lighting parameters

such as vertical illuminance, color rendering, and melanopic impact are considered to enhance both visual comfort and biological effectiveness. Intelligent control strategies, including time-based scheduling and sensor integration, are employed to ensure energy efficiency and user adaptability.

This project demonstrates the application of human-centric lighting in spaces such as offices, educational institutions, healthcare facilities, and residential environments. By integrating lighting design with human biological needs, the system contributes to improved mood, sleep quality, cognitive performance, and overall well-being. The project highlights the potential of human-centric lighting as a sustainable and user-focused solution for modern built environments, aligning with emerging lighting standards and wellness-oriented building practices.

Keywords: human-centric lighting, melanopic impact, energy efficiency

Scheme-Setu

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Background / Introduction: Governments globally, and particularly in India, allocate massive resources to social welfare initiatives designed to bridge socioeconomic gaps. However, a critical "information asymmetry" exists between the administration and the intended beneficiaries. Thousands of schemes—ranging from agricultural subsidies to educational scholarships—are documented across fragmented state portals, obscure PDF gazettes, and complex notification circulars. Consequently, eligible citizens often remain unaware of their entitlements, leading to the underutilization of public funds. Existing solutions are insufficient; traditional keyword-based search engines lack context awareness, while generic Generative AI chatbots (like ChatGPT) frequently "hallucinate" eligibility details or fail to perform the strict mathematical verification required for compliance.

Objectives / Purpose: The primary objective of this project is to develop Scheme-Setu, a specialized AI assistant that automates the "Scheme Discovery" pipeline. The system aims to move beyond simple information retrieval to provide hyper-personalized "eligibility consultancy." Specifically, we aim to build a system that can: (1) Dynamically ingest and

structure government data from disparate sources without manual entry; (2) Accurately match user demographics (age, caste, income) against scheme rules with zero false positives; and (3) Provide a conversational interface that lowers the barrier to entry for digitally illiterate users.

Methodology: We propose a novel Hybrid Matching Architecture that combines the creativity of Large Language Models (LLMs) with the precision of structured databases. The workflow consists of three stages:

Data Ingestion & ETL: Using Python-based scrapers (Scrapy) and Optical Character Recognition (OCR), we harvest raw text from government websites and notification PDFs. An LLM-based parsing engine then extracts key entities—Age Limits, Income Caps, Caste Categories, and Deadlines—transforming unstructured text into a standardized JSON schema.

Hybrid Storage: This data is stored in a PostgreSQL database enabled with pgvector, allowing for both relational and vector data storage.

Dual-Layer Filtering Logic: When a user queries the system, a two-step verification occurs. First, a Deterministic SQL Filter strictly eliminates schemes where user attributes violate hard constraints (e.g., if User Age > Scheme Max Age). Second, a Vector Semantic Search ranks the remaining eligible schemes based on how closely the user's natural language description of their needs matches the scheme's benefits.

Results / Findings : Preliminary testing of the prototype indicates that the Hybrid Matching approach significantly outperforms standalone Vector Search or Keyword Search. While pure Vector Search often recommends schemes that appear relevant but for which the user is ineligible (e.g., recommending a "Senior Citizen Pension" to a 25-year-old searching for "pensions"), our Dual-Layer system achieves near-100% precision in eligibility enforcement. Furthermore, the automated ETL pipeline demonstrates the capability to process complex government notifications into structured rules in seconds, drastically reducing the latency between a scheme's announcement and its availability on the platform.

Conclusion / Implications: Scheme-Setu represents a scalable digital infrastructure capable of democratizing access to welfare. By abstracting the complexity of bureaucratic documentation into a simple, conversational interaction, the system ensures that a citizen's eligibility—not their ability to navigate complex websites—determines their access to support. This project contributes significantly to the field of "AI for Social Good," demonstrating how

advanced NLP and Data Engineering can solve last-mile delivery challenges in public governance.

Keywords: Retrieval-Augmented Generation, Government Welfare, Hybrid Search, Natural Language Processing, Digital Governance, Data Engineering

Smart Waste Sorting Systems: Bridging Technology and Community for Sustainable Urban Futures

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Introduction:

Rapid urbanization and population growth have intensified the global challenge of waste management. Traditional systems often rely on manual sorting, which is inefficient, costly, and prone to contamination. This results in significant environmental degradation, increased landfill dependency, and missed opportunities for resource recovery. The motivation behind this work stems from the urgent need to develop scalable, technology-driven solutions that can transform waste into a resource while reducing human error and operational costs. By leveraging smart infrastructure, sensor-based automation, and community engagement, this project seeks to address the pressing question: how can waste sorting be made more efficient, sustainable, and socially impactful at scale?

Objectives:

The primary objective of this work is to design, test, and deploy a smart waste-sorting system capable of functioning reliably in public spaces. The purpose is threefold:

- To explore the integration of sensor technologies for accurate material identification.
- To build a cost-effective, modular framework that can be scaled across municipalities.
- To understand the social dynamics of public adoption, including behavioral change and civic participation.

Ultimately, the project aims to bridge the gap between technological innovation and community-driven sustainability, ensuring that waste management becomes both efficient and participatory.

Methodology:

The approach combines technical experimentation with social engagement. A prototype machine was developed using a suite of sensors—including infrared, weight-based, and inductive sensors—to classify waste into categories such as plastics, metals, paper, and organics. The hardware was designed for durability and low maintenance, with modular components to allow easy upgrades. Cost modeling was conducted to evaluate financial feasibility, projecting scenarios for pilot deployment, breakeven points, and long-term ROI. Alongside technical trials, community engagement strategies were tested through interactive installations, symbolic street plays, and participatory campaigns to encourage proper waste disposal. Data was collected from pilot runs in controlled environments, measuring sorting accuracy, throughput, and user interaction patterns.

Results:

Preliminary findings indicate that the sensor suite achieved an average sorting accuracy of over 85%, with plastics and metals being most reliably identified. Cost analysis revealed that the system could reach breakeven within three years under moderate adoption rates, with significant savings in manual labor costs. Community engagement trials demonstrated that symbolic and interactive approaches—such as street plays and participatory slogans—substantially increased public awareness and compliance. Importantly, the pilot highlighted the need for iterative refinement in both hardware reliability and messaging strategies to maximize impact. These findings suggest that smart waste-sorting systems are not only technically feasible but also socially resonant when paired with creative outreach.

Conclusion:

This work contributes to the field of sustainable infrastructure by demonstrating a viable pathway for integrating smart technology with civic participation in waste management. The implications extend beyond technical efficiency: by fostering community ownership and behavioral change, the project lays the foundation for a circular economy model in urban environments. The significance lies in its dual impact—reducing environmental harm while empowering citizens to become active participants in sustainability. As municipalities worldwide grapple with mounting waste challenges, this initiative offers a replicable, scalable solution that blends innovation, economics, and social engagement. In doing so, it advances both the technological frontier of smart infrastructure and the societal goal of collective responsibility for environmental stewardship.

Keywords: - (Smart Waste Sorting, Sensor Integration, Community Engagement, Circular Economy, Sustainable Urban Infrastructure)

“Microcontroller-Based Electric Auto Jack for Vehicle Lifting Applications”

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This project focuses on the design and development of an Electric Auto Jack System that automates the vehicle lifting process during tire replacement and maintenance. The system uses an electric motor-driven hydraulic mechanism controlled by a microcontroller to lift vehicles with minimal human effort. Compared to conventional manual jacks, this system improves safety, reduces physical strain, and saves time. The project aims to provide a compact, reliable, and user-friendly lifting solution suitable for modern vehicles, including electric vehicles. The main objectives of the Electric Auto Jack System are: To eliminate manual effort in vehicle lifting. To increase safety during tire changing and maintenance. To reduce the time required to lift and lower a vehicle. To design a compact, battery-operated, and easy-to-use system. To integrate automation and basic safety features using electronics. The Electric Auto Jack System works on the principle of hydraulic pressure generated by an electrically driven pump. System Design The system consists of a hydraulic cylinder, a DC motor-driven pump, a control unit (Arduino/ESP32), and a 12V rechargeable battery. Sensors are integrated for safety and automation. Working Procedure: The user activates the system using a switch or wireless remote. The control unit sends a signal to the DC motor. The motor drives the hydraulic pump, increasing fluid pressure. The hydraulic cylinder lifts the vehicle smoothly. Once the maximum height is reached, the system automatically stops.

After maintenance, the jack lowers the vehicle safely. Safety Measures: Overload sensors, auto shut-off mechanisms, and stabilizer supports are used to prevent accidents and equipment damage. The system successfully lifted a vehicle smoothly without manual effort. Lifting time was significantly reduced compared to a manual jack. The operation was stable and safe due to automatic shut-off and stabilizers. The system functioned reliably on battery power. User convenience and safety were clearly improved. The Electric Auto Jack System proves to be an efficient and practical solution for vehicle lifting applications. By combining hydraulic power with electronic control, the system reduces physical effort, enhances safety, and saves time. This project demonstrates how automation can improve traditional mechanical tools. With further refinement, the system can be commercially implemented in automobiles, workshops, and emergency roadside kits.

Stock Price Prediction Using Machine Learning, API-Based News Analysis, and Safe Price Estimation

Kolte P

Stock market prediction remains one of the most challenging problems in financial analytics due to its dynamic, non-linear, and uncertainty-driven nature. This research presents a novel stock price prediction system that integrates machine learning algorithms, real-time market data, and news-based sentiment analysis through APIs to estimate a safe and optimized stock price for the subsequent trading day. The proposed model combines historical price trends, technical indicators, and external news sentiment to capture both quantitative and qualitative market signals. Advanced machine learning techniques such as regression models, ensemble learning, and time-series forecasting methods are employed to enhance prediction robustness and reduce volatility-driven risk. Real-time API integration enables continuous data ingestion, ensuring adaptability to sudden market movements and breaking news. Rather than predicting a single exact value, the system focuses on forecasting a safe price range that supports informed, risk-aware decision-making. Experimental analysis demonstrates improved prediction stability and practical applicability for short-term investors. This framework highlights how intelligent fusion of machine learning, API-driven analytics, and sentiment-aware modeling can contribute to more reliable stock market forecasting.

Keywords: Stock price prediction, machine learning, sentiment analysis, financial APIs.

Different Synthesis Methods for CuO and Cu₂O Nanoparticles

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CuO and Cu₂O nanoparticles are significant materials with unique electrical, optical, and catalytic properties. They can be synthesized using various methods, including chemical reduction, thermal decomposition, chemical precipitation, green synthesis, sol-gel, hydrothermal, and electrochemical techniques. Each method has its own advantages: chemical precipitation is simple and low-cost, chemical reduction allows control over oxidation state,

sol–gel and hydrothermal methods produce uniform and highly crystalline nanoparticles, and green synthesis is environmentally friendly. The choice of method depends on the desired particle size, purity, and application. The synthesized nanoparticles are characterized to confirm their formation and properties. Due to their nanoscale size and unique characteristics, CuO and Cu₂O nanoparticles are widely used in sensors, solar cells, batteries and photocatalytic applications.

Keywords: - CuO, Cu₂O, Synthesis Methods

Plant-Mediated Green Synthesis of Silver Nanoparticles Using *Pithecellobium dulce*: Characterization and Biological Activity Assessment

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The present investigation focuses on the green synthesis of silver nanoparticles (AgNPs) using leaf extract of *Pithecellobium dulce*, a medicinal plant widely distributed in the Melghat region. The plant-mediated approach offers an environmentally friendly, economical, and sustainable alternative to conventional chemical synthesis methods by eliminating the use of toxic reducing and stabilizing agents.

The formation of silver nanoparticles was initially indicated by a visible change in the colour of the reaction mixture upon interaction with silver nitrate solution. Confirmation of nanoparticle synthesis was further achieved through UV–visible spectrophotometric analysis, which displayed a characteristic surface plasmon resonance peak specific to silver nanoparticles.

Physicochemical characterization of the synthesized AgNPs was carried out using standard analytical techniques. Field Emission Scanning Electron Microscopy (FESEM) was employed to examine the surface morphology and size distribution of the nanoparticles. Fourier Transform Infrared (FTIR) spectroscopy was used to identify the phytochemical functional groups involved in the reduction and stabilization process, while X-ray Diffraction (XRD) analysis confirmed the crystalline nature of the synthesized nanoparticles.

The biological activities of *Pithecellobium dulce*-derived silver nanoparticles were evaluated through antioxidant assays and antimicrobial studies against selected bacterial and fungal strains. The results revealed notable antioxidant potential along with effective antimicrobial activity, suggesting the suitability of these nanoparticles for possible biomedical and pharmaceutical applications.

Overall, the study highlights the efficiency of *Pithecellobium dulce* as a biological resource for green nanoparticle synthesis and emphasizes the importance of utilizing locally available medicinal plants for the advancement of sustainable nanotechnology.

Keywords: Silver nanoparticles; Green synthesis; *Pithecellobium dulce*; Characterization; Antioxidant activity; Antimicrobial activity; Green nanotechnology

Edge-AI Enabled Thermal Early Warning System for Leopard Intrusion Detection

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This research introduces a novel, cost-effective technological intervention designed to address the critical issue of **Human-Leopard Conflict** in rural agricultural zones. The proposed system features a compact, plug-and-play device integrated into a portable chip-like form factor that utilizes a custom-trained **CNN-based** (Convolutional Neural Network) architecture for real-time object detection. By incorporating a high-sensitivity **Thermal Sensor**, the device overcomes the limitations of traditional optical surveillance, enabling the identification of leopards in total darkness or dense vegetation.

The system's architecture is designed for immediate community response. Upon the detection of a predator, the device triggers a high-decibel village siren to provide an instant audible warning to the local population. Simultaneously, the data is transmitted to a custom-built mobile application that provides a live **Thermal Image Feed**, functioning similarly to a remote CCTV system. This allows farmers to monitor livestock and movement from a safe distance. By combining localized artificial intelligence with an integrated alert network, this project offers a proactive solution to protect livelihoods and prevent fatal encounters, fostering a safer coexistence between humans and wildlife through advanced Edge-AI technology and real-time **Siren System** alerts.

Keywords : Thermal Image Feed, Livestock Monitoring, Predator Detection, Artificial Intelligence, Cost-Effective Solution, Rural Agricultural Zones

The OSMF Protocol: A Comprehensive Approach from Diagnosis to Rehabilitation

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Oral Submucous Fibrosis (OSMF) is a chronic, progressive condition marked by fibrosis of the oral mucosa, resulting in trismus and impaired oral function. Its management poses challenges due to difficult airway access, surgical complexity, and risk of relapse. This study

evaluates a structured, protocol-based surgical and rehabilitative approach for non-malignant OSMF cases.

A prospective clinical study was conducted on 60 patients diagnosed with OSMF. Based on mouth opening, patients were grouped into mild, moderate, and severe restriction categories. Airway strategies included video laryngoscopy and elective tracheostomy. Coronoid involvement, assessed through OPG/CBCT, determined the need for coronoidotomy or coronoidectomy. Reconstruction was tailored using nasolabial, buccal fat pad, submental, platysma, or radial forearm flaps depending on defect size. Postoperative physiotherapy was initiated after 2–3 weeks to allow graft stabilization.

Patients were followed up for six months to assess mouth opening, complications, and functional recovery. All patients successfully underwent surgery following the standardized protocol. Mean preoperative mouth opening improved from 13.4 ± 4.2 mm to 31.2 ± 3.6 mm at six months ($p < 0.001$). Coronoidectomy was performed in 35% of cases. Minor complications included flap necrosis ($n=2$) and infection ($n=3$). Functional outcomes were favorable in 83.3% of patients, with sustained improvements in mouth opening, speech, and mastication.

The “OSMF Protocol” provides a comprehensive framework that enhances surgical safety, optimizes functional outcomes, and minimizes complications in non-malignant OSMF cases.

Keywords: Oral Submucous Fibrosis; Protocol-based Management; Coronoidectomy; Flap Reconstruction; Postoperative Rehabilitation; Trismus.

Quantitative Chronological Constraints on Martian Fluvial Systems: A Multi-Technique Geochronological Approach

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Establishing a quantitative timeline for planetary evolution is fundamental for reconstructing geological histories and testing evolutionary models. Geochronology constrains the timing and duration of key geological eras, including periods of significant volcanic, tectonic, and climatic activity. A robust temporal framework is critical for assessing the potential for past habitable environments. This research focuses on synthesizing relative and absolute dating principles to determine the period of activity for specific Martian alluvial systems.

Relative dating establishes a sequential order of events based on stratigraphic relationships and Crater Size-Frequency Distribution (CSFD) analysis. Absolute dating assigns quantitative ages (Ga) by measuring the decay of radioactive isotopes in mineral samples, such as Martian SNC meteorites, which provide the "ground truth" necessary to calibrate cratering models.

The methodology utilizes **stratigraphic bracketing** to constrain the age of features that cannot be dated directly. This study analyzes high-resolution orbital data from the **Mars Reconnaissance Orbiter (MRO)**, using **CTX** (~6 m/pixel) for regional mapping and **HiRISE** (~0.25 m/pixel) for precise crater measurement.

Results from the CSFD analysis of the incised Noachian plains unit yield a maximum age of 3.82 ± 0.05 Ga. Analysis of the crater population superposed on fluvial delta deposits provides a minimum age of 3.61 ± 0.08 Ga. Consequently, the primary period of fluvial activity is constrained to the **Late Noachian / Early Hesperian** transition, between 3.82 and 3.61 Ga. These findings contribute to a quantitative timeline for surface water activity, aiding our understanding of Mars' climate transition from a "warm and wet" state to a "cold and dry" planet. Future work involving **Mars Sample Return** remains critical for establishing an absolute chronology.

Keywords: Geochronology, Mars, Crater Size-Frequency Distribution (CSFD), Fluvial Systems, Planetary Evolution, Stratigraphic Bracketing.

Biorefinery-Based Valorization of Citrus Peel Waste for Green Pectin Production

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India is among the world's leading producers of citrus fruits, yet it remains heavily dependent on imports for pectin, a high-value biopolymer widely used in food, pharmaceutical, and cosmetic industries. Simultaneously, enormous quantities of citrus peel waste are generated daily by juice vendors and processing units, particularly in regions such as Vidarbha, where improper disposal leads to environmental pollution and loss of economic value. Conventional industrial pectin extraction relies on acid-based chemical processes that are energy-intensive and environmentally hazardous, highlighting the urgent need for sustainable alternatives that align with circular economy principles.

The present research proposes the development of an improved, integrated, and eco-friendly biorefinery process for the valorization of citrus peel waste, with a primary focus on enzymatic extraction of high-quality pectin alongside the recovery of essential oils and other value-added co-products. The study aims to systematically screen citrus peels for pectin content, optimize mild drying and preprocessing techniques to preserve polymer integrity, and develop enzymatic extraction protocols using cellulase and hemicellulase to maximize yield and functional quality. The extracted pectin will be purified and characterized in terms of degree of esterification, methoxylation, galacturonic acid content, molecular structure, and rheological properties, followed by evaluation of its applicability in selected food formulations.

The proposed methodology emphasizes green chemistry, energy efficiency, and near-zero waste utilization by integrating multiple product streams within a single processing framework. Expected outcomes include the production of export-quality green-labelled pectin, recovery of commercially viable essential oils, and productive utilization of residual biomass, thereby reducing environmental burden while generating additional income opportunities for farmers and juice vendors. By linking agro-waste management with high-value bioproduct development, the research contributes to import substitution, strengthens India's position in the global pectin market, and supports national priorities such as "Waste to Wealth" and the United Nations Sustainable Development Goals related to sustainable production, climate action, and rural economic empowerment.

Keywords: Citrus Peel Waste; Pectin; Enzymatic Extraction; Biopolymers; Waste Valorization; Circular Economy

Medicine & Pharmacy

Modified Healthy Lifestyle in Modern Life Ara to Improve Health but Neglected Part is Mind Gym

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The mind is mental phenomena encompasses thoughts and reasoning origin from brains complex network of nerve cells. Mind gives signal to brain; the brain sends signals to the body and body send signals back to brain. The body is physiological system that respond to brains signals. So, the mind, brain and body are deeply interconnected and interdependent. Scientific evidence indicating that mind-body interaction is the root of health and disease. Psychological factors seem to play an important role in the course of many chronic diseases as diabetes mellitus, hypertension, hypothyroidism, heart issues, and hyperlipidaemia. Chronic stress activates brain areas that release lots of inflammatory compounds that weakens the defence mechanism of the body and hormonal imbalance that associated with diseases. Our survey it is observed that maximum peoples concentrate on body and do daily exercises, diet plan but not alert about mind (psychological) part. Less attention given to mind, which is root part linked with physical health and disease. Many stressful life events in routine daily work have been affecting the health. To improve health, we should not separate mind and body, they are integrated.

Key Words: Healthy life style, Mind-Brain-Body relation, Chronic Diseases, Mind gym

Junk Food versus Health: Unpacking Dietary Habits and Health Impacts Among Medical Students

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Junk food consumption has emerged as a growing public health concern, particularly among young adults and college students. Medical students form a unique population as they possess basic knowledge regarding nutrition and health but often experience academic stress, time constraints, irregular schedules, and limited access to healthy meals. These factors may encourage unhealthy dietary habits, creating a discrepancy between knowledge and practice. Frequent consumption of junk food, which is typically high in salt, sugar, and unhealthy fats, is associated with adverse health outcomes such as weight gain, dermatological issues,

digestive disturbances, hormonal imbalance, fatigue, and psychological effects. Understanding dietary behaviors in medical students is important, as they are future healthcare professionals expected to promote healthy lifestyles.

This study aimed to assess the pattern and prevalence of junk food consumption among undergraduate medical students. The objectives included identifying commonly consumed junk food items, sources of procurement, frequency and timing of consumption, reasons for intake, perceived health effects, awareness of health risks, attempts to reduce consumption, and associated lifestyle factors such as physical activity.

A cross-sectional study was conducted among 160 undergraduate medical students using a structured, self-administered questionnaire distributed via Google Forms. The questionnaire collected information on demographic characteristics, junk food consumption habits, sources of purchase, frequency and timing of intake, perceived health impacts, exercise patterns, awareness levels, and sources of dietary information. Participation was voluntary, and confidentiality was maintained. Data were analyzed using descriptive statistics and expressed as frequencies and percentages.

Among the participants, 70.6% were female and 29.4% were male, with most students aged between 20 and 24 years. Regular junk food consumption was reported by 42% of students. Chips, snacks, and fast food were the most commonly consumed items. Supermarkets and online food delivery platforms were the primary sources of junk food. Although 78% of students acknowledged the negative impact of junk food on health, taste, lack of time for healthy meal preparation, convenience, and stress were the main reasons for continued consumption. Frequently reported health issues included acne and skin problems, weight gain, digestive disturbances, low energy levels, menstrual irregularities, and mood changes. Many students attempted to reduce junk food intake; however, a significant proportion found it difficult despite engaging in The study reveals a high prevalence of junk food consumption among medical students despite substantial awareness of its adverse health effects. This highlights a gap between knowledge and behavior, influenced by lifestyle and environmental factors. Targeted nutritional education, stress management strategies, and improved availability of healthy food options within medical institutions are essential to promote healthier dietary practices among future healthcare professionals.

Keywords: Junk food; Medical students; Dietary habits; Health awareness; Lifestyle factors

“Bioactive Phytochemicals and Antibacterial Potential of *Moringa oleifera* Leaves: Dose-Dependent In-Vitro Analysis Against *Escherichiacoli*.”

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Moringa oleifera is widely used in traditional medicine and is known to contain bioactive phytochemical with potential antimicrobial properties. The result demonstrated moringa extract exhibited notable antibacterial activity against *E. coli*.

Our objectives are to test antimicrobial activity of moringa extract against *E. coli*. and to analyses the potential of moringa as a natural antibacterial agent. The present study employed healthy, disease-free leaves of *Moringa* spp., which were collected and processed for phytochemical extraction. The leaves were thoroughly washed, shade-dried, and finely ground to obtain a homogeneous powder that served as the sample material. Bioactive constituents were extracted from the powdered leaves using the Soxhlet extraction technique. The antibacterial efficacy of the extract was evaluated against *Escherichia coli* using the disc diffusion method. Mueller–Hinton agar was prepared as the growth medium, and the bacterial strain was uniformly inoculated onto the agar surface. Sterile discs impregnated with the *Moringa* leaf extract were placed on the inoculated plates and incubated at 37 °C for 24 hours. Following incubation, the zones of inhibition surrounding the discs were observed and measured to determine the antibacterial potential of the *Moringa* extract. The results revealed that the *Moringa* leaf extract exhibited notable antimicrobial activity against the tested microorganism, as evidenced by the clear zones of inhibition surrounding the extract-impregnated discs. A progressive increase in the diameter of the inhibition zones was observed with increasing extract concentration, indicating a distinct dose-dependent antibacterial response. These findings demonstrate that *Moringa* leaves contain bioactive compounds capable of suppressing microbial growth. The outcomes of the study support the traditional use of *Moringa* in the treatment of infectious conditions and highlight its potential as a natural source of antibacterial agents.

Keywords : Antibacterial, bioactive, phytochemical, *Moringa oleifera*, *Escherichia coli*

Bloodstain Pattern Analysis (BPA)

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A Model for Bloodstain Pattern Analysis and Biological Profiling (Age and Gender)
Bloodstains are among the most critical pieces of physical evidence found at violent crime scenes. This research presents a comprehensive working model that simulates both the physical trajectory of blood and the biochemical analysis required to estimate the age and gender of the source from a single stain. The primary goal of this model is twofold: first, to utilize fluid dynamics and trigonometry to identify the area of origin of an impact; and second, to demonstrate the methodology for extracting biological markers (biomarkers) from bloodstains to determine the demographic profile (age and gender) of the individual involved. The physical component of the model utilizes a blood-mimetic fluid to simulate various impact scenarios. The model incorporates a simulated biochemical assay. Gender determination is modelled through the detection of Sex-Determining Region Y (SRY) gene markers for males or the analysis of hormonal concentrations (Estrogen vs. Testosterone ratios). Age estimation is modelled through the analysis of haemoglobin glycation levels or DNA methylation patterns. The working model uses a colorimetric representative test to show how these biomarkers react differently based on the age and gender of the blood sample provided. The physical model successfully demonstrated that spatter morphology is a reliable indicator of the point of origin, with a calculated accuracy of within 5cm in a controlled environment. This research demonstrates that bloodstains are not merely static marks but are dynamic data repositories. By combining the physics of BPA with the biology of age and gender profiling, forensic investigators can narrow down suspect pools significantly faster than using traditional DNA sequencing alone. This model provides low-cost, high-impact framework for modern forensic education and investigative practice, proving that the geometry of a stain can reveal the identity of its source.

Keywords: BPA, DNA, Glycation, model, colorimetric, environment

Bridging the Gap: Breast Cancer Awareness and Self-Examination Knowledge in Tribal Areas of Maharashtra

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Breast cancer is one of the leading causes of cancer-related mortality among women worldwide, with a growing incidence in India. Tribal women face many barriers, including limited access to healthcare, cultural taboos, and low awareness of breast cancer and self-breast examination (SBE), leading to late diagnosis and poor outcomes. This study aimed to assess the knowledge, attitudes, and practices related to breast cancer and SBE among women in tribal areas of Maharashtra. To evaluate the level of awareness about breast cancer among tribal women. To assess knowledge and practices of self-breast examination. To assess participants' knowledge of breast cancer risk factors and symptoms. A community-based cross-sectional study was conducted among 193 women in tribal areas. Data were collected through a structured questionnaire assessing demographics, knowledge of breast cancer, SBE practices, and healthcare access. Statistical analysis was performed to identify gaps in awareness and factors influencing SBE knowledge. Only 27% of participants had heard of breast cancer, and 15% were aware of SBE. Common barriers included lack of healthcare facilities (56%) and cultural stigma (32%). Women with prior exposure to healthcare workers demonstrated better knowledge ($p < 0.05$). There is a significant gap in awareness and practice of breast cancer prevention among tribal women. Community-based interventions, including culturally sensitive education and mobile healthcare units, are essential to bridge this gap. By identifying barriers and promoting culturally tailored interventions, it can reduce cancer-related mortality, improving women's health, strengthening public health systems in tribals, ultimately supporting India's broader health and development goals.

Keywords: Breast cancer, tribal health, self-breast examination, awareness

Assessing Impact Of Bmi On Menstrual Patterns In Adolescent Girls In An Urban Area Of Amravati District.

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Background: Adolescence marks a critical transitional phase characterized by significant physical, mental, emotional, and hormonal changes, including the onset of the menstrual cycle. The nature of the menstrual cycle established during this time can profoundly influence reproductive health later in life. Regular menstruation is a sign of good health and normal development of an adolescent. There are several conditions which are medical, genetic, hormonal in nature that can affect and cause irregularity of the menstrual cycle. A paradigm shift has been noted in the pattern of lifestyle, habits, diet, sleep and physical activity since childhood and are known to affect menstrual health. However, this part of women's health is mostly neglected or not talked about. Body Mass Index (BMI) has got a great impact on menstrual functions. Both obese and underweight girls are likely to have menstrual irregularities as compared to those with a normal BMI. This study was conducted to assess the impact of BMI on menstrual patterns in adolescent girls. This study also aims to identify the prevalence of underweight and overweight girls and to raise awareness among school going girls about the importance of maintaining a healthy BMI. An observational, prospective study was conducted in four schools in an urban area in Maharashtra. Using structured questionnaires and anthropometric measurements, BMI and menstrual patterns were assessed and statistically analysed using SPSS. Adolescent girls who had BMI more than normal experienced more distinct symptoms and problems associated with the menstrual cycle than normal and underweight girls. Higher BMI is linked to earlier onset of menstruation, irregular cycles, and heavier bleeding, while menstrual duration and pain are not greatly influenced. Menstrual abnormalities are distinctly seen in adolescent girls and BMI play a vital role in it. Maintaining a normal BMI through healthy lifestyle practices since early adolescence is crucial for ensuring and promoting overall reproductive well-being among young girls.

Keywords: Adolescence, BMI, Menstrual Pattern, Irregular cycle.

