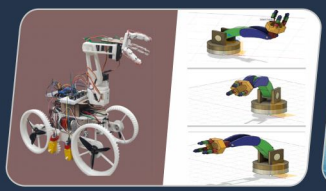
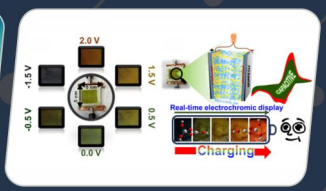
A Handbook of

Ideas, Innovations & Technologies of IIT Indore

2nd Edition Feb' 2025





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Directors' Message

It is with great pleasure that I present the second edition of 'A Handbook of Ideas, Innovation & Technologies of IIT Indore'. It is a compilation of technologies developed by faculty members of IIT Indore along with their students. Over the years, the Institute has been continuously striving to enhance the readiness level of the technologies emanating from the fundamental research that our faculty and students have been undertaking. This compilation presents a brief about the indigenously developed technologies that have been patented or being patented.

We invite the technology enthusiasts, prospective entrepreneurs and the leaders from industries and society, to visit us at IIT Indore to know more details on these technologies. The Institute will make every possible effort to demonstrate the technologies to you. We also solicit your views and suggestions on the technologies.

I want to put on record my most sincere appreciation for the faculty members and students of IIT Indore who have contributed to this edition of the technology compilation. I wish them all success in their endeavours of translating deep-tech or fundamental research into proto-types or products that are useful to industries or members of the society.

We hope that this compilation will help IIT Indore technologies travel miles into society and benefit them in several ways.

With best wishes

Prof. Suhas Joshi
Ph.D., FNAE, FNASc
Director, IIT Indore

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Speech-to-Text/Speech Translation of Indic Languages

The research focuses on Speech-to-Text (S2T) and Speech-to-Speech (S2S) Translation for 15 Indic languages, using cascade, end-to-end, and multilingual models. The study addresses the challenge of low-resource languages by converting source speech into target language text or speech. It utilizes advanced techniques like pre-trained models, data augmentation, and zero-shot learning.

The project includes a 7K-hour English speech dataset, 22 million parallel sentences, and 459 million tokens, using transformers and Language IDs for translation. Applications include online education, subtitles, and accessibility. Dataset creation is completed, and the focus is on improving efficiency for Indic languages.

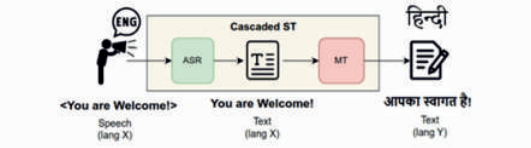


Fig. 1. Cascade Speech-to-Text Translation with source speech in English, intermediate text in English, and output text translation in Hindi.

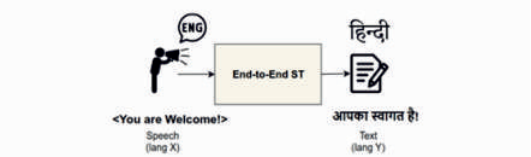


Fig. 2. End-to-End Speech-to-Text Translation with source speech in English and text translations in Hindi.

Patent: Nil

Proposed Relevant Industries: Education, Media & Entertainment, Healthcare, Government & Legal, Social Media & Communication, Accessibility Services, and Business & Corporate

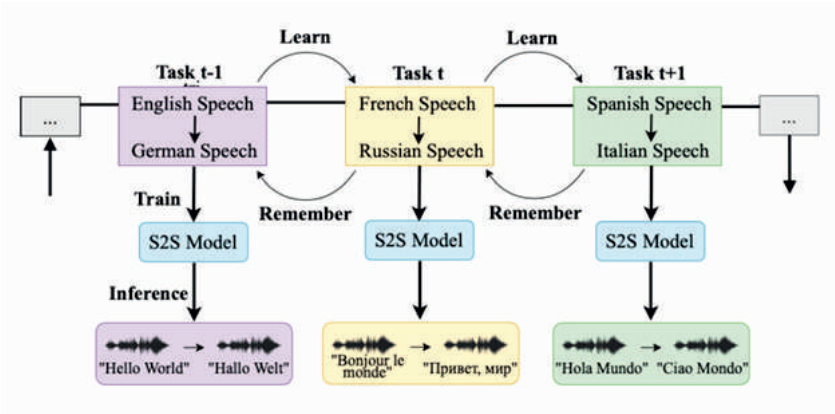
Inventors: Nivedita Sethiya, Dr. Chandresh Kumar Maurya (chandresh@iiti.ac.in), Department of Computer Science and Engineering

A System and Method for End-to-End Continual Speech-to-Speech Translation

This invention is an audio-language machine learning model for multilingual speech-to-speech translation. It uses self-supervised and continual learning, updating the model incrementally while maintaining a replay buffer of previously trained language samples.

The model prevents catastrophic forgetting through gradient-based sampling and a combination of language-proportional and random sampling, eliminating the need to store and retrain on entire past datasets.

The approach enables efficient, lifelong learning for multilingual speech-to-speech systems, supporting incremental updates without performance degradation. It can be used for voiceover.



Patent: Published
Proposed Relevant Industries: Sony, Samsung, Amazon, Netflix
Inventors: Aditi Rao S, Ankit Malviya, Balaram Sarkar, Chandresh Kumar Maurya (chandresh@iiti.ac.in), Department of Computer Science and Engineering

Early disease identification in crops using AI based hyperspectral remote sensing

Crop diseases cause significant crop losses, affecting food security. An end-to-end solution using Deep learning based hyperspectral remote sensing has been developed to detect diseases in soybean leaves at an early stage. The hyperspectral camera captures spectral signatures of chlorophyll content, leaf structure, and water content. The developed model recognizes discriminatory features from hyperspectral data that can distinguish between healthy and diseased leaves yielding realistic disease monitoring. The technology developed can provide an efficient, scalable solution for precision agriculture for other crops as well and prevent the spread of diseases, minimize crop losses and reduce the use of pesticides.

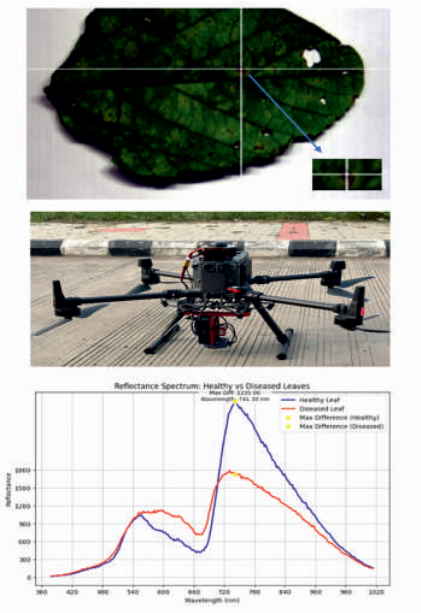


Fig: The top panel shows deceased soybean leaf, middle panel shows the UAV integrated with hyperspectral camera payload and bottom panel shows the spectral variation between healthy and diseased leaf

Patent Status: Nil

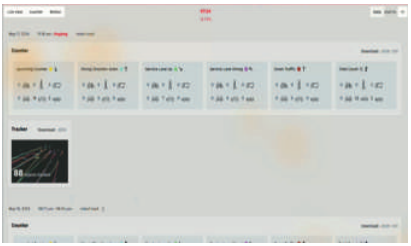
Relevant Industries: Agriculture, Environmental Monitoring, Aerospace and Defense, Forestry

Inventors: Mr. Abhishek Darwai and Dr. Saurabh Das (saurabh.das@iiti.ac.in), Department of Computer Science and Engineering

Video Incident Detection System for Highways

This is a surveillance system based on real-time video anomaly detection using deep learning techniques, aimed at highway safety, effective traffic management, and timely emergency responses. Currently at Technology Readiness Level 4, our system has been rigorously trained and tested on highway toll videos in laboratory settings. Initial results demonstrate better anomaly detection rates compared to traditional methods. Continuous refinements aim to enhance its performance in diverse real-world scenarios, ensuring robust functionality across different conditions. In addition to anomaly detection, our solution offers a comprehensive suite of features: vehicle counting, heatmaps for identifying blind spots, vehicle tracking, multi-axle classification, and speed detection. These features collectively improve traffic management, reduce response times, and minimize accident risks caused by speeding or surveillance blind spots.

Live highway view with vehicle count and classification displayed.

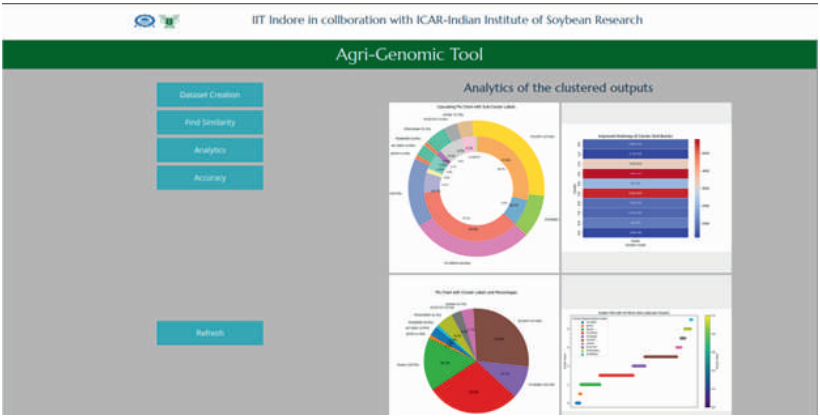


Real time Highway Video Surveillance system dashboard

Patent Application No. / Patent No.: Nil
Relevant industries: Transportation
Inventors: Prof. Aruna Tiwari, (artiwari@iiti.ac.in), Department of Computer Science and Engineering in collaboration with Dr. Sanjay Singh CSIR-CEERI Pilani

AgGeno

AgGeno is an end-to-end plant genome data analysis tool. By identifying special traits for improving seed quality, we aim to cut down the time for production for farmers. The tool is equipped with the integration of pipelines for sequence quality analysis, genomic data assembly, and the establishment of a standardized variant calling pipeline. Novel dataset creation (Soybean SNP sequence dataset) and feature extraction techniques have also been developed. The first prototype consists of algorithms for clustering and classification of genomic data, and a user-friendly Graphical User Interface (GUI) has been developed to streamline data input and output processes.



