

Vulnerability Level



Low



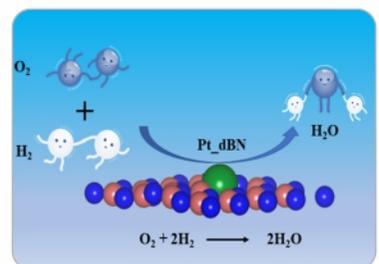
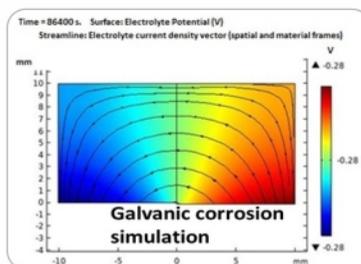
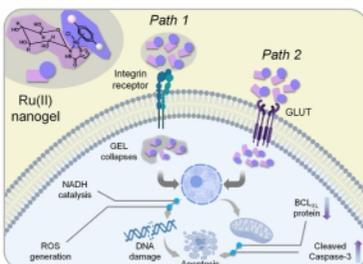
Medium



High



Very High



## Research Spectrum

A Compendium of Graphical Abstracts Illustrating Research at IIT Indore

Office of Research & Development,

**Indian Institute of Technology Indore**

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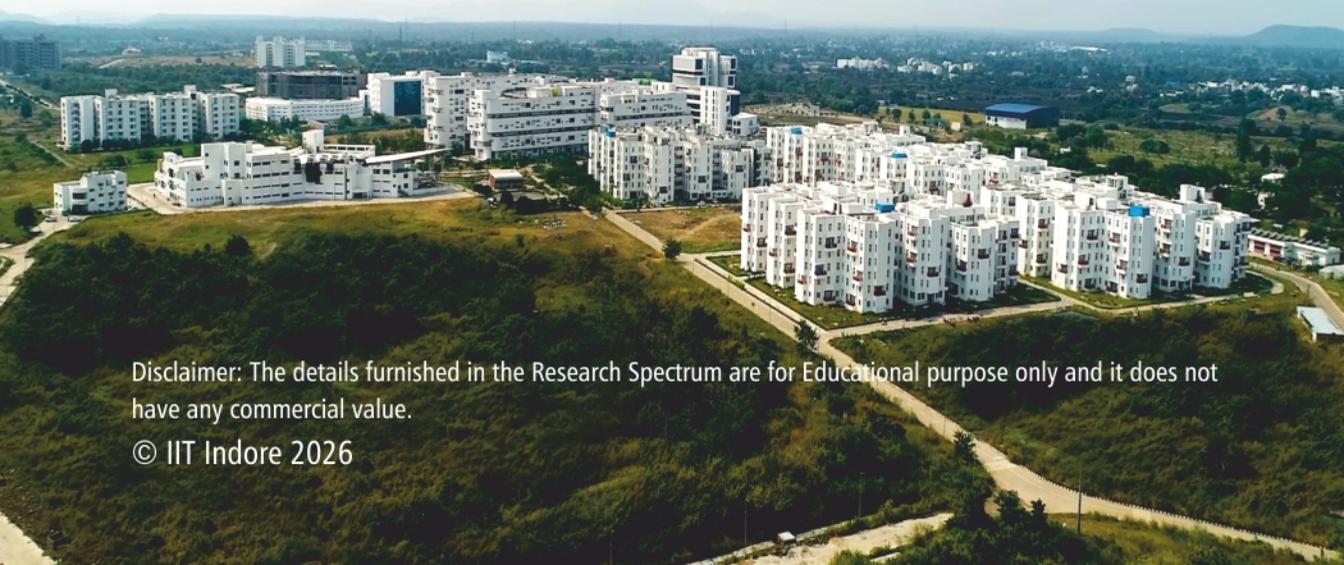
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### Director's Message

With great pride and honour, I write this foreword to the Forth Issue of the Second Volume of 'Research Spectrum'. My heartiest congratulations to the team of Editors, and the executive team from R&D office, Prof. Abhirup Datta, Dean R&D for their consistent efforts in publishing it regularly.

The endeavor of 'Research Spectrum' aims to disseminate wonderful research carried out by the professors and students of IIT Indore, in the form of pictorial abstracts.

We sincerely wish that the readers will find Research Spectrum containing graphical abstracts, easy to understand we hope that it will further help disseminate the novel research ideas depicted therein amongst the avid researchers and lovers of technology.

With best wishes,

**Prof. Suhas S. Joshi**  
Director

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# Recent Trends

## Impact of the Epoch of Reionization Sources on the 21-cm Bispectrum

Leon Noble<sup>1</sup>, Mohd Kamran<sup>2</sup>, Suman Majumdar<sup>1</sup>, Chandra Shekhar Murmu<sup>1</sup>,  
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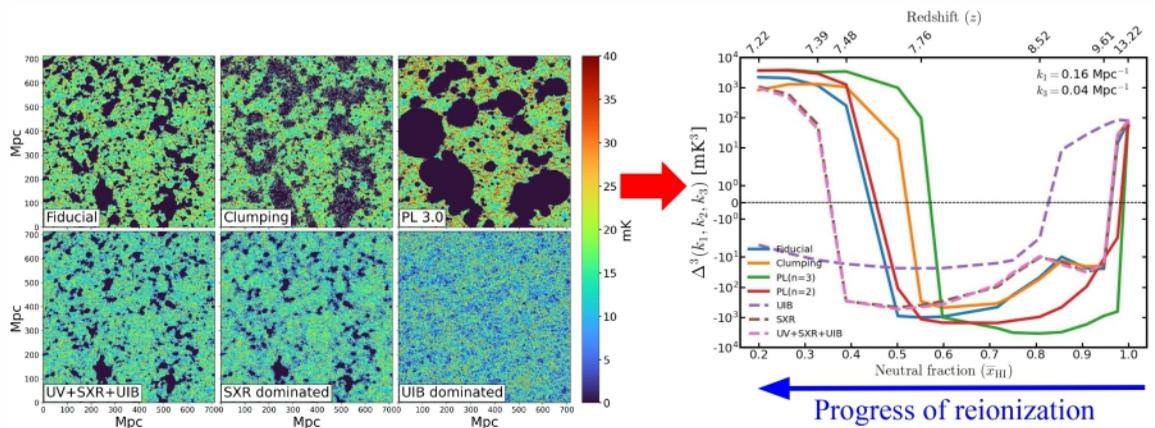


Figure: The left panel shows simulated EoR 21-cm maps as expected in SKA observations for different reionization scenarios. The right panel shows 21-cm bispectrum measured from these observations.

One of the most crucial phases in the history of our Universe is the Epoch of Reionization (EoR), when the first light sources ionized the neutral hydrogen in the intergalactic medium (IGM). The upcoming Square Kilometre Array (SKA), with India as a major partner, will provide the first tomographic observations of this era through the redshifted 21-cm line. Using large-scale simulations developed at IIT Indore, we show that a unique statistic—the bispectrum—can distinguish between different reionization scenarios. With 1000 hours of SKA observations, it will be possible to differentiate between inside-out, outside-in, and a varied mix of reionization morphologies and source models.