From Gut Guardians to Biotherapeutic Agents: Probiotics

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The rapid global rise in antimicrobial resistance has become a serious public health concern due to the declining effectiveness of conventional antibiotics and the increasing incidence of drug-resistant pathogens. Excessive and inappropriate use of antimicrobial agents has accelerated resistance development, posing significant challenges to infection control and treatment strategies. In response to this growing threat, there is an urgent need to explore safer, sustainable, and biologically based alternatives. Probiotic microorganisms, particularly lactic acid bacteria (LAB) isolated from fermented food sources, have gained increasing attention because of their natural ability to inhibit pathogenic microorganisms while maintaining intestinal microbial balance. These beneficial bacteria function as gut protectors through mechanisms such as competitive exclusion, production of antimicrobial metabolites, and modulation of host immune responses. The present study aimed to isolate and characterize probiotic lactic acid bacteria from fermented foods and evaluate their probiotic attributes and antimicrobial potential against major human pathogens. An additional objective was to identify potent LAB isolates at the molecular level and develop a stable, bio therapeutically relevant probiotic capsule formulation capable of delivering viable and functional probiotic cells. LAB isolates were obtained from fermented food samples and subjected to detailed morphological, biochemical, and physiological characterization to assess their probiotic traits. The isolates were screened for antimicrobial activity against selected human pathogenic bacteria using standard in vitro assays. Potent isolates exhibiting strong antagonistic activity and desirable probiotic properties were further identified by 16S rRNA gene sequencing. Based on experimental evaluation, selected LAB strains were formulated into a probiotic capsule. Freeze-drying (lyophilization) was employed as the preservation technique to enhance bacterial stability, viability, and shelf life of the final formulation. The results demonstrated that several LAB isolates possessed strong probiotic characteristics along with significant antimicrobial activity against pathogenic microorganisms. Molecular identification confirmed the identity of the most potent isolates. The lyophilized probiotic capsule exhibited improved stability and retention of viable cells, indicating the effectiveness of freeze-drying in preserving functional probiotic properties. The developed formulation represents a practical and stable probiotic delivery system. The study highlights the potential of probiotic lactic acid bacteria as natural

biotherapeutic agents capable of combating pathogenic microorganisms while supporting gut health. The successful development of a lyophilized probiotic capsule underscores its applicability as a stable and effective alternative to conventional antimicrobial approaches. These findings contribute to the expanding field of probiotic research and offer promising implications for gut health management, pathogen control, and future biotherapeutic applications.

Keywords: Antimicrobial resistance, Probiotics, Lactic acid bacteria (LAB), Antimicrobial activity, Lyophilization, Gut health.

Harnessing The Power of Herbal Tea: A Plant Based Nutrition for Women's Reproductive Health and Cancer Prevention

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Women encounter various challenges throughout different phases of their lives due to hormonal changes, lifestyle choices, and aging. During perimenopause, women may face nearly 48 distinct symptoms, such as irregular menstrual cycles, heavy bleeding, hot flashes, night sweats, mood swings, anxiety, sleep issues, fatigue, weight gain, joint discomfort, decreased bone density, and cognitive alterations. Furthermore, the increasing prevalence of reproductive cancers like breast, ovarian, and cervical cancer has emerged as a significant public health issue. Factors such as hormonal imbalances, chronic stress, inadequate diet, anemia, lack of physical activity, and prolonged use of synthetic medications heighten this vulnerability. While dietary supplements and hormone therapies exist, their high costs often make them inaccessible to women from middle- and low-income backgrounds, including homemakers. Long-term use of conventional medicines can also result in negative side effects, underscoring the necessity for a safe, affordable, and preventive option. In this scenario, herbal tea offers a straightforward and culturally accepted method for daily intake. The aim of this study was to create a herbal tea formulation focused on women's needs, intended to help maintain hormonal balance, lower oxidative stress, and enhance reproductive health during perimenopause by utilizing specific medicinal herbs. The formulation was developed through literature research and traditional medicinal practices. Chosen plant materials known for their antioxidant, anti-inflammatory, adaptogenic, and hormone-regulating properties were shade-dried, coarsely ground, and mixed in suitable proportions to produce a consistent herbal tea blend. The formulation was assessed

for organoleptic characteristics such as color, aroma, and flavor. Initial phytochemical screening was conducted to detect significant bioactive components. Antioxidant capabilities were evaluated using standard qualitative techniques. The resulting herbal tea formulation displayed a muddy-brown hue accompanied by a gentle earthy scent and flavor, indicative of the natural plant constituents. Phytochemical analysis validated the presence of flavonoids, saponins, anthocyanins, and phenolic compounds, which are linked to antioxidant, anti-inflammatory, and hormone-regulating effects. The formulation showed robust antioxidant potential, suggesting a possible role in cancer prevention through the reduction of oxidative stress. The inclusion of Shatavari and Punarnava may aid in maintaining hormonal balance, support reproductive health, and regulate fluids during perimenopause. Overall, the herbal tea exhibited acceptable organoleptic qualities and potential therapeutic benefits, although additional refinement could enhance its taste and color appeal. The study concludes that the created herbal tea formulation provides a safe, cost-effective, and easily consumable alternative for promoting women's health during perimenopause. This research emphasizes the promise of herbal formulations as preventive healthcare alternatives and contributes to the expanding domain of women-oriented, natural wellness products.

Keywords : Perimenopause, Herbal tea, reproductive health, ovarian cancer

AI and IoMT: Hope for Diabetic Lives

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India is known as the diabetes capital of the world due to the rapidly increasing number of diabetic patients. Lifestyle changes, unhealthy dietary habits, stress, and lack of physical activity have significantly contributed to the rising prevalence of diabetes in both urban and rural populations. Diabetes is a chronic metabolic disorder that not only affects blood glucose levels but is also associated with several co-morbid conditions such as cardiovascular diseases, kidney disorders, neuropathy, and vision impairment. Effective diabetic control is essential to prevent these complications and to improve the overall quality of life of patients. Conventional diabetes management mainly depends on manual blood glucose testing and periodic hospital visits, which often fail to provide continuous monitoring and early prediction of glucose fluctuations. These limitation highlights the need for intelligent and real-time healthcare solutions. In this context, Artificial Intelligence (AI) and the Internet of Medical Things (IoMT) offer innovative and promising approaches to diabetes management. IoMT devices such as Continuous Glucose Monitoring (CGM) systems, wearable sensors, and smart insulin delivery

devices enable real-time collection of patient health data. AI algorithms analyze this data to identify glucose patterns, predict hyperglycemia and hypoglycemia events, and support personalized diabetes management. Thus, the integration of AI and IoMT plays a crucial role in transforming conventional diabetes care into predictive and preventive healthcare. To understand the capabilities of Artificial Intelligence in diabetes management. To study how AI analyzes glucose patterns for better diabetic control. To explore how AI and IoMT together can act as an effective solution for diabetes. To study the application of CGM and other IoMT devices in real-time monitoring AI techniques such as machine learning (ML), deep learning and predictive analytics are integrated with IoMT devices including CGM, smart insulin pumps, wearable sensors and mobile health applications. This system will collect real time physiological and behavioral data which are analyzed to detect patterns, predicts glycemic condition and provide personalized recommendations. Cloud computing and edge AI enable secured data storage, remote monitoring and real time clinical decisions supports for both patients as well as physicians. The integration of AI and IoMT have significantly improved diabetes management by enabling CGM, early detection of hypoglycemia and hyperglycemia, automated insulin delivery and personalized treatment plan. This may help in reducing hospital visits, an improved quality of life with diabetes. In near future fully automated closed loop system, improved interoperability explainable AI model may be developed. Integrating genomics may further help in development of precision and personalized medicine. Continued research, sizable investment in related infrastructure will be essential for large scale adaption and access to this technology by common people.

Key Words: Artificial Intelligence, IoMT, Diabetes, CGM, ML

RxHope: Safer Prescription, Smarter Care

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Rapid advancements in medical science have greatly expanded treatment options, but they have also increased the risk of medication-related complications. Prescription errors, adverse drug reactions, and inappropriate drug use continue to pose serious challenges to patient safety worldwide. These problems often occur due to complex treatment regimens, incomplete patient information, heavy clinical workloads, and limited awareness among patients regarding proper

medication use. Preventable medication errors not only affect patient health outcomes but also contribute to higher healthcare costs and reduced trust in healthcare systems. This situation creates a strong need for intelligent digital solutions that can support safer prescribing practices while improving medication awareness among the general population. The primary objective of this work is to present RxHope, an innovative AI-driven platform designed to reduce prescription errors and adverse drug reactions by identifying potential drug interactions before they occur. The platform aims to assist healthcare professionals in making safer and more informed prescribing decisions without replacing clinical judgment. Additionally, RxHope seeks to improve public access to reliable pharmaceutical information, encourage rational medication practices, and strengthen communication between patients and pharmacists. The study explores how artificial intelligence can be effectively used to enhance both clinical decision-making and patient engagement in medication management. The methodology of RxHope is based on the integration of artificial intelligence with a comprehensive drug database and patient-specific information. The system analyzes patient data such as medical history, known allergies, genetic details, and current medications. Intelligent algorithms process this information to detect possible drug interactions, contraindications, and safety concerns, and then suggest safer or more effective alternatives when necessary. Alongside professional support features, the platform allows patients to organize prescriptions, receive medication reminders, and access verified information about drug usage and interactions. RxHope also supports pharmacist–patient interaction, promoting professional guidance and rational drug use. The platform is designed with offline compatibility and seamless integration with electronic health records, ensuring usability in areas with limited internet connectivity. Preliminary findings suggest that RxHope has strong potential to improve prescription safety and reduce medication-related risks. By identifying possible issues before drug administration, the platform enhances prescription accuracy and supports preventive healthcare. Patient-focused features contribute to better medication adherence and awareness, while pharmacist involvement improves understanding and correct usage of medicines. Compliance with HIPAA data security standards ensures confidentiality, reliability, and user trust in the system. In conclusion, RxHope represents a significant step toward safer, personalized, and knowledge-based healthcare. By combining artificial intelligence with pharmaceutical expertise, the platform contributes to improved patient safety, reduced preventable medication errors, and enhanced public health awareness. Its balanced focus on professional support and patient empowerment makes it a valuable innovation in digital healthcare. With further development

and real-world validation, RxHope has the potential to positively impact healthcare delivery and promote safer medication practices across society.

Keywords: Prescription Errors, Artificial Intelligence, Clinical Decision Support, Patient Safety, Digital Healthcare, Medication Management

Evaluation of Antibiotic Administration for Catheter-Associated Urinary Tract Infections in a Tertiary Care Hospital in Amravati

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Catheter-Associated Urinary Tract infections (CAUTI) rank among the most prevalent hospital-acquired infections and pose a significant challenge due to the rising incidence of multidrug-resistant bacteria. The current study aimed to assess the bacterial profile and antibiotic susceptibility of isolates from catheterized patients. A total of 50 catheter samples were aseptically collected from individuals undergoing urinary catheterization at tertiary care hospitals. The primary organisms identified in the catheter samples included *Escherichia coli*, *Staphylococcus aureus*, *Klebsiella pneumoniae*, and *Pseudomonas aeruginosa*. *Escherichia coli* being the most frequently isolated, followed by *Klebsiella pneumoniae*, *Staphylococcus aureus*, and *Pseudomonas aeruginosa*. The high incidence of Gram-negative bacteria underscores their crucial involvement in catheter-associated infections.

The antibiogram indicated significant resistance among Gram-negative isolates to commonly prescribed antibiotics such as ampicillin and ciprofloxacin. *Pseudomonas aeruginosa* exhibited considerable resistance to various antibiotics, while *Klebsiella pneumoniae* showed resistance to several β -lactam antibiotics. Isolates of *Staphylococcus aureus* showed mixed sensitivity, with some strains resistant to penicillin, methicillin, and ampicillin and few are sensitive to vancomycin.

The results of this study highlight the increasing issue of antimicrobial resistance in bacterial pathogens associated with catheters. Consistent monitoring of bacterial profiles and antibiogram trends is crucial for directing suitable antibiotic treatment, preventing the development of resistant strains, and enhancing infection control measures in healthcare settings.

Key words: CAUTI, Hospital acquired infections, E. coli, K.pneumoniae, S. aureus, P. aeruginosa

Host Range and Distribution of *Ganoderma* Species in Melghat (Non-Core), Maharashtra, India

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The genus *Ganoderma* comprises ecologically and medicinally important wood-decaying fungi widely distributed in tropical forests. The present study documents the host range and distribution of *Ganoderma* species in the non-core areas of Melghat, Maharashtra, India. Field surveys were conducted during the monsoon and post-monsoon seasons across forest margins, village outskirts, roadside plantations, and agricultural boundaries.

Four *Ganoderma* species were recorded: *Ganoderma lucidum*, *G. applanatum*, *G. gibbosum*, and *G. resinaceum*. These species showed a broad host range, predominantly colonizing hardwood tree species. Common host families included Combretaceae, Lythraceae, Moraceae, Anacardiaceae, Burseraceae, Rubiaceae, and Lamiaceae. Frequently infected hosts were *Terminalia* spp., *Tectona grandis*, *Mangifera indica*, *Syzygium cumini*, and *Ficus* spp. Most basidiocarps were observed on living trunks, followed by dead logs and stumps.

The spatial distribution of *Ganoderma* species was clustered and strongly influenced by host availability, moisture conditions, and habitat disturbance. Non-core areas with moderate anthropogenic activity supported higher species diversity, possibly due to increased host diversity and favorable microclimatic conditions. Fruiting was seasonal, with peak abundance during periods of high rainfall and humidity.

This study provides baseline information on the diversity, host association, and distribution of *Ganoderma* species in Melghat's non-core regions. The findings contribute to fungal biodiversity documentation and support sustainable management and conservation of medicinally important *Ganoderma* species.

Keywords: *Ganoderma* species; host range; distribution pattern; non-core forest; Melghat; wood-decaying fungi; Maharashtra

Orange Peel: Nature's Citrus Treasure for Skin, Aroma & Wellness

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The discarded orange peel from the citrus fruit industry has recently been found to have potential benefits for skin health. Orange peel contains flavonoids, limonoids, and carotenoids, which possess antioxidant and anti-inflammatory properties. These compounds protect the skin from oxidative stress and inflammation caused by environmental factors like ultraviolet (UV) radiation and pollution. This peel is also observed as a rich source of vitamin C which is

beneficial in maintaining collagen synthesis, a protein that maintains skin elasticity and firmness. Using orange peel extract or essential oil in cosmetics reduces the appearance of wrinkles, fine lines, and age spots. The compounds present in orange peel also possess antimicrobial properties, which are beneficial for treating acne and other skin infections. Additionally, the extracts of orange peel can lighten the skin and have potential to treat hyperpigmentation and uneven skin tone. Through this investigation, the goal is to get a better understanding of how orange peel can support healthy skin and potentially offer natural solutions for skin-related concerns. The findings from this study will serve as a basis for future research and the potential creation of skincare products incorporating orange peel extracts. Orange peel extracts. The present project involves the development of a natural skin brightening cream and gentle exfoliating scrub using orange peel, a commonly discarded agricultural waste. Orange peels are rich in vitamin C and antioxidants that promote skin health and brightness. The formulations were prepared using only natural ingredients such as aloe vera gel, almond oil, honey, rice flour, beeswax, and rose water, without any chemical base, synthetic preservatives, or artificial additives. Simple and low-cost preparation methods suitable for student-level production were employed. Skin safety was ensured through patch testing, pH evaluation, sensitivity testing, and abrasiveness assessment. The products were found to be skin-friendly, eco-friendly, and cost-effective. This study demonstrates a sustainable waste-to-wealth approach with potential for green entrepreneurship and reduction of organic waste. Concisely, the integration of many aspects of the study strengthens the concept that orange peel is not only a secondary product, but rather a repository of bioactive substances that have significant effects on skin health. The findings from this study serve as a cornerstone for future research and the development of skincare products that harness the power of orange peel as the beauty and wellness sectors continue to embrace the possibilities of natural solutions. In essence, this study serves as a pivotal milestone on the path towards holistic and nature-inspired skincare, as it offers insights into the potential benefits of orange peel for skin health.

Keywords: Orange peel, cosmetics, skin care

Prolonged High-Pressure Compression Induces Digestive Resistance in Low-Moisture Coix Starch: Mechanistic Insights and Metabolic Benefits

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Chemical and physical methods commonly employed for starch modification often compromise functional properties and raise safety and environmental concerns due to the use of heat or chemical reagents. Coix starch (Job's tears starch), characterized by dominant A-type crystallinity, has considerable potential as a functional food ingredient; however, its native

structure limits resistant starch (RS) content and associated metabolic benefits. Moreover, efficient non-thermal and chemical-free approaches capable of inducing polymorphic transformation and enhancing RS formation remain scarce. Addressing this gap, the present study explores prolonged mechanical compression as a safe, non-thermal, and non-chemical strategy to structurally modify purified coix starch (PCS) under low-moisture conditions (~10% w/w).

The primary objective was to determine whether sustained uniaxial compression could induce gelatinization-like disruption and promote changes in starch crystallinity and resistant starch (RS) content. Purified coix starch (PCS) was subjected to hydraulic compression at 5 T (≈ 360 MPa), 10 T (≈ 740 MPa), and 15 T (≈ 1100 MPa) for 7, 15, and 30 days, enabling systematic evaluation of the effects of pressure magnitude and treatment duration on structural evolution. Structural and physicochemical changes were comprehensively characterized using scanning electron microscopy (SEM) for morphology, X-ray diffraction (XRD) for crystalline polymorphism, differential scanning calorimetry (DSC) for thermal stability, and rapid visco analysis (RVA) along with amylose leaching measurements to assess gelatinization behavior. Enzymatic hydrolysis resistance was evaluated *in vitro*, and RS content was quantified using standardized enzymatic methods. To assess physiological relevance, metabolic effects were examined in high-fat diet-fed rats supplemented with the most structurally modified sample, CRPCS15-30D (15 T, 30 days).

At low pressure and short duration (5 T, 7 days), PCS showed negligible structural or functional changes, indicating insufficient mechanical energy to disrupt native organizations. Moderate to high pressures (10–15 T) applied for 15 days resulted in granule aggregation, altered pasting behavior, increased amylose leaching, and partial loss of native crystallinity, collectively suggesting pressure-induced gelatinization-like disruption even under low-moisture conditions. Prolonging compression to 30 days at 10–15 T promoted recrystallization and structural reordering, evidenced by increased crystallinity and significantly elevated RS content. Notably, treatment at 15 T for 30 days induced a clear polymorphic transition from A-type to digestion-resistant B-type crystallinity.

In vivo studies demonstrated that CRPCS15-30D supplementation significantly reduced body weight gain, improved glucose tolerance, and alleviated dyslipidemia in high-fat diet-fed rats, confirming the metabolic benefits of compression-induced RS formation. Overall, prolonged high-pressure compression (1100 MPa, 30 days) induces disruption followed by strain relaxation and molecular reorganization in low-moisture PCS, yielding digestion-resistant

type-B starch. This mechanochemical approach represents a scalable, environmentally friendly alternative for producing healthier starch ingredients, advancing food science by enhancing RS content and metabolic health benefits without the use of heat or chemical modifiers.

Keywords: Coix starch, Crystallinity, Compression pressure, A-Type polymorph, Resistant starch.

Development of an Ashwagandha-Based Medicated Transdermal Patch for Stress Management

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Stress has emerged as a major public health concern worldwide, significantly affecting mental well-being, productivity, and quality of life. Modern lifestyles, occupational pressures, and socio-economic challenges have contributed to a growing prevalence of stress-related disorders such as anxiety, insomnia, fatigue, and cognitive impairment. Conventional oral pharmacotherapy for stress management often suffers from limitations including first-pass metabolism, fluctuating plasma drug levels, gastrointestinal side effects, and poor patient compliance. These challenges necessitate the development of alternative, patient-friendly, and sustained drug delivery approaches.

The present work focuses on the development of ShantiDots, a novel medicated transdermal drug delivery system (TDDS) incorporating Ashwagandha (*Withania somnifera*) extract, a well-established adaptogenic herb known for its anti-stress, anxiolytic, and neuroprotective properties. The primary objective of this study was to formulate an eco-friendly, non-invasive transdermal patch capable of delivering bioactive withanolides through the skin in a controlled and sustained manner, thereby improving therapeutic efficacy and patient compliance.

The formulation was developed using biodegradable polymeric materials suitable for transdermal application. Hydroalcoholic extract of Ashwagandha was incorporated into the polymer matrix, and patches were prepared using a solvent casting technique. The prepared patches were evaluated for physicochemical parameters including thickness, weight uniformity, folding endurance, moisture content, and drug content uniformity. In-vitro release and permeation studies were conducted to assess the release profile and skin permeation

behavior of the active constituents. Stability and preliminary safety assessments were also performed to ensure formulation suitability.

The results demonstrated that the formulated ShantiDots patches possessed satisfactory mechanical strength, uniform drug distribution, and controlled release characteristics. In-vitro studies indicated sustained release of withanolides over an extended period, suggesting effective transdermal permeation. The transdermal route bypasses hepatic first-pass metabolism, enabling consistent drug delivery and potentially reducing the required dose and side effects associated with oral formulations.

In conclusion, Shanti Dots represents a promising herbal transdermal delivery system for stress management, offering advantages such as ease of use, non-invasiveness, sustained drug release, and improved patient compliance. The formulation holds significant potential as an adjuvant or alternative therapy in the cosmetic, OTC, prescription, and AYUSH segments, particularly for women's health and lifestyle-related stress conditions. This work contributes to the growing field of herbal TDDS and supports the integration of traditional medicinal plants with modern drug delivery technologies for holistic healthcare solutions.

Keywords: Transdermal drug delivery, Ashwagandha, Withanolides, Stress management, Herbal patch, Women's health

Empowering Adolescent Girls Through a Comprehensive Health Management Mobile Application

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Adolescence is a crucial phase of growth and development characterized by significant physical, emotional, and psychological changes. It is during this period that lifelong health behaviors and habits are established. Adolescent girls, in particular, face unique health challenges related to nutrition, menstrual health, mental well-being, safety, and access to reliable health information. Inadequate awareness, poor health monitoring, and limited access to age-appropriate guidance can negatively impact their present and future health outcomes. With the increasing penetration of smartphones and digital technologies in India, mobile health applications offer an innovative and scalable solution to address these gaps. Designing a

dedicated health management application for adolescent girls can empower individuals while simultaneously strengthening public health monitoring and intervention strategies.

The primary objective of this work is to propose and conceptualize a comprehensive mobile-based (Android) health management application tailored specifically for adolescent girls across the country. The app aims to empower adolescent girls to actively monitor and manage their health, promote healthy behaviors, and provide accurate, age-appropriate health education. From a public health perspective, the application seeks to support health authorities by enabling data-driven decision-making, early identification of health issues, and improved implementation of adolescent health programs.

This work follows a conceptual and design-based approach. The proposed application framework includes key functional components such as health tracking, reminders and alerts, nutritional monitoring, safety features, and health education modules. Users can input and monitor vital health parameters including height, weight, body mass index (BMI), and menstrual cycle details. Reminder systems are designed for medications, health appointments, and daily health tasks. Nutritional monitoring allows logging of daily meals with access to calorific values and personalized dietary recommendations. Safety features include information on sexual health, substance abuse prevention, bullying awareness, and access to emergency contacts and helplines. From a public health standpoint, anonymized aggregated data can be collected to assess health trends, monitor program reach, and facilitate early interventions.

The proposed application is expected to improve health awareness, self-monitoring practices, and preventive health behaviors among adolescent girls. By enabling regular tracking and timely reminders, the app can support early identification of health issues and promote timely care-seeking. Aggregated anonymized data can provide valuable insights into adolescent health trends, nutritional status, and program gaps at a population level. The platform also offers an effective medium for public health agencies to disseminate health information, promote vaccinations, and conduct targeted health awareness campaigns.

The development of a comprehensive health management application for adolescent girls represents a forward-thinking and cost-effective public health intervention. By integrating individual empowerment with population-level data insights, the proposed app has the potential to strengthen adolescent health outcomes, reduce the burden of preventable diseases, and support evidence-based policymaking. Investing in digital health solutions for adolescents today is an investment in building a healthier and more informed future generation.

Keywords: Adolescent health, Mobile health application, public health, Health tracking, Health education

Formulation and Evaluation of Omega Fatty Acid Enriched Cream for Enhancing Skin Hydration and Barrier Function

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Dysfunction of the skin barrier and dehydration are among the primary dermatological issues associated with premature aging, irritation, and environmental sensitivity. Plant-derived omega fatty acids have gained attention for their biocompatibility, barrier-repair properties, and anti-inflammatory potential; however, comprehensive evaluations of multi-oil omega-enriched formulations integrating both *in vitro* and *in vivo* evidence remain limited. The research aimed to design and evaluate an omega fatty acid cream enriched with hemp seed, soybean, sea buckthorn, and flaxseed oils, and to assess the compound's effectiveness in enhancing skin hydration and barrier function, as well as its dermatological safety. The study further investigated molecular mechanisms underlying hydration enhancement, particularly aquaporin-3 (AQP-3) expression. The formulated cream underwent physicochemical characterization and stability testing. *In vivo* hydration performance and barrier function were assessed using skin hydration and transepidermal water loss (TEWL) measurements, compared with untreated control sites. *In vitro* evaluation using HaCaT keratinocytes included cytocompatibility testing, hyaluronidase inhibition assays, and analysis of AQP-3 gene expression. Dermatological safety was assessed via human patch testing in Fitzpatrick skin types III–V. The formulation displayed good physicochemical stability and good sensory characteristics. Skin hydration and TEWL decreased significantly after eight hours of application. High cell viability, significant hyaluronidase inhibition, and a 10.02-fold increase in AQP-3 expression (indicating increased water transport in the epidermis) were shown *in vitro*. Human patch testing demonstrated that it is well tolerated, with no irritation. The omega fatty acid-enriched cream is efficacious in improving skin hydration, reinforcing barrier activity, and epidermal repair in two complementary biophysical and molecular processes. The results of these studies indicate its promise as a safe, natural, and effective cosmeceutical formulation for long-term use in preventing skin barrier dysfunction.

Keywords: Omega fatty acids, skin hydration, transepidermal water loss, hyaluronidase inhibition, AQP-3 expression

AI driven Cardiovascular Diseases prediction

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Cardiovascular diseases (CVDs) are among the leading causes of mortality worldwide, emphasizing the need for early and accurate diagnosis to reduce health risks and improve patient outcomes. Conventional diagnostic methods often depend on clinical expertise and medical tests, which may be time-consuming, costly, and subject to human error. Recent advancements in Artificial Intelligence (AI) and machine learning offer promising opportunities to enhance cardiovascular disease prediction by leveraging large volumes of patient data. The objective of this study is to develop an AI-driven framework for predicting cardiovascular disease risk using clinical and demographic data. The research aims to evaluate the effectiveness of machine learning models in early risk identification and to assess their suitability as clinical decision support tools for preventive healthcare. The proposed methodology involves preprocessing structured patient data, including age, gender, blood pressure, cholesterol levels, glucose levels, body mass index, and lifestyle factors. Data cleaning, normalization, and feature selection techniques are applied to improve model performance. Several machine learning algorithms, such as Logistic Regression, Support Vector Machines, Decision Trees, Random Forest, and ensemble methods, are trained and evaluated using standard performance metrics, including accuracy, precision, recall, F1-score, and area under the ROC curve (AUC). The results indicate that AI-based models outperform traditional approaches in predicting cardiovascular disease risk, with ensemble and tree-based algorithms demonstrating superior accuracy and reliability. The proposed system effectively classifies individuals into different risk categories, enabling early intervention and personalized treatment strategies. In conclusion, this study demonstrates the potential of AI-driven cardiovascular disease prediction systems to support clinical decision-making, improve diagnostic accuracy, and promote preventive healthcare. Such systems can play a vital role in reducing the global burden of cardiovascular diseases and enhancing overall healthcare efficiency. Ultimately, AI-driven cardiovascular disease prediction systems hold significant

societal value by improving patient outcomes, optimizing healthcare resources, and reducing the global burden of cardiovascular diseases.

Keywords: Artificial Intelligence, Cardiovascular Disease Prediction, Machine Learning, Clinical Decision Support, Healthcare Analytics

Formulation and Evaluation of herbal hand Sanitizer and herbal hand wash.

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The present study focuses on the formulation and evaluation of a herbal hand sanitizer and herbal handwash using medicinal plant extracts with known antimicrobial properties. Natural ingredients such as *Azadirachta indica* (Neem), *Ocimum sanctum* (Tulsi), and *Aloe vera* were incorporated to enhance antimicrobial efficacy and skin compatibility. The herbal hand sanitizer was prepared as an alcohol-based formulation, while the herbal handwash was developed using mild surfactants along with herbal extracts.

Both formulations were evaluated for physicochemical parameters including pH, viscosity, appearance, stability, and spreadability. Foam height and foam retention were additionally assessed for the handwash. Antimicrobial activity was evaluated against selected pathogenic microorganisms using standard laboratory methods. Skin irritation and sensitivity tests were carried out to ensure safety for regular use.

The results revealed that the formulated herbal hand sanitizer and handwash possessed acceptable physicochemical characteristics, good antimicrobial activity, and satisfactory stability without causing skin irritation. Thus, the study supports the potential of herbal hand hygiene products as safe and effective alternatives to synthetic formulations.

Keywords: Herbal Hand sanitizer, herbal handwash, *Azadirachta indica* (Neem) *Ocimum sanctum* (tulsi) hand hygiene.

Cost-Effective Formulation Strategies for Emulsions and Suspensions in Pharmaceuticals, Agrochemicals, and Micronutrients

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Cost reduction is an essential aspect while formulating active ingredients across pesticide, pharmaceutical, food, and micronutrient industries. These technical substances are formulated into dispersed systems, like Emulsifiable concentrates (EC), Suspensions, lotions, Wetttable dispersible powders (WDP). The traditional formulation prioritises stability and quality, but does not focus on formulation process cost savings. This also affects financial viability /economic scalability.

This article focuses on cost-reduction measures in the formulation process with compliance with relevant stability/ quality parameters.

Traditional formulation strategies emphasise on physico-chemical stability, but not the economic implications. The material selection processing method are suggested that culminates in cost saving ,namely cheaper inputs, optimised process cost while maintaining critical parameters— pH, HLB, Agitation energy, temperature to ensure conformity with prescribed quality specifications, statutory requirements. This article does not focus on inventing new formulation methods but endeavours to develop and validate cost optimisation techniques in the existing formulation process.

Cost is assessed as a major scientific factor but controllable measurable variable by correlating with other parameters. The cost is surely a controllable measurable variable, correlating it with other formulation parameters, with concurrent compliance with prescribed quality standards.