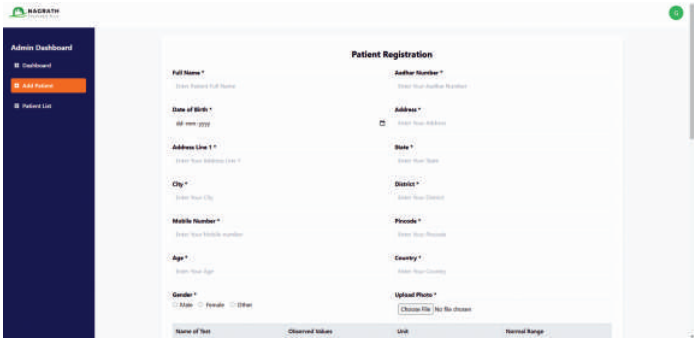
Patent: Nil

Relevant industries: Agriculture

Inventors: Prof. Aruna Tiwari, (artiwari@iiti.ac.in), Department of Computer Science and Engineering in collaboration with Dr. Milind Ratnparkhe, ICAR-IISR Indore & Devaditya Technocrates Pvt. Ltd.

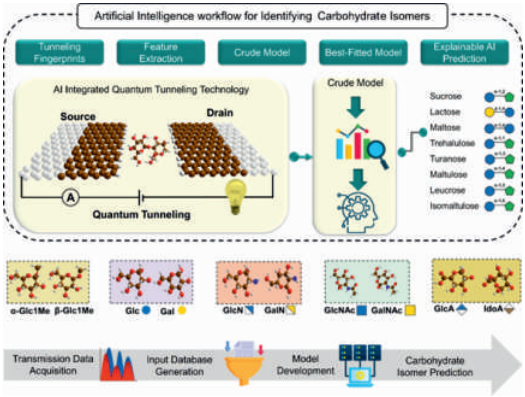
An app for Patient Record Management System for the Rural Area

This application is designed for efficient patient record management, enabling seamless tracking of medical test data. It collects and stores values from 70+ critical blood and diagnostic tests in a centralized database. The app, developed as part of Nagarth Charitable Trust's commitment to equitable community health services for villages surrounding IIT Indore, generates a unique QR code linked to the patient's records. Patients receive a physical card embedded with this QR code, ensuring quick and secure access to their prior test results. During subsequent visits, doctors can instantly retrieve historical medical data by scanning the QR code, facilitating informed diagnosis and treatment planning. This innovative solution streamlines medical workflows, enhances patient care, and reduces redundancy in diagnostic testing.



Patent: Under Process
Relevant Industries: Biomedical databases, Hospital management through
Inventor: Prof. Aruna Tiwari (artiwari@iiti.ac.in), Department of Computer Science and Engineering

Artificial Intelligence (AI) Integrated Quantum Tunneling for Stereoselective & Regioselective Identification of Carbohydrate Isomers



The AI-integrated quantum tunneling approach for stereoselective and regioselective identification of carbohydrate isomers aims to provide a quick and accurate platform for sequencing carbohydrates, a major stumble block in the progress of glycosciences. Carbohydrate isomers, which share the same molecular formula but differ in the spatial arrangement of atoms, pose significant challenges in structural identification due to their subtle variations in pyranose and furanose ring sizes, stereochemistry, anomericity, and diverse regiochemistry of glycosidic linkages. The core objective of our technology is to deliver rapid and cheap high-throughput carbohydrate sequencing by capturing the unique electronic signatures of carbohydrate isomers, encompassing a broad range of anomers, stereoisomers, and regioisomers at single molecule resolution.

Patent(s): Nil

Relevant Industries: AI/ML, Pharmaceutical Industry, Biotechnology, Materials Science, drug development, disease diagnostics

Inventor: Prof. Biswarup Pathak (biswarup@iiti.ac.in), Department of Chemistry

Road Surface Quality Assessment and Monitoring

India has the second-largest road network globally, making maintenance a significant challenge. This system identifies defects, potholes, and road furniture, ensuring transparency and good governance through visualization and reports. Administrators access ground reality on road conditions with a click, enabling accurate material estimation, efficient rectification, budget planning, and repair quality prediction. Existing solutions are either expensive imported products or low-cost smartphone-based systems lacking precision and standards compliance. At TRL 5-6, this system offers a cost-effective alternative. Improved roads enhance connectivity, save lives, boost GDP, and support government schemes, making high-quality maintenance essential for economic growth and public welfare.

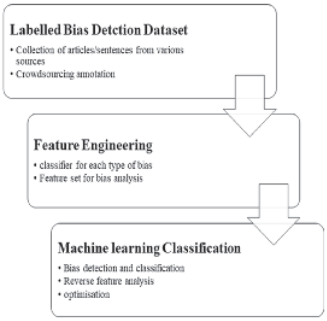
Mounting and Testing of PoC

UI showing comparison video of Before and after, with map

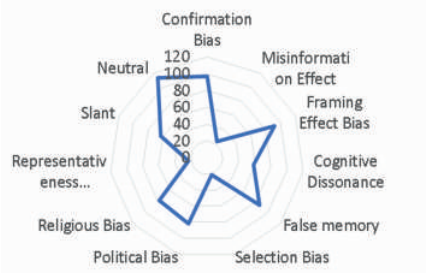
Patent: Under Process
Proposed Relevant Industries: Infrastructure Companies, NHAI, State Road Departments, Smart City, Contractors, and System Integrators
Inventor: Prof. Vimal Bhatia (vbhatia@iiti.ac.in), Department of Electrical Engineering

A Semi-Automated Target-oriented Linguistic Bias Detection and Classification Tool For 1947 Partition Texts

Bias analysis estimates the rationale, direction, and magnitude of systematic errors influencing measures of associations in a text (Lash et al., 2016; Frampton et al., 2022). It helps readers critically review information. This tool categorizes biases across ten linguistic categories in 1947 Partition texts. The dataset includes 6,850 sentences from Partition texts and Wikipedia articles under the NPOV (Neutral Point of View) dispute category. For the detection module, this study adapts the methods from the metrics of Chen et.al (Chen,2020; Chen,2020; Chen,2018) and Pryzant et.al (Pryzant, 2020). Using RNN (Recurrent Neural Network) classifiers with GRU (Gated Recurrent Unit) cells of size 32, the study employs GloVe word embedding dimension of 50, Adam optimizer, and a 0.001 learning rate to detect word- and sentence-level bias strength.



Architecture and workflow of the model



Bias Analysis Results of Urvashi Butalia's The Other Side of Silence

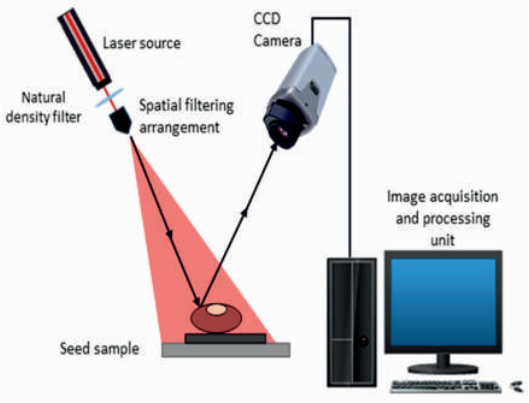
Patent: Nil

Proposed Relevant Industries: Social Media Analytics/ Media/ Scholarly Publishing

Inventors: Justy Joseph, Prof. Nirmala Menon (nmenon@iiti.ac.in), School of Humanities and Social Sciences

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

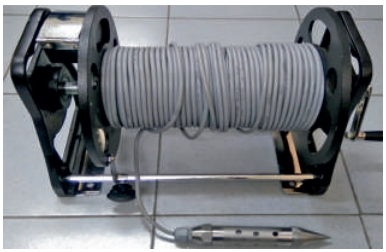
Agriculture is crucial for India's economic and human development. This interdisciplinary work integrates laser biospeckle with deep learning to automate real-time seed quality estimation. A deep learning-based framework extracts spatial and temporal features from speckle images, employing models like convolution neural networks (CNN), deep neural networks (DNN), recurrent neural networks (RNN), and artificial neural networks (ANN). The technology, at TRL 3-4, has no current equivalent; C-DAC's Aanadarpan uses only 2D imaging. This product enables seed testing for farmers in rural and urban areas, supports industries enhancing seed productivity, and serves as a training tool for academic institutes.



Patent: Granted, Indian Patent No. 389627
Proposed Relevant Industries: Farming, Agriculture and Seed Industry.
Inventor: Prof. Vimal Bhatia (vbhatia@iiti.ac.in), Department of Electrical Engineering

Ground Water Management App and Ground Water Level Measuring Device

The technology aims to develop an integrated app and advanced measuring device for effective groundwater monitoring and conservation. The device is an electric switch-type with electrodes connected to a battery, beeper, and LED. The associated app includes a geolocator, water level visualization, comparison, and multilingual features. The technology is copyrighted and transferred to an NGO and four African countries. This system facilitates real-time monitoring, supports informed decision-making, and ensures sustainable water resource management, safeguarding agriculture and enhancing climate resilience. It also promotes community engagement and environmental stewardship, contributing to socio-economic well-being and responsible resource utilization.



Patent: The Ground Water Management App developed by IIT Indore under the supervision of Prof. Aruna Tiwari in collaboration with RuTAG IIT Delhi has been copyrighted jointly with IIT Delhi. Proposed Relevant Industries: The app is given to an NGO, Ramkrishna Jaidayal Dalmia Seva Sansthan, Block-Chirawa, Dist- Jhunjhunu, Rajasthan (Bhupendra Paliwal, Project Manager) on Sept. 28, 2022, The complete unit (Groundwater level measuring device and Groundwater Management app) is presented to African Asian Rural Development Organization (AARDO) member countries (Sudan, Namibia, Zambia, and Ghana) in a technology awareness and outreach event, a joint initiative of AARDO & office of PSA to the Government of India. Inventors: Anjali Gupta, Deepali Sukhija, Deepika Sukhija, Subir Kumar Saha, Dr. Davinder Pal, Prof. Aruna Tiwari (artiwari@iiti.ac.in), Department of Computer Science and Engineering

Development of Mobile App for Farmers to Help Them in Agricultural Activities: Krishi Sewa

The "Krishi Sewa" app assists farmers and stakeholders with potato crop management. It features identification of 17 major diseases and insects, confidence score and threshold mechanisms, and a database creation facility. The app asks questions related to symptoms to confirm diseases. Future plans include integrating Machine Learning models for disease and pest prediction using weather and other parameters, with precision agriculture, image processing, and AI/ML technologies. Currently in its final stage, the app will be used by ICAR-CIAE Bhopal. Developed under the Center for Rural Development and Technology (CRDT), IIT Indore, it aims to improve crop yields and empower farmers.