This work has been published in the *Journal of Cosmology and Astroparticle Physics*, Volume (2024), Issue 10, id.003, 32 pp. DOI:10.1088/1475-7516/2024/10/003



## A Composition for Sepsis and Method Thereof

Rajat Atre<sup>1</sup>, Alexander G. Obukhov<sup>2,3</sup>, Rahul Sharma<sup>1</sup>, Faaiza Siddiqi<sup>1</sup>, Fletcher A. White<sup>3,4</sup>,  
Syed M. Faisal<sup>5</sup>, Vivek P. Varma<sup>5</sup>, Gajanan N. Darwhekar<sup>6</sup>, Mirza S. Baig<sup>1\*</sup>

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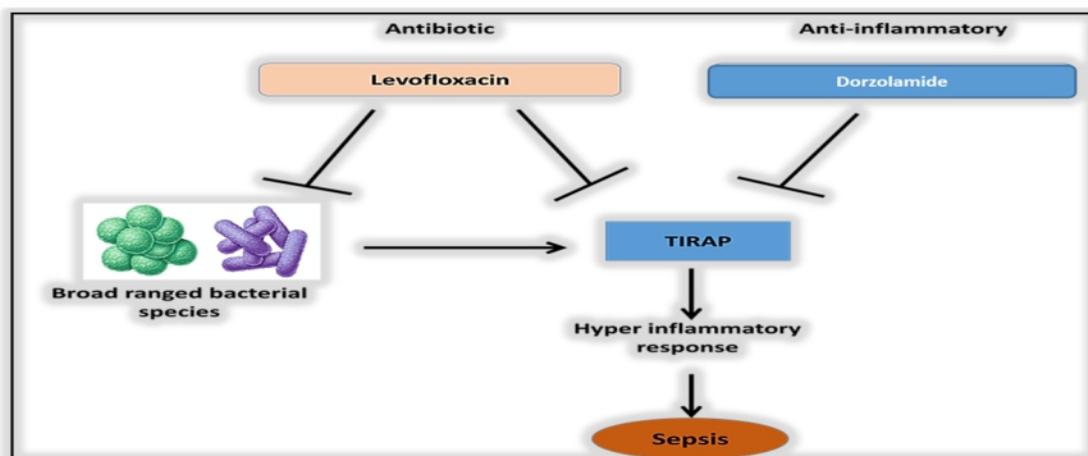


Figure: The diagram shows the key elements of the proposed LeDoz combination therapy for treating sepsis. Levofloxacin and dorzolamide are the two constituents of &quot;LeDoz.&quot; Both drugs inhibit TIRAP activity involved in the pathogenesis of sepsis. Additionally, levofloxacin is a broad-spectrum antibiotic that reduces the bacterial load in septic patients.

This study explored the effect of the combination of levofloxacin and dorzolamide (LeDoz) to target the dual challenges of sepsis—bacterial infection and inflammation-mediated organ damage. In a septic mouse model, LeDoz enhanced survival, reduced cytokines, and restored organ function by normalizing liver, lung and kidney morphology. Mechanistically, levofloxacin reduces bacterial load, while dorzolamide and levofloxacin synergistically target TIRAP-mediated chronic inflammatory signalling in macrophages. The combination mitigated systemic inflammation and tissue damage, demonstrating a dual-action strategy that concurrently addresses infection and host inflammatory cascades. These findings highlight the potential of repurposing existing drugs for improved sepsis outcomes through synergistic antimicrobial and immunomodulatory effects.

The work has been published in *Biochemical Pharmacology*: Baig et al. *Biochem Pharmacol.* (2025), 242, 117353 DOI: <https://doi.org/10.1016/j.bcp.2025.117353>

Indian patent Application No. 202321038927 filed

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## Chitosan–Biotin-Conjugated pH-Responsive Ru(II) Glucose Nanogel: A Dual Pathway of Targeting Cancer Cells and Self-Drug Delivery

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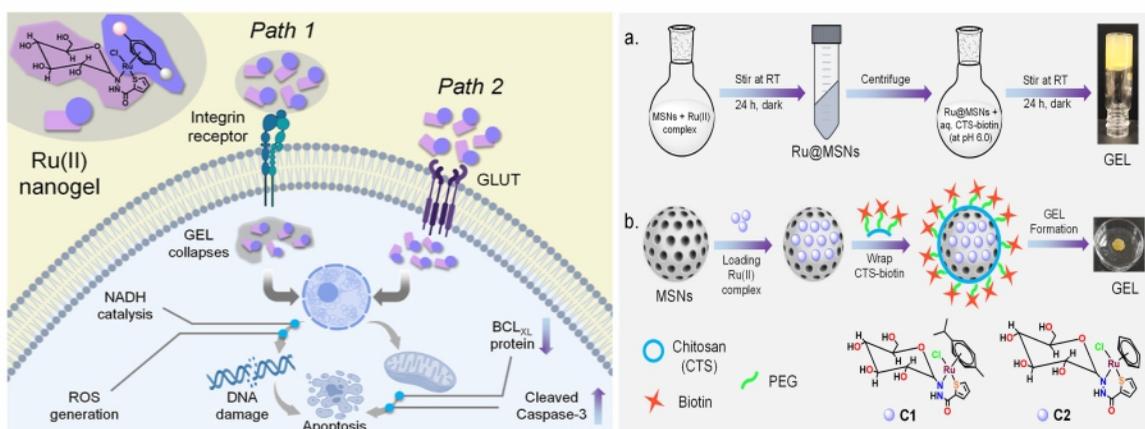


Figure: Synthesis and mechanistic representation of Ru(II)-arene complex loaded nanogels.

This study presents pH-responsive chitosan–biotin nanogels (GC1 and GC2) loaded with ruthenium(II) arene complexes for targeted cancer therapy. These nanogels exploit the acidic tumor environment (pH  $\sim$ 5.5) and biotin's selective targeting to enhance drug delivery. Characterized by advanced spectroscopic and microscopic techniques, the nanogels showed potent, selective anticancer activity ( $IC_{50}$ : 7.50–18.86  $\mu$ M) by inducing ROS-mediated apoptosis via NADH oxidation, DNA binding, and modulation of caspase-3 and BCL-XL. *In vivo* zebrafish assays indicated moderate toxicity ( $LD_{50}$ : 1185.93 and 823.03  $\mu$ M). Overall, these drug-loaded nanogels show promise as chemotherapeutic and chemopreventive agents.

The work has been published in the *ACS Applied Materials and Interfaces*: Pragti et al. *ACS Appl. Mater. Interfaces* (2023), 15, 37, 43345–43358. DOI: 10.1021/acsami.3c07157



## Development of a Low-Cost Bus Cleaning System Prototype

Anshul Gaharwal<sup>1</sup>, Ashutosh Diyewar<sup>2</sup>, Anurag Sinha<sup>2</sup>, Vedansh Shrivastava<sup>1</sup>,  
Atiharsh Bhatt<sup>2</sup>, Gourab Sil<sup>2</sup>, Ayan Mondal<sup>3</sup>, I.A. Palani<sup>1</sup>

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Figure: Snapshot of the developed prototype

A semi-automated bus cleaning system is developed to address the shortcomings of traditional manual and fully automated methods. The cleaning process is segregated into four stages: pre-wash, soap application, scrubbing, and rinsing, where each stage is managed by specialized gates. This structured approach ensures thorough cleanliness while reducing water and energy consumption upto 30%. The system accommodates different size of buses and simplifies operations. The prototype prioritizes speed, sustainability, ease of use, and low upkeep, making it a practical, affordable, and adaptable solution for public transport maintenance. This work is being further extended for full-scale implementation at AiCTSL bus depots.