The study deals with cost-saving pathways, their implications for sustainable, economically viable formulation practices in Pharma/ Pesticide, Agro chemical industries, while fully preserving the stability, safe performance characteristics of the active ingredient as per standards.

Keywords: Emulsifiable Concentrate, Wetttable Dispersible Powder, Hydrophilic–Lipophilic Balance, Biopharmaceutics Classification System

Screening of antibacterial activity of *Tinospora cordifolia* against clinical isolates

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The rise of antimicrobial resistance among clinical pathogens has increased the need for safe and effective natural antimicrobial agents. The World Health Organization (WHO) estimated that up to 80% of people still depend mainly on traditional remedies such as medicinal plants for their medicines. Recently, scientists are showing a great interest in the development of new drugs from traditional medicinal plants .*Tinospora cordifolia* (Amrita or Guduchi) is an

important medicinal plant of the family *Menispermaceae*. In Indian literature Ayurveda, *Tinospora* has been recorded to use over centuries to treat various diseases .It is widely used in traditional Indian medicine to treat various diseases such as fever, diabetes, skin infections and urinary disorders. The objective of the present study was to screen the antimicrobial activity of *Tinospora cordifolia* against selected clinical isolates. The plant part used was leaf in this study for antibacterial activity of the *Tinospora cordifolia* against clinical isolates as per CLSI guidelines A comparative study with standard antibiotics was carried out.

The findings of the study showed that the leaf part of *Tinospora cordifolia* exhibited significant antibacterial activity against the tested clinical isolates. In conclusion, *Tinospora cordifolia* has strong potential as a natural antimicrobial source and may contribute to the development of alternative treatments against infectious diseases.

Keywords: *Tinospora cordifolia*, Guduchi, bioactive compounds, antimicrobial activity

ORIME- *Organic me* (No irritation, comfort and care absorbency)

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Menstruation is a process which occurs from the lining of the uterus at an interval of about 28 to 35 days from puberty to menopause in which women discharge blood. On average a woman spends 3000days on periods in her lifetime. By using the chemical sanitary pads in their regular menstruation periods, it may cause serious problems to women's society.

Our herbal pad embraces your natural cycle with care and attention. Each month is an opportunity to learn to grow and love yourself even more. Our herbs say no to toxins and say yes to clean and safe periods. Our herbal pads are plant-based polymers which absorb up to 300times its weight in liquid.

On exposure to commercial pads phthalates, a plastic which is present in napkins have been linked to a variety of health concerns including endocrine disruption, impacts to the heart and reproductive system, diabetics, some cancers and birth defects. These commercial pads which were changed, on long available on market must be changed within 3 to 4 hrs for our internal hygiene, whether it is bleeding or not we must use of this chemical pad for maximum time 6 hrs may release a chemical called dioxin, which leads to cervical cancer. Our vagina has

its own cleaning tendency which may clean itself without using any external wash and it may absorb the chemicals easily. When these chemicals come into contact with our sensitive tissue it may lead to infertility. The deodorants and synthetic materials used in sanitary pads block dampness and heat which encourages yeast and bacterial growth. This pad includes a chlorine bleaching process so that the pad may look white. They also use adhesive chemicals

Why are no ingredients or chemicals used that are not mentioned in their commercial products (napkins)?

In India sanitary pads are labelled as medicinal products in 1980 BIS (Bureau of industry and security) on their guidelines medicinal products need not or necessary to show their ingredients in their samples, due to this act the pad companies claimed pads as a medicinal product so they don't print ingredients in it.

Every pad must have ISO certification.

--- our ORIME pads don't contain those chemicals like commercial pads, our pads are phthalates free. It doesn't contain VOC chemicals like acetone, chlorine bleaching, furan and no artificial colours.

Background / Introduction:

Menstruation is a process which occurs from the lining of the uterus at an interval of about 28 to 35 days from puberty to menopause in which women discharge blood. On average a woman spends 3000 days on periods in her lifetime. By using the chemical sanitary pads in their regular menstruation periods, it may cause serious problems to women's society. At NEW DELHI a study by nonprofit organization, Toxic Links, has indicated that most of the popular brands of sanitary napkins sold in INDIA contain harmful chemicals. The study by NGO, Toxic Link, found the presence of Phthalates [are the plastic solvent used in the sanitary pads which is used to soften and give flexibility to that particular product and VOC [volatile organic compound] a chemical used for freshener, nail-polish remover, they give fragrance to the product in total- of 10 samples 6 inorganic and 4 organic sanitary pads available in market contain these harmful chemicals. The finding was published in a report titled "Menstrual Waste 2022" these may also include bleaching so that we may be attracted to that pad if we think it contains no chemical.

b. Objectives / Purpose:

To give organic sanitary pads at low cost.

To promote social awareness among peoples.

To improve fertility and hygiene.

Our herbal pads say yes to a healthier future for everyone and it's safe for the environment.

c. Methodology:

Raw material:

Surgical cotton.

Two-way tape (adhesives).

Non-woven thick paper (typically polypropylene) on alternative to this compound we can use banana fibre, wood-pulp, bamboo-pulp, corn starch, which is easily available on markets.

Non-woven thin paper” act as an observant layer as well as a barrier sheet (both these thin and thick papers of non-woven is Eco friendly and easily recyclable and durable).

ADL sheet- It distributes the fluid eventually into the observant core which prevents leakage so that users may feel comfort.

Herbal powders infused in our pads:

Aloe Vera powder-which has antibacterial properties, which reduces body heat.

Neem powder-which has anti-bacterial properties and kills bacteria.

Triphala powder-which reduces white discharge and regulates blood flow.

Malai vembu - which cleans the uterus.

d. Results / Findings:

The commercial pads which were available on the market took nearly decades to decay (kill the microorganism present in the soil) . By burning these pads it affects our lungs and human health.

But our herbal sanitary pads are oxo-biodegradable (when exposed to oxygen, heat, light causing them to fragment into smaller pieces (micro plastic) so that the microorganism can easily digest our product.

Our pad increases women's health-especially strengthen the uterus and regulate the mensuration and it is cost efficient to produce.

On protection of our herbal pads, we can give job opportunity to small vendors, cottage industries.,

Our product is eco-friendly and doesn't affect natural life.

Even on regular use of our herbal napkins it doesn't affect women's health and on usage of more than 6 months we can see the visible result in internal and external body systems.

e. Conclusion / Implications:

Our herbal pads have 3X absorbency 2pads/day ultra-thin no leakage. Our main goal is to make women comfortable on periods through ORIME- Organic me which defines a healthy lifestyle. Our product is worth buying every month because it is oxo-biodegradable, rash free and extremely soft. There are no toxins, no artificial fragrance or any plastic solvents. Herbal powders are infused in our ORIME which regulates period cycle. It is also a simple tool for period hygiene

Keywords: - ORIME pads, Aloe Vera powder, ADL sheet, Triphala powder

Mori Safe : Eco-friendly Sanitary Pads with Moringa oleifera based Odour Control and Antimicrobial Protection”

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Menstrual hygiene is an essential component of women's health, yet conventional sanitary pads largely rely on synthetic polymers, chemical absorbents, and plastic back sheets, which may cause skin irritation, odor and environmental pollution. The growing demand for safer and eco-friendly menstrual hygiene *Moringa* products has encouraged the exploration of plant-based additives with biological activity. *Moringaoleifera*, a widely distributed medicinal plant, has gained attention for its potential application in sanitary pads due to its rich phytochemical composition and antimicrobial properties.

Leaves of *Moringaoleifera* contain bioactive compounds such as flavonoids, phenolic acids, tannins, and isothiocyanates, which exhibit strong antibacterial, antifungal, anti-inflammatory, and deodorizing activities. In sanitary pad applications, is primarily incorporated as a natural antimicrobial agent rather than as a main absorbent material. *Moringa* leaf extracts can be used to treat the top sheet or absorbent layers of sanitary pads, thereby inhibiting the growth of pathogenic microorganisms commonly associated with menstrual odor and infections, including fungal and bacterial.

In experimental designs, moringa leaves may be blended in limited proportions with conventional absorbent materials. The inclusion of moringa reduces microbial load, controls unpleasant odor and improves user comfort without the need for synthetic fragrances or chemical preservatives. Additionally, the plant-based origin of moringa supports biodegradability and reduces dependence on harmful chemical additives.

Key words- *Moringaolifera* Leaves, Women's health, Sanitary pads, Environmental pollution, Biodegradable products.

Assessing the factors for complete doses of Vitamin A Supplementation for respective age among under-5 children in rural settings

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National Immunization Program and National Health Policy recommended total of nine doses of Vitamin-A supplementation. This program is planned not only to prevent micronutrient deficiency but also to support efficiency of other vaccines by boosting up the immunity. However, out of nine doses, mostly first two (20%) are given and documented along with Measles and MMR vaccines. This reflects that coverage of rest of 80% doses are unsupervised. Vitamin-A supplementation coverage in India was overall 60.5%. Hence, through this research work we tried to find out the gaps for vitamin A Supplementation at Beneficiary level.

Objectives: To find out promoting and hindering factors for complete coverage of Vitamin-A Supplementation in rural settings.

Methodology: Cross sectional survey was conducted during 2025 in rural settings of Amravati district and participants were beneficiaries of children aged 9-59 months. As per WHO cluster coverage sampling method, a total of 30 clusters from 5 talukas were selected and a total of 210 beneficiaries were included in the assessment. Talukas included Bhatkuli, Nandgaon Khandeshwar, Tiosa, Chandur Railway, and Achalpur. Quantitative data was collected by using questionnaires and checklists for interviews of parents to obtain information regarding Vitamin-A doses received or not, number of doses, reasons for drop-out, and challenges. Responses after interview of parents are cross-checked on immunization card to verify the details of Vitamin A supplementation. Gathered information was entered in MS Excel sheets and analysed. This project is funded by Indian Council of Medical Research (ICMR) under Short Term Studentship Scheme.

Results: Out of the total 210 respondents covered, 51.4% were males and 48.6% were females, by socioeconomic status 68.8% were in below poverty line and 19.3% were in above poverty line category. As per national program total nine doses of vit-A should be given during the age of 9 months to 5 years. Here, 1st and 2nd doses of Vitamin A were given in 98% and 94%% of the beneficiaries respectively, whereas coverage of remaining seven doses was found to be very poor. Promoting factors for starting doses were observed that motivation by peripheral health workers i.e. highest by ASHA worker (85%), followed by nursing staff (ANM- 22.2%) and least by Anganwadi workers (9.3%). Higher education of the parents was also the promoting factors. Challenges for supplementation of remaining seven doses of Vitamin-A were 58.9% due to lack of awareness about the nine doses of Vitamin A under the national program, 43.8% due to non-remembrance by health worker, 34.2% were due to non-availability of Vitamin A supplements at health center, and 32.9% were due to non-remembrance by parents.

Conclusion: From this research, the promoting factors were higher education of parents and motivation by peripheral health workers. Hindering factors were lack of awareness, non-remembrance by health workers, and by parents themselves. Hence, there is a need to increase the awareness

Keywords: National Immunization Program, National Prophylaxis Program against Nutritional Blindness, Vitamin-A Supplementation

Formulation of eco-friendly herbal insecticide

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In-discriminate use of synthetic insecticides have caused drug residue in animal food products and leads to undesirable environmental persistence. Therefore, there is a need of herbal insecticides that are prepared from plant extracts as they are ecofriendly, effective and economical. The present study deals with the use of Plant extracts prepared from Neem and Chrysanthemum for studying the insect toxicity with target organism Cockroach. Results showed high repellency and mortality at higher concentrations. The synergistic action of Neem's azadirachtin and Chrysanthemum's pyrethrins proved effective. Thus, this herbal formulation offers a safe, biodegradable and sustainable alternative to chemical insecticides.

Keywords: Herbal insecticide, Neem (*Azadirachta indica*), Chrysanthemum, Azadirachtin, Pyrethrins, Cockroach toxicity, Plant extracts, Eco-friendly pest control, Biodegradable insecticide, Synergistic action

Ecological Impact of Feral Pigeons (*Columba livia*): A Study on Public Health Concerns

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Feral pigeons (*Columba livia domestica*) are among the most successful synanthropic bird species in urban ecosystems and their rapidly increasing populations have emerged as a growing ecological and public health concern. This study evaluates the ecological impact of feral pigeons in Amravati City, Maharashtra, with particular emphasis on avifaunal dynamics, pathogen carriage, environmental contamination and associated risks to human health. Urban ecological surveys indicate a marked dominance of pigeons in highly urbanized and residential zones, coupled with reduced species richness and biotic homogenization, highlighting their role as urban exploiters. High population densities are supported by abundant anthropogenic food resources and artificial nesting structures, leading to displacement of native avifauna and increased environmental loading of biological contaminants.

Microbiological and epidemiological evidence demonstrates that pigeons act as reservoirs and disseminators of multiple zoonotic pathogens, including *Chlamydia psittaci*, *Salmonella* spp., *Cryptococcus neoformans*, intestinal parasites and helminths, with several of these organisms detected in both pigeon and environmental samples. The study further emphasizes the role of

pigeons in the maintenance and spread of avian viral pathogens such as Newcastle Disease Virus, pigeon circovirus and pigeon herpesvirus, which pose significant threats to poultry health and contribute indirectly to human health risks. In addition, pigeons accumulate heavy metals such as lead, cadmium, arsenic, zinc and copper, reflecting urban pollution and raising concerns regarding food safety where pigeons are consumed.

Beyond infectious hazards, pigeon droppings and nesting activities cause structural damage to buildings, block drainage systems, increase slip-related accidents, exacerbate respiratory and allergic conditions and support arthropod vectors of medical importance. Overall, the findings indicate that uncontrolled feral pigeon populations in Amravati represent a multifaceted public health and environmental challenge. The study underscores the need for integrated urban wildlife management strategies, public awareness campaigns, regulation of pigeon feeding and improved sanitation to mitigate health risks and promote sustainable urban ecosystems.

LIFELINE SATELLITE: A Disaster-Resilient Network Repeater & SOS System

Joshi GA

Communication failures during natural disasters such as floods, cyclones, landslides, and severe storms often lead to critical delays in rescue and relief operations. These challenges are especially severe in remote, rural, coastal, and monsoon-prone regions where conventional mobile networks, internet connectivity, and even electrical power infrastructure frequently collapse. As a result, affected populations become isolated at the very moment when timely communication and coordination are most essential for saving lives.

The Lifeline Satellite project addresses this real-world problem by proposing a portable, battery-powered emergency communication system designed to function reliably in network-dark and infrastructure-damaged environments. The system integrates multiple communication and sensing technologies, including LoRa-based mesh networking, satellite backhaul communication, a local Wi-Fi hotspot for user access, GPS-based location tracking, and environmental sensors capable of monitoring parameters such as rainfall intensity, flood level, temperature, and pressure.

Each Lifeline node operates as an intelligent emergency communication point. Using simple, threshold-based AI logic, the node continuously evaluates environmental sensor data to detect potentially dangerous conditions. In the event of a detected disaster or a manually triggered SOS, the node packages essential information—including GPS coordinates, time stamps, sensor readings, and node identification—into a compact SOS message. This message is forwarded through a multi-hop LoRa mesh network to the nearest node with clear satellite visibility, ensuring delivery even when direct links are unavailable.

By combining satellite communication, resilient mesh networking, and AI-assisted decision-making into a low-cost and energy-efficient design, Lifeline Satellite provides a robust and scalable lifeline for emergency communication. The system has strong potential to significantly improve rescue response times and save lives in disaster-affected and remote regions.

OTHERS
Including Humanities,
Languages and
Fine Arts

Morphology-Engineered CuS Nanostructures towards Efficient Photodegradation of Organic Pollutants

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The development of efficient visible-light-driven photocatalysts is crucial for the removal of organic pollutants from wastewater. In this work, transition-metal doped copper sulfide (CuS) nanostructures were synthesized to investigate the combined effects of elemental doping and morphology modification on photodegradation performance. Structural characterization confirmed the formation of phase-pure CuS, while morphological analysis revealed the evolution of hierarchical, flower-like architectures composed of self-assembled nanoflakes. Such morphology provides an increased surface area and abundant active sites, facilitating enhanced light absorption and interfacial reactions. The incorporation of transition-metal dopant effectively tunes the electronic structure of CuS, leading to improved charge separation and suppressed recombination of photogenerated charge carriers. As a result, the doped CuS photocatalysts exhibit significantly enhanced degradation efficiency toward organic dye pollutants under visible-light irradiation. Kinetic analysis demonstrates that the degradation process follows pseudo-first-order reaction behaviour, with doped samples showing higher reaction rate constants compared to pristine CuS. Reactive species investigations using terephthalic acid test and scavenger experiments reveal that superoxide radicals ($\bullet\text{O}_2^-$) play a dominant role in the degradation mechanism, while hydroxyl radicals contribute to a lesser extent. In addition, the photocatalysts display good structural stability and reusability, maintaining high degradation efficiency over multiple consecutive cycles. The synergistic effects of transition-metal doping and morphology modulation are shown to be key factors in enhancing photocatalytic activity. This study highlights an effective strategy for designing CuS-based photocatalysts with improved performance for organic pollutant degradation.

Keywords: Covellite (CuS), Transition-metal doping, Morphology engineering, Nanoflower, Photodegradation, Stability & Reusability.

Covert Jewellery-Based Safety Beacon

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In high-stakes emergencies, panic or restraints often block smartphone access, crippling app-based safety tools that need screens, power, and networks—especially in rural India. This project proposes a covert jewellery beacon (ring, pendant, bracelet) with hidden push-button, converting daily wear into an independent SOS guardian for instant GPS location sharing via GSM to contacts. It integrates Arduino Nano, NEO-6M GPS (<5s fix), SIM800L GSM (SMS to 5+ numbers), and LiPo battery (72h standby), coded in Arduino C++ for tamper alerts and low power. Standalone from phones/Wi-Fi, single long-press triggers reliable dispatch.

Prototype tests (50 trials, urban/rural) hit 98% success (99% urban, 95% rural), 10m accuracy, <₹1200 cost—3x faster/discreeter than apps. Outshining mobile solutions in constrained scenarios, its seamless disguise enables 24/7 wear, stress-free activation, and scalability for women/vulnerable users. This embedded innovation boosts personal safety tech for Indian contexts, primed for NSC publication.

Keywords: Jewellery Safety Beacon, GPS-GSM SOS, Discreet Wearable, Arduino Emergency Alert, Women Safety Device, Embedded Guardian.

Dry Flower Artistic: An Unique Entrepreneurship Scope For

Craft Makers

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Drying and preserving flowers and plant materials is a form of artistic expression that was very popular during the Victorian age. Dried or Dehydrated Flowers or Plant part like Roots, leaves, Stem, Bark or Whole plant can be used for ornamental purposes. Dried flowers and plant parts are low-cost, environmental-friendly, long lasting, biodegradable and readily available. It can enhance Initiate entrepreneurship skills amongst students by preparing decorative things from dried flowers and plant parts. Flowers and other plant materials collected from Gardens, Temples and Farms. The various processes involved in the production of dried plant material including sun drying, air drying, oven drying, drying using desiccants, microwave oven drying, press drying, water drying and glycerinization treatment. In the present study we had taken initiative to prepare greetings and decorative things from dried flowers.

Preserving dried flowers in resin is an artful way to create a one-of-a-kind keepsake. "Whether they are your favorite flowers or flowers tied to an important event like your wedding bouquet, preserving them in resin will capture their beauty forever. Resin art, with its liquid, glass-like finish, offers a unique way to capture the beauty of nature, including the delicate charm of dried plant parts. Embedding dried flower in resin created different attractive artifacts and lasts for many years. This initiative is a sustainable approach as it mainly involves eco-friendly and biodegradable substances and avoids any use of plastics. Dehydrated products can be used for the production of distinct and artistic decorative items. These items aid to generate revenue.

Present attempt also used to develop resin art among artisans. This pioneer step may lead to develop a new kind of art in present era.

Keywords: Dry flower, Craft, Entrepreneurship, Resin art, eco-friendly, Artifacts

A Study on Crowd Control and Public Behaviour Management at Amravati MSRTC Bus Stand & similar MSRTC locations.

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This study focuses on **crowd control and public behaviour management** at **Amravati MSRTC Bus Stand**, one of the busiest public transport hubs in the region. The bus stand experiences significant challenges such as overcrowding, lack of queue discipline, and confusion among passengers during peak hours, weekends, and festivals. These issues cause inconvenience, delays, and safety risks, particularly for women and senior citizens. The research aims to **analyze passenger behaviour, identify key crowd-related problems, and propose a practical, low-cost model for managing both crowd flow and public conduct.** Primary data were collected through questionnaires, direct observation, and informal interviews with passengers and MSRTC staff. Findings reveal that measures such as **behavioural awareness initiatives, volunteer guidance, organized entry–exit flow, and clear information systems** can significantly reduce congestion and improve discipline. The proposed model directly addresses the problems highlighted in the study title and is suitable for implementation at Amravati Bus Stand and other similar MSRTC locations.

Keywords: Crowd Control, Public Behaviour, Queue Management, Passenger Safety, MSRTC Bus Stand, Volunteer Guidance.

Assessment of Fungal Deterioration of Historical Monuments from Amravati District

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Historical monuments represent invaluable cultural assets that reflect the artistic, architectural, and social heritage of past civilizations. The Amravati district of Maharashtra is home to several historically and religiously significant monuments, including Ambadevi Temple, Ekvira Devi Temple, Anandeshwar Temple at Lasur, the stepwells of Mahimapur and Riddhapur, Gawilgarh Fort in Chikhaldara, and Kondeshwar Temple at Govindpur. These monuments not only serve as symbols of regional identity but also play an important role in promoting cultural tourism. However, many of these heritage structures are increasingly

threatened by progressive deterioration processes, which compromise their aesthetic appeal, material integrity, and long-term structural stability. Among the various physical, chemical, and biological agents responsible for monument degradation, biological deterioration particularly fungal biodeterioration has emerged as a significant but relatively underexplored factor in this region. Stone surfaces of these monuments frequently exhibit visible signs of deterioration, such as surface flaking, exfoliation, biofilm formation, discoloration, crust development, and gradual loss of sculptural and decorative details. These alterations are largely attributed to fungal colonization, which accelerates stone decay through both mechanical penetration and biochemical processes, including the production of organic acids, pigments, and extracellular enzymes. Despite the evident impact of fungal growth on these monuments, systematic scientific investigations focusing on fungal biodiversity, colonization patterns, and deterioration mechanisms in the Amravati district are limited. The present study aims to evaluate the extent and nature of fungal-induced biodeterioration affecting selected historical monuments in the district. The objectives include the isolation and identification of dominant biodeteriorative fungal species, assessment of their deteriorative potential, and understanding the interaction between fungal activity and local environmental conditions. Preliminary investigations have revealed the dominance of several filamentous fungi commonly associated with stone biodeterioration, including *Aspergillus niger*, *Cladosporium* spp., *Penicillium* spp., *Alternaria alternata*, *Curvularia* spp., *Epicoccum nigrum*, *Fusarium* spp., and *Rhizopus* spp. These fungi are well known for their adaptability to harsh environmental conditions and their strong ability to deteriorate stone substrates through acidogenesis, pigment production, and hyphal penetration into microcracks and pores.

To better understand the factors influencing fungal colonization and deterioration intensity, environmental parameters such as temperature, relative humidity, rainfall, and light exposure will be recorded and statistically correlated with the severity and type of biodeterioration observed at different sites. The study also considers the influence of stone type, surface orientation, and microclimatic variations on fungal growth dynamics. The expected outcomes of this research include the development of a comprehensive, region-specific catalogue of biodeteriorative fungi affecting historical monuments in the Amravati district, enhanced understanding of stone material vulnerability under semi-arid tropical climatic conditions, and insights into fungus–environment interactions. Ultimately, the findings aim to support the formulation of effective, eco-friendly, and sustainable conservation and management strategies for the preservation of cultural heritage monuments. By contributing region-specific data, this

study also seeks to strengthen the global understanding of fungal biodeterioration in cultural heritage conservation.

Keywords: fungal biodeterioration, historical monuments, stone decay, cultural heritage, Amravati district.

Development of Bioplastic from Shrimp Shell Waste

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Plastic waste has become a major environmental problem due to the widespread use of conventional plastics that do not decompose easily. As a result, there is a growing need to develop eco-friendly and biodegradable alternatives. This study focuses on the development of bioplastic using shrimp shell waste, which is commonly discarded by seafood processing industries. Shrimp shells are a rich source of chitin, a natural polymer that can be converted into chitosan, a biodegradable and environmentally safe material. The main aim of this research is to extract chitosan from shrimp shell waste and use it to produce bioplastic films. The extraction process includes demineralization, deproteinization, and deacetylation of the shrimp shells. The obtained chitosan is then blended with a plasticizer such as glycerol to improve flexibility and strength. The prepared bioplastic is tested for properties like biodegradability, tensile strength, water absorption, and overall durability. The findings show that the shrimp shell-based bioplastic has good mechanical properties and decomposes naturally within a short period when compared to conventional plastic materials. In addition, this method helps reduce environmental pollution by converting seafood waste into a useful and value-added product. Overall, this study highlights the potential of shrimp shell waste as a sustainable raw material for bioplastic production. The development of such biodegradable materials can play an important role in reducing plastic pollution and promoting sustainable waste management practices. Plastic is used in almost every part of our daily life, but most plastics do not break down easily and remain in the environment for many years. This causes serious pollution problems, especially in land and water bodies (*Geyer, R., Jambeck, J. R., & Law, K. L. (2017)*). At the same time, shrimp processing industries generate large amounts of shell waste, which is usually thrown away and creates disposal issues. Globally, the seafood processing sector

produces millions of tonnes of crustacean shell waste each year—estimates suggest around **6–8 million tonnes of crab, shrimp, and lobster shells** are generated annually, with shrimp processing alone contributing a significant portion of this waste stream. Much of this waste ends up in landfills or is dumped into the environment, where it can cause **serious pollution problems**. Shrimp shells contain a natural biopolymer called **chitin**, which can be chemically converted into **chitosan**, a biodegradable and versatile material. This project focuses on using shrimp shell waste to produce **bioplastic**, offering an eco-friendly solution that **addresses both plastic pollution and seafood waste problems** by converting otherwise discarded material into a valuable sustainable product (*Arvanitoyannis, I. S., & Kassaveti, A. et al., 2008*). To extract chitin and separation of chitosan, shrimp shells were collected from local fish markets in Akkaraipettai. To prepare bioplastic using chitosan and natural plasticizers To study the strength and biodegradability of the bioplastic We collected shrimp shells from local seafood markets, washed them thoroughly to remove any residue, and dried them before grinding into a fine powder. The powdered shells were treated with mild acids to remove minerals and then with alkali to remove proteins, resulting in **chitin**. This chitin was converted into **chitosan** through a deacetylation process using an alkaline solution. To make bioplastic, the chitosan was dissolved in a mild acidic solution and mixed with **glycerol** as a plasticizer. The mixture was then poured onto flat trays and dried to form **flexible, biodegradable bioplastic sheets**, which were later tested for strength, flexibility, and environmental friendliness (*Kurita, K. et al., 2001*). From **10 kg of shrimp shells**, we were able to create several valuable products. About **3–3.5 kg of chitin** was extracted after removing minerals and proteins, and this was further converted into roughly **2.5–3 kg of chitosan**. Finally, around **2–2.5 kg of flexible, biodegradable bioplastic sheets** was produced by adding glycerol and drying the chitosan. This demonstrates that shrimp shell waste, which is usually discarded, can be effectively transformed into **useful and eco-friendly materials** (*Islam, S., Khan, M., & Alam, A. N. et al., 2017*). This study shows that shrimp shell waste can be turned into **chitin, chitosan, and biodegradable bioplastic**, transforming what is usually thrown away into something useful. This not only helps **reduce environmental pollution** but also provides a **sustainable alternative to traditional plastics**. To reduce plastic waste and promote sustainable use of natural resources. By reusing seafood waste in this way, we can support **waste management, eco-friendly innovation, and a circular economy**, creating materials that are both practical and environmentally friendly (*Islam, S., Khan, M., & Alam, A. N. et al., 2017*)

Keywords: Bioplastic, Shrimp Shell Waste, Chitin, Chitosan, Biodegradability

Sustainable Utilization Fish Waste Into Value Added Fishery By Products

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Fish processing industries generate a large amount of waste such as fish heads, bones, skins, scales, and internal organs. When this waste is not managed properly, it can cause environmental pollution and health problems. Instead of treating fish waste as a problem, it can be used as a valuable resource. This study focuses on the sustainable use of fish waste by converting it into useful and value-added fishery by-products. Fish waste contains many important components such as proteins, oils, collagen, gelatin, and minerals. In this work, simple and eco-friendly methods are used to extract these components and produce products like fish protein hydrolysates, fish oil, gelatin, organic manure, and animal feed ingredients. These products have wide applications in food, pharmaceutical, cosmetic, agricultural, and aquaculture industries. The results show that utilizing fish waste in a sustainable way helps reduce environmental pollution and minimizes waste disposal issues. At the same time, it creates additional income opportunities for fish processors and supports small-scale industries. This approach also encourages better use of natural resources and promotes a circular economy, where waste materials are reused instead of being discarded. Overall, the sustainable utilization of fish waste plays an important role in environmental protection, economic development, and responsible fisheries management. Converting fish waste into value-added by-products not only reduces waste but also contributes to sustainable growth in the fisheries sector. Fish processing produces a lot of waste like skin, bones, and offal, which is often thrown away, causing pollution. Our project turns this waste into useful products: a moisturizer from collagen, a wound-healing film from gelatin, and fish feed and fertilizer from the rest. This reduces waste, adds value, and supports sustainability in fisheries (*Nagai, T., & Suzuki, N. et al., 2000*). Extract collagen from fish skin and bones and develop a natural, eco-friendly moisturizer (Skin Care Product) Obtain gelatin from fish waste and create a wound-healing film for medical use (Health Care Product). Convert remaining fish waste into nutrient-rich fish feed (Aquaculture) and organic fertilizer (Agriculture). Implement a zero-waste, sustainable process that reduces pollution and adds economic value (*G. B., & Duodu, K. G. et*

al.,2004). We collected fish waste such as skin, bones, scales, and guts from local markets, cleaned it thoroughly, and cut it into small pieces. To produce **gelatin for wound healing**, we treated fish skin and bones with mild acid and alkali, then heated them in water to extract gelatin, which was filtered, concentrated, and dried. For **collagen to make a moisturizer**, fish skin was soaked in acetic acid and treated with an enzyme to extract collagen, which was purified, dried, and mixed into a cream. The remaining fish waste was **dried and ground to prepare high-protein animal feed**, while some waste was **composted for several weeks to create organic fertilizer** (*Rustad, T., Slizyte, R. et al.,2011*). From **10 kg of fish waste**, we were able to create several valuable products. We extracted about **1.3 kg of gelatin** from the fish skin and bones, which can be used for wound healing, and around **0.9 kg of collagen** from the skin for making a moisturizing cream. The remaining waste was turned into **4 kg of nutritious animal feed**, while **3 kg of organic fertilizer** was produced from fish offal and scraps to enrich the soil. This shows that fish waste can be effectively reused, reducing pollution and creating useful products for health, agriculture, and livestock (*Storro, I.,R. et al.,2011*). From this study, it is clear that fish waste can be turned into useful products like **gelatin for wound healing, collagen for moisturizers, animal feed, and organic fertilizer**. This not only helps **reduce environmental pollution** but also creates **economic value** from something that would otherwise be thrown away. Using fish waste in this way promotes **sustainable practices**, supports agriculture and livestock, and shows that even waste materials can become **valuable resources** (*FAO,2012*).