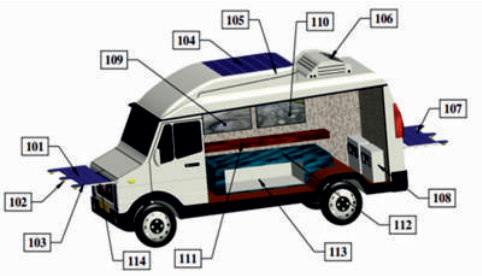
Patent: Upon completion of the app, it will be copyrighted and given to ICAR-CIAE for future use.

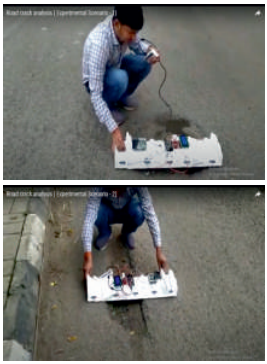
Proposed Relevant Industries: ICAR-CIAE Bhopal, NGOs, Farmers

Inventors: Prof. Aruna Tiwari (CSE), Krish Agarwal, Divya Agarwal, Yash Vasistha, Shashi Rawat, Prof. Aruna Tiwari (artiwari@iiti.ac.in), Department of Computer Science and Engineering

A Smart Road Asset Management System and Method There of

The Smart Road Asset Management System helps estimate potholes, cracks (including bleeding, block cracks, edge cracks, longitudinal cracks, ravelling, transverse cracks), and other damages, reducing workforce, equipment, time, and cost. It calculates total area and budget for road maintenance (Rural/Urban/ Highway) and assists with road maintenance tenders. Developed and delivered, the technology aims to reduce manpower in crack identification. In India, it enhances road infrastructure maintenance, reducing accidents, travel time, and vehicle wear, while improving safety and sustainability. The system also promotes smoother traffic flow, reduces fuel consumption, and creates tech-sector job opportunities, supporting India's smart infrastructure goals.

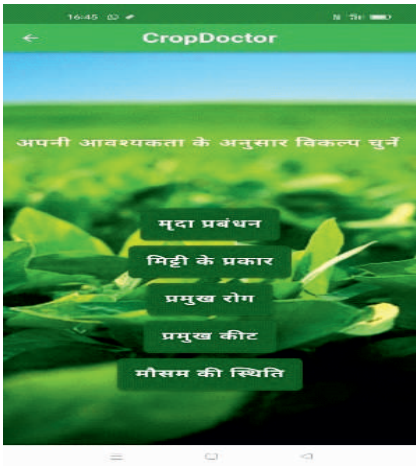




Patent: Granted, Indian Patent No. 440090
Proposed Relevant Industries: Transportation
Inventors: Ashish Verma, Neetesh Kumar, Sanjay Patidar, Upendra Singh, Prof. Aruna Tiwari (artiwari@iiti.ac.in), Department of Computer Science and Engineering

Crop Doctor : An Extensive Soybean Information App

The Crop Doctor app helps identify diseases and insects in Soybean crops. It provides information on major diseases, insect identification, soil health, and weather in English and Hindi. The app has been developed and is in the copyright process. Soybean, a vital oilseed crop in India, faces yield losses due to pests and diseases. This app allows farmers to upload crop pictures, identify issues, and receive treatment suggestions. It promotes sustainable farming by enhancing soil health using biological control agents. Developed under the Rural Technology Action Group (RuTAG) initiative, the app supports farmers in managing pests efficiently and economically.



Patent: Currently this App is in Copyright Process.

Proposed Relevant Industries: ICAR-IISR Indore, Agricultural NGO 'Samarth Society', Bhopal

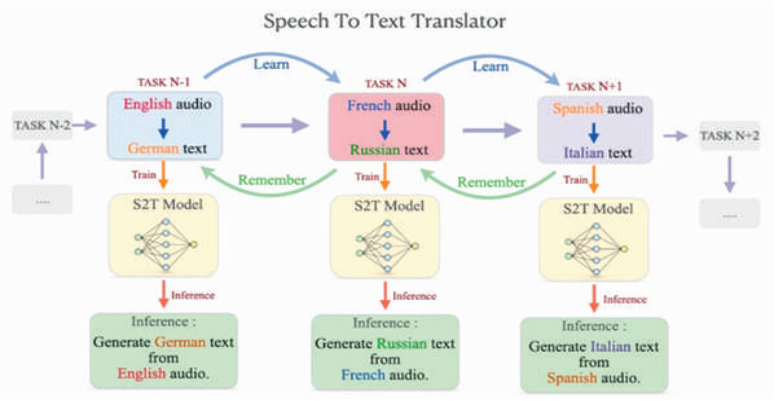
Inventors: Rajesh Dwivedi, Pranjal Gadge, Parul Mogre, Dr. Milind Ratnaparkhe, Prof. Aruna Tiwari (artiwari@iiti.ac.in), Department of Computer Science and Engineering

System And Method For Speech-To-Text Translation Based On Continual Learning Technique

This invention presents a system for end-to-end speech-to-text translation with continual learning. The model converts speech in one language to text in another while updating itself to prevent performance degradation across multiple languages.

The model supports incremental learning by maintaining a replay buffer of previously trained language samples, eliminating the need to store all past data. It prevents catastrophic forgetting through gradient-based sampling followed by a mix of language-proportional and random sampling.

This approach enables efficient, lifelong learning, enhancing multilingual speech-to-text systems without retraining on entire datasets.



Patent: Published

Proposed Relevant Industries: Sony, Samsung, LG, Boat

Inventors: Ankit Malviya, Balaram Sarkar, Prabav Karande, Chandresh Kumar Maurya (chandresh@iiti.ac.in), Department of Computer Science and Engineering

System and Method for Summarization of Speech to Text/Speech Translation

This work introduces a cross-lingual speech-to-text/speech summarization system that converts speech in one language into summarized text/speech in another. The two-stage cascade model integrates speech recognition, machine translation, text summarization, and text-to-speech synthesis, optimized for low-resource languages like Hindi, Bengali, and Tamil.

The approach uses synthetic datasets and pre-trained models like BART, mT5, and mBART, employing a two-stage pipeline to reduce training time and error propagation. Potential applications include news summaries, educational content localization, and accessibility for multilingual audiences. The dataset and baseline models are ready for public release.

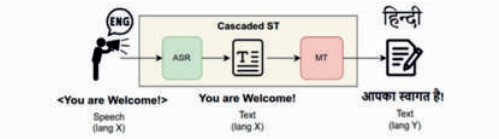


Fig. 1. Cascade Speech-to-Text Translation with source speech in English, intermediate text in English, and output text translation in Hindi.

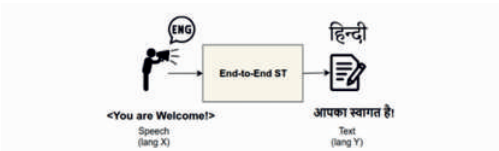
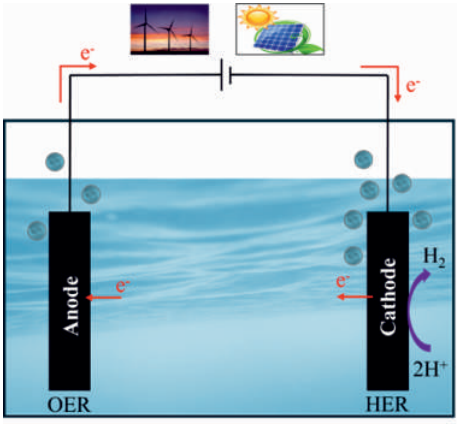


Fig. 2. End-to-End Speech-to-Text Translation with source speech in English and text translations in Hindi.

Patent: Under Process (Indian Patent application No. 202421035153)
Proposed Relevant Industries: Information Technology, Education, Media & Entertainment, Healthcare, Customer Support, Government & Public Services, E-commerce, and Telecommunications
Inventors: Nivedita Sethiya, Balaram Sarkar, Dr. Chandresh Kumar Maurya (chandresh@iiti.ac.in), Department of Computer Science and Engineering

Clean Energy & Renewable
(Including Hydrogen & EV)

Renewable Hydrogen Production for Sustainable Energy Solutions.



H_2 has gained prominence as a renewable energy carrier, serving as a cornerstone for achieving sustainable energy solutions. Our research is dedicated to developing efficient and cost-effective strategies for H_2 production through water splitting, utilizing advanced electrocatalytic materials. These state-of-the-art catalysts demonstrate exceptional properties, delivering superior performance in the H_2 evolution reaction (HER) under ambient conditions. Integrating innovative material design with renewable energy principles aims to accelerate the transition to green hydrogen production while ensuring industrial scalability. Ultimately, this work contributes significantly to global efforts to achieve decarbonization and sustainable energy systems.

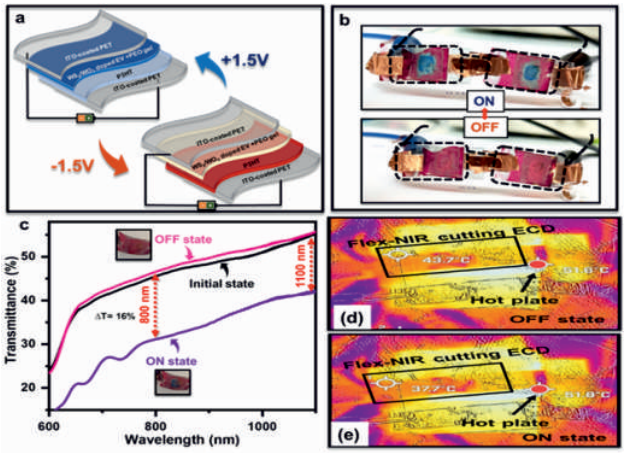
Patent(s): Nil

Relevant Industries: Chemical Manufacturing, Energy Production, Construction Materials, Agriculture

Inventor: Dr. Srimanta Pakhira (spakhira@iiti.ac.in), Department of Physics and Centre for Advanced Electronics (CAE)

Technology for developing thermal eye-soothing electrochromic goggles

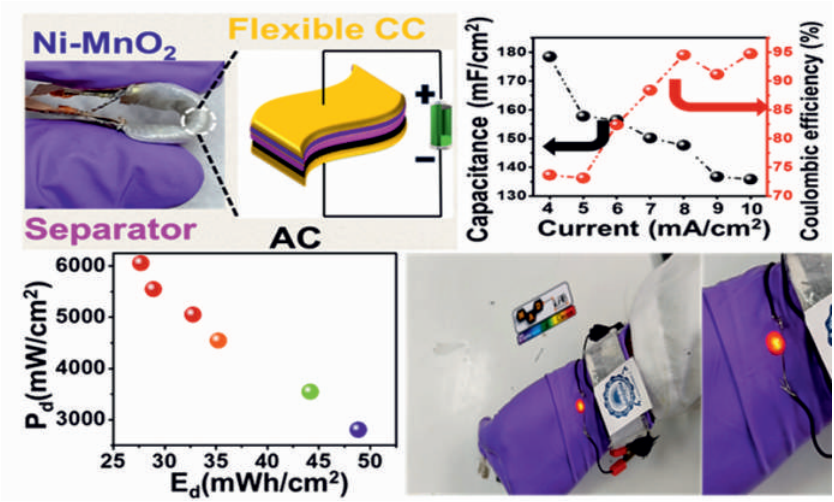
A highly flexible prototype goggle based on WS_2/WO_3 with heat filtering capabilities has been developed and demonstrated to have a heat-soothing effect. The electrochromic goggle shows high near-infrared shielding by maintaining a temperature difference of 6°C and cuts more than 15% of the heat in the ON state. The prototype delivers an optical modulation of 60% and a photopic coloration efficiency of 34 cm^2/C along with excellent cyclic stability. The real-world applicability has been demonstrated by making mini-goggles that change color between blue and magenta and cut heat making a way for designing flexible and bendable heat-soothing eye-care gadgets.