**The Prototype has been delivered to Atal Indore City Transport Service Ltd. (AICTSL), Indore**

## Catalyst Development and Techno-economic Study of Two-step Catalytic Cracking of Waste Plastic Using Bimetallic/Hierarchical Zeolite Supported Catalysts

Rajan Singh<sup>1</sup>

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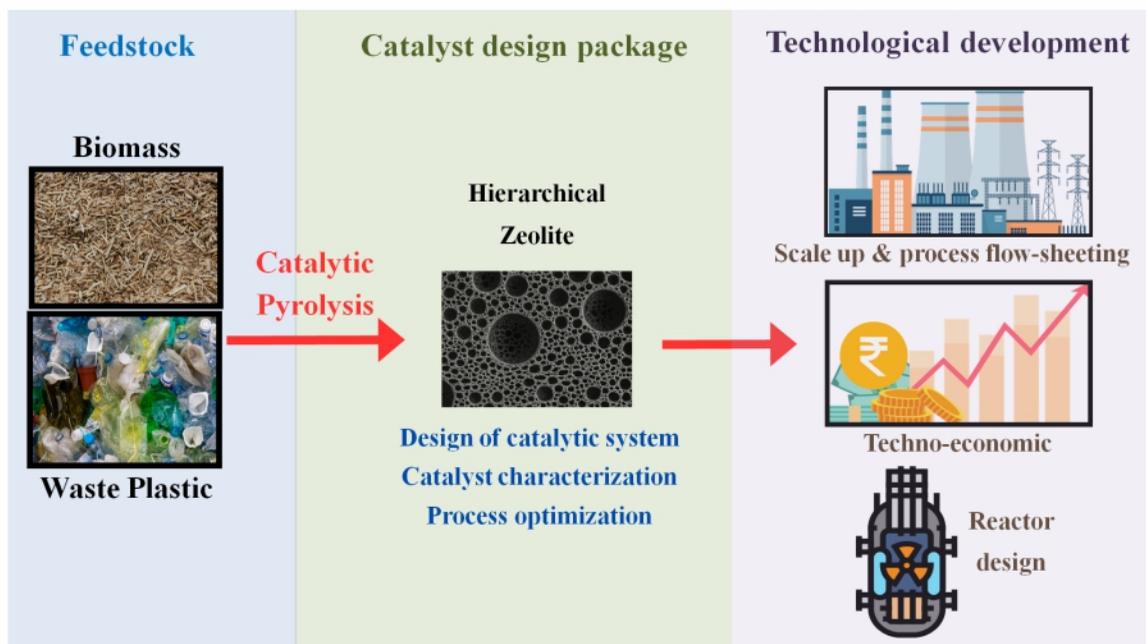


Figure: Catalyst development and techno-economic study of two-step catalytic cracking of waste plastic/biomass using bimetallic/hierarchical zeolite supported catalysts

This project focuses on converting waste plastics into  $C_6$ – $C_{20}$  fuel-range hydrocarbons using bimetallic/ hierarchical zeolite-supported catalysts. Catalysts will be synthesized and screened for performance and selectivity. Key process variables and reactor design will be optimized to enhance product yield and distribution. The project also includes technology development for a scalable two-step catalytic process. A comprehensive techno-economic analysis will assess the feasibility, aiming to deliver an efficient, sustainable solution for plastic waste valorization and fuel production.

Manuscript under construction

## Security Vulnerability (Backdoor Trojan) during ML Accelerator Design Phases

Anirban Sengupta<sup>1</sup>, Aditya Anshul<sup>1</sup>, Vishal Chourasia<sup>1</sup>, Nabendu Bhui<sup>1</sup>

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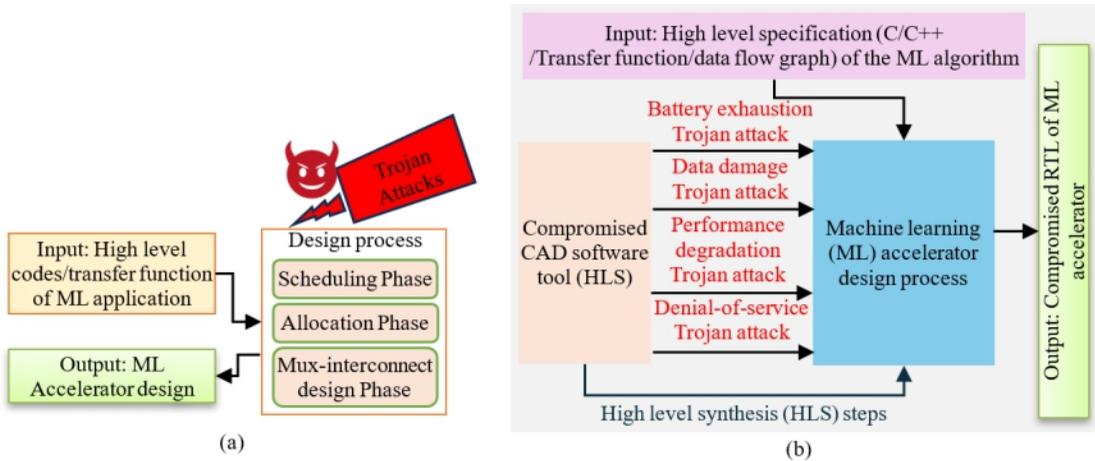


Figure: (a) Overview of Trojan attack during ML accelerator design process, and (b) Established Trojan attacks on ML accelerator

This article offers a comprehensive overview of how hackers/attackers can exploit security vulnerabilities in machine learning (ML) accelerators, such as convolutional neural networks (CNNs), during various design stages. It reviews academic and industrial ML accelerators, detailing points where Trojan attacks may be introduced, triggered, and exploited to degrade performance, damage data, or exhaust power resources. Additionally, the article surveys existing literature on such attacks and discusses detection and mitigation strategies, ultimately recommending a potential solution to enhance ML accelerator security.

The work has been published in IEEE IT Professional, vol. 27, no. 1, pp. 65-72, (2025). Doi: 10.1109/MITP.2024.3519632.



## AI Based Soyabean-Seed Viability Sensor for Assessment of Seed-Quality

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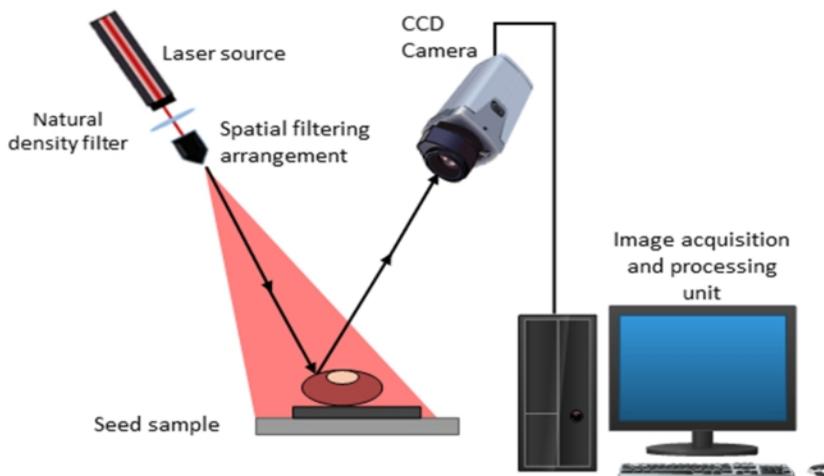


Figure: Experimental setup used for biospeckle image acquisition

Major problems being faced in the agriculture sector are the adverse effects of low quality seeds. The developed solution automates and improves estimation in real-time for seed quality estimation. We have developed and are currently enhancing the deep learning based processing framework for extraction of both spatial as well as temporal features associated with the speckle images. The developed sensor opens an industrial application that can be a useful initiative in agriculture. Automatic seed-testing procedures will help farmers to choose high-quality seeds even in remote areas where experts related to seed testing are not available.