Keywords: Fish Waste, Value-Added Products, Sustainable Fisheries, By-Products, Waste Utilization, Circular Economy

Development of Readymade Seaweed Soup Mix

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Seaweed is a Marine Algae and also nutritious marine ingredient, packed with vitamins, minerals, dietary fiber, and other beneficial compounds, making it an excellent choice for healthy foods. With more people looking for convenient, ready-to-cook meals that are also good for them, this study focuses on developing a seaweed soup mix that is both tasty and nutritious. In this project, high-quality edible seaweed was carefully selected, dried, and ground

before being blended with complementary ingredients such as spices and natural seasonings. Different recipes were tested to evaluate taste, aroma, texture, and overall acceptability using a panel of trained testers. Nutritional analysis was also carried out to measure protein, fiber, mineral content, and antioxidant property. Additionally, shelf-life tests ensured the soup mix remains safe and stable under normal storage conditions. The results showed that the final seaweed soup mix had a pleasant taste, appealing aroma, and smooth texture, while also providing high nutritional value. It maintained good shelf stability and offered potential health benefits, such as supporting digestion and overall well-being. This study demonstrates that seaweed can be successfully transformed into a convenient, ready-to-use product that meets consumer demand for functional foods. The developed soup mix has strong potential for commercialization, providing Seaweed soup is full of vitamins and minerals that help children grow and support their brain development. Its fiber aids digestion. For adults, it provides antioxidants and fiber to protect the body and support a healthy gut. For people in old age, it supplies minerals for strong bones, may ease joint discomfort, and is easy to digest and promoting the sustainable use of marine resources. Seaweed is a nutritious and versatile marine ingredient, packed with vitamins, minerals, dietary fiber, and antioxidants. As people become more health-conscious and look for convenient meal options, seaweed-based foods are gaining attention. This project focuses on developing a ready-to-cook seaweed soup mix that combines health benefits, great taste, and convenience (*Gupta, S., & Abu-Ghannam, N. et.al.,2011*). Select and process high-quality edible seaweed. Identify a balanced soup mix with natural spices and seasonings. Evaluate taste, aroma, texture, and overall acceptability. Analyze nutritional content, including protein, fiber, minerals, and antioxidants. Test shelf-life and storage stability. We collect fresh, edible seaweed from local farms or markets, making sure to select only clean and high-quality pieces. The seaweed is washed thoroughly with fresh water to remove sand, salt, and any impurities, and any damaged parts are removed. Once cleaned, the seaweed is dried under sunlight or using a dehydrator until all moisture is gone. The dried seaweed is then ground into a fine powder, which becomes the main ingredient for the soup mix. This powder is blended with dehydrated vegetables, spices, and seasonings to create a ready-to-cook mix that is flavorful, nutritious, and easy to prepare. Finally, the mix is packed into airtight containers or pouches to keep it fresh, maintain its quality, and extend its shelf-life (*Mabeau, S., & Fleurence, J.et.al.,1993*). From **10 kg of fresh seaweed**, we were able to make about **2–2.5 kg of dried seaweed powder**, which was then used to prepare around **5–6 kg of ready-to-cook seaweed soup mix** by adding dehydrated vegetables, spices, and seasonings. The soup mix was **nutritious, tasty, and easy to prepare**, rich in fiber, vitamins, minerals, and

iodine. It also had a **pleasant aroma and good texture**, with a long shelf-life, showing that fresh seaweed can be transformed into a **convenient and value-added food product** (Holdt, S. L., & Kraan, S. (2011)). This project shows that fresh seaweed can be turned into a **ready-to-cook, nutritious soup mix**, making it a convenient and healthy food option. The soup is packed with **fiber, vitamins, minerals, and iodine**, supporting better health while being quick and easy to prepare. By creating this product, we can **reduce seaweed waste, add value to natural resources, and promote sustainable use of marine products**. It also opens the door to **healthy, eco-friendly, and innovative food solutions** for the market (Mabeau, S., & Fleurence, J. et al., 1993).

Keywords: Seaweed, Soup Mix, Functional Food, Nutrition, Shelf Stability, Sensory Evaluation

Comparative study of commercial hand sanitizers on bacterial growth

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Hand hygiene is essential for preventing the spread of infectious diseases, and various commercial hand sanitizers are commonly utilized for quick microbial control. This study aimed to assess and compare the antibacterial effectiveness of several hand sanitizers, including Dettol, Purest, Herbal Hanluv, Mandhana alcohol-based, and a locally produced sanitizer, against prevalence of pathogenic bacteria such as *Staphylococcus aureus*, *Escherichia coli*, and *Pseudomonas aeruginosa*, which are often linked to community and healthcare-associated infections.

An in vitro comparative analysis was conducted using the agar well diffusion method. Clinical bacterial isolates were isolated and inoculated on Mueller–Hinton agar plates. Each well was filled with equal volumes of the sanitizers, and antibacterial effectiveness was determined by measuring the inhibition zones after incubation. The tests were repeated thrice to ensure the reliability of the results.

The results indicated significant variations in antibacterial effectiveness among the sanitizers tested. The Mandhana alcohol-based sanitizer exhibited the strongest antibacterial action against all three bacterial strains, particularly *E. coli* and *P. aeruginosa*, likely due to its high

alcohol content. Dettol hand sanitizer also presented robust and consistent inhibitory effects, particularly against *S. aureus*, demonstrating broad-spectrum antimicrobial properties. Purest hand sanitizer showed moderate antibacterial activity against all pathogens tested, while the Herbal Hanluv sanitizer was less effective, especially against Gram-negative bacteria. The local hand sanitizer had the weakest antibacterial effect, raising concerns about its formulation quality and effectiveness.

Overall, *S. aureus* was more easily inhibited by the sanitizers compared to *E. coli* and *P. aeruginosa*. The study concludes that the concentration of alcohol and formulation significantly impact sanitizer efficacy, and not all commercial products ensure sufficient antibacterial protection. These findings highlight the necessity of choosing scientifically validated hand sanitizers for effective infection control.

Keywords: Hand sanitizers, commercial formulations, antibacterial activity, bacterial growth inhibition, zone of inhibition, antimicrobial efficacy.

Human-Induced Threatsand Their Effects on Wetland Bird Communities at Malkhed Lake

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Wetlands are among the most productive ecosystems and play a crucial role in supporting avian biodiversity. Malkhed Lake, located in the Amravati district of Maharashtra, serves as an important habitat for both resident and migratory wetland birds. The present study aims to assess human-induced threats and their ecological impacts on wetland'd bird communities at Malkhed Lake. Field surveys were conducted during 2020-2022 to document species diversity, abundance, and seasonal variation, while breeding records were monitored from 2021 to 2023 using direct observation methods. A total of 106 wetland bird species belonging to 23 families were recorded, with Anatidae and Scolopacidae emerging as dominant families. Of the total species, 52 were residents and 54 were migratory, with maximum diversity observed during the winter season (October-January). Most species were categorized under the Least Concern category; however, several Near Threatened and Vulnerable species, including Ferruginous Pochard, Black-tailed Godwit, River Tern, Darter, and Common Pochard, were also recorded, highlighting the conservation significance of the lake. Major

human-induced threats observed included water level fluctuations, degradation of mudflats, disturbance near nesting sites, and habitat alteration along the lake margins. Breeding failure was notably associated with the submergence of nesting islands during early monsoon rains, leading to significant nest loss in certain years. These disturbances adversely affected feeding, nesting success, and habitat utilization patterns of wetland birds. The study emphasizes the urgent need for habitat protection, regulated human activity, and long-term monitoring to ensure sustainable conservation of wetland bird communities at Malkhed Lake.

Keywords: Wetland birds, Anthropogenic threats, Habitat degradation, Malkhed Lake

Marine Sponges as Natural Biofilters for Microplastics: An Empirical *Synthesis of Existing Evidence*

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Microplastics (MP) are now pervasive components of the marine environment from the benthic region to the pelagic zones, imposing risks on the marine ecosystems. Variability in size, structure, density, and shape of MPs complicate mitigation and exposure pathways. Conventional plastic removal strategies, such as manual collection, and the wastewater treatment process in open marine systems remains inadequate. Marine sponges (phylum *Porifera*) are sessile benthic filter-feeders with high pumping rates and complex aquiferous systems, positioning them as transient sinks for microplastics. Although marine sponges have been widely recognized as effective bioindicators of MP contamination, the mechanisms governing sponge and MP interactions remain poorly understood. This study is based on empirical evidence from published studies evaluating MP- sponges interaction. MP are dispersed into the water column by oceanographic processes, and physical characteristics of MP itself, increasing sponge exposure, particularly in benthic habitats. Existing studies suggest that the MP accumulation in sponges is primarily influenced by spatial variation, followed by particle morphology. Observations indicate MP interception by aquiferous systems and ectosomal incorporation, though precise mechanisms remain unidentified. Studies further suggest that particle ingestion is largely incidental, with subsequent egestion indicating that selection may operate post-ingestion. Variation in the ingestion of MP depends upon the

morphology, physiology of sponges and spatial variability. Reported physiological responses of sponges to MP exposure range from negligible effects to reduced filtration activity.

Collectively, this synthesis interprets sponges as natural biofilters and effective bio-interceptors that mediate the concentration and distribution of MP, highlighting the need for mechanistic frameworks to evaluate their role in MP interception.

Keywords: Biofiltration, Biointerceptors, Bioindicators, Microplastics, Marine pollution, Marine Sponges

Sustainable Marine Derived MgO Nanoparticles: Anti-Oxidant and Anti-cancer Efficacy in HT-29 cell line

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Magnesium oxide (MgO) nanoparticles were synthesized using an environmentally friendly green approach that utilizes marine-derived biomolecules as natural reducing and stabilizing agents. This sustainable strategy eliminates the use of hazardous chemicals and energy-intensive conditions typically associated with conventional synthesis methods, making it suitable for biomedical applications. The formation of MgO nanoparticles was confirmed through physicochemical characterization, revealing well-defined nanoscale particles with stable morphology and crystalline nature. The presence of marine biomolecules on the nanoparticle surface is expected to enhance biocompatibility and functional performance. The biological potential of the synthesized MgO nanoparticles was assessed through antioxidant and anticancer studies. Antioxidant assays demonstrated a significant free radical scavenging ability, which can be attributed to the synergistic effect of MgO and surface-bound marine bioactive compounds. The anticancer efficacy was evaluated *in vitro* using the human colorectal cancer cell line HT-29. The results showed a clear concentration-dependent decrease in cell viability upon treatment with MgO nanoparticles, indicating effective cytotoxic activity against cancer cells. This anticancer effect is likely mediated by nanoparticle-induced oxidative stress, disruption of cellular homeostasis, and improved cellular uptake facilitated by the marine biomass coating. Overall, the findings of this study highlight the effectiveness of marine biomass as a green platform for the synthesis of MgO nanoparticles with notable antioxidant and anticancer properties. The combination of sustainability, biocompatibility, and biological activity of marine biomass facilitated MgO nanoparticles as promising candidates for future

cancer related nanomedicine applications and supports further investigation into their underlying mechanisms and therapeutic potential.

Keywords: HT-29 cell line, Seaweed, Nanoparticles, Anti-cancer, Anti-Oxidant

From Soil to Shield: Antibacterial Potential of Dominant Arbuscular Mycorrhizal Fungi

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Arbuscular mycorrhizal fungi (AMF) are well recognized for their symbiotic role in enhancing plant nutrition and stress tolerance; however, their potential as sources of bioactive antimicrobial compounds remains underexplored. The present study evaluates the antibacterial efficacy of dominant AMF species isolated from the rhizosphere of selected medicinal plants. Three prevalent species—*Glomus reticulatum*, *Glomus fasciculatum*, and *Glomus leptotichum*—were isolated, morphologically identified, and mass-multiplied under controlled conditions. Monoculture inocula were applied to *Zea mays* grown in sterilized soil to establish successful mycorrhization, which was confirmed at intervals ranging from 5 to 50 days post-inoculation. Root samples with adhering spores were subjected to ethanolic extraction using the maceration technique to obtain crude fungal extracts. Antibacterial activity was assessed against Gram-positive (*Clavibacter michiganensis*) and Gram-negative (*Ralstonia solanacearum*) bacterial pathogens employing the disc diffusion assay. The results demonstrated notable antibacterial activity across all AMF species tested, with *G. reticulatum* exhibiting the highest inhibition zones, followed by moderate activity in *G. fasciculatum* against both bacterial strains. These findings underscore the promising role of AMF as natural producers of antimicrobial metabolites and highlight their potential application as eco-friendly biocontrol agents in sustainable agriculture and plant disease management.

Keywords: Arbuscular mycorrhizal fungi, *Glomus* spp., Antibacterial activity, Bio-control agents, Sustainable agriculture, Plant–microbe interaction.

Synthesis of oxygen containing heterocyclic compounds by using green approach, its characterization and biological study

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The heterocyclic compounds having oxygen nowadays are an important class of organic compounds which consist of ringlike structure having one O2 atom and adjacent carbon atoms forms ring structure. The heterocyclic compounds are classified in various categories such as 3,4,5,6,7,8 membered rings and fused heterocyclic compounds. The heterocyclic compounds are nowadays becoming an important substituent for the synthesis of new drug derivatives in drug discovery. the heterocyclics rings such as pyran, furan, oxirane are likely present in many drug substances. These heterocycles, simple and complex compounds are naturally present in alkaloids, vitamins, pigments, antibiotics and secondary metabolites. The derivatives are widespread involved in pharmaceuticals drug substances. around 312 drugs approved by FDA consist of at least one O2 ring structure. These are present in nearly 90% new entities in pharmaceuticals. The synthesis of oxygen containing heterocyclic compound can be possibly synthesis by using various named reactions such as Pechman condensation ,Perkin reaction, Knoevenagel cyclization, Wittig reaction, and Claisen rearrangement reaction, and its methods employed that the proposed heterocyclic derivatives would be further investigated for the biological activity and its efficacy and for the therapeutics such as anticancer, anticoagulation, anti-inflammatory and antibacterial activity. In the context of the present research work area the proposed research-oriented work will take a step for the synthesis of the novel oxygen containing heterocyclic compounds and drug intermediates. The potential excellence of the derivatives in biological study and evaluation would have potent activity against therapeutics and diseases. The proposed research work will be conducting SAR studies for its cytotoxicity effects of the prepared heterocyclic compounds. The synthesise derivatives will be use as a key starting raw material for the novel drug development program and the optimization of the resources and cutting-edge technology. the route of synthesis of the compounds will promote flow chemistry. The present work targeted as a new strategy for the synthesis of oxygen heterocycles by using various low cost catalysts for the maximum yield through the atom economy concept. The electronic transition study will be carried out of organo chromophore group by UV-visible spectrophotometer, PMR and carbon skeleton study by proton & Carbon

nuclear magnetic resonance -spectroscopy and exact mass, its mass fragmentation calculation mass spectroscopy. The objective of a recent study is to synthesize new type of O₂ containing coumarin and furan by Knoevenagel method by accelerating rate of the reaction by low-cost catalyst piperidine/pyridine base via simple an efficient step by reducing burden of hazardous solvents. The synthesized compounds will be screened against selected bacterial strains for its biological study.

Keywords: heterocyclic, organo chromophore, Knoevenagel, pharmaceuticals, anti-inflammatory.

Renewable Energy Systems and Sustainable Power : Challenges, Opportunities, and Innovations

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Introduction

The global energy landscape is undergoing a transformative shift, driven by the urgent need to reduce greenhouse gas emissions and ensure sustainable development. Conventional fossil fuel-based energy systems are increasingly unsustainable due to environmental degradation, resource depletion, and rising energy demands. Renewable energy systems, encompassing solar, wind, hydropower, and biomass, offer promising pathways toward cleaner, more resilient, and sustainable power generation. This study examines the role of renewable energy in advancing sustainable energy development.

Keywords Renewable energy ,Sustainable power ,Solar and wind energy ,Energy efficiency ,Clean energy systems

Objectives:

The study aims to evaluate the potential of renewable energy technologies in meeting contemporary energy demands while minimizing environmental impacts. It seeks to identify strategies for effective integration of these systems into existing power grids and to assess their social, economic, and ecological implications.

Methodology:

A combination of literature review, case study analysis, and modeling techniques was employed to investigate the performance, efficiency, and sustainability of various renewable energy systems. Comparative analyses were conducted against conventional energy sources to quantify environmental benefits, economic feasibility, and operational reliability.

Results:

Findings reveal that renewable energy systems can substantially reduce dependence on fossil fuels while providing reliable and sustainable power. Solar and wind technologies emerged as highly scalable and cost-effective solutions, whereas hydropower and biomass contributed to steady energy supply. Integration of renewable sources into power networks improved overall system resilience and reduced carbon emissions, with long-term economic benefits outweighing initial capital investments.

Conclusion:

Renewable energy systems represent a crucial pillar for sustainable power development. Their widespread adoption not only addresses environmental and energy security challenges but also fosters economic growth and social advancement. Strategic planning, technological innovation, and supportive policy frameworks are essential to fully realize the potential of renewable energy for a sustainable energy future.

Production of Biodegradable Plastic using corn starch

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Plastic offer a variety of benefits, in a variety of shapes, such as sheets, panels, film, which can all be flexible as the application requires. Due to its properties like light weight, strong, visually aesthetic, flexible size and shape and cheaper price it has number of applications in our day to day life. However, our increasing dependency on the plastic resulting in a massive environmental pollution. The increasing accumulation of non-biodegradable plastic waste has become a major environmental concern worldwide, leading to soil pollution, water contamination, and harm to wildlife. Conventional plastics are derived from petroleum sources and require hundreds of years to decompose, causing long-term ecological damage. This situation highlights the urgent need for sustainable and eco-friendly alternatives.

Biodegradable plastics produced from natural polymers such as starch offer a promising solution due to their renewability, low cost, and ability to decompose naturally. Cornstarch, being abundant, inexpensive, and easily available, serves as an excellent raw material for the production of biodegradable plastic. The main objective of this study is to produce biodegradable plastic using cornstarch and evaluate its basic physical properties such as flexibility, strength, and biodegradability. The study also aims to develop a simple and cost-effective laboratory-scale method that can be easily adopted by students and small research facilities. Additionally, the work seeks to promote awareness about sustainable materials and reduce dependency on petroleum-based plastics.

The methodology involves the preparation of bioplastic through gelatinization of cornstarch in the presence of water, plasticizers such as glycerol, and mild heating. Cornstarch is dissolved in distilled water and heated continuously to form a homogeneous gel. Glycerol is added as a plasticizer to improve flexibility, and vinegar may be used to enhance polymer bonding. The mixture is heated until a transparent paste is formed and then cast onto a flat surface to dry at room temperature. After drying, the formed bioplastic sheet is peeled off and subjected to simple tests such as tensile strength, flexibility, water absorption, and biodegradability in soil. The results demonstrate that cornstarch-based bioplastic exhibits good flexibility and moderate mechanical strength depending on the concentration of glycerol used. The material shows partial resistance to tearing and can be molded into thin sheets. Soil burial tests indicate that the bioplastic starts degrading within a few weeks, confirming its biodegradable nature. Higher glycerol content increases flexibility but slightly reduces strength, whereas lower glycerol concentration improves stiffness. In conclusion, the study successfully demonstrates the production of biodegradable plastic from cornstarch using a simple and economical method. This bioplastic shows promising properties suitable for light packaging and disposable applications. The findings suggest that starch-based bioplastics can serve as an eco-friendly alternative to conventional plastics, contributing to environmental sustainability and waste reduction. The project highlights the potential of renewable resources in addressing plastic pollution and if the synthetic plastic is replaced by the bio-plastic, even if on a small scale in our day to day life it may have the bigger impact on saving environment.

Keywords: - Biodegradable, Plastic, pollution, decompose

Comparative study of load Microorganisms in fresh fruit juice and packed fruit juice

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Fruit juices are widely consumed across all age groups due to their nutritional value, refreshing taste, and perceived health benefits. However, their high moisture content, natural sugars, and near-neutral pH make them an excellent medium for microbial growth if not properly handled or processed. The present study was undertaken to carry out a comparative analysis of the microbial load present in fresh fruit juices and commercially packed fruit juices, with the objective of evaluating their microbiological safety and quality.

Fresh fruit juice samples were prepared under local market conditions using commonly consumed fruits such as orange, apple, and pineapple, while commercially packed fruit juice samples of the same varieties were procured from retail outlets. All samples were analyzed for total viable count (TVC), coliform count, and the presence of common spoilage and pathogenic microorganisms using standard microbiological techniques. Serial dilution followed by the pour plate and spread plate methods was employed for microbial enumeration. Selective and differential media such as Nutrient Agar, MacConkey Agar, and Potato Dextrose Agar were used to isolate bacteria and fungi. The results were expressed as colony-forming units per milliliter (CFU/ml).

The findings revealed that fresh fruit juice samples exhibited significantly higher microbial loads compared to packed fruit juice samples. Fresh juices showed elevated total viable counts, often exceeding acceptable microbial limits, indicating poor hygienic practices during juice extraction, handling, and storage. Coliform bacteria were detected in several fresh juice samples, suggesting possible fecal contamination due to the use of contaminated water, unclean utensils, or improper personal hygiene of vendors. Commonly isolated bacteria included *Escherichia coli*, *Staphylococcus aureus*, and *Bacillus* species, while fungal isolates such as *Aspergillus* and *Penicillium* species were also observed.

In contrast, packed fruit juice samples demonstrated comparatively lower microbial counts, which can be attributed to industrial processing techniques such as pasteurization, aseptic packaging, and the use of preservatives. Most packed juice samples were within permissible

microbiological limits, although low levels of microbial presence in some samples indicated possible post-processing contamination or improper storage conditions.

This comparative study highlights the potential health risks associated with the consumption of fresh fruit juices prepared under unhygienic conditions, especially when sold by street vendors. The study emphasizes the need for strict adherence to good manufacturing practices (GMP), proper sanitation, and quality control measures during juice preparation and distribution. Moreover, consumer awareness regarding the safety of fresh and packed fruit juices is essential. Overall, the study concludes that while fresh fruit juices offer nutritional benefits, packed fruit juices are microbiologically safer when produced and stored under regulated conditions.

Keywords:-Fresh fruit juice, Packed fruit juice, Microbial load, Total viable count (TVC), Coliform bacteria, Food safety, CFU/ml, Juice contamination, Microbiological quality, Pasteurization

Development and Implementation of a Low-Cost Water Purification System for Rural Communities

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Background / Introduction: Access to clean drinking water remains a critical challenge in many rural regions, where centralized water treatment infrastructure is often absent or poorly maintained. Many communities rely on open water sources contaminated with pathogens, suspended solids, and chemical runoff. High-tech purification systems (like Reverse Osmosis) are frequently unsustainable in these areas due to high initial costs, electricity requirements, and complex maintenance needs. There is an urgent need for a decentralized, "appropriate technology" solution that utilizes locally available materials.

The primary objective of this project is to design, construct, and evaluate a low-cost, gravity-fed water purification system specifically tailored for household use in rural settings. The study aims to achieve a significant reduction in turbidity and microbial load without the use of electricity or expensive chemicals, ensuring the system is both economically viable and easy for community members to operate.

This project demonstrates that high-quality water filtration is achievable through simple, low-cost engineering. By utilizing local materials and gravity-based mechanics, the proposed system offers a scalable solution for water-scarce rural communities. Implementation of this technology can lead to a substantial decrease in waterborne diseases, reducing the economic burden of healthcare on marginalized families and contributing to the global goal of universal access to safe water.

Keywords: -Water Purification, Rural Development, Sustainable Technology, Slow Sand Filtration, Potable Water.

Effect of different colors and heat on lifecycle and metabolic activities of fishes applied on glass of aquarium tank.

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Background / Introduction: In most of the aquarium the glass of fish tank or wall behind it is colored by mainly by black color, which absorbed heat and affects the metabolic activities of aquatic animal like fishes. This research can help us know which color is suitable for this purpose so that fishes can complete their natural metabolism and lifecycle.

Objectives / Purpose: This experiment will run to test the effect of different colors mainly primary like yellow, blue, Orange, Red on fishes activities. The LED light though produce very low heat but the color used for beautification can change the amount of heat absorbed.

Methodology: In this we print the five fish tank glass on outer side by yellow, blue, Orange, Red and Black color respectively. And then study the effects of it on aquatic life of tank (usually fishes). In second set up we check the effect of light of different intensities i.e.. Emitting photons of different intensities and frequencies.

Results / Findings: The fish tank which is having its one side painted black absorbed more heat and increase the temperature of water in tank. These disturb the various activities of fishes.

Among red, blue, orange, and yellow, blue light absorbs more energy and is absorbed more readily by materials than the others because it has shorter wavelengths and higher energy; red and orange light have longer wavelengths and less energy, so they are absorbed less and penetrate further in some mediums like water.

e. Conclusion / Implications: These help us understand the effect of different colors on the activities of fishes and by the help of this knowledge we can literate farmers involved in aqua culture, professional in this field, and may be researcher and know the basic about effect of different colors on metabolic activities of fishes.

d. Results / Findings:

In addition to basic emotion classification, Sensei has custom algorithms to derive more complex educational metrics. Engagement, concentration and confusion levels are calculated using weighted combinations of detected emotion probabilities. Focus and distraction are assessed by analyzing gaze direction and iris movement with temporal smoothing to ensure stability across frames. The system's backend is built with the Flask web framework, allowing real-time video streaming and emotion data sharing through Server-Sent Events. A web-based dashboard displays live visuals of emotional trends and cognitive metrics. This lets instructors monitor learner behavior throughout a session.

e. Conclusion / Implications:

Experiments show that the system works reliably in real time and can analyze multiple learners simultaneously with standard hardware. In conclusion, Sensei - AI for Smart Education, signifies a shift from content-focused to human-centered AI education. By incorporating emotion and engagement intelligence into digital learning platforms, the system encourages adaptive teaching, boosts student participation and leads to better learning outcomes. It plays a part in creating emotionally aware and intelligent educational technologies.

Keywords :-Fishes lifecycle, colors effect, heat production, Heat adsorption, glass reflection

Bio-Hybrid Aqua-Purifier: An Integrated Multi-Stage Water Filtration System

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Access to safe and clean drinking water remains a critical global challenge, particularly in rural and semi-urban regions where conventional water treatment technologies are either expensive or energy-intensive. To address this issue, the Bio-Hybrid Aqua-Purifier: An Integrated Multi-

Stage System is proposed as a sustainable, cost-effective, and eco-friendly water purification solution. This system integrates biological, physical, and chemical purification processes into a single hybrid framework to ensure efficient removal of physical impurities, chemical contaminants, and pathogenic microorganisms.

The proposed bio-hybrid aqua-purifier operates through a multi-stage purification mechanism, beginning with a pre-filtration stage that removes large suspended particles such as sand, silt, and debris using gravel and mesh filters. This stage prevents clogging and enhances the efficiency of subsequent purification processes. The second stage consists of a biological filtration unit, utilizing natural bio-media such as activated bio-sand, beneficial microbial layers, and plant-based fibers. These biological components facilitate the degradation of organic matter and significantly reduce microbial load through natural bio-oxidation and adsorption mechanisms.

Following biological treatment, the system incorporates a chemical adsorption stage using activated charcoal, bio-char, or natural adsorbents such as coconut shell carbon. This stage effectively removes dissolved organic compounds, residual odors, chlorine, and heavy metal traces. The final stage includes disinfection, achieved through eco-friendly methods such as UV exposure, solar disinfection, or herbal antimicrobial extracts, ensuring complete elimination of pathogenic bacteria and viruses without generating harmful by-products.

One of the key advantages of the Bio-Hybrid Aqua-Purifier is its low energy requirement and minimal operational cost, making it highly suitable for remote and resource-limited settings. The system can be operated using gravity flow or low-power solar energy, thereby promoting sustainability and reducing dependence on conventional electricity sources. Additionally, the modular design allows easy maintenance, scalability, and customization based on local water quality conditions.

Experimental observations and preliminary performance analysis indicate that the integrated multi-stage approach significantly improves water quality parameters such as turbidity, biological oxygen demand (BOD), chemical oxygen demand (COD), and microbial count, meeting standard drinking water guidelines. Furthermore, the use of biodegradable and locally available materials enhances environmental compatibility and community acceptance.

In conclusion, the Bio-Hybrid Aqua-Purifier represents an innovative and practical solution for sustainable water purification. By combining biological treatment with physical filtration and

chemical adsorption, the system offers an efficient, affordable, and environmentally responsible alternative to conventional water purification technologies. This integrated approach holds strong potential for addressing water scarcity and public health challenges, especially in developing regions.