Patent: Nil
Proposed Relevant Industries: Eyewear Goggles
Inventors: Bhumika Sahu, Love Bansal, Nikita Ahlawat, Deb Kumar Rath, Subin Kaladi Chondath, and Prof. Rajesh Kumar, Department of Astronomy, Astrophysics and Space Engineering

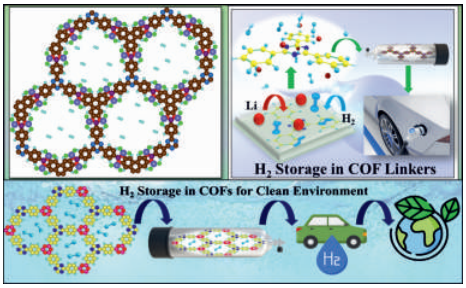
Technology for developing wearable supercapacitor based on Ni-MnO_2

The present work reports a technology for the fabrication of an asymmetric all-solid-state wearable supercapacitor (ASWSC) device using a nickel-doped manganese oxide (Ni-MnO_2) electrode. The ASWSC device demonstrates super-bendability with excellent energy storage capability delivering a high specific capacitance of 178 mF/cm^2, 95 % coulombic efficiency, and an impressive power density of 6056 mW/cm^2 at 28 mWh/cm^2. A wristband-type ASWSC device fabricated by connecting two devices in series for glowing a red LED for a few minutes reveals the practical importance of the device in flexible electronics.



Patent: Nil
Proposed Relevant Industries: EV, automobiles
Inventor: Subin Kaladi Chondath, Love Bansal, Bhumika Sahu, Nikita Ahlawat, Prof. Rajesh Kumar, Department of Astronomy, Astrophysics and Space Engineering

Onboard H_2 storage in porous materials for vehicular applications.



Hydrogen, with its high energy density and zero-emission potential, is a promising candidate for future transportation fuels, particularly in fuel cell vehicles. However, challenges related to its production, storage, and transportation persist. Among the safest storage methods, the interaction of H_2 with porous materials via chemical or physical adsorption is highly regarded. Metal-organic frameworks and covalent organic frameworks offer high surface area, rapid sorption-desorption kinetics, and large pore volume, making them ideal candidates for hydrogen storage. We have investigated the H_2 storage properties of various metal-doped and chelated COFs and MOFs using DFT methods, providing valuable insights into H_2 physisorption behavior. These findings contribute to the design of efficient, reversible storage materials under ambient conditions.

Patent(s): Nil
Relevant Industries: Research and Development Institutes, Material Science and Nanotechnology Laboratory, Automotive Industries, and Energy and Utilities Sector.
Inventor: Dr. Srimanta Pakhira (spakhira@iiti.ac.in), Department of Physics

A thin film rechargeable battery and method thereof

Our research work on advanced electrical energy storage, establishes the potential of light-weight, binder-free thin-film electrodes for safer, low-cost, rechargeable Li-ion battery with high performance. We have developed the prototype of a thin-film rechargeable Li-ion battery consists of novel lightweight, binder-free, cost-effective, environment friendly tin-oxide (SnO_2) composite-based cathode with current collector, and Li as anode, which exhibits remarkably high performance delivering extremely high capacity, stability and lifetime (1430 mAh g^{-1} and 1160 mAh g^{-1} even after 100 and 400 cycles respectively), high-rate capability (300 mA g^{-1}), and high coulombic efficiency (98-99%), as compared to the standard graphite and the other available cathodes.

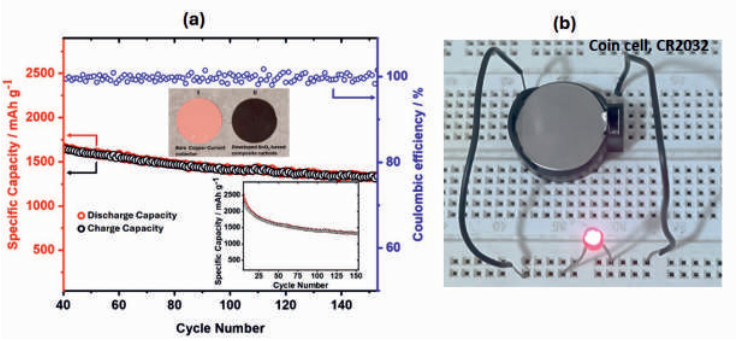
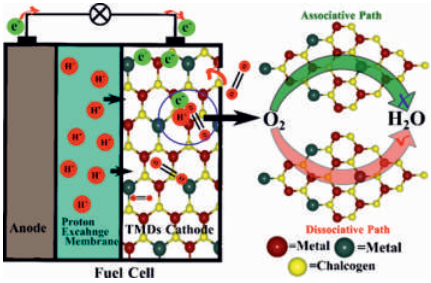


Fig: Performance of the thin-film battery prototype was tested through lighting up the red LED in requisite time scale.

Patent(s): Filed, Indian Patent Application No. 202421038081
Relevant Industries: Energy storage, Battery industries
Inventors: Prof. Sudeshna Bandyopadhyay (Chattopadhyay) (sudeshna@iiti.ac.in), Banadeep Dutta, Adi Pratap Singh, Department of Physics.

Revolutionizing Oxygen Reduction Reaction (ORR) Through Novel Electrocatalyst Design with Advanced Computational Methods



The exploration of inexpensive electrocatalysts with excellent catalytic activity and chemical stability for the oxygen reduction reaction (ORR) is crucial for the widespread adoption of sustainable and renewable energy conversion technologies in practical applications. The two-dimensional transition metal dichalcogenides (TMDs) and carbon nanotubes (CNTs) have demonstrated a great capability to serve as substitutes for conventional catalysts (Pt) support owing to their considerable advantages such as large specific area, high electric conductivity, tunable properties, robust durability, and resistance to byproduct poisoning. We explored the potential of the two-dimensional Pt-doped zirconium disulfide (Pt-ZrS_2), Nb-doped zirconium diselenide (Nb-$ZrSe_2$), and Co nanoparticle encapsulated single-wall carbon nanotubes (Co@SWCNT) as efficient electrocatalysts for ORR.

Patent(s): Nil
Relevant Industries: Renewable Energy Sector (including fuel cells and metal-air batteries), Catalysis and Electrocatalysis, Green Energy Technologies.
Inventors: Dr. Srimanta Pakhira (spakhira@iiti.ac.in), Department of Physics and Centre of Advanced Electronics (CAE).

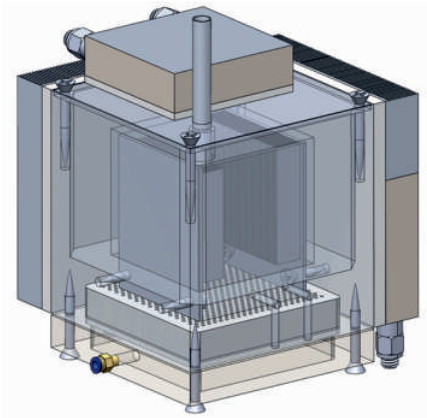
Unraveling the O_2 Reduction Reaction on 2D Monolayer $LaNiO_3$ Perovskite

The transition to clean energy is vital for a sustainable future. Hydrogen, as a versatile energy carrier, holds immense potential for decarbonizing industries, transportation, and energy storage. Coupled with the rise of Electric Vehicles (EVs), powered by renewable energy sources, the global push for reducing greenhouse gas emissions is gaining momentum. Innovations in hydrogen production, such as green hydrogen, and advancements in EV battery technology are accelerating this shift. These developments not only mitigate climate change but also foster energy independence, making clean energy solutions a cornerstone for achieving global environmental and economic goals. We theoretically studied the structural and electronic properties of 3D bulk $LaNiO_3$ perovskite. We have cleaved the (0 0 1) surface from 3D $LaNiO_3$, which has a zero-band gap (Eg), to create 2D monolayer $LaNiO_3$ computationally and studied its electronic properties. We explored the ORR mechanism on the 2D monolayer $LaNiO_3$ perovskite by inspecting each intermediate. The present research work provides an insight into the evolution of 2D TMD-based multifunctional electrocatalysts towards HER/ORR and also a deep understanding of the nature of active sites.

Patent(s): Nil
Relevant Industries: Renewable Energy Sector (including fuel cells and metal-air batteries), Catalysis and Electrocatalysis, Green Energy Technologies.
Faculty: Dr. Srimanta Pakhira (spakhira@iiti.ac.in), Department of Physics and Centre of Advanced Electronics (CAE).