The work has been published in Thakur et al. WRAP (2022), 1–2. "Machine learning based biospeckle technique for identification of seed viability using spatio-temporal analysis." Workshop on Recent Advances in Photonics (WRAP) 2022, IIT Bombay. Doi: 10.1109/WRAP54064.2022.9758219



## Assessment of Livelihood Vulnerability to Climate Change among Tribal Communities in Chhindwara and Dhar District, Central India

Amit Kumar<sup>1</sup>, T. Mohanasundari<sup>1</sup>

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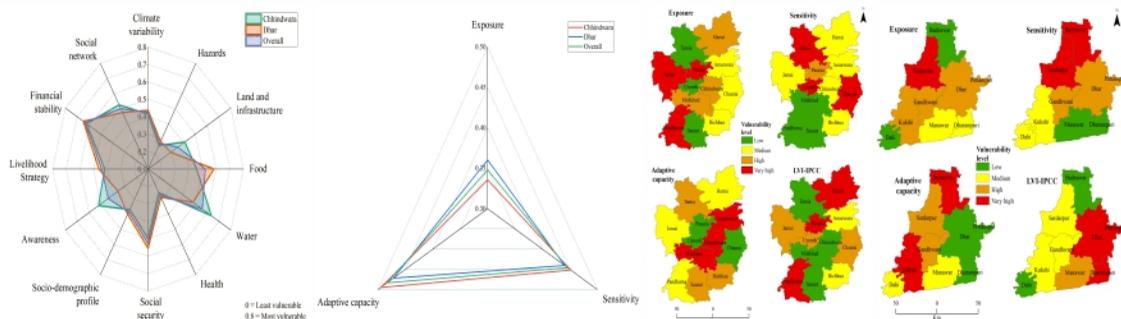


Figure 1: Major components and Contributing factors of the LVI-IPCC

	Chhindwara			Dhar		
Variables	ITA	Slope	P-value	ITA	Slope	P-value
Rain	-0.072	-0.239	0.412	-0.193	-0.476	0.235
Tmax	0.106	0.013	0.001	0.070	0.009	0.001
Tmin	-0.253	-0.005	0.002	0.805	0.015	0.003

Figure 2: Geographical variation of contributing factors and LVI-IPCC of (a) Chhindwara and (b) Dhar districts

Climate change threatens marginalized communities, especially rural and tribal population. This study assessed livelihood vulnerability among tribal households in Chhindwara and Dhar districts, Central India. Using a mixed-method approach, including Innovative trend analysis LVI-IPCC, SPI-1, and Multiple Linear Regression, findings reveal significant climatic shifts, with Dhar being more vulnerable. Key factors influencing vulnerability include income, extreme weather, and water access. Results emphasize the need for targeted policies to enhance adaptive capacity and resilience. Integrating climate data (1954–2023) with household surveys (n=535), this study provides evidence-based insights for sustainable development and climate adaptation in tribal regions.

The work has been published in Scientific Reports: Kumar, A. & Mohanasundari, T. Scientific Reports (2025), 15, 8843. DOI: 10.1038/s41598-025-90769-8



## Impacts of Time-delay in a Bistable Predator-Prey System

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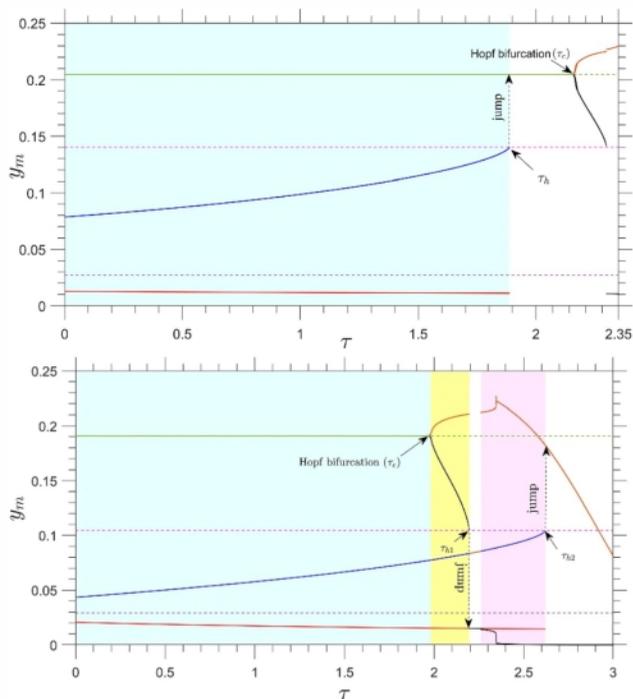


Figure: Bifurcation diagrams illustrating two distinct evolutions of cycle-node bistable mode w.r.t time delay  $\tau$ .

This work examines how time delay could affect predator-prey dynamics with multiple coexisting equilibria. Without delay, the predator-prey system exhibits focus-node and cycle-node bistability. We derive criteria for delay-induced stability switches and analyze how bistability evolves with increasing delay. For focus-node bistability, the system evolves through focus-node  $\rightarrow$  focus-focus  $\rightarrow$  focus-cycle modes. For cycle-node bistability, it follows either cycle-node  $\rightarrow$  cycle-focus or cycle-node  $\rightarrow$  cycle-focus  $\rightarrow$  cycle-cycle transitional pattern. A homoclinic bifurcation is identified, leading to a loss of bistability. Mean population density computations reveal that time delay can be either beneficial or harmful for species conservation.

The work has been published in *Nonlinear Dynamics*: Pati et al., *Nonlinear Dyn.* (2023) 111:22707-22726



## A Detailed Investigation Regarding the Corrosion and Electrocatalytic Performance of Fe-Co-Ni-Cr-V High Entropy Alloy

Girish Khanna<sup>1</sup>, Sarathkumar Krishnan<sup>1</sup>, Mayank K. Singh<sup>1</sup>, Dharendra Kumar Rai<sup>1</sup>, Sumanta Samal<sup>1\*</sup>

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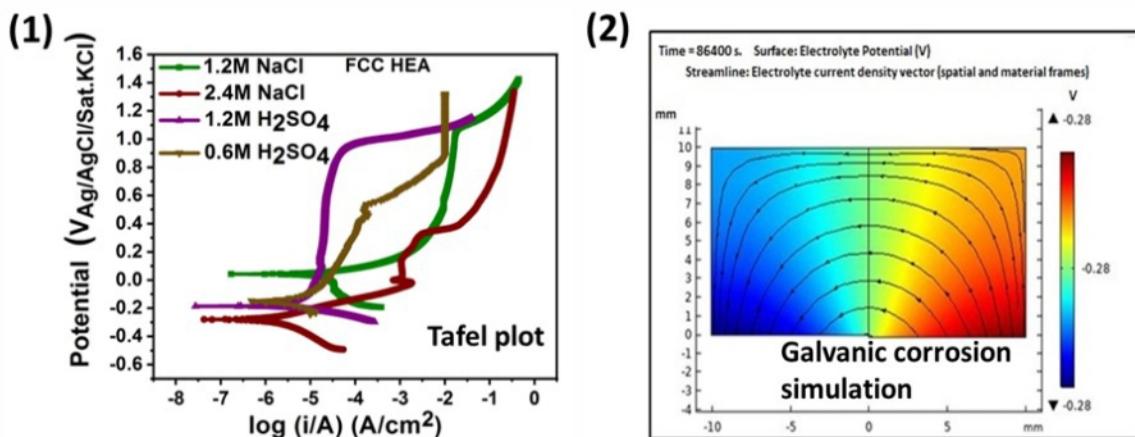


Figure 1: Potentiodynamic polarization curves for HEA in different electrolyte solutions, and Figure 2: Corrosion simulation potential distribution in the electrolyte along the electrode surface of HEA

For the first time, the current investigation reports the experimental and numerical simulation studies on the galvanic corrosion behaviour of a single-phase face-centered cubic (FCC)  $\text{Fe}_{25}\text{Co}_{25}\text{Ni}_{25}\text{Cr}_{20}\text{V}_5$  high entropy alloy (HEA). Based upon the simulation and experimental data, the galvanic corrosion rate was 6.751 mmpy and 7.152 mmpy respectively. The highest passive window of 1.0856 V and good passivation film resistance of 4586  $\text{Ohms.cm}^2$  were observed in 1.2 M sulfuric acid solution. The studied FCC HEA exhibits excellent electrocatalytic activity towards hydrogen evolution reactions (HERs) with low Tafel slope of 68 mV/dec and an overpotential of -355.8 mV.