Keywords: Bio-Hybrid Aqua Purifier, Multi-Stage Water Purification, Biological Filtration System, Activated Carbon Adsorption

Effect of pH on phase formation and crystallinity of CuO/Cu₂O nanoparticles synthesized from copper nitrate + Azadirachta indica (neem) leaf extract via precipitation

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Copper oxide nanoparticles (CuO/Cu₂O) show excellent potential in photocatalysis, antibacterial applications, and sensors, but achieving phase purity and optimal crystallinity remains challenging in green synthesis routes. While chemical precipitation methods demonstrate pH controls CuO (monoclinic) vs Cu₂O (cubic) phase formation, systematic studies using eco-friendly Azadirachta indica (neem) leaf extract as both reducing and capping agent remain limited, creating a gap in understanding pH-dependent phase evolution and structural properties in this sustainable system.

b.Purpose:

This study systematically investigates how pH solution influences phase formation (CuO vs Cu₂O ratio) and crystallinity parameters (crystallite size, lattice strain, crystallinity index) of nanoparticles synthesized via single-step precipitation from copper nitrate and neem leaf extract, aiming to establish pH optimization guidelines for tailored green synthesis of copper oxide nanomaterials.

c.Methodology:

Aqueous neem leaf extract (standardized 10% w/v) was mixed with 0.1 M Cu(NO₃)₂·3H₂O solution at pH 6.0, 7.0, 8.0, 9.0, 10.0, 11.0, and 12.0 (adjusted using 1 M NaOH), maintaining fixed precursor-to-extract ratio (1:2 v/v), 80°C temperature, and 2-hour stirring. Synthesized nanoparticles were characterized by X-ray diffraction (XRD) for phase identification and

crystallite size (Scherrer equation), Williamson-Hall analysis for lattice strain, UV-Visible spectroscopy for bandgap, FTIR for functional groups, and SEM for morphology.

d.Results:

XRD analysis reveals pH-dependent phase transition: acidic pH 6-8 yields Cu₂O-dominant phase with smaller crystallites (15-22 nm) and higher lattice strain (0.8-1.2%); neutral-alkaline pH 9-10 shows mixed CuO/Cu₂O phases; alkaline pH 11-12 produces pure CuO with largest crystallites (28-35 nm), minimum strain (0.4%), and optimal crystallinity (lowest FWHM). UV-Vis confirms bandgap narrowing from 2.1 eV (Cu₂O, pH 6) to 2.7 eV (CuO, pH 12). SEM shows morphological evolution from spherical Cu₂O to rod-like CuO with increasing pH.

e. Conclusion:

This work establishes the first systematic pH-phase-crystallinity relationship for neem extract-mediated CuO/Cu₂O synthesis, demonstrating precise control over phase purity and structural properties through simple pH adjustment. These findings provide reproducible green synthesis protocols for application-specific copper oxide nanoparticles, advance sustainable nanotechnology using indigenous plant resources, and contribute quantitative reference data for future materials optimization in photocatalysis and antimicrobial applications.

Keywords: -CuO nanoparticles, Cu₂O nanoparticles, pH effect, neem leaf extract, green synthesis, phase formation, crystallinity, XRD analysis

Study of Antibacterial Potential of Medicinal Plant Extracts

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Antibiotic resistance has emerged as one of the most critical global health challenges of the present century, leading to increased treatment failures, prolonged illnesses, and higher healthcare costs. The extensive and often indiscriminate use of synthetic antibiotics has accelerated the development of resistant strains of pathogenic microorganisms, thereby reducing the effectiveness of conventional antimicrobial therapies. This alarming situation has created an urgent need to explore alternative, safe, and sustainable sources of antimicrobial

agents. Medicinal plants have been traditionally used in various systems of medicine for the treatment of infectious diseases and are known to possess a wide range of therapeutic properties. Previous studies have reported that medicinal plants contain bioactive phytochemicals such as flavonoids, phenolic compounds, alkaloids, and tannins, which contribute to their antibacterial potential.

The present study aims to explore the antibacterial potential of medicinal plant extracts against common pathogenic microorganisms. The primary objective of this research is to scientifically evaluate the effectiveness of selected medicinal plant extracts as alternative antimicrobial agents and to provide a scientific basis for their traditional use. By focusing on plant-based antimicrobials, the study seeks to contribute to the development of natural and eco-friendly solutions to combat antibiotic resistance.

The proposed methodology involves the collection and preparation of medicinal plant materials followed by extraction using suitable solvents. The antibacterial activity of the prepared plant extracts will be assessed using standard microbiological techniques such as the agar well diffusion method to determine the zone of inhibition and the minimum inhibitory concentration method to evaluate the lowest concentration required to inhibit microbial growth. Common pathogenic microorganisms, including both gram-positive and gram-negative bacteria, will be used to assess the spectrum of antibacterial activity. Standard laboratory protocols will be followed to ensure accuracy and reproducibility of results.

It is expected that the medicinal plant extracts will exhibit significant antibacterial activity, with comparatively higher effectiveness against gram-positive bacteria due to differences in cell wall structure. The findings of this study are anticipated to highlight the potential of medicinal plants as promising sources of natural antimicrobial compounds. Even preliminary observations are expected to provide valuable insights into the antibacterial efficacy of plant-derived extracts.

In conclusion, this study emphasizes the importance of exploring medicinal plants as eco-friendly, cost-effective, and sustainable alternatives to synthetic antibiotics. The outcomes of this research may contribute to addressing the growing challenge of antibiotic resistance and encourage further investigations into plant-based antimicrobial agents. Our vision is to scientifically validate natural products as potential therapeutic alternatives and to promote sustainable research approaches that bridge traditional medicinal knowledge with modern microbiological science.

Keywords :-Antibiotic resistance, Medicinal plants, Antibacterial activity, Plant extracts, Herbal extract.

Synergistic effects of antibiotic and plant extract against acne causing bacteria

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Acne vulgaris is a multifactorial skin disorder commonly associated with bacterial pathogens such as *Cutibacterium acnes*, *Staphylococcus aureus*, *Pseudomonas aeruginosa*, *Staphylococcus epidermidis* and *Escherichia coli*. Prolonged use of antibiotics in acne treatment has led to the emergence of antibiotic resistance, creating a need for alternative or adjunct therapeutic strategies. The present study was designed to evaluate the synergistic antibacterial effect of selected antibiotics and medicinal plant extracts against acne-causing bacteria.

In this study, commonly used antibiotics namely clindamycin, tetracycline, erythromycin, and streptomycin were selected. Medicinal plants known for their antimicrobial and anti-inflammatory properties, including *Ocimum tenuiflorum*, *Curcuma longa*, *Moringa oleifera*, and *Salvia rosmarinus*, were used for the preparation of plant extracts. The antibacterial activity of antibiotics and plant extracts was assessed individually and in combination using standard agar diffusion techniques. Synergistic interactions were determined by comparing the zones of inhibition obtained with antibiotics alone and in combination with plant extracts.

The results demonstrated enhanced antibacterial activity in several antibiotic–plant extract combinations, indicating a positive synergistic effect. The observed synergy suggests that plant-based bioactive compounds can improve the efficacy of conventional antibiotics against acne-causing bacteria.

The study concludes that plant antibiotic combinations may serve as a promising approach for effective acne management, potentially reducing antibiotic dosage and limiting the development of resistance. This work supports the development of novel herbal-based adjunct therapies for dermatological applications.

Keywords: Acne vulgaris, Synergistic effect, Antibiotics, Medicinal plants, Antibacterial activity

Antimicrobial Susceptibility Pattern of E.coli isolated from Clinical Pus Samples

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At the existing scenario, the indiscriminate and misuse of antibiotics has also lead to the increase in multi-drug resistant organisms (MDRO). The spread of bacterial infection by resistant microorganisms can be severe, resulting in prolonged illness due to delayed antibiotic administration, susceptibility to infection for patients undergoing surgery, higher mortality and cost. The aim of the present work was to focus on antibiotic resistance pattern of *Escherichia coli*, a gram negative bacteria belongs *Enterobacteriaceae* family. In present study the screening of total 250 clinical pus samples were performed. Out of that 75 samples were found to be positive for *Escherichia coli*. In all 25 antibiotics of different classes were screened against the clinical isolates.

The findings showed that maximum isolates of *E.coli* were highly resistant to maximum antibiotics and moderately sensitive towards few of the antibiotics. *E.coli* was found to be highly sensitive only towards Chloramphenicol and Imipenem. The antimicrobial susceptibility of bacterial isolates from pus samples should be continuously monitored in order to select the choice of drugs for prevention and treatment of infection. Public awareness to strictly avoid the excessive use of antibiotics is crucial.

Keywords: Pus, E. coli, MDR, antibiotic resistance

Numerical solutions of schrodinger equations for qunatam machanical system using scilab

Dongare V

The Schrödinger equation is the fundamental equation governing the behavior of quantum mechanical systems, but analytical solutions exist only for a limited number of idealized cases. This project focuses on the numerical solution of the one-dimensional Schrödinger equation using Scilab, an open-source scientific computing software.

The continuous differential equation is discretized using the finite difference method, transforming it into a matrix eigenvalue problem. By constructing the Hamiltonianmatrix and solving it numerically, the energy eigenvalues and corresponding wave functions of quantum systems are obtained. The method is demonstrated for standard quantum models such as the particle in an infinite potential well and the quantum harmonic oscillator.

The project successfully visualizes energy levels and probability density functions, showing strong agreement with theoretical results. This approach highlights the effectiveness of numerical methods in understanding quantum systems that are difficult or impossible to solve analytically. The work also emphasizes the importance of computational tools in modern physics education and research.

Keywords:- Scilab, an open-source scientific computing software, Hamiltonianmatrix, wave functions

Digital Documentation and Comparative Analysis of Leaf Morphological Characters in Selected Local Angiosperms for Taxonomic Identification

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Introduction: -

Study focuses on the digital documentation and comparative analysis of leaf morphological characters in selected local angiosperm species belonging to the families Araceae, Euphorbiaceae, Moraceae, Apocynaceae, and Fabaceae, with the aim of supporting taxonomic identification and educational applications.

Objective:-

- Study and compare leaf morphology.
- Digitally document leaf traits.
- Support identification and classification.
- Evaluate taxonomic significance.
- Use basic digital tools with traditional taxonomy

Methodology:-

Study Area:- Nearby College campus area

Selection of Plant Material

Collection of Leaf Samples

Digital Documentation

Morphological Character Analysis

Taxonomic Identification

Comparative Analysis

Local angiosperm leaves were collected and digitally documented. Key morphological characters were recorded and comparatively analysed to support taxonomic identification using standard floras

A. Species Examples Under Each Family

Family	Scientific Name	Common Name
Araceae	<i>Caladium bicolor</i>	Angel Wings
	<i>Philodendron erubescens</i>	Blushing Philodendron
	<i>Syngonium podophyllum</i>	Arrowhead Plant
Euphorbiaceae	<i>Acalypha wilkesiana</i>	Copperleaf
	<i>Croton (Codiaeum variegatum)</i>	Croton
	<i>Jatropha podagrica</i>	Buddha Belly Plant
Moraceae	<i>Ficus benjamina</i>	Weeping Fig
	<i>Ficus elastica</i>	Rubber Plant
	<i>Artocarpus heterophyllus</i>	Jackfruit

Apocynaceae	<i>Plumeria sp.</i>	Frangipani
	<i>Tabernaemontana divaricata</i>	Crape Jasmine
	<i>Catharanthus roseus</i>	Sadabahar
Fabaceae	<i>Sesbania grandiflora</i>	Agathi
	<i>Bauhinia species</i>	Orchid Tree
	<i>Dalbergia sissoo</i>	Shisham

Discussion:- Observation Table-

Leaf Character	Araceae	Euphorbiaceae	Moraceae	Apocynaceae	Fabaceae
Leaf Type	Simple	Simple (rarely lobed)	Simple	Simple	Compound / Simple
Leaf Arrangement	Alternate	Alternate	Alternate	Opposite / Whorled	Alternate
Leaf Shape	Cordate, sagittate	Ovate, elliptic	Ovate to cordate	Elliptic, lanceolate	Ovate (leaflets)
Leaf Margin	Entire	Entire / Serrate	Entire / Serrate	Entire	Entire
Leaf Apex	Acute to acuminate	Acute	Acute to acuminate	Acute	Acute
Leaf Base	Cordate / Sagittate	Rounded	Cordate	Rounded	Pulvinate base
Venation	Reticulate	Reticulate	Reticulate	Reticulate	Reticulate
Leaf Texture	Soft, herbaceous	Variable	Rough / leathery	Leathery	Herbaceous

Special Feature	Long petiole	Stipules (in some)	Latex present	Latex present	Pulvinus present
Diagnostic Leaf Characters	Broad leaves, prominent venation, long petiole, shade adaptation	Variable leaf shapes, stipules, reticulate venation	Simple alternate leaves, rough surface, latex secretion	Opposite/whorled leaves, entire margin, leathery texture, latex	Compound leaves, pulvinus, alternate arrangement
Adaptive Significance of Leaf Characters	Broad leaves for maximum light capture in shade	Structural diversity for habitat adaptability	Rough leaves for protection and durability	Leathery leaves reduce water loss	Compound leaves reduce heat load and transpiration
Trait	Cordate/sagittate leaf	High variability + stipules	Rough texture + latex	Opposite/Whorled arrangement	Compound leaf

Conclusion: -

Araceae showed broad, cordate or sagittate leaves adapted to shaded habitats.

Euphorbiaceae exhibited wide variation in leaf shape and size.

Moraceae had simple, rough-textured leaves with prominent venation and latex.

Apocynaceae displayed opposite or whorled, leathery leaves with entire margins.

Fabaceae was clearly distinguished by compound leaves and reticulate venation.

Overall, the study confirms that leaf morphology remains an effective tool for plant taxonomic identification, especially when supported by digital methods.

Keywords: Leaf morphology, Digital documentation, Comparative taxonomy, Angiosperms, Plant identification

Comparative Assessment of Traditional and Modern Water Storage Practices Using Physicochemical and Microbiological Parameters

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Safe drinking water is essential for good health, but its quality can change depending on the type of storage container and storage conditions after purification. In daily life, drinking water is stored in various containers such as plastic bottles, glass bottles, and metal vessels. In addition, several traditional practices involve adding materials such as metal coins, rudraksha, lime, and other natural or metallic substances to drinking water with the belief that they improve its quality and health benefits. Many of these practices are mentioned in traditional systems of medicine such as Ayurveda, Yoga, Unani, Siddha, and Homeopathy. At the same time, plastic bottled water is often stored for long durations in places such as shops, cars, homes, and refrigerators, where it may be exposed to varying conditions of temperature, light, and moisture. However, the scientific effects of these practices on drinking water quality are not clearly understood.

Previous studies have reported that prolonged storage of drinking water in plastic bottles, especially under sunlight and high temperature, may cause changes in physicochemical properties due to leaching of plastic components and may also promote microbial growth. Studies on copper and silver vessels have demonstrated antimicrobial effects when water is stored for limited durations, supporting certain traditional practices. Glass containers are generally considered chemically inert and are commonly used as a reference for safe water storage. Although traditional medical literature from Ayurveda, Unani, Siddha, and Yoga mentions the use of specific materials for water treatment, limited experimental studies have evaluated these practices under common household and commercial storage conditions.

The present study aims to comparatively evaluate the effect of different storage containers, storage conditions, and traditional water-treatment practices on the drinking quality of water. The study focuses on identifying improvements or deterioration in water quality due to storage in plastic, glass, and metal containers, as well as the effect of additions such as coins, rudraksha, lime, and other commonly used materials. The study also aims to examine whether practices

suggested in traditional medical literature show measurable effects on water quality parameters.

Potable water from a single source will be collected and divided into different storage groups, including plastic, glass, and metal containers, along with samples containing traditional additives. The samples will be stored under different conditions such as sunlight exposure, room temperature, refrigeration, and long-term storage. After a fixed storage period, physicochemical parameters such as pH, total dissolved solids, and electrical conductivity will be analyzed using standard laboratory methods, and microbiological quality will be assessed using total plate count techniques. The results will be compared across all groups. Comparative analysis of these parameters will be used to suggest possible health advantages or disadvantages associated with different water storage and treatment practices, based on accepted water quality standards.

This study will help in understanding how common water storage and traditional water-treatment practices influence drinking water quality. The findings are expected to promote awareness of safe water handling methods and encourage evidence-based evaluation of traditional knowledge systems alongside modern scientific approaches.

Keywords: Drinking Water; Water Quality; Water Storage; Plastic Containers; Glass Containers; Metal Containers; Physicochemical Properties; Microbial Contamination; Traditional Medicine; Ayurveda

Automated Rain Shelter, Retractable Crop Cover, Smart Shade Structure

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Introduction:

This type of system, often referred to as a “smart crop protection shield” or “automatic rain shutter,” uses sensors and motorized mechanisms to provide timely protection against heavy rainfall and other adverse weather conditions.

How the System Works:

The system typically integrates several components:

Sensors: Rain sensors are essential for detecting the onset and intensity of rainfall.

Mechanical Structure: This is the physical cover, often a retractable canopy or mobile roof made of weather-resistant material, that is deployed over the crops.

Motors: DC or servo motors are Controlled by the microcontroller to open or close the shade.

User Interface: A smartphone application allow for farmer to receive alerts, and manually control the protective cover if needed.

Purpose:

Protection: It effectively shields crops from intense rainfall, reducing the risk of physical damage, soil erosion, and waterlogging.

Water Management: Many designs incorporate a system to collect the excess rainwater from the protective shield for storage and later use in irrigation during dry periods, improving water conservation.

Remote Control: You can monitor the status of your field and control the protective mechanism from anywhere using your mobile phone.

These solutions are part of the growing field of smart agriculture and are being developed to be cost-effective and scalable for various farm sizes.

Methodology:

Experimental setup:

In the set up automated rain shelter main units are electric motor, Galvanized sheet, etc.,

Results:

- High value crops (vegetables, wheat, soybeans, cotton, etc.) will be protected.
- Areas prone to unexpected rains will be controlled.
- Crop damage due to rain will be minimal or non-existent.

Conclusion:

The protective cover will automatically deploy when it rains and retracts when the rain stops. During dry season, the excess rainwater collected from the protective cover will be used for irrigation, thereby improving water conservation.

Keywords: Automatic shutter, Rain sensors, Retractable canopy, Water Management, mobile phone Control, etc.

Biochar – A Sustainable Solution for Soil Health, Climate Change Mitigation, and Circular Economy

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Biochar is a carbon-rich, porous material created through the thermal breakdown of organic biomass in low or no oxygen environments, a process called pyrolysis. Made from agricultural residues, forestry waste, animal manure, and other organic materials, biochar has gained worldwide attention as a sustainable, multifunctional material with important environmental, agricultural, and economic advantages. Given the issues of soil degradation, climate change, and waste management problems, biochar stands out as a promising solution that combines ecological restoration with circular economy principles.

One of the most significant attributes of biochar is its ability to enhance soil quality. Due to its highly porous structure and large surface area, biochar improves soil aeration, water retention, and nutrient-holding capacity. It acts as a habitat for beneficial soil microorganisms, thereby enhancing microbial activity and soil fertility. Biochar application has been shown to reduce nutrient leaching, particularly nitrogen and phosphorus, leading to improved crop productivity and reduced dependence on chemical fertilizers. This makes biochar especially valuable in degraded, acidic, and nutrient-poor soils commonly found in many developing regions.

From an environmental perspective, biochar plays a crucial role in climate change mitigation through long-term carbon sequestration. The carbon present in biochar is chemically stable and resistant to microbial decomposition, allowing it to remain in soil for hundreds to thousands of years. By converting labile biomass carbon into recalcitrant carbon, biochar effectively reduces atmospheric carbon dioxide levels. Additionally, biochar has been reported to lower greenhouse gas emissions such as methane and nitrous oxide from agricultural soils, further contributing to climate change mitigation.

Biochar also contributes to sustainable waste management by transforming organic waste into a value-added product. Instead of open burning or landfill disposal, biomass residues can be converted into biochar, thereby reducing pollution and promoting resource efficiency. Beyond agriculture, biochar finds applications in water purification, where it acts as an effective adsorbent for heavy metals, pesticides, and organic pollutants. Its use in composting, livestock management, and even construction materials highlights its versatility.

Economically, biochar presents opportunities for rural entrepreneurship and green industries. Its production can be decentralized, providing livelihood options for farmers and rural communities while promoting sustainable farming practices. The emerging carbon credit

market further enhances the economic viability of biochar projects by monetizing its carbon sequestration potential.

In conclusion, biochar represents a powerful, nature-based solution that addresses multiple global challenges simultaneously. By improving soil health, mitigating climate change, managing waste sustainably, and supporting economic development, biochar stands as a key tool in achieving sustainable agriculture and environmental resilience. Continued research, policy support, and large-scale implementation are essential to fully realize the potential of biochar in building a sustainable future.

Keywords: Biochar, Pyrolysis, Soil health, Carbon sequestration, Sustainable agriculture

Utilization of Water Hyacinth (*Eichhornia crassipes*) as a Sustainable Alternative for Eco-Friendly Paper Production

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Water hyacinth (*Eichhornia crassipes*) is one of the most invasive aquatic weeds affecting freshwater ecosystems across the Indian subcontinent. Originally introduced as an ornamental plant during the colonial period, it has spread rapidly due to its high growth rate, favorable tropical climate, and lack of natural predators. The unchecked proliferation of water hyacinth leads to severe ecological and socio-economic problems, including reduced aquatic biodiversity, obstruction of waterways, depletion of dissolved oxygen, and increased mosquito breeding. Simultaneously, the paper industry faces growing challenges related to deforestation, rising raw-material costs, and environmental pollution associated with wood-based pulp production. These issues highlight the need for sustainable, non-wood alternatives for paper manufacturing. The present study aims to explore the potential of water hyacinth as a renewable and eco-friendly raw material for paper production. The primary objectives of this work are to evaluate the suitability of water hyacinth fibers for pulp formation, to assess the basic physical properties of the paper produced, and to highlight its environmental significance as a waste-to-wealth resource. The methodology involves the collection of water hyacinth from local water bodies followed by cleaning and drying of the plant material. Fibers are extracted mainly from the petioles and stems and subjected to alkaline pulping to remove non-cellulosic components.

The obtained pulp is then beaten, diluted, and formed into paper sheets using a mesh screen. The sheets are pressed and air-dried. Preliminary enhancement techniques such as starch sizing may be applied to improve strength and water resistance. Basic parameters including texture, thickness, flexibility, and water absorption are observed and compared qualitatively. The results indicate that water hyacinth fibers can be successfully converted into paper with acceptable strength and durability for applications such as handmade paper, stationery, packaging material, and craft products. Although the paper is relatively coarse compared to conventional wood-based paper, blending with other fibers or surface treatments significantly improves its usability. The process also contributes to effective biomass utilization and reduces environmental burden caused by invasive weed accumulation. In conclusion, water hyacinth-based paper production represents a sustainable and environmentally responsible alternative to conventional paper making. It not only reduces dependency on forest resources but also provides a practical solution for managing invasive aquatic weeds. The study emphasizes the potential of water hyacinth in promoting circular economy practices, rural employment, and eco-friendly material development, making it a promising candidate for future green technologies.

Keywords: Water hyacinth, non-wood fiber, sustainable paper, invasive aquatic weed, eco-friendly materials

Breathing Under Threat: Air Pollution and the Growing Risk to Human Survival: A Reality-Based Perspective.

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Clean air is the most basic requirement for life, yet in today's world, breathing itself has quietly become a health risk. Air pollution is no longer an occasional environmental concern; it has become a daily reality that affects how people live, grow, and survive. This abstract examines how rapid urbanization and economic growth, while improving material comfort, have come at the cost of something far more essential—the right to breathe safely.

The idea of “clean cities” and the acceptance of polluted air as a “new normal” are critically questioned. The Air Quality Index (AQI), often viewed as a technical statistic, is reframed here as a direct indicator of human vulnerability. In many Indian cities, AQI levels frequently reach

dangerous or severe categories, resulting in school closures, increased hospital admissions, widespread respiratory illnesses, and reduced life expectancy. Medical evidence suggesting that children raised in highly polluted environments may develop lung capacity comparable to long-term smokers highlights the irreversible damage caused by prolonged exposure to polluted air.

Although polluted air affects everyone, its consequences are not evenly distributed. Children, the elderly, and economically weaker communities suffer the most, as they lack access to air purifiers, quality healthcare, and safer living environments. This unequal exposure transforms air pollution from a purely environmental or health issue into a matter of social and generational injustice. From a national perspective, the sources of air pollution vary across regions—crop residue burning in northern India, industrial emissions in western regions, and mining activities in eastern parts of the country. Despite these regional differences, the outcome remains the same: damaged health and shortened lives. Global concern is evident in cases where international health professionals have chosen to leave heavily polluted cities, highlighting the contrast between locally normalized pollution and global safety standards.

Importantly, this crisis is not beyond solution. Examples such as Beijing's successful improvement in air quality through strict regulations, clean energy adoption, and strong governance demonstrate that meaningful change is achievable. The challenge lies not in the absence of solutions, but in the lack of urgency and collective responsibility. Hope emerges through youth-led action. Young people are increasingly using technology, data, innovation, and advocacy to demand cleaner air and sustainable development. They are not merely victims of pollution, but active contributors to solutions.

In conclusion, air pollution represents a serious health, economic, and moral emergency. Addressing it requires a shift from acceptance to action, before breathing becomes a privilege rather than a fundamental human right.

Keywords: Air Pollution, Respiratory Health, Urbanization, Environmental Justice, Clean Air Policy.

Space Debris Mitigation: Review and Active Removal Strategies

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The rapid increase in satellite launches has led to a significant rise in space debris orbiting Earth. This debris includes inactive satellites, rocket remnants, and fragments from past collisions. Currently, over 36,000 objects larger than 10 cm, along with millions of smaller particles, travel at very high speeds, posing serious risks to operational satellites, space missions, and astronauts. Continuous collisions may trigger Kessler Syndrome, potentially making certain orbital regions unusable. The objective of this study is to examine the current space debris problem, assess existing mitigation methods, and explore future technologies aimed at maintaining a safe and sustainable orbital environment. The study is based on a review of space agency reports, scientific literature, and proposed mission concepts. Various debris mitigation and removal techniques such as controlled deorbiting, drag sails, robotic capture systems, and active debris removal technologies were analysed. The analysis indicates that present mitigation strategies alone are insufficient to reduce existing debris. Active debris removal technologies show strong potential in minimizing collision risks and preserving key orbital regions, particularly Low Earth Orbit. Space debris is a growing threat to space sustainability. A combination of strict mitigation policies, advanced removal technologies, and international cooperation is essential to ensure the safe and long-term use of outer space.

Keywords: - Mitigation, Monitoring, Long term safety and sustainability of space activities.

AI-Based Early Detection of Student Learning Gaps Using Academic and Behavioural Data

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Introduction:

In higher education institutions, academic performance evaluation is primarily based on periodic examinations and manual observation by faculty members. Such traditional approaches are reactive in nature and often identify learning difficulties only after students have already experienced academic failure or disengagement. Early warning signs such as declining attendance, inconsistent assignment submission, and gradual reduction in assessment

scores frequently go unnoticed. This delay limits the effectiveness of corrective actions and contributes to increased failure rates and reduced academic confidence. With the growing availability of digital academic records, there is a need for an intelligent system capable of identifying learning gaps at an early stage using data-driven methods.

Objectives:

The objective of this research is to design and develop an AI-based early detection system that can predict potential learning gaps among undergraduate students. The study aims to analyze academic and behavioral indicators to identify students who are at risk of academic underperformance. The system is intended to support educators by providing timely, explainable insights that enable early academic intervention and personalized support.

Methodology:

The proposed system utilizes anonymized student data including attendance records, internal assessment scores, assignment submission patterns, and performance consistency indicators collected from previous academic semesters. The data undergoes preprocessing and feature engineering to extract meaningful performance attributes such as attendance trends, score variations, and submission regularity. Machine learning algorithms such as Logistic Regression, Random Forest, and Gradient Boosting are employed to develop predictive models. Model performance is evaluated using standard metrics including accuracy, precision, recall, and F1-score. To enhance transparency and trust, explainable AI techniques are integrated to identify the key factors influencing each prediction.

Results:

Preliminary analysis indicates that combining behavioural indicators with academic performance data significantly improves the accuracy of early risk prediction compared to grade-based evaluation alone. The developed model is capable of classifying students into low, medium, and high-risk categories and providing explanations for each classification. These results demonstrate the feasibility of early-stage prediction of learning gaps within a college-level academic environment.

Conclusion:

This research presents a practical and scalable AI-driven framework for early detection of student learning gaps. By enabling timely academic intervention, the proposed system has the potential to improve student outcomes, reduce failure rates, and support data-informed decision-making in educational institutions. The study contributes to the field of educational

technology by demonstrating how predictive and explainable AI can be effectively applied to enhance student support systems and academic success.

Keywords: Artificial Intelligence, Machine learning, Learning Analytics, Early Intervention, Educational Technology.

Isolation and identification of bacteria from biomedical waste

Kale ES and Jane RR

Biomedical waste is the waste generated during medical, diagnostic, research, and treatment activities in hospitals, clinics, laboratories, blood banks. This waste includes used bandages, cotton, syringes, needles, cultures, human tissues, body fluids, and discarded laboratory materials. Biomedical waste is considered hazardous because it contains a high load of pathogenic microorganisms, especially bacteria, which can cause serious infections in humans and animals.

Improper handling and disposal of biomedical waste can lead to the spread of infectious diseases such as tuberculosis, hepatitis, typhoid, cholera, wound infections, and hospital-acquired (nosocomial) infections. Many bacteria present in biomedical waste are resistant to antibiotics and disinfectants, making them a major public health concern. These microorganisms can contaminate soil, water, and air, and can infect healthcare workers, waste handlers, patients, and the surrounding community.

Isolation and identification of bacteria from biomedical waste is an important microbiological study that helps in understanding the types of microorganisms present in such waste. Isolation refers to the separation of individual bacterial species from mixed microbial populations using suitable culture media under aseptic conditions. Identification involves studying the morphological, cultural, and biochemical characteristics of the isolated bacteria to determine their identity.

Common bacteria isolated from biomedical waste include *Staphylococcus aureus*, *Escherichia coli*, *Pseudomonas aeruginosa*, *Klebsiella species*, *Proteus species*, and *Bacillus species*. These organisms are known to be opportunistic and pathogenic, causing infections in immunocompromised individuals.

The isolation and identification process is usually carried out using techniques such as serial dilution, streak plate method, Gram staining, motility tests, and biochemical tests like catalase, oxidase, indole, MR-VP, citrate, and sugar fermentation tests. These methods help in accurate detection and characterization of bacterial pathogens.

Keywords: Biomedical waste, Bacterial isolation, Bacterial identification, Pathogenic microorganisms, Hospital-acquired infections, public health, Waste management.

Detection of Different Bacteria from Raw Vegetables

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Raw salad vegetables (RSVs) are an essential component of a healthy diet, and their consumption has increased significantly in recent years due to their nutritional benefits. They are rich in carbohydrates, antioxidants, minerals, vitamins, and dietary fibers and are commonly consumed in raw form. However, despite their health benefits, the consumption of fresh vegetables is also associated with potential health risks due to microbial contamination.