Thermoelectric Generator Based Portable Power Generation Unit (TEG-PPGU)

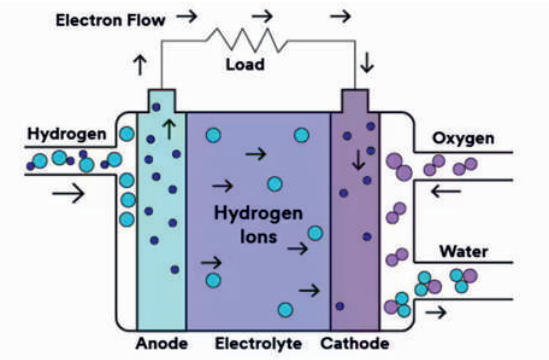
The TEG-PPGU (Thermoelectric Generator-Based Portable Power Generation Unit) is an innovative solution for compact and efficient energy generation. It integrates phase-change material (PCM) for stabilized heat absorption and phase transition, enabling consistent energy storage and delivery. The system includes a flameless premixed burner for enhanced fuel efficiency and a centralized cooling mechanism to optimize TEG performance. Designed for portability and ease of refueling via canisters, the unit is ideally suited for powering drones, camping equipment, defense applications, and small electric vehicles in remote environments. Its quiet operation and reliability make it a versatile energy source for diverse applications.



Patent(s): Filed, Indian Patent Application No.: 202421072219
Relevant Industries: Aerospace, Defense, Outdoor & Adventure, Automotive, EVs.
Inventor: Prof. Devendra Laxmanrao Deshmukh (dldeshmukh@iiti.ac.in), Department of Mechanical Engineering

Exploring perovskite materials for potential ORR applications.

Fuel cells are promising energy conversion devices, relying on the oxygen reduction reaction (ORR) at the cathode. However, ORR's sluggish kinetics demand efficient electrocatalysts, with Pt-based materials being the benchmark despite their cost and scarcity. To overcome these limitations, 2D perovskite monolayers offer a novel solution due to their tunable electronic properties. Computational studies reveal that the 2D monolayers perovskites enhance electronic density at the Fermi level, facilitating improved ORR activity. By exploring both associative and dissociative ORR pathways, these materials demonstrate thermodynamically favorable intermediates and a $4e^-$ transfer mechanism. Integrating 2D perovskite monolayers can revolutionize fuel cell technology with cost-effective, sustainable alternatives.



Patent(s): Nil
Relevant Industries: Renewable Energy Sector (including fuel cells and metal-air batteries), Catalysis and Electrocatalysis, Green Energy Technologies.
Inventor: Dr. Srimanta Pakhira (spakhira@iiti.ac.in), Department of Physics and Centre of Advanced Electronics (CAE).

Innovative Cathode Design: High-Entropy Prussian Blue Analogs for Sodium-Ion Capacitors

The increasing demand for high-performance energy storage systems has driven the development of technologies that bridge the gap between batteries and supercapacitors. In response to this need, our group has developed hybrid sodium-ion capacitors (SICs) by combining a high-entropy Prussian blue analog (HEPBA: $K_3Cu_{0.2}Ni_{0.2}Co_{0.2}Mg_{0.2}Zn_{0.2}[Fe(CN)_6]$) cathode with an activated carbon anode. The specific multi-metallic composition of HEPBA enabled the resulting SIC to show a significant improvement in energy storage performance compared to conventional cathodes. This work offers an affordable and sustainable energy storage solution, addressing critical issues such as lithium scarcity and the environmental impact of traditional lithium-based systems, marking an important advancement in next-generation energy storage technology.

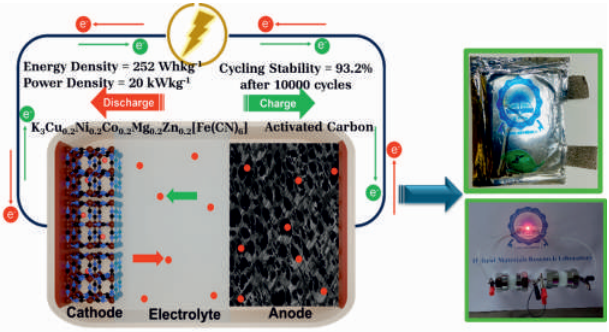
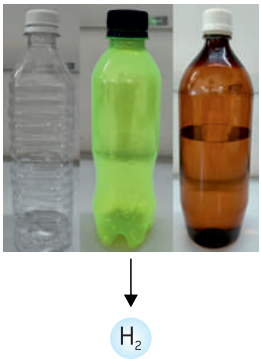


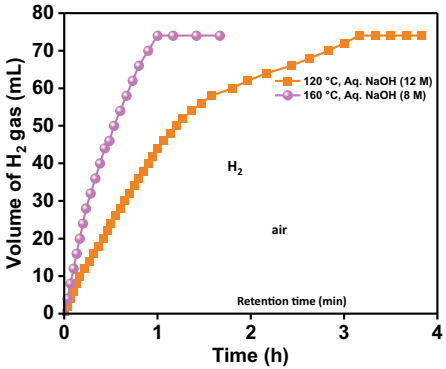
Figure 1. $K_3Cu_{0.2}Ni_{0.2}Co_{0.2}Mg_{0.2}Zn_{0.2}[Fe(CN)_6]$/ AC-based sodium-ion capacitors and its device.

Patent(s): Under Process
Relevant Industries: Electric Vehicle, Electronics, Battery
Inventor: Dr. Dhirendra Kumar Rai (dkrai@iiti.ac.in), Metallurgical Engineering and Materials Science.

Catalytic Process for Hydrogen Production from Polymeric Polyethylene Terephthalate (PET) Waste

This technology reports the one-pot upcycling of PET-based plastic waste for hydrogen production at low temperature. The solution generates high-purity hydrogen gas from PET waste. Developed at a laboratory scale, the current Technology Readiness Level (TRL) is 4. The technology has been patented by the India Patent Office (IPO) and published in the Wiley-VCH journal (ChemCatChem, 2023, 15, e202300574). Upcycling PET waste into hydrogen gas and valuable chemicals reduces landfill use, cuts plastic pollution, promotes recycling, and generates jobs in research and waste management, offering cleaner energy solutions for communities.





- *One-pot upcycling of PET into H2gas*
- *Complete selectivity for H_2*
- *High yield of H_2 (~38 L H_2/100 9PET/GRU)*
- *Works for different types of PET*

Catalytic hydrogen production from PET-based plastic waste over ruthenium catalyst (inset: GC-TCD analysis of produced gas).

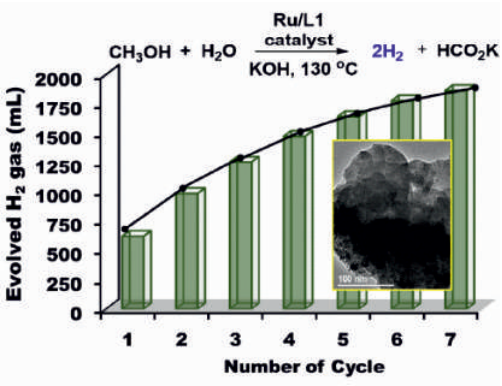
Patent: Granted, Indian Patent No. 422056

Proposed Relevant Industries: Energy, Fuel etc.

Inventor: Prof. Sanjay Kumar Singh (sksingh@iiti.ac.in), Department of Chemistry

Catalysts for Low-temperature Hydrogen Production

This technology reports low-temperature hydrogen production from methanol, generating high-purity hydrogen gas. Developed at a laboratory scale, the current Technology Readiness Level (TRL) is 4. The technology has been patented by the India Patent Office (IPO) and published in the RSC journal (Catal. Sci. Technol, 2021, 11, 136-142). Utilizing methanol for hydrogen production promotes a sustainable energy future by enhancing energy security, reducing greenhouse gas emissions, and supporting the transition to a low-carbon economy. Using biomass-derived bagasse for methanol production offers an eco-friendly alternative to fossil fuels, contributing to climate change mitigation and sustainable development.

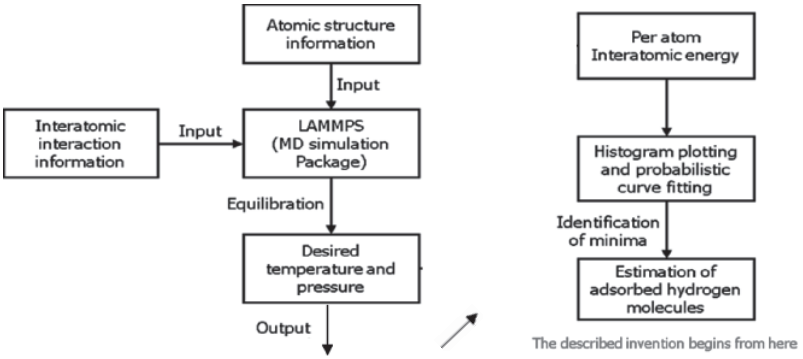


Catalytic conversion of methanol to hydrogen gas and format in water over the ruthenium catalyst.

Patent: Granted, India Patent No.386686
Proposed Relevant Industries: Energy, Fuel etc.
Inventor: Prof. Sanjay Kumar Singh, Professor (sksingh@iiti.ac.in), Department of Chemistry

A Method for Estimating the Gas Adsorption Capacity of a Solid Adsorbent

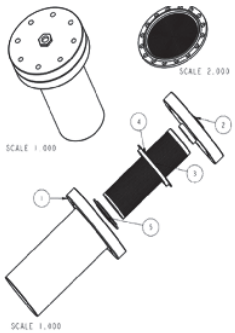
This technology involves a method for estimating gas adsorption capacity on solid substrates using molecular dynamics simulations. While performing simulations of adsorbents and adsorbates at the nanoscale, estimating the amount of adsorbate adsorbed is crucial, especially for structures with complex geometry, ill-defined pores, and warps. The method uses computational techniques like Density Functional Theory (DFT), DFT-molecular dynamics, semi-empirical methods, and classical molecular dynamics. Classical molecular dynamics is preferred for its computational efficiency. The process helps calculate the gravimetric density of adsorbed quantities and the number of hydrogen molecules adsorbed during simulations at specified temperatures and pressure.



Patent: Filed, Indian Patent Application No. 202221024912
Proposed Relevant Industries: Gas Adsorption/Storage, Materials Studio etc.
Inventors: Nitin Luhadiya, Dr. Shailesh Kundalwal (kundalwal@iiti.ac.in), Prof. Santosh Kumar Sahu (sksahu@iiti.ac.in), Department of Mechanical Engineering

A Modular Reactor for Manometric Apparatus Operable in a Hydrogen Environment at High Pressures and Capable of Handling Powdered/porous Nanomaterials

The invented modular reactor accurately measures hydrogen gas adsorption/desorption capacities of powdered/porous nanomaterials. Traditional manometric apparatus is challenging due to gas diffusion at high pressures and hydrogen embrittlement, which may cause malfunctioning of sensors and valves. This reactor has a calibrated volumetric capacity and features mesh at the top and bottom to isolate the sample from the reactor walls, preventing sample permeation. The mesh ensures gas reaches the sample from all directions, increasing permeability and promoting fast adsorption/desorption reversibility. This modular reactor is beneficial for industries supporting the hydrogen economy and automobile sectors developing hydrogen fuel cell vehicles.