The work has been published in the *Electrochimica Acta* journal: G. Khanna R et al. *Electrochimica Acta* (2023), 460, 142582. Doi: 10.1016/j.electacta.2023.142582



## IoT-enabled Smart Absorbent Material and Sanitary Device

Kailaash Pandiyan C<sup>1</sup>, Aditi T<sup>1</sup>, Ms. Pragya Singh<sup>1</sup>, Ms. Ayushi Agrawal<sup>1</sup>,  
Ms. Kanishka Goyal<sup>1</sup>, Mr. D J Mistry<sup>1</sup> and Prof. I.A. Palani<sup>1</sup>

<sup>1</sup>Department of Mechanical Engineering, Indian Institute of Technology Indore 453552, India

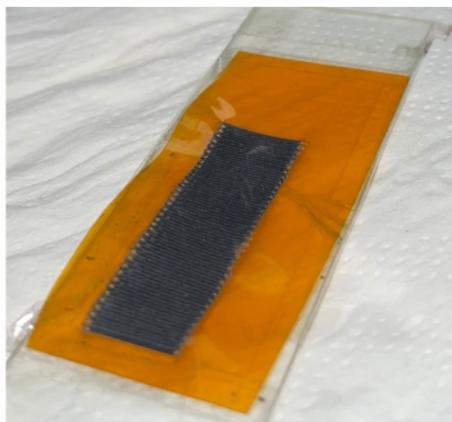


Figure 1: Laser-induced Graphene Electrodes

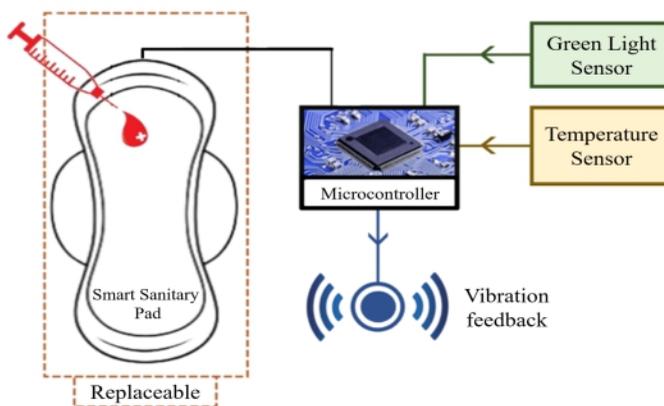


Figure 2: Schematic of the Technology

Prolonged usage of sanitary pads leads to bacterial vaginosis and toxic shock syndrome. Laser-induced graphene (LIG) and thin metal infused in sanitary pads present a solution for leakage detection when integrated into sanitary pads, enabling biofluid detection without directly contacting the skin. An IoT device around the waist enhance health monitoring, detection and personal vibrational feedback upon instant menstruation blood contact and to replace after complete saturation of the pad. The technology allows young girls, women and elderly to track the status of their sanitary pad saturation based on vibrational feedback and an app.

“Let technology unfold societies and beyond”

The work has been patented in India: IoT-Enabled Smart Absorbent Material and Sanitary Device (IN 202321067855)

## Platinum-adsorbed Defective 2D Monolayer Boron Nitride: A Promising Electrocatalyst for O<sub>2</sub> Reduction Reaction

Lokesh Yadav<sup>1</sup> and Srimanta Pakhira<sup>1, 2</sup>

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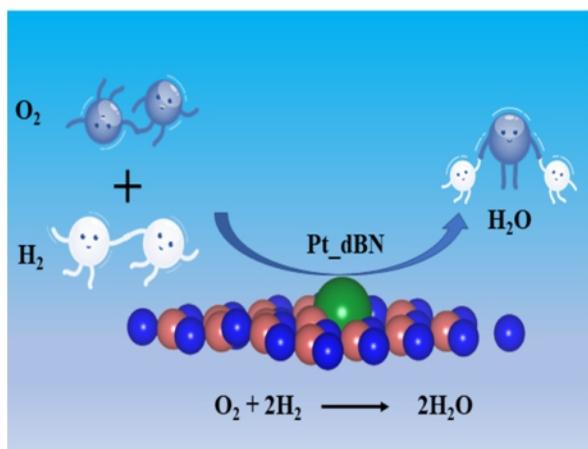


Figure 1: ORR mechanism on the surface of Pt-d-BN material

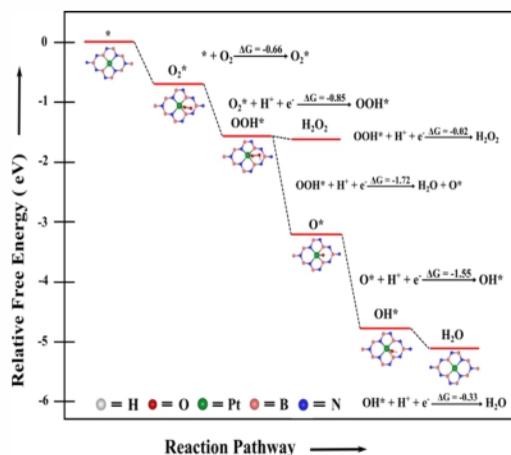


Figure 2: Potential energy surface diagram for the associative ORR mechanism

Hexagonal boron nitride (hBN) has long been considered chemically inert due to its strong covalent bonds and wide bandgap, making it unsuitable for energy conversion applications. To overcome this limitation, we have computationally designed a 2D monolayer hBN with a single nitrogen (N) and boron (B) di-vacancy denoted by  $V_{BN}$  defective-BN (d-BN), to activate the chemical reactivity, which is an effective strategy to use d-BN for potential applications especially in electrochemistry. By introducing a single platinum atom to the  $V_{BN}$  defective area named Pt-d-BN, it functions as a single-atom catalyst (SAC), demonstrating remarkable performance in the oxygen reduction reaction (ORR).

The work has been published in the Royal Society of Chemistry (RSC): Lokesh et al. DOI: <https://doi.org/10.1039/D3TC02399K>





# Major Sponsored Research Projects

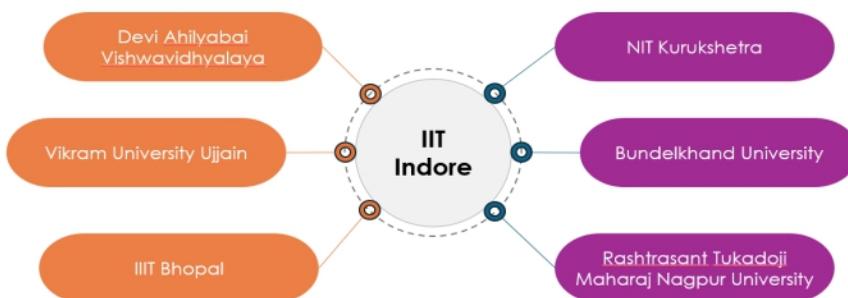
### IIT Indore to Lead Prestigious SAKSHAM Network under ₹100 Crore ANRF-PAIR Grant

Indian Institute of Technology Indore has been selected as the lead institute for the SAKSHAM network (Scientific Advancements in Knowledge for Sustainability, Healthcare, and Materials) under the prestigious ₹100 crore ANRF-PAIR grant. IIT Indore is one of only seven academic institutions to earn this distinguished recognition, reflecting its leadership in pioneering interdisciplinary research.