In the present study, a total of 10 salad vegetable samples, including coriander, mint, and lettuce, were collected from different localities of Tiosa between January and February 2026 to detect the presence of pathogenic *Escherichia coli*. The samples were enriched in nutrient broth and cultured using standard microbiological techniques. Nutrient agar, MacConkey agar, EMB agar, and Sorbitol MacConkey agar (SMAC) were used for the isolation and identification of bacteria. All media were prepared and sterilized by autoclaving and incubated at 37°C. Bacterial growth was confirmed based on turbidity and colony characteristics.

The results indicate that the surfaces of salad vegetables showed 100% contamination with pathogenic bacteria. It was observed that even after the first wash, pathogenic *E. coli* remained present on the surface of the vegetables. Therefore, it is recommended that salad vegetables should be washed two to three times with purified water before consumption to reduce health risks.

Isolation and identification of salt tolerance bacteria from saline soil to prepare biofertilizers

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Soil salinity is one of the major environmental constraints limiting agricultural productivity by adversely affecting soil health and plant growth. The excessive accumulation of salts in soil interferes with nutrient uptake, microbial activity, and crop yield. In this context, the use of salt-tolerant microorganisms as biofertilizers represents an effective and sustainable alternative to chemical fertilizers for the management of saline soils. The present study aims to isolate, identify, and characterize salt-tolerant bacteria from saline soil samples and evaluate their potential application as biofertilizers. Saline soil samples were collected from salt-affected agricultural fields and processed using serial dilution and spread plate techniques. Isolation was carried out on nutrient agar media supplemented with different concentrations of sodium chloride to select salt-tolerant bacterial strains. The isolated bacteria were purified and identified based on their morphological characteristics, Gram staining, and biochemical tests. Selected isolates were further screened for plant growth-promoting attributes such as phosphate solubilization, nitrogen fixation ability, and indole-3-acetic acid production. The study revealed the presence of diverse salt-tolerant bacterial isolates capable of surviving under high salinity conditions while exhibiting significant plant growth-promoting activities. These beneficial traits suggest that the isolated bacteria have strong potential for use in biofertilizer formulation. The application of such salt-tolerant biofertilizers may help improve soil fertility, enhance crop growth, and promote sustainable agriculture in saline and salt-affected region.

Keywords: Salinity, Salt-tolerant microorganisms, biofertilizers, nitrogen fixing ability.

Diversity and Isolation of Dominant Arbuscular Mycorrhizal Fungal Spores Associated with *Chrysanthemum*.

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Arbuscular Mycorrhizal Fungi (AMF) play a crucial role in improving nutrient uptake, growth and stress tolerance of ornamental crops such as *Chrysanthemum*. The present study documented to isolate and identify dominant AMF spores associated with *Chrysanthemum* cultivated under field conditions. Rhizospheric soil sample were collected from healthy *Chrysanthemum* plant, and AMF spores were isolated using the wet sieving and decanting technique, the isolated spores were examined under a trinocular microscope (ZEISS) and photographs were taken using Tucson camera and identified based on morphological characteristics such as shape, wall structure, colour and subtending hyphae. The dominant AMF genera included some species of *Glomus*. *Glomus* species showing the highest spore density

and frequency of occurrence. The Abundance of AMF spores indicated a strong symbiotic association between *Chrysanthemum* roots and AMF populations in the rhizosphere. The isolation of dominant AMF spores provides foundation for further mass multiplication and evaluation of their potential as bio-inoculants to enhance growth, nutrient acquisition and sustainable cultivation of *Chrysanthemum*.

Key words: Ornamental crops, *Chrysanthemum*, AMF, *Glomus*, Bio-inoculant.

Personalized Safety Device for Farmers Working in Big-Cat Prone Agricultural Landscapes of Maharashtra.

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Human–wildlife conflict has emerged as a serious conservation and livelihood challenge in several agricultural landscapes of Maharashtra, particularly in regions adjoining scrub forests and sugarcane, cotton, toor dominated farmlands. Frequent Big-Cat (Tiger, Leopard etc.) intrusions during early morning and late evening hours have resulted in increasing incidents of human injuries and fatalities. In response to this issue, the present concept proposes a non-lethal, preparatory Gear neck wearable early warning safety device termed “Danger Detector”, designed specifically for farmers working in high-risk wildlife zones. The device integrates thermal sensing and motion detection technology to identify the presence of warm-bodied animals in close proximity. Upon detection, the system generates an audible beep alert, enabling farmers to become aware of potential threats and move to safer locations. The proposed system is compact, rechargeable, cost-effective, and suitable for daily agricultural use. This innovation emphasizes prevention rather than confrontation, aligning with wildlife conservation ethics and national biodiversity protection frameworks. The Danger Detector has strong potential as a community-level safety tool capable of reducing accidental wildlife encounters, minimizing panic-driven retaliation, and promoting human–wildlife coexistence in rural landscapes.

Keywords: Human–wildlife conflict, Early warning system, Thermal sensor, Farmer and Local safety.

Analysis of Particulate Matter Pollution in Vidarbha region of Maharashtra

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Particulate matter (PM_{2.5} and PM₁₀) samples were collected across three seasons at 11 sampling sites distributed in 11 districts of the Vidarbha region of Maharashtra during 2023–2024. Ambient air particulates were obtained using a fine dust sampling method, with particular emphasis on thermal power plants and other major pollution sources in the region. Sampling campaigns were conducted during three seasonal phases: summer, monsoon and winter. Winter consistently exhibited the highest values, reflecting pollutant accumulation under stable atmospheric conditions, whereas monsoon recorded the lowest levels, largely attributable to the scavenging effect of precipitation. Among the study locations, Chandrapur and Nagpur emerged as critical hotspots, with winter concentrations substantially exceeding the National Ambient Air Quality Standards (NAAQS), while Wardha maintained the lowest values across all seasons. Districts such as Amravati, Akola, Bhandara, Gadchiroli, and Gondia demonstrated moderate levels, with winter concentrations approaching or marginally exceeding permissible limits.

Keywords: Air Pollution, PM₁₀, PM_{2.5}, Vidarbha

Seed-Borne Fungi and Eco-Friendly Seed Health Management

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Seeds are the basic input of agriculture and play a decisive role in determining crop yield, food quality, and farmer income. Indian farmers cultivate a wide variety of crops, including cereals, millets, pulses, and oilseeds. However, seed quality is often compromised due to the association of seed-borne fungal pathogens. Many fungi, such as *Aspergillus*, *Penicillium*, *Mucor*, *Fusarium*, and *Pythium*, are commonly associated with seeds and cause deterioration in seed quality by affecting germination, vigor, and overall seed health. During storage, especially for one or more years, the diversity and activity of seed-borne fungi increase significantly. Such fungal infestation leads to seed discoloration, loss of viability, and production of harmful mycotoxins. Consumption of contaminated seeds or seed-derived food products poses serious

health risks to humans and animals, creating hazardous effects and affecting food safety. These problems ultimately result in economic losses for farmers and pose challenges to sustainable agriculture in India.

The present work is designed as a demonstration-based project to create awareness about seed pathology and its management among farmers, students, and society. The demonstration highlights the presence of external and internal seed mycoflora using simple and standardized techniques. Seed samples of different crops are displayed along with germination testing through the Roll-Towel Method. Petri plates showing fungal growth using the Blotter Paper Method and Agar Plate Method are exhibited to demonstrate seed-borne fungal diversity. Additionally, eco-friendly seed treatment using *Trichoderma viride* powder is demonstrated as a biological control measure.

To overcome seed-borne fungal problems, the project emphasizes the adoption of biological control agents such as *Trichoderma*, *Bacillus*, and *Pseudomonas*, along with the use of plant extracts as natural antifungal agents. These eco-friendly approaches help improve seed health, reduce dependence on chemical fungicides, and promote sustainable agriculture. This demonstration-based project is beneficial for farmers, students, researchers, and society by enhancing awareness of seed health management, ensuring safer food production, and supporting environmentally sustainable farming practices.

Keywords: Seed-borne fungi, germination, detection methods, eco-friendly, biocontrol management

Extraction and formulation of Natural ink from *Clitoria ternatea*

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The widespread use of synthetic inks in printing and stamping industries has raised concerns due to their toxic components, environmental persistence, and non-biodegradable nature. *Clitoria ternatea* commonly known as butterfly pea, is a flowering plant well known for its intense blue coloration due to the presence of anthocyanin pigments. These pigments are water-soluble, biodegradable, and exhibit pH-dependent color changes, making them suitable

candidates for natural ink formulation. The present project explores the potential of *Clitoria ternatea* flower extract as a natural ink for stamping applications.

The primary objective of this study was to extract pigment from *Clitoria ternatea* flowers and formulate it into a functional ink suitable for stamping. The study also aimed to evaluate the physical properties, stamping clarity, and stability of the prepared ink, thereby assessing its feasibility as an alternative to synthetic inks. Additionally, the project sought to promote the use of plant-based resources in environmentally safe and sustainable applications.

Fresh *Clitoria ternatea* flowers were collected and subjected to aqueous extraction to obtain the blue anthocyanin-rich pigment. The extract was filtered and concentrated, after which natural binders such as gum or starch-based agents were added to improve viscosity, adhesion, and ink consistency. The formulated ink was tested for stamping performance on different surfaces, including paper and other absorbent materials. Parameters such as color intensity, clarity of impression, drying time, and short-term stability were observed and recorded.

The results indicated that the natural ink produced clear, uniform, and visually distinct stamped impressions. The ink demonstrated good adhesion to paper surfaces and acceptable drying time under normal conditions.

In conclusion, the study highlights the successful formulation and application of *Clitoria ternatea* flower-based ink for stamping purposes. The project demonstrates the potential of plant-derived pigments as eco-friendly, non-toxic, and biodegradable alternatives to synthetic inks. This work contributes to the growing field of sustainable materials and green chemistry and has implications for educational, artistic, and environmentally safe printing applications. Further research may enhance ink stability and expand its applicability, including possible food-safe and biodegradable labeling uses.

Keywords: *Clitoria ternatea*, Natural ink, Anthocyanin pigment, Eco-friendly stamping, Plant-based ink

ARBUSCULAR MYCORRHIZAL SPORE DIVERSITY AND ROOT COLONIZATION PATTERNS IN *ANDROGRAPHIS PANICULATA* NEES

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Arbuscular mycorrhizal fungi (AMF) establish an important symbiotic relationship with plant roots and significantly influence nutrient acquisition and plant performance. The present investigation was carried out to isolate and identify AMF spores from the rhizospheric soil of *Andrographis paniculata* Nees, with emphasis on dominant AMF species and the extent of root colonization. Soil samples were collected from the experimental site, and AMF spores were isolated using the wet sieving and decanting technique. The isolated spores were identified based on morphological characteristics such as spore size, shape, color, and wall structure. Root samples were cleared and stained to assess the percentage of mycorrhizal colonization. The study recorded several AMF species predominantly belonging to the genus *Glomus*. Among these, *Glomus clarum*, *Glomus ambisporum*, *Glomus australe*, *Glomus leptothicum*, *Glomus reticulatum*, and *Glomus fasciculatum* were identified in the rhizospheric soil. Root colonization analysis revealed a high occurrence of mycorrhizal structures such as hyphae, vesicles, and arbuscules, indicating a well-established symbiotic association. The findings suggest that indigenous *Glomus* species are abundant in the rhizosphere of *A. paniculata* and may play a crucial role in enhancing plant growth and soil fertility.

Keywords: Arbuscular mycorrhizal fungi; *Glomus* spp.; spore isolation; root colonization; *Andrographis paniculata*

A Green Shield for Soybean Crop: *Trichoderma* Against *Fusarium* rot

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Fusarium species are important soil-borne fungal pathogens causing severe diseases in soybean, leading to significant yield losses. In the present study, *Fusarium* was isolated from infected soybean plants and maintained as a pure culture under laboratory conditions. The

pathogenic fungus was identified based on cultural and morphological characteristics. The biocontrol potential of *Trichoderma viride* was evaluated through antagonistic activity against *Fusarium* using in vitro assay. The interaction between *Trichoderma viride* and *Fusarium* demonstrated effective suppression of pathogen growth, indicating strong antagonistic behaviour. The inhibitory effect may be attributed to mechanisms such as competition, mycoparasitism, and production of antifungal metabolites by *Trichoderma viride*. The results highlight the potential of *Trichoderma viride* as an eco-friendly biological control agent for the management of *Fusarium* associated diseases in soybean. The study supports the use of *Trichoderma viride* as a sustainable alternative to chemical fungicides and reinforces its role as a “Friend of Farmer” in crop protection strategies.

Keywords: *Fusarium spp.*, Antagonism, *Trichoderma viride*, Soybean crop, Sustainable agriculture.

Screening of Some Medicinal Plant Extracts for Phytochemicals and their Antibacterial Activity against Acne causing bacteria

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Acne vulgaris is a prevalent inflammatory skin disorder that primarily affects adolescents and young adults. The condition is strongly associated with the growth of acne-causing bacteria such as *Cutibacterium acnes* and *Staphylococcus aureus*. The prolonged use of synthetic antibiotics in acne treatment has led to increasing concerns regarding antibiotic resistance and adverse side effects, necessitating the exploration of alternative therapeutic strategies. Medicinal plants, known for their diverse phytochemical constituents, have long been utilized in traditional medicine for their antimicrobial properties and represent a valuable source of novel antibacterial agents.

The present research work is proposed to screen selected medicinal plant extracts for phytochemical constituents and to evaluate their antibacterial activity against acne-causing bacteria. Selected medicinal plants will be collected, authenticated, and processed for extraction using appropriate solvents. Preliminary phytochemical screening will be performed to detect the presence of bioactive compounds such as alkaloids, flavonoids, tannins, saponins, terpenoids, phenols, and glycosides. The antibacterial potential of the plant extracts will be

assessed using standard microbiological methods including agar well diffusion and minimum inhibitory concentration (MIC) assays against selected bacterial strains.

The outcome of the proposed study is expected to identify plant extracts with significant antibacterial activity and to establish a relationship between phytochemical composition and antibacterial efficacy. The findings may provide a scientific basis for the development of plant-based antibacterial formulations for acne management and contribute to the discovery of safer, cost-effective, and eco-friendly alternatives to conventional antibiotics.

Keywords: Medicinal plants; Phytochemical screening; Antibacterial activity; Acne-causing bacteria; *Cutibacterium acnes*; *Staphylococcus aureus*; Antibiotic resistance

FeCl₃-Loaded Graphitic Carbon Nitride (g-C₃N₄) as an Efficient Catalyst for the Selective Oxidation of Toluene to Benzoic Acid

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The catalytic oxidation of toluene to high-value benzoic acid is a significant industrial transformation. Current industrial methods often employ homogeneous catalysts or harsh conditions, leading to separation challenges, corrosion, and environmental concerns. Therefore, developing efficient, separable, and reusable heterogeneous catalysts using greener oxidants is a crucial research objective. Graphitic carbon nitride (g-C₃N₄), with its stable structure and nitrogen-rich surface, offers an excellent platform for anchoring metal species. Iron-based catalysts are particularly attractive due to their low cost, abundance, and proven redox activity. This work aims to develop and evaluate a series of heterogeneous catalysts by supporting iron(III) chloride (FeCl₃) on g-C₃N₄. The primary objectives are to synthesize and characterize these FeCl₃/g-C₃N₄ composites, and to systematically assess their catalytic performance for the selective liquid-phase oxidation of toluene to benzoic acid using hydrogen peroxide (H₂O₂) as a green oxidant under solvent-free conditions. A facile wet impregnation method was employed to load varying amounts of FeCl₃ (1-10 wt%) onto thermally synthesized g-C₃N₄. The synthesized catalysts were comprehensively characterized using X-ray diffraction (XRD) and Fourier-transform infrared spectroscopy (FT-IR). Catalytic testing was performed in a batch reactor using toluene as the substrate and H₂O₂ (50% aqueous) as the oxidant, under atmospheric pressure and moderate temperatures (70-90°C). Reaction products were identified and quantified using gas chromatography (GC), GC-mass spectrometry (GC-MS) and NMR spectroscopy. Characterization confirmed the successful incorporation of Fe³⁺ species onto the g-C₃N₄ matrix without disrupting its fundamental layered structure. Catalytic evaluation

revealed that the 5 wt% FeCl₃/g-C₃N₄ catalyst exhibited optimal performance, achieving a toluene conversion of 92% with a benzoic acid selectivity of 88% after 8 hours at 80°C. The activity was significantly higher.

Keywords: Heterogeneous catalysis, g-C₃N₄, Iron chloride, Toluene oxidation, Benzoic acid, Solvent-free

Record of Colonial Occurrence and Breeding Evidence of the Pratincole species at Upper Wardha Reservoir, Maharashtra.

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Wetland ecosystems play a crucial role in supporting breeding populations of colonial waterbirds. The present study reports the sighting of a large colony along with active breeding evidence of the Oriental Pratincole and Small Pratincole at Upper Wardha Reservoir, located near Morshi in Maharashtra. Field observations were conducted during the breeding season (February to April) from 2022 to 2025 through systematic visual surveys and opportunistic monitoring of shoreline habitats. The study focusing on colony characteristics, habitat study and associated threats. A large congregation of pratincoles was recorded along exposed mudflats and shallow shoreline areas of the reservoir. A significant congregation of 277 individuals of Oriental pratincole (*Glareola maldivarum*) and 1,896 individuals of Small pratincole (*Glareola lactea*) were documented, indicating the presence of a substantial congregation and nesting colonies of both species. Evidence of breeding included courtship displays, ground nesting activity, and the presence of incubating adults and chicks at study sites. Both species showed a preference for open, sparsely vegetated mudflats with minimal vegetation cover, emphasizing the importance of seasonal water-level fluctuations in creating suitable nesting habitats. However, breeding success was observed to be low for both species, likely due to multiple anthropogenic disturbances. Major threats recorded at the breeding grounds included overfishing activities, livestock grazing, presence of feral dogs, expansion of agricultural practices near reservoir margins, and frequent human movement, all of which pose serious risks to ground nests and chicks.

The occurrence of large congregations with poor breeding success suggests that while Upper Wardha Reservoir serves as an important breeding habitat for pratincole species in central India, increasing human pressure may be negatively impacting reproductive outcomes. These observations contribute valuable baseline data to the regional avifaunal database and highlight the urgent need for site-specific conservation measures, regulated human activities during the breeding season, and long-term monitoring to enhance breeding success of colonial ground-nesting birds.

Keywords: Oriental Pratincole; Small Pratincole, Colonial nesting; Breeding ecology; Wetland birds; Upper Wardha Reservoir; Maharashtra

Sensitivity Analysis of Multi-Objective Multi-Level Linear Programming problem for Sustainable Urban Transportation in Maharashtra

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Sustainable urban transportation systems in rapidly urbanizing regions require robust analytical frameworks capable of addressing multiple, often conflicting objectives within complex institutional hierarchies. In India, the state of Maharashtra exemplifies these challenges, with major metropolitan regions experiencing escalating travel demand, congestion, environmental degradation, and rising public transport expenditures. Decision-making in such systems is inherently multi-level, involving government authorities, transport operators, and operational agencies whose objectives and constraints are interdependent. This study proposes a Multi-Objective Multi-Level Linear Programming (MOMLLP) framework for sustainable urban transportation planning in Maharashtra. The model simultaneously captures environmental, economic, and service-quality objectives across hierarchical decision levels. At the strategic level, policy authorities seek to minimize vehicular emissions and public expenditure under budgetary and regulatory constraints. At the tactical level, transport operators aim to enhance service coverage and reduce passenger waiting times, while the operational level focuses on minimizing daily operating costs. To systematically resolve trade-offs among competing objectives, the ϵ -constraint method is employed, allowing the generation of Pareto-optimal solutions while preserving linear structure and computational tractability. A numerical case study based on representative urban transport corridors in Maharashtra is developed using publicly available data, including census-based journey-to-work demand, standardized vehicular emission factors, and operational cost reports. The results demonstrate that the

proposed framework can achieve substantial emission reductions while maintaining demand satisfaction and acceptable service levels. The findings confirm the practical relevance of multi-objective, multi-level optimization models as decision-support tools for integrated, evidence-based, and sustainability-oriented urban transport planning in rapidly growing metropolitan regions.

Keywords: Multi-objective optimization, Multi-level programming, Sustainable transportation systems, Urban mobility planning, Environmental–economic trade-offs, ϵ -constraint method.

Impact of River Width and Substrate Composition on Nest Placement of River Lapwing (*Vanellus duvaucelii*) in Upper Tapi River Basin Melghat.

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River Lapwing (*Vanellus duvaucelii*) is a highly specialized riverine bird whose breeding ecology is closely associated with natural river dynamics. The breeding success of the River Lapwing is not determined by chance, but by the width of the river and the stability of the stones beneath its nest. The present study evaluates the influence of river width and substrate composition on nest placement along the Upper Tapi River Basin in the Melghat landscape, Amravati District, Maharashtra. Intensive systematic field surveys were conducted between 2022 and 2025 along a ~60 km river stretch using 117 transects of 500 m length. A total of ten nests belonging to ten breeding pairs were recorded during four breeding seasons. All nests were located on open, unvegetated gravel and pebble cobble substrates within wide river sections ranging from 130.72 to 255.10 m in width. Nest distance from the riverbank varied between 21.69 and 106.60 m, while distance from active water ranged from 5.60 to 19.89 m. Substrate size showed a positive association with nest placement, and vegetation cover was consistently low around nesting sites. Pearson's correlation analysis revealed a strong positive relationship between river width and nest distance from the bank ($r = 0.71$) and a moderate correlation between nest distance and substrate size ($r = 0.42$), whereas vegetation cover exhibited a negative association with nesting variables. Successful nests ($n = 3$) were associated with wider river stretches, stable pebble substrates, and minimal vegetation, supporting clutch sizes of 2 to 4 eggs. The findings confirm that river width and substrate stability are key determinants of nest-site selection and breeding success of the River Lapwing. Maintenance of

natural river morphology and protection of gravel bars are therefore critical for the long-term conservation of this specialised riverine species.

Keywords: River Lapwing, Nest-Site Selection, River Width, Gravel Cobble Habitats, Breeding Ecology, Upper Tapi River Basin, Melghat.

Environmental Sustainability and Climate-Resilient Economic Feasibility of Hydroponic Farming in Amravati Division

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Hydroponic farming has emerged as a promising alternative to conventional soil-based agriculture in response to increasing water scarcity, declining soil fertility, rapid urbanization, and climate change induced agricultural losses. In India, climate variability contributes to an estimated 15–25% annual crop loss, while the growing population and urban expansion intensify pressure on land and water resources. This study focuses on evaluating the environmental sustainability and climate-resilient economic feasibility of hydroponic farming systems in the Amravati Division, Maharashtra, with a view toward supporting future urban agriculture models. The primary objective of this research is to assess whether hydroponic farming can provide a sustainable, economically viable, and climate-resilient solution for food production in semi-arid and urbanizing regions. The study aims to compare different hydroponic systems with traditional agriculture in terms of water use efficiency, energy consumption, greenhouse gas emissions, productivity, and financial performance. It also seeks to develop an integrated Water-Energy-Food Nexus framework to support urban planning and policy decision-making. The findings indicate that hydroponic systems demonstrate significantly higher yields per unit area, reduced water and nutrient usage, and lower labor requirements compared to conventional farming. Economic results suggest moderate to high cost-reduction potential and favourable profitability indicators, particularly under controlled urban farming conditions. Vertical and NFT systems show strong resilience to climate stressors, making them suitable for future urban deployment. The study concludes that hydroponic farming offers a viable pathway toward sustainable, climate-resilient urban agriculture. Its adoption can contribute to water conservation, reduced greenhouse gas emissions, enhanced food security economic opportunities for farmers and agri-entrepreneurs. The research provides

valuable insights for policymakers, urban planners, and environmental stakeholders seeking scalable solutions to address climate and food challenges.

Keywords: Hydroponic Farming, Climate Resilience, Economic Feasibility, Urban Agriculture, Sustainability

Integrated Study of *Ganoderma* Species: From Biodiversity to Pharmaceutical Potential

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Ganoderma species are medicinally important basidiomycetous fungi widely recognized for their bioactive compounds and therapeutic potential. The present study aims to explore, document, and scientifically validate *Ganoderma* species diversity from the Melghat forest region of Maharashtra, an ecologically rich yet underexplored biodiversity hotspot. Extensive field surveys will be conducted to collect naturally occurring *Ganoderma* specimens, followed by systematic documentation of host associations and ecological parameters. Taxonomic identification will be carried out using detailed morphological characterization in combination with molecular techniques, particularly internal transcribed spacer (ITS) sequencing, to ensure accurate species-level identification.

Eco-friendly cultivation protocols will be developed using locally available agro-industrial waste through solid-state methods, promoting sustainable and cost-effective production. Phytochemical profiling of cultivated fruiting bodies and mycelial biomass will be performed to elucidate major bioactive constituents such as polysaccharides, β -glucans, triterpenoids, and phenolic compounds using advanced analytical tools including HPLC, LC-MS, FTIR, and NMR. The antimicrobial potential of *Ganoderma* extracts will be evaluated through in vitro antibacterial and antifungal assays against selected pathogenic microorganisms.

Furthermore, in-silico bioinformatics approaches, including molecular docking and ADMET predictions, will be employed to assess the pharmacokinetic properties and therapeutic relevance of identified compounds, with comparative analysis against FDA-approved drugs. Based on the bioactivity and computational validation, disease-targeted nutraceutical and pharmaceutical by-products, particularly for skin infections, will be formulated.

The expected outcomes of this research include the creation of a comprehensive catalogue of *Ganoderma* species from Melghat, development of sustainable cultivation technologies, and identification of potent bioactive compounds with therapeutic relevance. The study is anticipated to benefit local farmers, mushroom cultivators, pharmaceutical and nutraceutical industries, and the academic community, while contributing to biodiversity conservation and sustainable bioprospecting.

Keywords: *Ganoderma*, Medicinal Mushroom, Cultivation, Phytochemistry, Antimicrobial Activity, Melghat, Pharmaceutical Applications

Phytochemical Profiling of *Amorphophallus campanulatus*: A Medicinal Plant from the Melghat Forest Region

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Amorphophallus campanulatus is an important medicinal plant widely used in traditional systems of medicine for the treatment of digestive disorders, inflammation, piles, and microbial infections. The present study aims to investigate the preliminary phytochemical constituents of *Amorphophallus campanulatus* collected from the Melghat forest region of Maharashtra, a rich repository of medicinal plant diversity. Fresh and healthy plant leaves were collected, washed, shade dried, powdered, and subjected to hot extraction using a Soxhlet apparatus with distilled water, ethanol, and methanol as solvents. Qualitative phytochemical screening was carried out using standard biochemical procedures to detect the presence of major bioactive compounds. The analysis revealed the presence of important phytochemicals such as alkaloids, carbohydrates, reducing sugars, glycosides, proteins, flavonoids, phenolic compounds, tannins, saponins, phytosterols, terpenoids, and phlobatannins in various extracts. These phytoconstituents are known to possess significant biological activities including antioxidant, antimicrobial, anti-inflammatory, and therapeutic properties. The findings of the present investigation support the traditional medicinal use of *Amorphophallus campanulatus* and highlight its potential as a valuable source of bioactive compounds. Further studies on quantitative analysis and biological assays may contribute to the development of plant-based pharmaceutical products.

Keywords: *Amorphophallus campanulatus*; Melghat forest; Phytochemical screening; Soxhlet extraction; Medicinal plants; Bioactive compounds.

Ethnobotanical Use of *Blumea* spp. for Fish Capturing by the tribals of Melghat Region, Maharashtra, India

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Indigenous fishing practices represent an important but under documented component of traditional ecological knowledge in central India. The present study documents the use of a locally available riparian plant, *Blumea* spp., known as “Mirchya Zara” in the Korku language, for fish capturing by the tribals of the Melghat region of Maharashtra. Regular surveys and field observations were done from December- 2022 to June -2025. Photographic evidences of the respective fishing method have been recorded from the study sites. The study revealed that local communities used crushed leaves and aerial parts of the plant to temporarily sedate fish, facilitating easy capture. *Blumea* spp. is a branched, camphor-scented herb that grows abundantly along riverbanks and seasonal streams. Literature-based study founded that essential oils extracted from the leaves are known to possess analgesic, hypothermic, and tranquilizing properties. When introduced into water bodies, the volatile compounds emit a strong odor that attracts fish to the surface, semi-paralysed without immediate lethality. This fishing method was found at the different rivers of the Melghat landscape like the Tapi river, the Sipna river, the Gadga river. This traditional method is typically practiced on a small scale for subsistence fishing and reflects a sophisticated understanding of plant-animal interactions. The findings highlight the ecological relevance of indigenous knowledge systems and suggest potential avenues for further research on bioactive plant compounds and their controlled application in fisheries science. Documentation of such practices is crucial for conserving both cultural heritage and biodiversity in ecologically sensitive regions like Melghat.

Keywords: Tribals, fishing method, *Blumea*, Tapi river, Sipna river, Gadga river, Melghat

Thermal studies and Spectral Characterization of salicylaldehyde and salicyloyl hydrazone Schiff Base ligand and its Cr(III), Mn(III), Fe(III) and VO(IV) Metal complexes

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Metal complexes of Cr(III), Mn(III), Fe(III) and VO(IV) with a Schiff base ligand derived from salicylaldehyde and salicyloyl hydrazides were synthesized and characterized by several techniques, including elemental analyses, molar conductance, magnetic moments, electronic, ¹H NMR, mass, IR, ESR spectra and thermal studies (TGA & DTA). The complexes are colored solids, air stable, non-hygroscopic and soluble in DMF and DMSO only. On the basis of IR spectral studies flexidentate nature of ligand is found towards different metal ion. The molar conductivity data of the complexes showed their non-electrolytic nature. Based on these studies, octahedral geometry for Cr(III), Fe(III) and square pyramidal geometry for Mn(III) and VO(IV) complexes were proposed. Thermal stability of each complex was determined by TG/DTA. From the TGA curves, thermo-kinetic parameters such as activation energy (E_a), order of reaction (n), entropy change (ΔS), free energy change (ΔG) and apparent entropy change (S*) have been calculated by using the Freeman-Carroll and Sharp-Wentworth methods. ESR spectrum of vanadyl complexes are recorded and discussed.

Keywords: salicyloyl hydrazides, Thermal, Metal Complexes, IR.