S.No.	Port Name	Qty
1	CYLINDER_BASE	1
2	CYLINDER_LID_COVER	1
3	CYLINDER_PTFE_RING	1
4	NANO_ARRESTOR	1
5	NANO_HOLDER	1

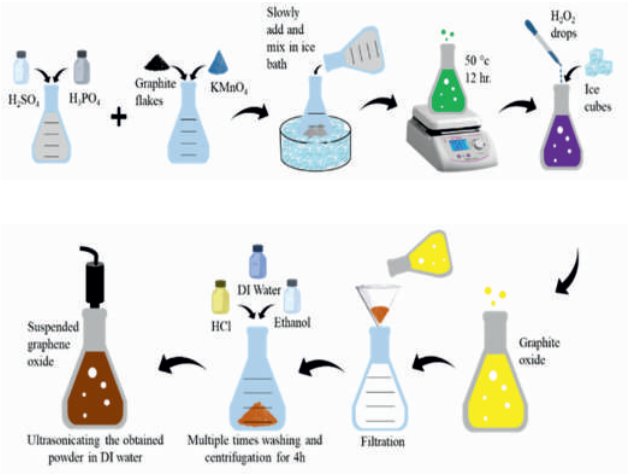
Patent: Filed, Indian Patent Application No. 202221069960

Proposed Relevant Industries: Green Energy, (The companies involved in hydrogen economy).

Inventors: Nitin Luhadiya, Saurabh Mishra, Dr. Shailesh Kundalwal (kundalwal@iiti.ac.in), Prof. Santosh Kumar Sahu (sksahu@iiti.ac.in), Department of Mechanical Engineering

Method for Synthesizing Reduced Graphene Oxide Aerogels

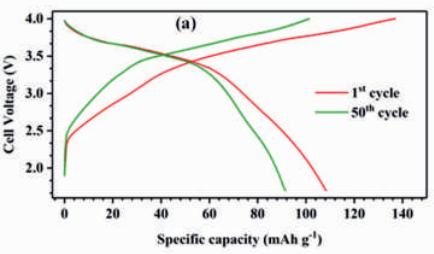
The invented process synthesizes low-density reduced graphene oxide (r-GO) aerogels functionalized with titanium nanoparticles (TiO_2) using a simple, scalable method. Graphite is first converted to graphene oxide (GO), and titanium (III) chloride ($TiCl_3$) is oxidized to produce TiO_2 nanoparticles. The GO solution and TiO_2 nanoparticles are combined to form the Ti-rGO aerogels. Unlike existing methods, which require multiple steps and equipment, this process is cost-effective and simple. The Ti-rGO aerogel, with TiO_2 in anatase form, is highly porous, aiding in gas adsorption, pollutant removal, and photocatalytic applications, with enhanced hydrogen adsorption capacity.



Patent: Filed, Indian Patent Application No. 202321016125
Proposed Relevant Industries: Automobile Industries, Insulation lining Industries etc.
Inventors: Nitin Luhadiya, Dr. Shailesh Kundalwal (kundalwal@iiti.ac.in), Prof. Santosh Kumar Sahu (sksahu@iiti.ac.in), Department of Mechanical Engineering

Na-ion Battery Based on Earth-Abundant Materials

To achieve 'Net Zero Emissions,' increasing renewable energy production is crucial. While lithium-ion batteries (LIBs) face sustainability issues due to limited lithium reserves, sodium-ion batteries (NIBs) offer a promising alternative for stationary storage and mid-range electric vehicles. NIBs, using abundant sodium, share similarities with LIBs. We developed a biphasic P2/O3 $NaMn_{0.60}Ni_{0.30}Cu_{0.10}O_2$ cathode and fabricated a pouch-type Na-ion cell with hard carbon as the anode. The developed cathode provides a capacity of 188 mAh/g, average cell voltage of 3.4 V, cell capacity of 108 mAh/g, specific energy of 367 Wh/kg, and TRL 4, with excellent performance due to the cathode's biphasic structure.

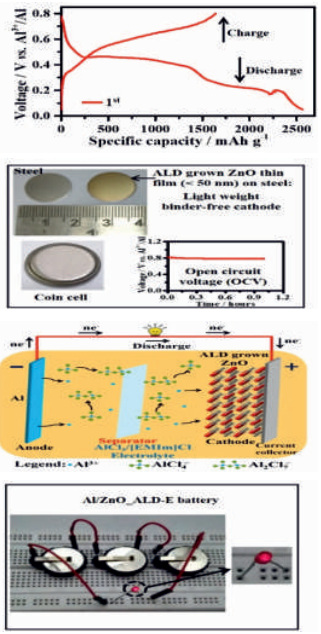


(a) Charge-discharge curve of 1st and 50th cycle. (b) Developed Na-ion pouch cell.

Patent: Under Process
Proposed Relevant Industries: Electric Vehicles, Renewable Energy Sector etc.
Inventor: Dr. Sunil Kumar (sunil@iiti.ac.in), Department of Metallurgical Engineering and Materials Science

Advanced Electrical Energy Storage (beyond Li-ion battery): Light-weight, binder-free thin-film cathode for high performance rechargeable, low-cost Aluminium-ion battery

As global power requirements rise, alternative energy storage systems like sodium-ion, magnesium-ion, and aluminum-ion batteries are gaining attention due to limitations of lithium-ion batteries, such as high cost and limited resources. Aluminum-ion batteries, known for low cost, high safety, low flammability, and environmental friendliness, are a promising solution. Prof. Sudeshna Chattopadhyay's research focuses on ultra-thin (< 50 nm), lightweight, high-performance, low-cost aluminum-ion batteries. This work, published in ChemistrySelect (2018, 3, 12512–12523), title: "Binder-Free ZnO Cathode synthesized via ALD by Direct Growth of Hierarchical ZnO Nanostructure on Current Collector for High-Performance Rechargeable Aluminium-Ion Batteries". Patents are being pursued for this innovation and other thin-film batteries.



Ultra-thin (< 50 nm), light-weight electrode for safe, low-cost, high performance Al-ion battery.

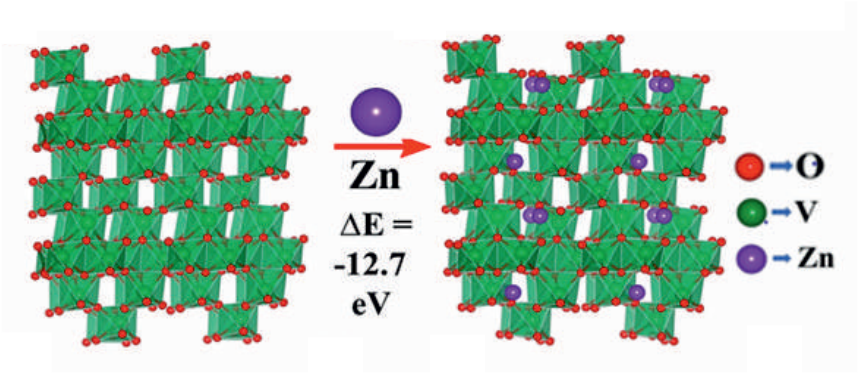
Patent: Nil

Proposed Relevant Industries: Battery Industries

Inventor: Prof. Sudeshna Chattopadhyay (sudeshna@iiti.ac.in), Department of Physics

Aging-Responsive Phase Transition of VOOH to $V_{10}O_{24}\cdot nH_2O$ vs Zn^{2+} Storage Performance as a Rechargeable Aqueous Zn-Ion Battery Cathode

Vanadium oxyhydroxide (VOOH) has been studied as a starting material for different vanadium oxide phases used as an aqueous zinc-ion battery (AZIB) cathode. This work explores the phase transition of VOOH to $V_{10}O_{24}\cdot nH_2O$ and its electrochemical performance for hosting Zn^{2+} ions. The VOOH cathode shows energy densities of 208.3, 281.2, 269.2, and 240.6 Wh/kg after aging for 0, 60, 120, and 150 days, respectively. The 150-day-aged VOOH cathode delivers 39.7 Wh/kg at 4466 W/kg, with minimal capacity loss (0.002%) over 20,300 cycles. The Zn//VOOH-150 cell demonstrates a breakthrough with 126.2 Wh/kg and 1033.2 W/kg, enhancing energy storage systems.



Pristine $V_{10}O_{24}$ and Zn-intercalated $V_{10}O_{24}$

Patent: Nil
Proposed Relevant Industries: Battery Industries
Inventor: Dr. Srimanta Pakhira (spakhira@iiti.ac.in), Department of Physics and Centre for Advanced Electronics (CAE)

Defense & Aerospace

A Method for Uniform Placement of Periodic Geometries on Curved Surfaces

A novel mapping method is developed and demonstrated for the uniform placement of periodic geometries on curved surfaces. Existing methods face several challenges, such as non-uniform separation distances between unit cells and difficulties in conformally wrapping unit cells over arbitrary surfaces, which often lead to degraded performance. In the proposed technique, a hybrid approach is implemented that employs a mathematical equation to find equidistant points over a non-planar surface and subsequently utilizes full-wave simulation to evaluate the electromagnetic responses of the overall geometry. The proposed method is demonstrated by designing a bandstop frequency selective surface (FSS)-based filter on various non-planar surfaces, including corrugated and hemispherical geometries. The structures are fabricated using 3-D printing, and their measured responses are closely matched with the simulated results. This innovation significantly enhances the applicability of FSS and other periodic geometries in aerospace and defense industries, ensuring reliable performance on curved surfaces.

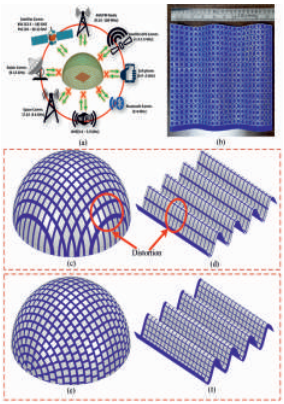


Fig. 1. (a) Applications of curved frequency selective surface (FSS). (b) Fabricated prototype made using the proposed technique. Comparison between different methods in designing periodic geometries on non-planar surfaces: (c) hemispherical surface and (d) sinusoidal surface developed using the conventional method, (e) hemispherical surface and (d) sinusoidal surface developed using the proposed method.