The SAKSHAM network, with esteemed partners including Devi Ahilya Vishwavidyalaya, NIT Kurukshetra, Vikram University, Bundelkhand University, RTM Nagpur University, and IIIT Bhopal, will focus on advanced materials, sustainability and energy storage, and health and medical technologies.

This initiative underscores IIT Indore’s unwavering commitment to strengthening India’s research ecosystem and empowering state universities, NITs, and IIITs.

#### ANRF PAIR Program Network



#### Thematic Research Areas



## Jaya Prakash Narayan National Centre of Excellence in the Humanities (JPN Centre)

The J P Narayan National Centre of Excellence is a unique centre of excellence established in 2022 at IIT Indore by the Ministry of Education. The JPN Centre has rapidly emerged as a national leader in Digital Humanities (DH) and Environmental Humanities (EH). The Centre has funded 29 diverse research projects across public universities and institutions, investing over ₹1.5 crores to support critical and innovative inquiries in DH and EH. The Centre launched a PhD programme in 2024, and is also preparing to commence an MA programme—marking a major step in academic training and curriculum development in these emerging fields.

The JPN Centre has hosted a wide range of national workshops, symposiums, and international collaborations, cultivating a vibrant scholarly ecosystem. It supports cutting-edge work in digitization, oral history preservation, cultural archiving, environmental data analysis, and ecocritical research, enabling impactful contributions across both Digital and Environmental Humanities. One of the major steps of the Centre recently is the launch of Digital Humanities Intersections (DHI), an open-access, peer-reviewed journal published by KSHIP, IIT Indore, the first Digital Humanities journal from India and one of the very few ones from Asia with a diverse and international Editorial and Advisory Board. JPN Centre with its interdisciplinary research and projects is shaping inclusive, future-oriented humanities scholarship across India.

JPN Website: <http://jpnnationalcentre.com>

DHI Website: <https://dhi.iiti.ac.in/index.php/dhjournal>



## Agriculture and Centre of Excellence (CoE)

AgriHub, an Innovation Hub for Agriculture and Centre of Excellence (CoE) for AI/ML and Deep Learning, was inaugurated on January 27, 2025, at IIT Indore, in collaboration with ICAR-NSRI Indore, ICAR-CIAE Bhopal, and CDAC Pune. Funded jointly by MeitY and the Government of Madhya Pradesh, it aims to transform agriculture through cutting-edge technology. Following inauguration, two workshops were conducted to promote industry-academia collaboration and research commercialization. AgriHub also launched Deep AgriTech Programs, where project proposals were called for funding. These projects span diverse applications like precision farming, genomic tools, drone technologies, and AI-based disease prediction. A Technology Centre is also being established with HPC and private cloud facilities to support large-scale agricultural data analysis and establish a data repository. AgriHub has also launched its Affiliate Membership Programme to connect academia, industry, and students. Members benefit from access to advanced tech resources, discounted training, networking opportunities, exclusive funding, and startup support.



## SwaYaan Project

The SwaYaan Capacity Building Project, launched in September 2022 by the Ministry of Electronics and Information Technology (MeitY), Government of India, in collaboration with IIT Indore, is a five-year national initiative (2022–2027) aimed at revolutionizing drone technology and unmanned aerial systems (UAS). The project seeks to establish a robust UAS ecosystem by enhancing institutional capabilities, setting up collaborative resource centers, and training across the country.

### SwaYaan Project Overview

CI – Dr. Sumit Gautam, Assistant Professor, EE Department, IIT Indore

Co–CI - Dr. Unmesh Khati, Assistant Professor, AASE Department, IIT Indore

Co–CI - Prof. Vivek Kanhangad, Professor, EE Department, IIT Indore

### Committee Members

Prof. Abhirup Datta – Dean R&D & Professor, AASE Department, IIT Indore

Prof. Anand Parey – Professor, ME Department, IIT Indore

Prof. Vimal Bhatia – Professor, EE Department, IIT Indore

Prof. Santosh Vishvakarma – Professor, EE Department, IIT Indore

Prof. P. K. Upadhyay – Professor, EE Department, IIT Indore

Dr. Swaminathan R – Associate Professor, EE Department, IIT Indore

IIT Indore, as a key Participating Institute, has pioneered Proof-of-Concept (PoC) funding, promoted intellectual property creation, and is soon planning to introduce a minor degree program to foster innovation. The project also focuses on solving real-world problems in agriculture, disaster management, and infrastructure monitoring through advanced UAS applications. The Mission of the project is to develop a robust UAS/Drone ecosystem in India by empowering individuals through cutting-edge education, training, and innovation, aligning with the Government of India's vision to make India a global Drone hub by 2030.

Project Achievements (as of now)	
Metric	Details
Bootcamps Organized	9
Students Trained	1023
Proof of Concepts (PoCs)	4
Patents Filed	2
Publications	2



### 5G Lab at IIT Indore

The 5G Lab at IIT Indore funded by Department of Telecommunications (DoT) is a state-of-the-art facility focused on advancing 5G, IoT, edge computing, and network innovation. It features a 5G Core, Radio Unit, IMS for multimedia services, Multi-access Edge Computing (MEC) for low-latency processing, and a Network Management System for real-time monitoring. Security and connectivity are ensured via a router with firewall, multiple 5G SIMs, and an IoT Gateway with diverse environmental sensors. The lab also includes advanced 5G devices like drones, XR headsets, indoor CPEs, cameras, and handsets for testing. Supporting infrastructure includes a UPS, managed switch, 24U rack, and testing tools. The lab enables real-time IoT applications, edge computing, smart surveillance, AR/VR development, and device testing. It supports research, internships, and training for students, faculty, and industry professionals, offering hands-on experience and skill development. Recently, Entrepreneurship Skill Development Programme has been organized and around 40 participants from MSMEs/Startups and faculty members of higher educational institutes have visited the 5G labs facility.



दूरसंचार विभाग  
Department of  
Telecommunications



मानव दूरसंचार  
JOT  
INDIA TELECOM

## AWARD of 5G LAB to IIT Indore



			
<b>5G Server Rack</b>	<b>5G NMS</b>	<b>5G LPRU</b>	<b>5G CPE</b>
			
<b>5G AI Camera</b>	<b>IoT Gateway and Sensors</b>	<b>5G XR/VR</b>	<b>5G Drone</b>

## IITI DRISHTI CPS Foundation, IIT Indore

IITI DRISHTI CPS Foundation, established by IIT Indore, is dedicated to supporting technology development, commercialization, and startup growth. Recently, we have been upgraded to a Technology Translation Research Park (TTRP) in the domain of Digital Healthcare under the National Mission on Interdisciplinary Cyber-Physical Systems (NMICPS) to push Government of India's vision of "Health for All" by backing technology solutions for disproportionate positive impact.

Our initiatives are backed by several Government of India ministries, including the Ministry of Science and Technology, the Ministry of Electronics and IT, and the Ministry of MSME, Indian Armed Forces as well as the Government of Madhya Pradesh and various corporate entities.

In Digital Healthcare, we are actively engaged in developing Human Digital Twin technology to advance Clinical Decision Support Systems. We have strategic partnerships with multiple AIIMS and Indian Army for technology development and validation. We have invested and supported more than 125 Technology Projects and Startups till date.