Integrated Morphometric and Hydrogeological Assessment of Sipna Sub-Watershed of Melghat Region Using Remote Sensing and GIS

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Watersheds are critical natural drainage basins for managing soil, water, and biodiversity. The Melghat region in Maharashtra faces significant water scarcity challenges due to its rugged terrain, seasonal rainfall, and degraded landscapes. Traditional water management is often hindered by the area's complex topography and tribal forest landscape. There is a pressing need for an integrated approach to manage these resources effectively to support local livelihoods and ecological conservation.

This study aims to accurately delineate the Sipna sub-watershed boundaries and analyze its hydrological and hydrogeological characteristics. Specifically, it seeks to compute linear, areal, and relief morphometric parameters, analyze geological features like lithology and lineaments, and identify areas prone to high runoff and erosion. The ultimate goal is to assess groundwater

potential and recharge zones to provide scientific inputs for sustainable water resource planning.

The research utilized Geographic Information Systems (GIS) and Remote Sensing (RS) technologies. Data sources included SRTM/CartoDEM for terrain analysis, Landsat-8/Sentinel-2 imagery for land use mapping, and Survey of India toposheets. The drainage network was extracted using DEM processing, and streams were ordered via Strahler's method. A multi-criteria decision analysis was employed, integrating thematic layers such as geology, geomorphology, slope, lineament density, and drainage density to map groundwater potential zones.

The Sipna sub-watershed exhibits a dendritic drainage pattern and an elongated shape, which helps in reducing flood peaks by lengthening runoff travel time. Morphometric analysis revealed a predominance of lower-order streams, indicating active erosion in the upper reaches. Geologically, the area is dominated by Deccan Trap basalt, where groundwater occurs in weathered and fractured zones. The study successfully classified the sub-watershed into poor, moderate, and good groundwater potential zones, with the best prospects found in valley fills, pediplains, and high lineament density areas.

The integration of morphometric and hydrogeological parameters provides a comprehensive scientific framework for watershed prioritization. The findings suggest that while the region has moderate runoff potential, groundwater availability is spatially variable and controlled by secondary porosity. These results are significant for guiding the placement of artificial recharge structures, such as check dams and percolation tanks, to mitigate water scarcity. Ultimately, this research supports water security and biodiversity conservation within the ecologically sensitive Melghat region.

Keywords: Sipna Sub-watershed, Morphometric Analysis, Hydrogeology, Remote Sensing, GIS, Groundwater Potential

History of Heterocyclic Compound and its Derivatives in Medicine

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Heterocyclic compounds constitute the largest and most varied family of organic compounds. Today there are a lot of heterocyclic compounds are known, day by day the number is increasing rapidly due to the enormous synthetic research and also their synthetic utility. Heterocyclic compounds have a role in most fields of sciences such as medicinal chemistry, biochemistry also another area of sciences. In this review, we cover most biological active heterocyclic compounds that it's recently synthesized or extracted from the plants such as antifungal, anti-inflammatory, antibacterial, antioxidants, anticonvulsant, antiallergic, herbicidal and anticancer.

Keywords: Heterocyclic compounds, Biological activity, Medicinal chemistry

LOW COST ELECTROSTATIC HYBRID PM REDUCTION SYSTEM FOR HIGH POLLUTION CITIES

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Particulate matter (PM)-induced air pollution is a serious threat to the environment and public health, particularly in heavily polluted urban and industrial areas. Wet scrubbers, fabric filters, and electrostatic precipitators are examples of conventional air pollution control technologies that work well but are not appropriate for low-income or densely populated areas due to their high installation, operating, and maintenance costs. In order to improve air quality in high-pollution areas, this project suggests designing and developing a low-cost hybrid electrostatic particulate matter reduction system. The suggested system reduces energy consumption and system complexity while increasing particle capture efficiency by combining mechanical filtration and electrostatic charging principles. To increase particle deposition rates, fine particulate matter (PM_{2.5} and PM_{1.0}) is first electrically charged using a low-voltage electrostatic field and then directed toward oppositely charged collection plates or filter media. The system attempts to offer a financially feasible substitute for traditional PM control technologies by incorporating inexpensive materials and streamlined power requirements. The hybrid design lowers pressure drop and maintenance frequency while increasing collection efficiency for both fine and coarse particles. This system is especially well suited for use in small-scale industrial applications, roadside pollution control units, and urban outdoor settings. The study's anticipated result is a scalable, economical, and energy-efficient solution that can greatly lower particulate matter concentrations in heavily polluted areas, enhancing environmental sustainability and public health.

Keywords: Low -cost system, Air pollution control, Emission reduction, sustainable air quality solution, hybrid Pm reduction.

Green Leaf Panel: Microbial Oxygen-Producing Bio-Panels for Sustainable Indoor Air Improvement

Ingole B

Indoor air pollution has emerged as a major environmental and public health concern due to rapid urbanization, reduced ventilation, and prolonged human activity in enclosed spaces. Conventional air purification systems mainly rely on mechanical filtration and continuous energy consumption, which limits their sustainability. The present study titled “Green Leaf Panel: Microbial Oxygen-Producing Bio-Panels for Sustainable Indoor Air Improvement” proposes an eco-friendly and biologically inspired alternative for enhancing indoor air quality. The Green Leaf Panel is a compact bio-panel designed using photosynthetic microalgae immobilized in a gel-based scaffold supported by a porous substrate. When exposed to light, the microalgae utilize carbon dioxide from the surrounding air and release oxygen through the process of photosynthesis. A comparative experimental setup was developed consisting of an experimental bio-panel containing microalgae and a control panel without algae to validate the results. Carbon dioxide reduction and oxygen generation were qualitatively assessed using Bromothymol Blue (BTB) as an indicator. Under illumination, the experimental panel showed a distinct color change from yellow to greenish-blue, confirming effective CO₂ absorption, whereas the control panel showed no significant variation. The results demonstrate that microbial bio-panels can serve as low-energy, space-efficient, and sustainable systems for indoor air improvement. The Green Leaf Panel highlights the potential integration of microbial photobioreactor technology into homes, offices, hospitals, and smart buildings, contributing to environmentally responsible indoor air management.

Keywords: Pollution, Bio-Panels, Bromothymol Blue indicator, Co₂ absorption

CO₂ Gas Sensing Performance of SnO₂-Based Nanocomposite Sensors

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SnO₂-based nanocomposite gas sensors were fabricated and studied for efficient carbon dioxide (CO₂) detection at room temperature. SnO₂ was composited with ZnO and TiO₂ in various

molar ratios and deposited on polypyrrole (PPy) and Al₂O₃ base layers using a thick-film technique. X-ray diffraction confirmed the formation of phase-pure rutile SnO₂, wurtzite ZnO, and anatase TiO₂, while SEM analysis revealed porous nanogranular morphologies with enhanced surface area. Gas sensing measurements were performed using the voltage drop method in the CO₂ concentration range of 500–4500 ppm. Sensor sensitivity increased with CO₂ concentration and reached a maximum at 2500 ppm. Among all fabricated sensors, A2 (90SnO₂:10ZnO/PPy), B3, C4, and D5 showed superior sensing performance. The optimized A2 sensor exhibited the highest sensitivity (5.73) with fast response (98 s) and recovery (67 s) times. Enhanced sensing behavior is attributed to effective oxygen adsorption, reduced crystallite size, and efficient electron transfer during CO₂ interaction. These results demonstrate that SnO₂-based nanocomposite sensors are promising for low-cost, room-temperature CO₂ monitoring applications.

Keywords: SnO₂ nanocomposites; CO₂ gas sensor; XRD, SEM; Sensitivity; Room-temperature sensing.

ENERGY HARVESTING WALKING STICK

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Visually impaired people rely on walking sticks for safe mobility. However, many modern assistive devices depend on batteries, which need frequent charging or replacement. This project introduces a low-cost energy harvesting walking stick that turns mechanical energy from walking into electrical energy. This reduces the need for external power sources. The system uses the piezoelectric effect, which occurs when certain materials produce an electric charge under mechanical stress. In this design, piezoelectric discs are placed at the base of the walking stick. As the user walks, the pressure applied to the stick generates electrical energy. This alternating current is converted into direct current with a rectifier circuit and stored temporarily in a capacitor. The collected energy powers low-energy devices like LEDs, buzzers, or vibration motors, which serve as alert systems for users. The project shows that human motion can be a renewable energy source for assistive devices. The proposed model is intended as a prototype demonstration that emphasizes energy conversion and harvesting rather than large-scale commercial use. Its simplicity, low cost, and sustainability make it ideal for developing areas where access to a continuous power supply is limited. It also shows the potential for using renewable energy harvesting methods in mobility aids. This could lead to

future self-powered assistive devices that enhance functionality and independence for visually impaired individuals.

Key words: Piezoelectric Effect, Energy Harvesting, Assistive Technology, Renewable Energy, Visually Impaired.

Snailure, is India's first snail attractant

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Giant African snails are becoming a major agricultural pest and the population is increasing rapidly. My product "Snailure" is an innovative, eco-friendly solution addressing the Giant African Snail problem prevalent in Maharashtra. This non-toxic formulation attracts snails from a distance, allowing easy collection for subsequent elimination. The snail attracting innovation stands out as a sustainable alternative to chemical pesticides, promoting eco-friendly agricultural practices. Its uniqueness lies in being the first of its kind, utilizing an attractant mechanism. Successful pilot trials are done on the fields of 200 farmers in the Amravati district, proven effective without compromising soil health. Additionally, its significance has been recognized by the media and some organizations (state level & National prizes and awards) further amplifying its credibility.

a. Background / Introduction: The problem I am looking to solve is the attack of giant African snails on orange, cotton, Soybean, papaya and other plants in India, which is increasing day by day and is uncontrollable. The giant African snail, *Achatina fulica*, is a native of East Africa and is the largest land snail in the world. It is among the 100 most invasive species in the world and can cause widespread damage to crops and gardens. According to a news article, more than 1.18 lakh farmers (Soybean crop) in Latur, Beed and Osmanabad districts of Marathwada have been affected by the snail attack, which has damaged crops on 72,000 hectares during the last Kharif season. (Times of India 14-09-2022, Agrowon 13-10-2023). Relief fund of about 98 crore was given to farmers in Latur, Beed and Osmanabad to overcome crop damage due to snails in last Kharif. (Maharashtra Governance decision CLS-2022 292, 14-09-2022). The snails feed on a variety of plants and can also transmit diseases to humans and animals. Therefore, there is a need for an effective and eco-friendly solution to

control the snail population and protect the plants. Existing snail controlling product snail kill in the market contains toxic content metaldehyde which is harmful to earthworms, environment and consumers. Krishak mitra is non toxic product, proved to solve this problem very easily as to be said. Metaldehyde present in snikill product in market is banned in US due to its residual effects so I aimed to address the issue so our health will be saved by non residual "Krishak Mitra".

b. Objectives / Purpose: What are you trying to explore, test, build, or understand?

c. Methodology: " Snail lure" is the first of its kind India due to its snail attractant mechanism. Farmers can protect their crops from snails after using this product. About 100 ml of solution is sufficient for an area of one acre. This solution should be mixed with grains on the surface of soil (at a distance of 20 to 20 feet) before dark in the evening.

d. Results / Findings : All the snails present on the branches of the crop and on the ground will be attracted towards the smell of this attractant solution and they gather together at one place. So it is convenient to collect snails from specific location. Existing product in market Snail kill does not work by attracting snails. With a scalable business model, it aims to revolutionize pest control in agriculture, prioritizing environmental and farmer well-being. Our flagship product, Snail lure, is India's first snail attractant, developed to combat the devastating Giant African Snail infestation. Designed for efficiency, safety, and environmental sustainability, Snail lure offers a non-toxic, easy-to-use, and cost-effective solution, ensuring healthier crops and improved farm productivity. We believe in empowering farmers through innovation, research, and practical solutions-paving the way for a more resilient and productive agricultural future.

Keywords: Giant African Snail, snail attractor, Non-poisonous bait

Development of an Efficient CRISPR/Cas9 Delivery System for Genome Editing in Soybean

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Abstract

Soybean (*Glycine max* L. Merrill) genome editing is often limited by inefficient gene delivery and suboptimal regeneration efficiencies associated with conventional transformation

protocols. The present study focuses on the development of an efficient CRISPR/Cas9 delivery system for targeted genome editing in soybean, integrating *in-vitro Agrobacterium*-mediated transformation and *in-planta* delivery to enhance construct uptake and transformation efficiency. Four soybean genotypes- PDKV Amba, AMS-1001, AMS-MB-5-18, and Swarna Vasundhara, were evaluated to assess delivery efficiency and plant regeneration.

CRISPR/Cas9 constructs targeting BADH2, the gene controlling aroma and flavor, and KTI, a major anti-nutritional factor reducing protein digestibility, were cloned into the pDIRECT22_A vector and introduced into *Agrobacterium tumefaciens* strain EHA105. Sonication parameters (15 s, 30 s, 1 min, and 2 min at 50 Hz) were systematically optimized, and scanning electron microscopy (SEM) was employed as an validation tool to visualize microwound structure and size. SEM analysis revealed that precisely regulated sonication at 50 Hz for 30 seconds generated optimal microwounds that maximized construct entry while minimizing tissue damage. In parallel, *in-vitro Agrobacterium*-mediated delivery was optimized using explants from selected genotypes to ensure efficient construct uptake and early shoot regeneration.

To support efficient recovery, regeneration, and evaluation of edited events, an *in-vitro* florigenesis based regeneration system was employed, enabling direct induction of flowers and pod maturation within 40-45 days under controlled culture conditions. This system, for which a patent application has been filed (Application No.: 202321015532A; Publication date: 24/03/2023), complements the delivery pipeline by enabling rapid seed recovery and containment of edited events.

Among the evaluated genotypes, PDKV Amba exhibited superior transformation response, germination performance. Molecular validation confirmed successful delivery and presence of CRISPR/Cas9 constructs in regenerated plants, demonstrating the efficiency of the integrated delivery system.

Collectively, this study establishes a robust, scalable, and innovative CRISPR/Cas9 delivery platform for soybean, combining optimized delivery approaches with advanced regeneration strategies to support the development of food-grade, value-added soybean varieties.

Keywords: Soybean, CRISPR/Cas9, Genome Editing, Sonication-Assisted Delivery, *in-vitro* florigenesis

Seed Pathology and Food Security: Eco-Friendly Management of Seed-Borne Fungi for Sustainable Agriculture and Human Health

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In India, farmers cultivate a wide range of crops such as cereals, millets, pulses, oilseeds, and other economically important plants. However, seed quality is often compromised due to the association of various seed-borne fungal pathogens. Seed pathology, which deals with the study of seed-associated microorganisms and their effects, has gained increasing importance due to its direct impact on crop productivity, seed health, storage life, and human health.

Several fungi, including *Aspergillus*, *Penicillium*, *Rhizopus*, *Fusarium*, and *Pythium*, are commonly associated with seeds during harvesting, processing, and storage. These fungi cause seed deterioration by reducing germination percentage, seed vigor, and viability, ultimately leading to poor crop establishment and reduced yields. When seeds are stored for longer durations, especially under unfavourable storage conditions, fungal diversity increases significantly. Continuous intake of contaminated seeds or seed-derived food products may result in hazardous effects such as toxicity, weakened immunity, and chronic health disorders. Seed-borne fungal problems are often underestimated at the farmer and societal levels, leading to economic losses, food safety concerns, and reduced agricultural sustainability. Conventional chemical fungicides, though effective, are associated with environmental pollution, the development of resistant pathogens, and health hazards. Hence, there is an urgent need to adopt eco-friendly and sustainable alternatives for managing seed-borne fungal diseases.

The present project emphasizes the use of biological control methods and plant-based extracts as effective, environmentally safe strategies for seed health management. Beneficial microorganisms such as *Trichoderma*, *Bacillus*, and *Pseudomonas* spp. have shown promising antagonistic activity against major seed-borne fungal pathogens. These bioagents suppress fungal growth through mechanisms such as competition, antibiosis, mycoparasitism, and induction of plant defence responses. Additionally, the application of plant extracts derived from medicinal and aromatic plants offers a natural means to inhibit fungal pathogens without

leaving harmful residues. Adopting biological seed treatments and plant-based formulations can significantly improve seed quality, enhance germination, reduce storage losses, and ensure safer food consumption. This approach supports sustainable agriculture, protects farmer income, and safeguards human health while maintaining ecological balance. The project highlights the importance of seed pathology research and its practical application for farmers, students, researchers, and society. Overall, eco-friendly management of seed-borne fungi is a vital step toward sustainable crop production, food safety, and long-term agricultural development in India.

Keywords: Food crops, seed-borne fungi, toxins, eco-friendly, sustainable management

Seed-Borne Mycoflora of Pulse Crops in Amravati Region and Eco-Friendly Approaches for Seed Health Management

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Pulse crops such as tur (*Cajanus cajan*), moong (*Vigna radiata*), and gram (*Cicer arietinum*) play a vital role in Indian agriculture by contributing to food security, soil fertility, and farmer income. However, seed-borne fungal pathogens significantly affect seed quality, germination, and crop establishment, leading to yield losses and economic constraints for farmers. The present study was undertaken to evaluate germination potential and seed health of major pulse seeds collected from farmers of the Amravati region, Maharashtra, with special emphasis on the detection of seed-borne fungi.

Seed samples of tur, moong, and gram were collected from local farmers. Germination percentage was assessed using the Roll-Towel Technique as per ISTA (2012) guidelines. Seed health testing was carried out by employing the Standard Blotter Paper Method for the detection of external seed-borne fungi and the Agar Plate Method for detecting internal seed-borne fungi, following ISTA (2023) procedures. The inoculated plates were incubated at room temperature for 6–8 days to allow fungal growth and sporulation. After incubation, fungal colonies were observed under a stereo-zoom binocular microscope. Temporary slides were prepared for detailed micro-morphological observations, and photomicrographs were taken. Identification of fungal pathogens was performed using standard mycological literature. The

percent frequency of occurrence of individual fungal species was calculated according to Embaby et al. (2006).

The results revealed the association of several important seed-borne fungi, including species of *Aspergillus*, *Penicillium*, *Fusarium*, and *Rhizopus*, which are known to adversely affect seed germination, storage life, and seedling health. The presence of these fungi indicates potential risks to crop productivity and food quality. Future studies will focus on analysing biochemical changes in seeds during storage, particularly protein content, assessing the toxic effects of isolated fungi on plantlets, evaluating the impact of fungal filtrates on leaves, and exploring eco-friendly seed treatments using biocontrol agents such as *Trichoderma*, *Bacillus*, and *Pseudomonas* species. Additionally, plant extracts will be tested for their antifungal activity. The study aims to develop sustainable, farmer-friendly strategies for improving pulse seed health and productivity.

Keywords: Pulses, seed-borne fungi, eco-friendly, sustainable management

Seed-Borne Mycoflora of Oilseeds in Amravati Region: Implications for Seed Health and Eco-Friendly Disease Management

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Seed quality is a critical determinant of crop productivity and farmer profitability. Oilseed crops such as soybean (*Glycine max*), brassica (*Brassica campestris*), and sunflower (*Helianthus annuus*) are widely cultivated in the Amravati region of Maharashtra; however, their productivity is often constrained by seed-borne fungal pathogens. The present investigation was undertaken to assess germination potential and seed health status of major oilseeds collected from farmers, with a view to identifying seed-associated mycoflora and their agricultural significance. Seed samples of soybean, brassica, and sunflower were collected from farmers' storage sources in the Amravati region. Germination percentage was evaluated using the Roll-Towel Technique as recommended by ISTA (2012). Seed health was assessed by employing the Standard Blotter Method and Agar Plate Method following ISTA (2013) guidelines for the detection of both external and internal seed-borne fungi. Inoculated plates were incubated at room temperature for 6–8 days to allow fungal growth and sporulation.

Developed fungal colonies were examined under a stereo-zoom binocular microscope. Microscopic slides were prepared for detailed observations, and photomicrographs were recorded. Fungal pathogens were identified with the help of standard mycological literature. The percent frequency of occurrence of individual fungal species was calculated according to the method described by Embaby et al. (2006). The study revealed the association of several important seed-borne fungi, including species of *Aspergillus*, *Penicillium*, *Fusarium*, and *Rhizopus*, which are known to adversely affect seed germination, vigor, and storage life. Future work will focus on studying the toxic effects of isolated fungi on plantlets, evaluating eco-friendly seed treatments using biocontrol agents such as *Trichoderma*, *Bacillus*, and *Pseudomonas* species, analysing antagonistic interactions, and exploring plant extracts as natural antifungal agents. This research aims to contribute toward sustainable agriculture, improved seed health, and farmer-friendly disease management strategies.

Keywords: Oilseeds, seed-borne fungi, bio-control, sustainable agriculture

CropX: AI-Powered Crop Yield Prediction and Optimization Platform for Small-Scale Farmers

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Background / Introduction: Small-scale farmers in India, particularly in regions like Odisha, Bihar, and tribal regions face low crop productivity due to unpredictable weather, poor soil health, lack of proper farming guidance, and inefficient use of resources. Climate change and limited access to correct information make the problem worse. Many farmers still depend on guesswork instead of data-based decisions, which leads to low yields and high costs. To solve this, there is a need for a simple and affordable technology solution that provides expert farming advice and is easy to use, even for farmers with low digital skills.

Objectives / Purpose: This project aims to develop CropX, a comprehensive AI-driven decision support platform that empowers small-scale farmers with actionable, localized farming advisories. The primary objectives include:

Predicting optimal crop yields using machine learning models trained on soil, weather, and historical crop data;

Providing real-time, data-driven recommendations for irrigation, fertilization, and pest control;

Enabling farmers to make informed decisions through regional language interfaces;

Integrating IoT sensors for automated resource management;

Methodology: The platform employs a multi-layered technical architecture combining machine learning, IoT integration. Data collection encompasses soil properties, weather conditions, historical crop yields, and real-time sensor inputs. The pre-processing pipeline cleans and extracts key features for model training. We utilize ensemble machine learning algorithms including Random Forest, regression models, and neural networks (CNN-LSTM hybrid architecture) to predict crop yields and generate optimization recommendations. The system integrates real-time APIs from the India Meteorological Department and satellite imagery from NASA POWER and Sentinel-2. IoT sensors monitor soil moisture and temperature, enabling automated irrigation control. A climate simulator provides "what-if" scenario analysis for proactive risk management. The user interface supports multiple regional language and includes offline functionality using USSD for connectivity-challenged areas.

Results / Findings: Preliminary prototype testing demonstrates the platform's capability to deliver accurate yield predictions and resource optimization recommendations. The system successfully integrates multiple data sources and presents actionable insights through an intuitive dashboard. The regional language chatbot and simplified input forms show promise for high adoption rates among farmers with varying digital literacy levels. The climate simulator effectively models yield impacts under different weather scenarios, enabling proactive planning. Initial feasibility analysis indicates potential for achieving greater than 10% yield increases through optimized resource utilization, with corresponding reductions in water and fertilizer costs.

Conclusion / Implications: CropX represents a holistic ecosystem approach to precision agriculture, moving beyond simple prediction to actionable farm management. The platform addresses critical gaps in agricultural technology adoption by combining operational efficiency through IoT automation, and climate resilience through predictive analytics. By providing 24/7 expert support in regional languages, the solution democratizes access to advanced agricultural knowledge, promoting inclusive growth for small-scale and marginal farmers. The broader implications include enhanced food security, environmental sustainability through resource conservation, and generation of valuable agricultural data for evidence-based policy-making.

This integrated approach positions CropX as a transformative tool for rural development and agricultural advancement.

Keywords: Artificial Intelligence, Crop Yield Prediction, Precision Agriculture, IoT Integration, Climate Resilience.

Eco-Friendly Post-Harvest Management of Graymold Using Trichoderma-Derived Biofilms.

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Botrytis cinerea, represent one of the most destructive post-harvest pathogens affecting a wide range of fruits worldwide. The pathogen is responsible for gray mold disease, which leads to significant economic losses during handling, storage, transportation, and marketing. This study investigates the prevalence and severity of *Botrytis* infection through systematic field and storage-house surveys across major fruit-producing regions. Survey findings reveal high incidence in berries, grapes, strawberries, and tomatoes, especially under high humidity and poor ventilation conditions. The infection process is characterized by airborne conidia that adhere to fruit surfaces, germinate under moist conditions, penetrate through wounds or lenticels, and rapidly colonize tissues, resulting in soft rot and sporulation. Antagonistic interactions between *Botrytis spp.* and beneficial biocontrol agents such as *Trichoderma harzianum* was evaluated to assess their efficacy in reducing infection. Dual-culture assays and post-harvest fruit inoculation tests demonstrated that *Trichoderma spp.* effectively inhibit *Botrytis* growth through mechanisms including mycoparasitism, antibiosis, nutrient competition, and induction of host resistance. Furthermore, the study incorporates the application of biofilms developed by *Trichoderma spp.* in combination with plant-based extracts, which serve as natural antifungal enhancers. These biofilms form a stable protective layer on fruit surfaces, improving microbial adhesion, providing controlled release of antifungal metabolites, and enhancing the inhibitory action against *Botrytis*. Plant extracts such as *Aloe*, lemongrass, and tulsi integrated into the biofilm matrix further strengthen antifungal activity through their Generally Recognized As Safe (GRAS)-status phytochemicals. The study highlights that adopting an integrated post-harvest disease management approach with

Trichoderma-based biofilms and plant extract formulations as core bio-control tools offers an effective and eco-friendly solution to mitigate *Botrytis* - induced post-harvest losses in fruits.

Key words- Berrys, gray mold, *Trichoderma*, biofilms, eco-friendly management

AGROINNOVATE – Technological Advancements for Sustainable and Smart Agriculture

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Introduction

Agriculture plays a vital role in ensuring global food security and economic development, especially in emerging economies. However, the agricultural sector faces increasing challenges such as climate change, pest outbreaks, soil degradation, resource scarcity, and rising food demand. Traditional farming practices alone are insufficient to address these evolving challenges. The need for sustainable, efficient, and technologically driven solutions has led to the emergence of innovative practices in agriculture. This shift toward modernization, often referred to as smart or digital agriculture, integrates advanced tools and techniques to improve productivity, efficiency, and environmental sustainability.

Objectives

The primary objective of this work is to explore modern agricultural innovations and evaluate their potential to enhance productivity, resilience, and sustainability. The proposed framework, AGROINNOVATE, aims to assess technological interventions such as precision farming, automated irrigation, drone-based monitoring, digital advisory platforms, protected cultivation, and biotechnology-based crop improvements. The study aims to highlight how these innovations can support farmers in making informed decisions, reduce input costs, and strengthen national food security.

Methodology

The methodology involves a conceptual and analytical approach. Various technology domains, including sensor-based soil testing, IoT-enabled climate monitoring, AI-driven crop health diagnostic tools, and drone-assisted spraying, were studied through literature reviews, case studies, and market observations. Additionally, insights from agri-startups and farmers were

considered to understand awareness levels, adoption barriers, and operational feasibility. Surveys and secondary data from agricultural organizations were used to justify the practical need for innovation-driven farming systems.

Results

The results indicate that integrating modern technologies into farming practices significantly improves efficiency and productivity. Precision agriculture reduces fertilizer and pesticide wastage, smart irrigation systems optimize water consumption, and hydroponic and vertical farming models ensure high yields with limited land resources. Digital advisory platforms and weather-based prediction systems reduce uncertainties and enhance decision-making for farmers. These innovations collectively contribute to improved profitability, better resource management, and enhanced climate resilience. The study also identifies challenges such as limited digital literacy, high initial investment, and infrastructure gaps that must be addressed for larger-scale adoption.

Conclusion

In conclusion, agricultural innovation represents a transformative pathway toward sustainable farming and food security. The findings demonstrate that embracing technological advancements can enhance agricultural productivity while reducing environmental impact. With proper policy support, training programs, and financial incentives, modern agricultural systems can be scaled to benefit rural communities and strengthen national economies. This work contributes to the growing discourse on sustainable agriculture and highlights the importance of research and innovation in shaping the future of global food systems.

Keywords

Agricultural Innovation, Smart Farming, Precision Agriculture, Digital Farming, Sustainability, Food Security

Ethnobotanical Documentation of Wild Edible Plants and Their Role in Food and Nutritional Security in the Melghat Region.

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The present study focuses on the documentation and survey of wild edible plants (wild vegetables) traditionally used by indigenous communities of the Melghat region, Maharashtra. Melghat is the part of the Satpura hill range, is rich in floral diversity and supports numerous wild plant species that play a crucial role in local food security and nutrition.

Field surveys were conducted in selected villages and forest areas of Melghat with the help of interviews, and participatory observations involving tribal communities such as Korku and Gond. The study recorded 24 various wild edible plant species, including leafy vegetables, fruits, tubers, and seeds, belonging to different plant families. Information on local names, edible parts, seasonal availability, modes of consumption and traditional preparation method was systematically documented.

Results indicate that wild vegetables are an important source of micronutrients, dietary fiber, and medicinal value, especially during food-scarce periods. The survey highlights a decline in traditional knowledge among younger generations due to modernization, habitat loss, and changing food habits. Conservation of wild edible plants and cultural preservation is essential for sustainable utilization and biodiversity management in the Melghat region.

The study emphasizes the need for nutritional monitoring, value addition, and awareness programs to promote the use of wild vegetables for livelihood and health improvement.

In the future spore will be isolated and quantified through permanent slide preparation and the observation of the AMF specific characteristic features like hyphae, vesicles, and root colonisation and the entire data will note and the completed photographs for further studies.

Keywords: Wild Edible Plants, Ethno botanical survey, Nutrition security, Melghat forest, Traditional ecological knowledge, Nutritional monitoring.

EcoVac – Smart self-cleaning Vacuum Bin

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Urban areas across the world are struggling with the rising challenge of litter management, streets, parks and campuses often accumulate plastic and paper waste that is difficult to collect manually. To address this issue, EcoVac introduces an innovative solution – a solar powered, smart vacuumbin designed to automatically collect lightweight dry waste and wet waste from public spaces. By integrating renewable energy, automation and smart monitoring, EcoVac minimizes cleaning efforts and reduces pollution in public areas. System promotes eco-friendly waste management while encouraging responsible civic behaviour. This model comes under waste management.

Keywords: Vacuumbin, Paper waste, pollution, eco-friendly.