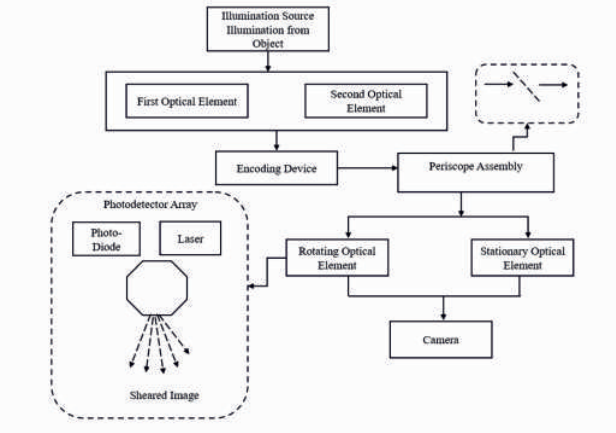
Patent: Filed, Indian Patent Application No. 202421033410

Relevant Industries: Aerospace and Defense Industries, Radio frequency and Microwave Industries

Inventor: Dr. Saptarshi Ghosh (sghosh@iiti.ac.in), Department of Electrical Engineering

Continuous Snapshots-Based Compressed Optical Streaking Ultrafast Photography System with Simultaneous Referencing

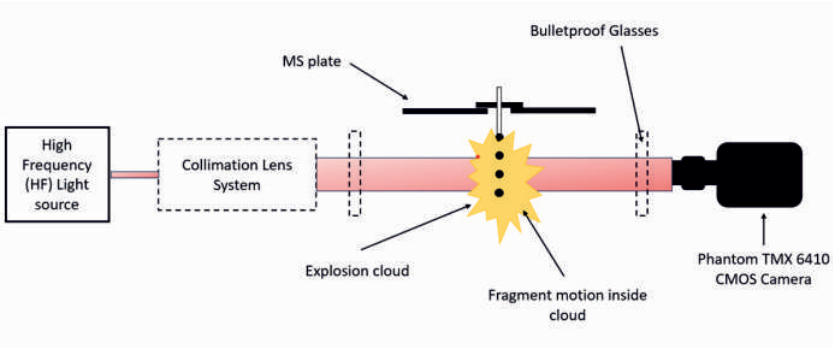
The Continuous Snapshots-Based Compressed Optical Streaking Ultrafast Photography (COSUP) system redefines high-speed imaging by combining reference and sheared imaging in a single, compact design. Featuring a periscope assembly, rotating optical element, and photodetector array, COSUP captures both stationary and sheared images simultaneously on a single camera sensor, eliminating the need for expensive delay generators. This breakthrough enables continuous imaging of long-duration ultrafast phenomena, addressing challenges in existing systems. Optimized for reduced complexity and cost, the COSUP system is particularly suited for small to medium R&D organizations, defense applications, and advanced research facilities, offering an economical yet powerful solution for high-speed diagnostics.



Patent(s): Application No. 202421093794
Relevant Industries: Defense and Aerospace R&D
Inventor: Prof. Devendra Laxmanrao Deshmukh (dldeshmukh@iiti.ac.in), Department of Mechanical Engineering

Digital Inline Holography to image high speed fragments inside explosion cloud

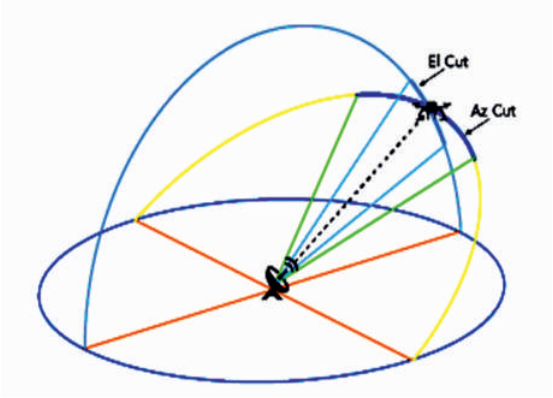
The Digital Inline Holography (DIH) system redefines high-speed imaging of explosive events by combining concepts of shadowgraphy and Digital Holography with simple and robust setup. Featuring a High Frequency (HF) illumination source with nanosecond pulse bursts, the system achieves astounding time resolution to nano seconds (ns) time scale eliminating the cons of previous used systems for explosion imaging. In addition, the illumination source shares its capacity of penetrating the dense detonation cloud to image high-speed moving fragments during their early-stage motion. This breakthrough enables continuous imaging of the fragment motion just after explosion initiation. Optimized for reduced complexity, the developed DIH sytem is particularly suited for small to medium R&D organizations, defense applications, offering a powerful solution for high-speed diagnostics.



Patent(s): Application No. 202411054524
Relevant Industries: Defense and Aerospace R&D.
Inventor: Prof. Devendra Laxmanrao Deshmukh (dldeshmukh@iiti.ac.in), Department of Mechanical Engineering

Low Frequency Antenna Characterization System for Space Application

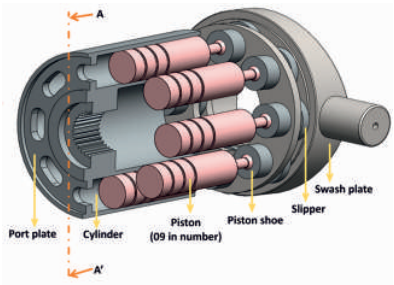
Characterizing large antennas, essential for applications like radio astronomy and deep-space communication, is challenging due to their size, which complicates measurements of gain, polarization, and radiation pattern. To address this, we propose a drone-based antenna characterization system. The drone autonomously revolves around the antenna with a Radio Frequency (RF) transmitting (Tx) payload, while the large antenna acts as a receiver (Rx). The ground station collects data from the drone's RF Tx payload and positional information, mapping it to characterize the antenna. The RF Tx payload has been tested, and its integration with the drone is under testing. This approach promises advancements in communication, scientific research, and more.

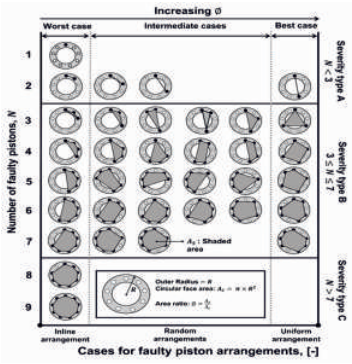


Patent: Under Process
Proposed Relevant Industries: Communication, Space and Defence Industries
Inventors: Harsha Avinash Tanti, Prof. Abhirup Datta (abhirup.datta@iiti.ac.in), Department of Astronomy, Astrophysics and Space Engineering

A Method of Maintenance for High-Performance Machineries Employing Axial Piston Pumps and Multiple Cylinders

The present disclosure relates to a method of maintenance and operation for high-performance machineries, employing axial pumps and multiple cylinders, which are omnipresent in earth moving equipment, mobile hydraulics, and steering systems of aircraft and sea-going vessels. The method comprises identifying the position of healthy pistons and faulty pistons inside the axial piston pump. The alternative configuration is determined for faulty piston positions in such a manner to generate the least amount of peak-to-peak pressure fluctuations. The faulty pistons are repositioned for uniform pressure distribution for an optimized performance of the axial piston pump under faulty conditions. The proposed method reduces the maintenance downtime significantly and results in substantial cost savings through the reuse of the damaged parts and increases the working life or the utilization of an otherwise faulty pump.

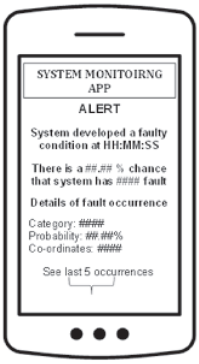




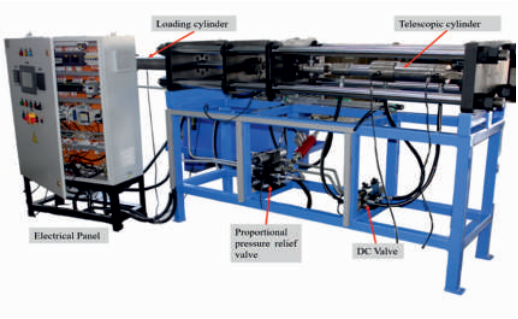
Patent: Granted, Indian Patent No. 412148
Proposed Relevant Industries: Defense and Aerospace
Inventors: Dr. Ankur Miglani (amiglani@iiti.ac.in), Prof. Pavan Kumar Kankar (pkankar@iiti.ac.in), Department of Mechanical Engineering

A Method and System for Detection and Determination of Failure of a Fluid-Power System

The invention provides a system for monitoring anomalies in a hydraulic system. It acquires sensor signals, such as flow and/or pressure sensors on the hydraulic cylinder and uses a microprocessor to convert these time-domain signals into a time-frequency spectrum, a 2-D representation. A vision sensor, attached to the microprocessor, continuously monitors the spectrum to localize and identify the system's operating condition. The system logs anomaly identification, converts it to a defined format (e.g., .txt or .csv), and transmits it to a central server, triggering alarms and notifications when anomalies are detected in the system or components.



User interface for warning and alert about system fault



Experimental test-rig for demonstrating the fault prognosis and diagnosis in a high-pressure hydraulic system

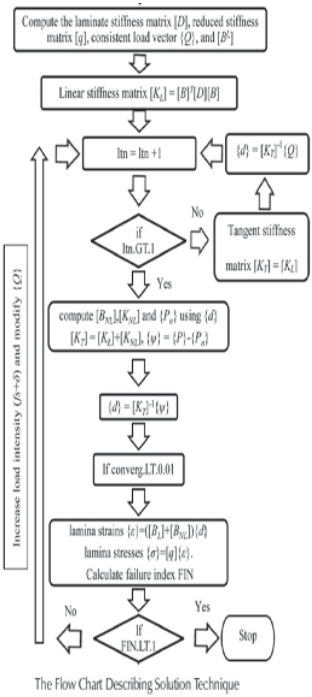
Patent: Filed, Indian Patent Application No. 202321059456
Proposed Relevant Industries: Defense and Aerospace
Inventors: Dr. Ankur Miglani (amiglani@iiti.ac.in), Prof. Pavan Kumar Kankar (pkankar@iiti.ac.in), Department of Mechanical Engineering

High-Performance Lightweight Curved Composites

Lightweight curved structures made from fiber-reinforced plastics, functionally graded sandwiched composites, and carbon nanotube (CNT) reinforced composites are used in weight-sensitive engineering applications like aircraft hangers, ship hulls, submarines, aircraft panels, jet engine cowling, furnaces, missiles, and bulletproof armors. Notable innovations include:

- Hygrothermal performance
- Progressive failure and crack propagation predictions
- Stiffened composites for increased load capacity within fixed material consumption
- Instability issues for thin panels

A computer code is developed which simulates fiber-reinforced, functionally graded composites, and curved structures (flat, cylindrical, conoidal, spherical, hyperbolic paraboloidal, elliptic paraboloidal). These lightweight structures offer better durability, heat/moisture resistance, and lower operational costs.