DRISHTI CPS collaboration with All India Institute of Medical Sciences Bhopal



DRISHTI CPS collaboration with MCTE, Indian Army

## Translational Research Fellowship (TRF) Scheme

The Translational Research Fellowship (TRF) Scheme at Indian Institute of Technology (IIT) Indore is a strategic initiative aimed at accelerating the translation of cutting-edge research into real-world applications. Designed to foster innovation-driven development, the fellowship supports researchers financially in advancing technologies. Under this scheme, fellows work closely with faculty mentors to bridge the gap between laboratory research and market-ready solutions. The fellowship is awarded to UG/PG/PhD students of IIT Indore initially for a period of one year to support translational research aiming to bring innovations from lab to market. It helps the fellow to gain experience in techno-commercial aspects and play a pivotal role in driving translational outcomes. At present there are 11 active fellowship members. By fostering a culture of application-oriented research, the TRF scheme plays a vital role in strengthening the institute's impact beyond academia and positioning it as a hub for technological innovation and deployment. It exemplifies IIT Indore's commitment to nurturing talent that drives change through science and technology and providing encouragement for technology transfer, and industrial partnerships. On a broader aspect, the TRF scheme aligns with the institute's vision of promoting translational research that contributes meaningfully to the economy, society, and national priorities.

### Translational Research Fellowship

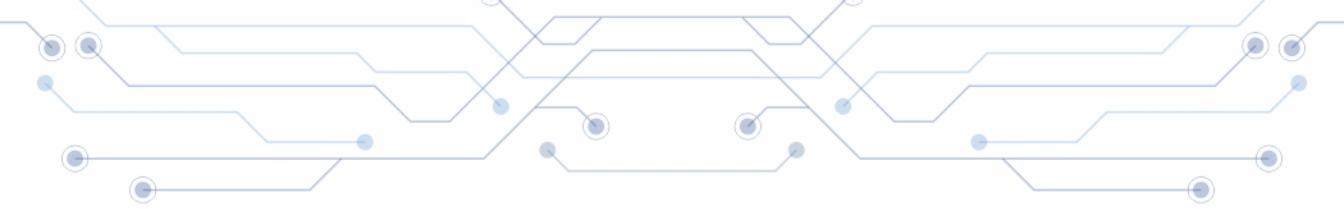


**TRL 1-3**  
( IIT Indore  
Ph.D scholar,  
B.Tech and PG  
students )

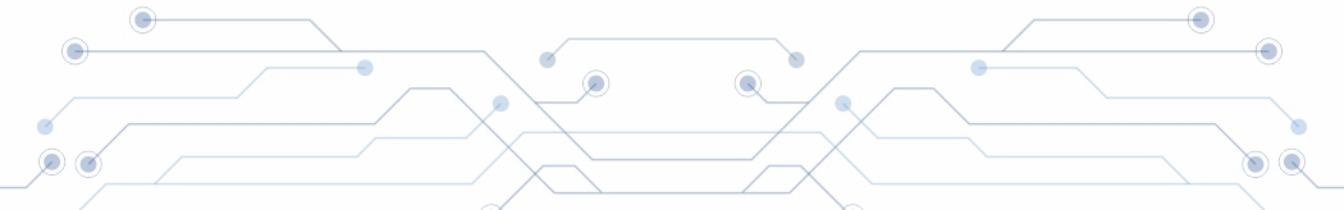
( TRF )

Handholding with  
IPR and Techno  
Commercial Expert

**TRL 5 and  
above**



# News at a Glance



## A Year of Momentum: Strengthening Innovation and IP at IIT Indore

The year 2025 marked a defining chapter in the innovation journey of Indian Institute of Technology Indore, reflecting a sharp rise in intellectual property creation and technology commercialization.

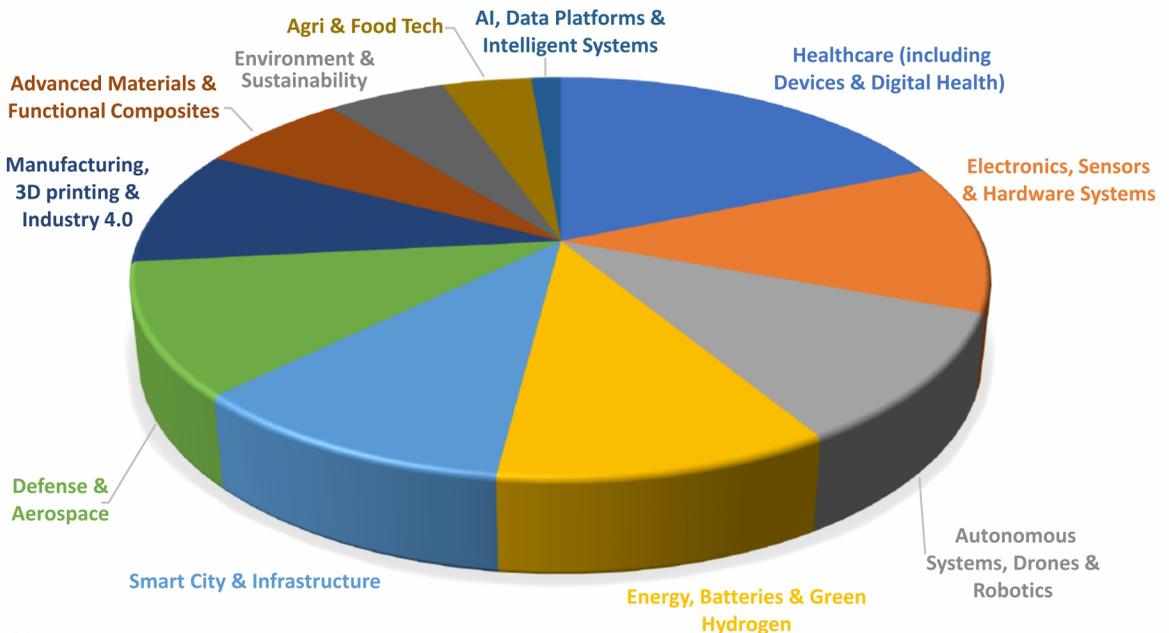
During the year, the Institute filed 75 patent applications, taking the cumulative patent portfolio to 237—a remarkable growth compared to 41 filings in 2024. Progress on the grant front was equally encouraging, with 40 patents granted in 2025, up from 30 grants in the previous year, bringing the total number of granted patents to 116.

Beyond patents, the Institute expanded its IP footprint with the registration of four trademarks and one industrial design, reinforcing brand value and design-led innovation. Technology commercialization also gained momentum: three technologies were successfully licensed, raising the total licensed technologies to seven, while seven technologies were adopted by start-ups, taking cumulative adoptions to twenty.

A notable highlight of the year was the effective utilization of national innovation support mechanisms. Sixty-seven patent applications received financial assistance under the KAPILA scheme for filing, early publication, and expedited examination—accelerating the path from invention to protection.

Together, these achievements underscore the Institute’s deepening commitment to innovation-led research, robust IP creation, and translation of knowledge into societal and industrial impact, positioning IIT Indore as a growing contributor to India’s innovation ecosystem.

### Domain-wise Distribution of Patents filed by IIT Indore (2025)



## World Quantum Day 2025 Celebrated at IIT Indore

The Department of Physics, IIT Indore, celebrated World Quantum Day on 17<sup>th</sup> April 2025, marking a vibrant showcase of innovation and excellence in Quantum Science and Technology. The event featured a captivating keynote by Prof. Anirban Pathak from Jaypee Institute of Information Technology, Noida, who illuminated recent breakthroughs in Quantum Cryptography and its transformative potential for secure communications.

Highlighting IIT Indore's leadership in frontier research, Dr. Bivas Dutta presented his pioneering work on topological Majorana edge modes. The event also hosted a dynamic panel discussion on "The Future of Quantum Technology in India," where Dr. Bodhisatwa Mazumdar, Dr. Ranveer Singh and Dr. Dutta shared strategic insights into the nation's quantum roadmap.

With enthusiastic participation from students and faculty, the event reflected IIT Indore's unwavering commitment to advancing quantum science, reinforcing its role at the forefront of India's quantum revolution.