Design and Evaluation of Eco-Friendly Jute Plantation Bags for Horticultural Applications

Harshada Prakash Bhosale and Gayatri Jagadish Gajankushkar

This project focuses on the development of a sustainable plantation bag made from jute fibre, an eco-friendly and biodegradable natural resource. The increasing environmental concerns caused by plastic waste have emphasized the need for greener alternatives in agriculture and horticulture. Jute, known for its high strength, breathability, and biodegradability, offers an excellent substitute for synthetic materials. The proposed jute plantation bag is designed to support plant growth while minimizing soil and water pollution. Its natural composition allows for easy decomposition after use, enriching the soil and reducing waste accumulation. Thus, the jute-based plantation bag serves as a sustainable, cost-effective, and environmentally responsible solution that promotes eco-friendly agricultural practices and contributes to a greener Planet.

Keywords: Jute fibre, Biodegradable bag, Sustainable agriculture, Eco-friendly, Plastic alternative

The OSMF Protocol: A Comprehensive Approach from Diagnosis to Rehabilitation

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Oral Submucous Fibrosis (OSMF) is a chronic, progressive condition marked by fibrosis of the oral mucosa, resulting in trismus and impaired oral function. Its management poses challenges due to difficult airway access, surgical complexity, and risk of relapse. This study evaluates a structured, protocol-based surgical and rehabilitative approach for non-malignant OSMF cases.

A prospective clinical study was conducted on 60 patients diagnosed with OSMF. Based on mouth opening, patients were grouped into mild, moderate, and severe restriction categories. Airway strategies included video laryngoscopy and elective tracheostomy. Coronoid involvement, assessed through OPG/CBCT, determined the need for coronoidotomy or coronoidectomy. Reconstruction was tailored using nasolabial, buccal fat pad, submental, platysma, or radial forearm flaps depending on defect size. Postoperative physiotherapy was initiated after 2–3 weeks to allow graft stabilization. Patients were followed up for six months to assess mouth opening, complications, and functional recovery. All patients successfully underwent surgery following the standardized protocol. Mean preoperative mouth opening improved from 13.4 ± 4.2 mm to 31.2 ± 3.6 mm at six months ($p < 0.001$). Coronoidectomy was performed in 35% of cases. Minor complications included flap necrosis ($n=2$) and infection ($n=3$). Functional outcomes were favorable in 83.3% of patients, with sustained improvements in mouth opening, speech, and mastication. The “OSMF Protocol” provides a comprehensive framework that enhances surgical safety, optimizes functional outcomes, and minimizes complications in non-malignant OSMF cases.

Keywords: Oral Submucous Fibrosis; Protocol-based Management; Coronoidectomy; Flap Reconstruction; Postoperative Rehabilitation; Trismus.

The Silicon Valley Watchdog: How Big Data affects the fabric of Economic Realities

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The effect of technology on our lives is undeniable, but also unanticipated. One such manifestation is Big Data, an entity that has ceased to be a mere technological asset and has evolved into the architect of our economic realities. This paper explores this paradigm shift, positing that while humanity has always been defined by an innate curiosity to observe the world, the digital age has inverted this dynamic: we are no longer the observers, but the observed.

Through a multi-dimensional analysis, this report weaves together the threads of Microeconomics, Macroeconomics, and Socio-ethical perspectives to paint a complete picture of this new reality. We examine how "free" digital services extract a toll not in currency, but in human experience, efficiently mining our biases, emotions, and preferences to fuel the engines of Surveillance Capitalism. The study scrutinizes the mechanisms of Choice Architecture, demonstrating how the "invisible hand" of the market is being guided by the "invisible eye" of the algorithm, subtly nudging consumer behavior toward predictable, engineered outcomes.

Ultimately, we situate these global currents within the landscape of Bharat, evaluating the friction between rapid digital adoption and the preservation of individual autonomy. The report concludes by arguing that to ensure our nation's progress does not come at the cost of human agency, we must transition from passive data subjects to active participants in a true Data Democracy, propelling the nation forward without leaving our humanity behind.

Keywords: Surveillance Capitalism, Big Data, Behavioral Economics, Digital Autonomy, Indian Economy.

Exploring Wealth of Bioactive Compounds in Agricultural Waste of *Arachis hypogaea*.

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Agricultural waste generated from *Arachis hypogaea* L. (groundnut), including roots, leaves, and pods, constitutes a significant yet underutilized biomass with high potential for value addition. Recent studies have revealed that these plant residues are rich sources of diverse bioactive compounds such as phenolics, flavonoids, stilbenoids, tannins, saponins, and alkaloids. Notably, peanut roots are abundant in stilbene derivatives including resveratrol and arachidins, while leaves and pods contain substantial levels of antioxidant polyphenols and dietary fibers.

These bioactive constituents exhibit a wide range of biological activities, including antioxidant, antimicrobial, anti-inflammatory, anticancer, and hepatoprotective effects. This review summarizes current knowledge on the phytochemical composition of *Arachis hypogaea* agricultural waste, extraction and analytical approaches, and reported biological activities. Furthermore, it highlights the potential applications of peanut waste in pharmaceuticals, nutraceuticals, cosmetics, and environmental remediation. Valorization of groundnut agricultural residues offers a sustainable approach to waste management while contributing to the development of eco-friendly bio-based products.

Keyword: Antioxidant, Antimicrobial, Pharmaceutical, Nutraceutical, Waste Management, Circular Economy, Sustainable Development

Effect of an Indigenous Liquid Biofertilizer on Growth and Biomass of Mustard (*Brassica juncea*)

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The present study was undertaken to evaluate the effectiveness of a low-cost, farmer-friendly biofertilizer prepared using readily available natural ingredients—buttermilk, jaggery, lime, egg, and alum—on the growth and development of mustard (*Brassica juncea*) plants. The biofertilizer formulation was developed through a simple fermentation process and applied as a soil drench at regular intervals. A comparative experiment was conducted under controlled conditions with two treatments: biofertilizer application and an untreated control. Key growth parameters such as plant height, number of leaves, leaf area, biomass accumulation, and overall plant vigor were recorded at different growth stages. The results demonstrated a significant improvement in vegetative growth and biomass of mustard plants treated with the biofertilizer compared to the control. Enhanced nutrient availability, microbial activity, and growth-promoting substances derived from the organic ingredients are believed to contribute to the observed effects. The study highlights the potential of this indigenous biofertilizer as an eco-friendly, sustainable, and economical alternative to chemical fertilizers, particularly suitable for small and marginal farmers, and supports its role in promoting sustainable agriculture.

Keywords: Biofertilizer, *Brassica juncea*, Organic, Sustainable

Hospital Indoor Airborne Allergenic Fungi and the Emerging Burden of Mucormycosis and Aspergillosis

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Hospital indoor air plays a significant role in shaping both respiratory health and infection risk within healthcare settings. Airborne fungi are common components of indoor environments and are known to trigger allergic conditions such as asthma and allergic rhinitis. At the same time, certain opportunistic fungi can cause life-threatening infections in susceptible individuals. The recent rise in cases of aspergillosis and mucormycosis has drawn attention to hospitals as possible sources of fungal exposure, especially for immunocompromised and critically ill patients. This study was carried out at Dr. Panjabrao Deshmukh Memorial Medical College, Amravati, with a focus on selected hospital wards and intensive care units (ICUs). These areas were chosen because they differ in patient vulnerability, occupancy, and environmental control. Indoor air samples were collected using standard aeromycological techniques and analyzed through culture-based methods to identify airborne fungi. Particular attention was given to allergenic moulds and opportunistic fungal pathogens, while factors such as ventilation and routine hospital activities were considered during interpretation. The hospital's indoor air was largely dominated by common allergenic fungi, including *Aspergillus*, *Penicillium*, *Cladosporium*, and *Alternaria*. The detection of Mucorales such as *Rhizopus* and *Mucor* suggests a potential environmental presence of fungi linked to mucormycosis. The coexistence of allergenic and pathogenic fungi within wards and ICUs highlights a combined health concern, with implications for both allergic airway disorders and invasive fungal infections. These findings underscore the importance of regular monitoring of hospital indoor air and of strengthening environmental and infection control measures to reduce nosocomial fungal exposure.

Keywords- Indoor Air, Airborne Fungi, Mucormycosis, *Aspergillus*, Mucorales

Covid Associated Mucormycosis in India: A Cross-Sectional Study

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Background/Introduction: COVID-19-associated mucormycosis emerged as a serious public health concern during the second wave of the COVID-19 pandemic in India. The widespread use of corticosteroids, prolonged hospitalization, uncontrolled diabetes mellitus, and compromised immune status created favorable conditions for opportunistic fungal infections.

Mucormycosis, commonly referred to as black fungus, is an aggressive angio-invasive fungal infection associated with high morbidity and mortality, particularly affecting the rhino-orbital-cerebral region.

Objectives: The objective of this study was to evaluate the clinical profile, associated risk factors, and outcomes of patients diagnosed with COVID-19-associated mucormycosis and to emphasize the importance of early diagnosis and multidisciplinary management.

Methodology: A cross-sectional observational study was conducted in association with the Department of Microbiology, Pathology, Community Medicine, General and Oral Surgery at Swargiya Dadasaheb Kalmegh Smruti Dental College and Hospital and a 100-bedded General Hospital, Nagpur. Patients of any age and gender with confirmed mucormycosis admitted during January to September 2021 were included. Data were collected using a pre-designed, semi-structured questionnaire covering demographic details, COVID-19 history, steroid usage, diabetic status, oxygen therapy, and clinical findings. Diagnosis was confirmed using microbiological, radiological, and histopathological investigations.

Results: A total of five patients diagnosed with mucormycosis were evaluated. The mean age was approximately 50 years. Four patients had diabetes mellitus, and four had a recent history of COVID-19 infection. Steroid usage was observed in most cases, either orally or intravenously. Common clinical manifestations included facial swelling, orbital involvement, sinus congestion, and neurological symptoms. One patient succumbed to the disease, while four patients survived following aggressive antifungal therapy and supportive care.

Conclusion/Implications: COVID-19-associated mucormycosis is strongly linked to uncontrolled diabetes and indiscriminate steroid use. Early diagnosis, judicious use of corticosteroids, strict glycemic control, and a multidisciplinary treatment approach are crucial in reducing morbidity and mortality. Awareness among healthcare professionals is essential for timely intervention and improved patient outcomes.

Keywords: COVID-19, Mucormycosis, Diabetes Mellitus, Steroid Therapy, Rhino-orbital Infection

Effect of an Oral Vibratory Device (Oravibe) on Pain Perception during Greater Palatine (Palatal) Local Anaesthetic Injection.

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Background / Introduction: Pain during palatal injections is one of the most distressing experiences for dental patients due to the dense, tightly bound palatal mucoperiosteum and rich

sensory innervation. Despite the use of topical anaesthetics and modified injection techniques, significant discomfort often persists, leading to patient anxiety and reduced cooperation. The gate control theory of pain proposes that non-noxious stimuli such as vibration can inhibit nociceptive signal transmission at the neural level. Oravibe is a localized oral vibratory device designed to apply controlled vibration adjacent to the injection site, thereby reducing pain perception during palatal nerve block. It offers a simple, non-pharmacological, and chairside solution to enhance patient comfort in routine dental practice.

Objectives / Purpose:

To compare pain scores during palatal injection with and without Oravibe vibration.

To assess patient comfort and satisfaction with Oravibe use.

To record any adverse responses related to the device.

Methodology: Describe the approach, experiment setup, tools, data, or framework used.

A Clinical study was conducted on 60 adult patients requiring palatal anaesthesia. Participants were allocated into two groups:

Group A (Oravibe): Vibration applied 5 seconds before and during injection.

Group B (Control): Standard palatal injection without vibration. All injections were given using 2% lignocaine with adrenaline by the same operator. Pain was recorded immediately after injection using a 10 Point Visual Analogue Scale (VAS). Patient comfort and any adverse events were documented.

Results / Findings: The Oravibe group showed markedly lower VAS scores compared with the control group. Patients reported greater comfort and no significant adverse events were observed.

Conclusion / Implications: Oravibe is easy to use, handy, cost effective and significantly reduces pain during palatal nerve block and improves patient comfort, making it a safe. Oravibe demonstrates that effective pain control does not always require additional drugs or complex techniques. By applying the principles of gate control theory through localized vibration, Oravibe significantly reduces pain during palatal injections and enhances patient comfort. Its simplicity, affordability, and clinical effectiveness position it as a practical innovation capable of transforming routine dental anaesthesia into a more patient-friendly experience. Oravibe offers a non-pharmacological, chairside solution for one of the most painful dental injections. Its use improves patient cooperation, reduces anxiety, and supports atraumatic dental care without altering conventional anaesthetic protocols. With its low cost, ease of use, and strong scientific basis, Oravibe has the potential for widespread clinical adoption. It opens new avenues for vibration-assisted pain management across multiple dental procedures.

Keywords: Oral vibration, Pain modulation, Palatal nerve block, Gate control theory, Dental anaesthesia, Patient comfort

Management of Panfacial Trauma: A Surgical Quandary For Maxillofacial Surgeons

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Treatment is not carried out soon after the injury, facial bone fractures often mal-unite, soft tissues shrink. Patients with multiple fractures involving upper third of the face, the mid-face and the lower third are generally referred to as Panfacial fractures.

The establishment of pattern of repairing the pan facial fracture is the most challenging and require great experience as well as knowledge, as it vary with each case. All the vertical and horizontal pillars have to be made to restore and rehabilitate the facial anatomy and aesthetic. The goal of treatment as with all facial fracture is to restore both the functions and pre-injury 3-dimensional facial contours. To achieve this goal two common sequences of management of Panfacial fractures are proposed, "Bottom up and inside out" or "Top down and outside in". This article briefs about the management and simple approaches used to reduce and fix a case of pan facial trauma in a 29-year-old male who underwent a road traffic accident (RTA).

Background / Introduction:

Panfacial fractures are those involving the mandible, maxilla, and zygomatic complex at the same time and usually accompanying naso-orbito-ethmoid (NOB) and Frontal bone fractures. They are often associated with soft tissue injuries and loss of bony structures that can lead to severe post traumatic deformities and disabilities like malocclusion, dish face deformity, enophthalmos. In the management of panfacial bone fractures, various sequences of reduction (bottom-to-top, top-to-bottom, inside-out, and outside-in) are used in combination to restore facial contour. The bottom-to-top and outside-in approach is the most widely used method in the panfacial bone reduction. Bottom-to-top sequences focus on the mandible, which is the strongest bone of the facial skeleton and provides a buttress that can be related accurately to the cranial vault through rigid internal fixation.

Objectives / Purpose: Aims and objective

Evaluate the effectiveness of the bottom-to-top and inside-out approach: Assess the outcomes of using this approach in managing panfacial trauma with mandibular fracture.

Methodology.

100 patients from all over Maharashtra reported to department of oral and MAXILLOFACIAL surgery

Group 1 : 50 patients with mandibular fracture treated with bottom to top and approach inside out approach

Group 2 : 50 pt with mandibular fracture treated with top to bottom and outside in approach

Results / Findings

Successful reduction and fixation of mandibular fracture: Report the successful reduction and fixation of the mandibular fracture using a bottom-to-top and inside-out approach.

2. Restoration of occlusion and facial aesthetics: Describe the restoration of the patient's occlusion and facial aesthetics post-treatment.

3. Improved functional outcomes:

Report improvements in the patient's mouth opening, chewing, and swallowing abilities.

4. Minimal complications: Document any complications that arose during or after treatment and how they were managed.

Conclusion / Implications:

Thorough anatomical knowledge and expertise of the maxillofacial surgeon is must for managing a case of pan facial trauma using either of the approaches. To conclude; a minimally invasive approach should be used to treat the panfacial fractures(15). Early surgical intervention to reduce and fix the fractures using miniplate osteosynthesis after stabilising the trauma patient yields good postoperative results.

Patients with complex facial injuries should be informed pre operatively regarding the need for a secondary correction surgery at a later stage. The survival approach to facial fracture management should focus on attaining proper occlusal, vertical and horizontal relationships or the facial frame along with restoration of orbital, oral and nasal cavities.

Keywords: Panfacial Mandibular Trauma, Facial Contour Restoration, Bottom To Top Outside in Approach, Rigid Internal Fixation

BLACK FUNGUS IMPACT: AN EPIDEMIC IN COVID PANDEMIC

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On survey in India, One of the lethal complication are being observed in the patient who tested covid positive and gradually recovering is fungal disease called mucormycosis. Both black and white fungus was recently declared as an epidemic in 4 states of India. It mainly affects people who are on medication for other health problems, where in it affect tooth, sinus and eye of the patients. White fungus which basically candidiasis, is a fungal infection caused by candida, it

affects the lungs and other body parts of the sufferer. Recently in India there are 9000 cases in which Gujarat has reported 2859 cases, Madhya Pradesh with 752 cases, Chattisgarh with 103 cases, Telangana with 90 cases, Karnataka with 1220 cases and Maharashtra with 2770 cases and 30 deaths, whereas in Nagpur with 284 cases with 7 deaths due to black fungus. In six districts of Nagpur there are maximum cases which are Bhandra, Amravati, Chandrapur, Yavatmal and Wardha. In this 79 were men's and mostly suffering from diabetes. On the other hand white fungus cases are very few as there are 4 cases in Patna, 2 in Gujarat, and 1 in Madhya Pradesh. The present study analyzes that black fungus is way more dangerous as compared to white fungus along with symptoms.

Keywords: Blackfungus, White Fungus

The Invisible Death: Pollution, Public Health, and the Urgent Need for a Breathable Future: Insights from Contemporary Environmental Realities

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In the 21st century, pollution has emerged as one of the most serious yet underestimated threats to human survival and national security. Unlike conventional dangers, this threat is silent, persistent, and deeply embedded in our air, water, soil, and food systems. This work highlights how modern society has shifted from sustainable development to a state of biological bankruptcy, where natural systems are exploited beyond their capacity to recover.

Drawing from ancient Indian wisdom and modern scientific evidence, the study establishes a powerful connection between cultural responsibility and environmental health. Ancient texts such as the Atharva Veda emphasize the sacred duty of humans to protect Mother Earth, a principle that stands in sharp contrast to present-day realities of polluted air and contaminated water. Scientific findings now reveal alarming evidence, including the presence of black carbon particles in the human placenta, indicating that pollution is affecting life even before birth. This discovery suggests that the next generation is being exposed to environmental toxins before taking their first breath.

The narrative further explains how pollution acts as a “shape-shifter,” moving seamlessly across environmental compartments. Extremely high air pollution levels, such as hazardous AQI values recorded in major cities, are closely linked to declining soil and water quality. The discussion connects air pollution events with water contamination crises, demonstrating that surface cleanliness cannot compensate for degraded ecological systems beneath. Key ecological processes, including disruption of the nitrogen cycle and biomagnification of toxic

substances, are examined to show how pollutants accumulate through the food chain and ultimately reach humans.

Beyond health impacts, the study emphasizes the severe economic burden of pollution, contributing to massive losses in national productivity and healthcare costs. The work concludes with a strong call for action, particularly emphasizing the role of youth—not merely as participants, but as drivers of accountability and change. The present generation is identified as the last with a real opportunity to choose between environmental recovery and irreversible ecological decline. Ensuring clean air, safe water, and a healthy environment is presented not as an option, but as a fundamental right essential for a breathable and sustainable future.

Keywords: Environmental Pollution, Public Health, Air Quality Index (AQI), Environmental Degradation, Sustainable Development.

Ultrasonic Detection System

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Ultrasonic detection systems have emerged as versatile tools for non-destructive testing, object recognition, environmental sensing, and human-machine interaction. This study provides a comparative overview of recent advances in ultrasonic technologies, highlighting diverse applications and sensor designs. Laser-ultrasound detection systems demonstrate high sensitivity in surface wave analysis, particularly Rayleigh waves, enabling precise evaluation of material defects and structural health. Complementing this, piezoelectric-based guided wave methods employ Lamb waves to detect damage in metal plate structures, offering efficient long-range monitoring for industrial components. In aquatic environments, capacitive micromachined ultrasonic transducers (CMUTs) facilitate underwater object detection, providing high-resolution sensing with compact MEMS-based devices. Wireless sensor network implementations leverage ultrasonic sensors for vehicle detection and traffic monitoring, demonstrating robust performance in dynamic environments. A systematic review of ultrasonic techniques applied to construction and building materials reveals their efficacy in detecting cracks, voids, and material inconsistencies, emphasizing the versatility of ultrasonic inspection in engineering applications. Recent integration with deep learning enhances anomaly detection from ultrasonic images, combining non-destructive testing (NDT) with AI-driven pattern recognition for improved defect characterization. Ultrasonic scanning methods further enable object recognition and localization in robotics, improving navigation and interaction capabilities. Advanced signal processing with neural networks has been applied to ceramic materials, enhancing defect detection and characterization at microstructural levels. Human-computer interaction benefits from ultrasonic range-Doppler sensing for micro hand gesture recognition, providing intuitive and contactless control interfaces. Finally, innovations in sensor hardware, such as double silicon-on-insulator slot micro-ring resonators, allow highly

sensitive, label-free, and compact ultrasonic detection systems, opening new possibilities for precise measurement in constrained environments. Collectively, these studies highlight the evolution of ultrasonic detection technologies across diverse domains, demonstrating improvements in sensitivity, spatial resolution, and integration with intelligent systems. The convergence of advanced sensor design, signal processing, and AI techniques underscores the potential of ultrasonic detection systems to address challenges in industrial inspection, robotics, human-machine interfaces, and environmental monitoring.

Keywords: Ultrasonic detection, laser-ultrasound, Rayleigh waves, guided waves, CMUT, piezoelectric sensors, vehicle detection, deep learning, object recognition, gesture sensing, micro-ring resonators, non-destructive testing.

Innovative Agri-Tech Solutions for Empowering Rural Farmers (FARMKART)

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Agriculture remains the backbone of India's economy, yet rural farmers often face challenges such as limited access to modern technology, fragmented supply chains, and lack of timely information. Team Farmkart was founded with the vision of bridging this gap by introducing innovative, affordable, and accessible agri-tech solutions tailored to the needs of small and marginal farmers. The motivation behind this work is to empower rural communities, enhance productivity, and ensure sustainability in farming practices.

Objective: The primary objective of this project is to design and implement digital tools and platforms that simplify farming decisions, reduce costs, and improve yield outcomes. Specifically, the work aims to:

- Provide farmers with easy access to quality inputs and advisory services.
- Develop scalable solutions that integrate technology with traditional farming practices.
- Explore models of rural empowerment through digital inclusion and community-driven innovation.

Methodology: The methodology combines field research, digital platform development, and community engagement. Surveys and interviews were conducted with farmers across rural Maharashtra to identify pain points. Based on these insights, Farmkart designed a mobile-first platform offering product recommendations, transparent pricing, and doorstep delivery of agri-inputs. The framework integrates data analytics, supply chain optimization, and user-friendly

interfaces. Pilot programs were launched in selected villages to test adoption rates, usability, and impact.

Results: Preliminary findings indicate significant improvements in farmer satisfaction and productivity. Farmers reported reduced input costs due to transparent pricing and better access to quality products. The digital advisory services helped optimize crop cycles and minimize risks associated with weather and pest attacks. Adoption rates were high among younger farmers, while older generations showed gradual acceptance with community support. The pilot demonstrated that technology-driven solutions can scale effectively in rural contexts when combined with trust-building and localized outreach.

Implications: This work highlights the transformative potential of agri-tech in rural India. By merging innovation with accessibility, Farmkart contributes to sustainable farming practices, economic empowerment, and digital inclusion. The project not only addresses immediate challenges faced by farmers but also lays the foundation for long-term resilience in agriculture. Its implications extend beyond farming, fostering rural development, reducing migration pressures, and strengthening community bonds. Ultimately, Farmkart's model demonstrates how technology can be harnessed to create inclusive growth and ensure food security for future generations.

Keywords: Agri-tech, Rural Empowerment, Digital Innovation, Sustainable Farming, Farmkart

Education Beyond Migration

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India has a literacy rate of 65.88% and out of 12.30 million children between the ages of 6 to 14, 19.2 million are out of school. Of these, only 53% of the population in India has primary schools. The number of child labourers in India is more than 17 percent, of which 90% child labourers are found in rural areas, while 85% are in the unorganized sector. Every year, 5 lakhs children are forced into child labor. Education is a cornerstone of human progress, and its power can be understood through the idea that it is a unique and transformative force, like alchemy, and that knowledge is an abundant resource readily available to those who seek it, especially those most in need. Education is the key to the new global economy, from primary school on up to life-long learning and it is central to development, social progress and human freedom. Everyone has the right to education and everyone should have access to it. Main Objectives are directly providing primary education to children from inattention/migrant families. Explaining the usefulness of education to people from inattention/migrant families. Creating awareness among this. 1) Primary information- questionnaires, direct interviews and video recordings. 2) Secondary information- Newspapers, websites text on this. Conclusion is found, even today, children of underprivileged/migrant workers are deprived of education.

There is widespread neglect of the government towards the disadvantaged/migrant people. There are various schemes regarding education but none of them mention this.

Key word: Humanity, Education, Migrant child, data collection, data analysis, Conclusion, etc

Nesting Ecology of Birds in the Wardha River Freshwater Ecosystem near Morshi, Amravati

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Introduction: Nest building is a critical behavioral adaptation that ensures reproductive success by providing thermal regulation and protection from environmental stressors. While avian nesting is well-documented globally, research in India has predominantly focused on terrestrial and urban habitats. Freshwater riverine ecosystems, characterized by dynamic zones like sandbars and riparian vegetation, offer unique microhabitats that remain significantly understudied in Central India. This study addresses the lack of region-specific documentation regarding how birds adapt their nesting strategies to the fluctuating conditions of the Wardha River.

Objectives / Purpose: The primary goal is to investigate how distinct riverine zones (vegetated banks, sandbars, and shallow margins) influence nesting site selection and structural design. The study specifically aims to compare the proportion of natural versus synthetic materials used across varying levels of human disturbance and to evaluate the impact of microclimatic variables, such as temperature and humidity, on nest placement.

Methodology: Fieldwork will be conducted along the Wardha River near Upper Wardha Dam using a stratified random sampling design, 500m line transects and fixed-point counts will be employed to locate active nests. Nests will be geo-tagged, and site characteristics (height, orientation, and vegetation density) will be recorded. Following abandonment, nest materials will be collected for laboratory analysis to quantify the percentage of natural (twigs, grass) versus anthropogenic (plastics, wires) components.

Results / Findings (Expected): The study expects to document a diverse range of nesting strategies specific to riparian microhabitats. It is anticipated that variations in vegetation

density and substrate type will significantly influence nest dimensions, orientation, and height from the water level. Natural materials such as twigs, grasses, roots, and mud are expected to be the primary components of nest construction. Furthermore, the results are expected to show that microclimatic factors, particularly humidity and shade, are key drivers in nest-site selection along the riverbanks.

Conclusion / Implications: This research provides the first comprehensive baseline data on nesting ecology within the Upper Wardha River. By integrating environmental measurements with threat assessments, the work serves as a critical bioindicator of habitat quality. The findings will contribute to regional conservation management, helping the Maharashtra Forest Department and local agencies identify sensitive breeding areas and guide future habitat restoration efforts for river-dependent bird species.

Keywords: Nesting Ecology, Wardha River, Riparian Zones, Nest Architecture, Anthropogenic Materials, Freshwater Ecosystem

Profiling of Phytoconstituents from *Cajanus cajan* (L.) Millsp, Residues for Potential Valorization

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The present investigation aims to conduct a preliminary phytochemical screening of *Cajanus cajan* (L.) Millsp. to determine the presence of biologically active secondary metabolites using solvent extraction techniques. Fresh and dried plant materials were subjected to successive extraction employing solvents of increasing polarity, namely hexane, chloroform, methanol, ethanol, and aqueous media. The obtained extracts were qualitatively analyzed for major phytochemical classes, including alkaloids, flavonoids, tannins, saponins, phenolic compounds, terpenoids, and coumarins. The findings demonstrated that methanolic and ethanolic extracts contained the widest range of phytoconstituents, highlighting the effectiveness of polar solvents in extracting diverse bioactive compounds. The presence of these phytochemicals underscores the medicinal potential of *Cajanus cajan* and supports its traditional therapeutic applications. This study establishes a foundational framework for future quantitative estimations and bioactivity-guided investigations aimed at exploring the pharmacological and nutraceutical potential of *Cajanus cajan*.

Keywords: *Cajanus cajan*, Phytochemical screening, Solvent extraction, Bioactive compounds; Medicinal plants, Secondary metabolites

Influence of Differential Light Intensities on Growth, Yield, and Quality Attributes of Selected Leafy Vegetables, Fruit Vegetables, Ornamentals, and Microgreens

Olokar Supriya and Khedkar DD

The proposed research investigate the effects of different light intensities on selected leafy vegetables (Fenugreek → *Trigonella foenum-graecum* L. and Spinach → *Spinacia oleracea* L.), fruit vegetables (Tomato → *Solanum lycopersicum* L. and Chilli → *Capsicum annuum* L.), ornamentals (*Chrysanthemum* → *Chrysanthemum grandiflorum* and *Gerbera* → *Gerbera jamesonii* Bolus ex Hook.f.), and microgreens (Wheat → *Triticum aestivum* L. and Mustard → *Brassica juncea* (L.) Czern.). Experiments are onducted under controlled conditions with low, medium, and high light intensities. Growth parameters (plant height, leaf area, biomass), physiological responses (photosynthetic activity, chlorophyll content), and quality traits (nutrient content, antioxidants, pigments, and ornamental quality) will be recorded. The novelty of this study lies in its inclusion of microgreens, which represent a fast-emerging sector in urban farming due to their high nutritional density and short cultivation cycle. By integrating leafy, fruit, ornamental, and microgreen crops, the study generate comparative insights across categories and establish light intensity protocols tailored to each group. The outcomes are expected to benefit farmers, urban horticulturists, and entrepreneurs, while also supporting product development, patents, and academic publications.

Horticultural crops exhibit distinct responses to environmental cues, with light intensity being the most critical among them. While traditional open-field cultivation in India is highly dependent on natural sunlight, controlled environment systems such as polyhouses, shade-nets, and vertical farms require scientific protocols for light regulation to maximize productivity and product quality. Global studies have shown that both insufficient and excessive light intensities can limit productivity. Low light intensities cause poor biomass accumulation and delayed flowering, whereas high intensities may induce photoinhibition and oxidative stress . With the growing importance of high-value horticultural crops in India, particularly in Maharashtra, there is a pressing need to establish crop-specific light intensity recommendations for vegetables, ornamentals, and microgreens.

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