## Rural Innovators Conclave (RIC) II on 21-22 March 2025

### Summary of the event

The Centre for Rural Development and Technology (CRDT), IIT Indore, organized the Rural Innovators Conclave II on 21–22 March 2025, to promote innovation for addressing rural India's unique challenges. The two-day event brought together rural innovators, entrepreneurs, academics, policymakers, and industry leaders. The first day featured an inaugural ceremony with keynote speeches by prominent figures from IITs and government institutions, emphasizing the need for bridging urban-rural divides through innovation. Sessions focused on sustainable agriculture, renewable energy, and water conservation, showcasing technologies like precision farming, solar and biomass energy, and affordable water management systems. An exhibition displayed practical rural innovations.

Day 2 emphasized collaborative efforts, beginning with a keynote by UGC Secretary Prof. Manish R. Joshi on the role of higher education in rural innovation. Further discussions explored European and Indian rural innovation models, Khadi industries' impact on rural employment, and the importance of incubators in scaling rural startups. Key sessions addressed funding, business development, and technology transfer for rural enterprises.

The conclave concluded with a networking session that fostered collaboration among stakeholders. Key takeaways included the significance of grassroots innovation, cross-sector partnerships, and institutional support in empowering rural communities. CRDT reaffirmed its commitment to rural development, with the conclave serving as a catalyst for future initiatives. The event successfully highlighted the transformative potential of rural entrepreneurship and sustainable innovation for long-term societal impact.



## MP SpaceTech Policy Consultation: Exploring Opportunities and Challenges

Indian Institute of Technology Indore, in collaboration with Madhya Pradesh State Electronics Development Corporation (MPSEDC) under the Government of Madhya Pradesh, hosted the first High-Level Stakeholder Consultation on the SpaceTech sector on June 12, 2025. Titled “MP SpaceTech Policy Consultation: Exploring Opportunities and Challenges,” the event marked a significant step toward formulating a dedicated SpaceTech policy for the state.

The consultation brought together leading industry experts, policymakers, academic researchers, startups, and representatives from Institutes of National Importance to deliberate on emerging trends, regulatory frameworks, infrastructure needs, and commercialization pathways in the SpaceTech ecosystem. Discussions focused on fostering innovation, attracting private investment, and strengthening academia–industry collaboration to position Madhya Pradesh as a competitive hub for SpaceTech development.

The conference served as a strategic platform for knowledge exchange and collective vision-building, laying the groundwork for a forward-looking SpaceTech policy aligned with national priorities and global advancements.



## Celebrating Academic Excellence: Institute Chair Professors at the Forefront of Impact

A moment of pride for the academic community at Indian Institute of Technology Indore.

Heartiest congratulations to Prof. Biswarup Pathak, Prof. Neelima Satyam, Prof. Nirmla Menon, Prof. Raghunath Sahoo, and Prof. Ram Bilas Pachori on their distinguished selection as Institute Chair Professors.

This prestigious recognition stands as a testament to their sustained excellence across research, teaching, mentorship, and academic leadership. Through years of rigorous inquiry and dedicated service, they have shaped scholarly discourse, inspired generations of students, and strengthened the intellectual fabric of the Institute.

As Institute Chair Professors, they now assume a pivotal role—nurturing young faculty, guiding emerging researchers, catalyzing departmental growth, and fostering collaborations that translate knowledge into societal impact. Their leadership will be instrumental in advancing IIT Indore's pursuit of global academic eminence.

We congratulate the awardees and look forward to the enduring impact of their vision, scholarship, and mentorship.



### Abhyuday–3: Advancing Technical Hindi in Science and Innovation

On January 5–6, 2026, Indian Institute of Technology Indore hosted the National Technical Hindi Seminar Abhyuday–3, in collaboration with Indian Institute of Technology Jodhpur and CSIR–National Institute of Science Communication and Policy Research. The two-day national forum brought together scholars, researchers, and practitioners to deliberate on the expanding role of Technical Hindi in contemporary knowledge systems.

#### A Scholarly Milestone: Release of the Smarika

A key highlight of the seminar was the release of the Smarika, a curated volume featuring 26 peer-reviewed research papers presented across two focused thematic sessions:

- Science & Engineering - 12 papers
- Digital Technology & Innovation - 14 papers

The contributions reflected both disciplinary depth and linguistic rigor, demonstrating how advanced scientific and technological discourse can thrive in Hindi without compromising precision or innovation.

#### Bridging Knowledge and Language

Abhyuday-3 reaffirmed the growing significance of Technical Hindi in higher education, research, innovation, and academic administration. The seminar aligned strongly with the national vision of democratizing knowledge—connecting cutting-edge research with vernacular languages to enhance accessibility, inclusivity, and societal impact. Through meaningful dialogue and scholarly exchange, the seminar underscored a shared commitment to strengthening India’s multilingual knowledge ecosystem—where language becomes a catalyst, not a barrier, to progress.



## AIMTDR 2025: Advancing Manufacturing Research at IIT Indore

Indian Institute of Technology Indore hosted AIMTDR 2025 - the All India Manufacturing Technology, Design and Research Conference, one of India's most respected platforms for manufacturing scholarship and innovation. The conference convened leading academicians, industry professionals, and young researchers to exchange ideas shaping the future of manufacturing.

AIMTDR 2025 featured high-quality peer-reviewed research spanning advanced manufacturing processes, product design, materials and composites, automation, digital and smart manufacturing, and sustainable technologies. The technical sessions reflected the sector's rapid evolution, highlighting Industry 4.0, AI-enabled manufacturing, and environmentally responsible practices.

A strong industry-academia interface enriched the conference, with keynote and invited talks offering insights into emerging trends, translational research, and workforce readiness. For research scholars and early-career engineers, AIMTDR 2025 provided a valuable forum to present work, receive expert feedback, and build meaningful collaborations.

Aligned with national priorities of innovation, self-reliance, and sustainable growth, AIMTDR 2025 reinforced the role of research-driven manufacturing in India's global aspirations-positioning IIT Indore as a key contributor to the country's advanced manufacturing ecosystem.



## Workshop on Scientific Project Management @ the Age of AI under SAKSHAM (ANRF-PAIR scheme)

The Indian Institute of Technology Indore) successfully organized a five-day SAKSHAM Workshop on “Scientific Project Management @ the Age of AI” from 2–6 February 2026, bringing together researchers, faculty members, and project professionals to explore contemporary approaches to managing scientific and R&D projects in an increasingly AI-driven ecosystem.

The workshop was designed to strengthen participants’ capabilities in planning, executing, and monitoring scientific projects by integrating classical project management principles with modern digital and artificial intelligence tools. Through a blend of expert lectures, interactive discussions, and practical sessions, participants gained insights into AI-enabled project planning, risk assessment, resource optimization, data-driven decision-making, and performance tracking.

A key focus of the programme was on addressing the unique challenges of scientific and academic projects—such as uncertainty in research outcomes, interdisciplinary coordination, and compliance with funding and reporting requirements—while demonstrating how AI tools can enhance efficiency, transparency, and impact. Sessions also highlighted best practices in proposal development, milestone management, team leadership, and ethical considerations in the use of AI for research management.

By organizing this workshop, IIT Indore reaffirmed its commitment to capacity building and professional development in the research ecosystem, equipping the scientific community with future-ready skills to manage complex projects effectively in the age of artificial intelligence.







Learning Resource Centre



Academic Building



Sports Complex



Central Workshop



Health Centre



Computer & Information Technology Centre



Vindhyaal Guest House



Hostel Accommodation



Nalanda Auditorium



Kendriya Vidyalaya



Seminar Hall



Faculty and Staff Residence



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