The Flow Chart Describing Solution Technique

Patent: Nil

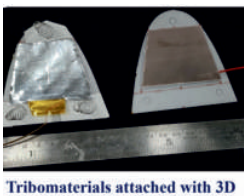
Proposed Relevant Industries: Civil Engineering Construction, Aircraft Manufacturing and Maintenance, Marine Structures Manufacturing and Maintenance, Defense Structure Manufacturing, Space Research Organizations, Sports Car Manufacturing

Inventor: Dr. Kaustav Bakshi (Kaustav.bakhi@iiti.ac.in), Department of Civil Engineering

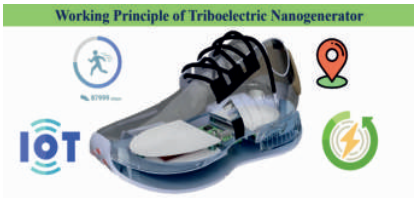
Triboelectric Based Shoe Shole for Energy Harvesting for Powering Microdevices for Army Personnels

To address frequent recharging of wearable electronics, a shoe with an integrated triboelectric nanogenerator (TENG) and electronic components is developed. TENGs convert mechanical energy into electrical energy through electrostatic induction between tribo-positive and tribo-negative surfaces. Installed within the shoe sole, the system generates and stores energy in a storage device as the user walks. This stored energy powers small microdevices, especially in remote locations. The solution offers a longer lifespan and eliminates frequent recharging. The technology is at Technology Readiness Level (TRL)-6, showcasing significant progress toward practical application.

Position of TENG inside the sole



Tribomaterials attached with 3D Printed Structure



Patent: Under Process in collaboration with ARDE Pune

Proposed Relevant Industries: Defense, Sports Shoe Manufactures, Biomedical Industries

Inventors: Prof. Vipul Singh, Department of Electrical Engineering, Prof. Palani I.A. (palaniia@iiti.ac.in), Department of Mechanical Engineering

Multilayer Hybrid Composite Panels Under Impact Loading

Assessing material performance under impact and blast loading is challenging due to extreme deformation and complex phenomena. This project introduces multilayer hybrid composite armor to enhance protective design. Unlike traditional ceramic-based armors, carbon fibers in hybrid composites are evaluated under high strain rates, aiming to replace ceramics for lightweight, cost-effective solutions. The developed armor offers superior penetration resistance, validated through experimental and numerical analysis, and can replace traditional composite materials. It benefits law enforcement, military personnel, and guards, contributing to improved performance, safety, and economy in protective systems. The study advances the state-of-the-art in impact-resistant materials.

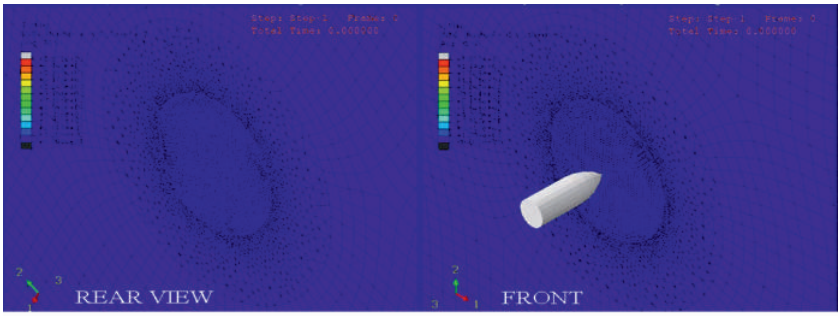


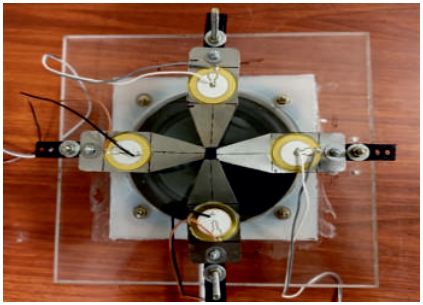
Plate of 2 mm thickness impacted with bullet of CRH 2 getting stuck in the plate

Patent: Nil
Proposed Relevant Industries: Defense
Inventors: Gyanesh Patnaik, Dr. Abhishek Rajput (abhishekrajput@iiti.ac.in), Department of Civil Engineering

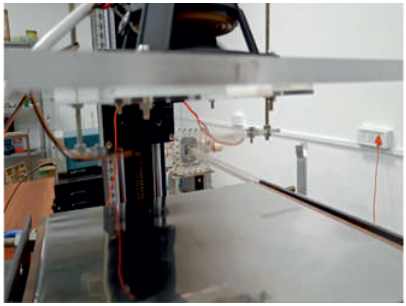
Environment & Sustainability
(Including Air, Water, Rivers)

Application of Synthetic Jet with Flaps for Thermal Management and Energy Harvesting

Thermal management is crucial for efficient operation, and synthetic jets are used for heat removal. However, conventional synthetic jets are less effective in compact devices. The proposed method uses piezoelectric flaps in the streamwise direction of a synthetic jet generated by an acoustic speaker. The flaps alter air recirculation patterns, improving heat transfer. The system with piezoelectric flaps showed a 55% improvement in the area-averaged Nusselt number and conserved up to 106 mW per strip. This system can enhance thermal management in applications like electronic components, electric vehicle battery packs, and solar photovoltaics, contributing to efficient, sustainable systems.



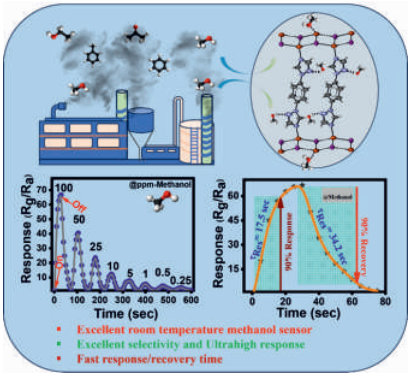
The prototype developed for an acoustically actuated synthetic jet with piezoelectric flaps



Working of the piezoelectric flaps when the synthetic jet is actuated using an acoustic speaker

Patent: Under Process
Proposed Relevant Industries: Electric vehicle/motor/battery pack manufacturing companies including
Inventors: Dnyanesh Mirikar, Rajat Kumar, Dinesh, Dr. Harekrishna Yadav (krishnpme@iiti.ac.in); Dr. Satyanarayan Patel (spatel@iiti.ac.in), Department of Mechanical Engineering

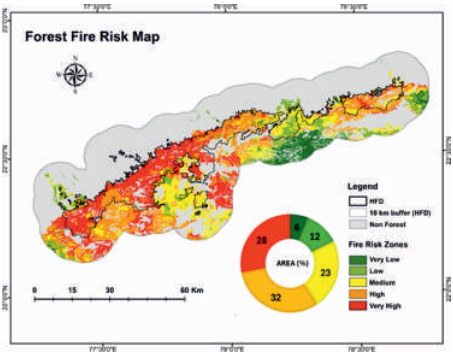
Room Temperature Chemiresistive Sensor for Methanol



Urbanisation and rapid industrialization pose several challenges, which include human exposure to toxic volatile compounds. Among these, methanol poses a severe health hazard, as ingestion, inhalation, or skin absorption can lead to tissue damage—particularly affecting the eyes and nervous system, and in extreme cases, can result in fatalities. To address this critical issue, the research group led by Dr. Abhinav Raghuvanshi from the Department of Chemistry, in collaboration with Prof. Shaibal Mukherjee from the Department of Electrical Engineering, has developed an State-of-the-art chemiresistive methanol sensor based on Copper(I) coordination polymer. The chemiresistive sensor demonstrates exceptional performance at room temperature, detecting 100 ppm methanol exposure within 17.5 seconds and a detection limit as low as 1.22 ppb. Convenient synthesis, cost-effectiveness and stability of the material, along with high sensitivity, selectivity, swift response and room temperature operation of the sensor, make this technology suitable for real-world applications.

Patent(s): Nil
Relevant Industries: Sensor technology
Inventors: Dr. Abhinav Raghuvanshi (r.abhinav@iiti.ac.in), Department of Chemistry, Prof. Shaibal Mukherjee (shaibal@iiti.ac.in), Department of Electrical Engineering

Investigation of wildfire risk and its mapping using GIS-integrated methods



Our research focuses on developing a framework for studying wildfires in small areas, using openly available data. It is especially relevant to tropical and subtropical regions of South Asia, where changing climates and human interventions increase wildfire risks. In India, deciduous forests, particularly during the pre-monsoon season, are vulnerable due to dry conditions and human activities.

The study, conducted in the Hoshangabad Forest Division, integrates geospatial analysis, remote sensing techniques, and the Analytical Hierarchy Process (AHP) within a GIS environment to assess wildfire risks. This methodology helps identify wildfire risk zones and analyze temporal patterns. This is an Integrated Methodological Framework for Wildfire Risk Assessment Using Open-Source Data in Small Forest Areas or National Parks.

The framework has shown good accuracy in risk zonation and is valuable for developing fire mitigation strategies. It can be applied to other areas to protect communities and ecosystems. The methodology has been implemented in two other forest divisions, achieving higher accuracy.

Patent: Nil

Proposed Relevant Industries: Disaster management department, official or ORGs & NGOs

Inventors: Mohd Amin Khan (phd2101161005@iiti.ac.in) & Prof. Pritee Sharma, School of Humanities and Social Sciences

Innovative CO_2 Capture and Conversion System for Sustainable Industrial Applications

The image showcases an innovative CO_2 capture and conversion system for sustainable industrial applications. It highlights integrating metal-organic and covalent organic frameworks with a futuristic and eco-friendly design.

This technology introduces an advanced system for capturing CO_2 emissions from industrial sources and converting them into valuable products such as synthetic fuels, chemicals, and construction materials. Using solid adsorbents (like metal-organic frameworks and covalent-organic frameworks) based adsorption process and catalytic conversion technologies, the system ensures higher stability, reusability, lower energy requirements, and cost-effectiveness, which are ideal for post-combustion capture in industrial plants. By transforming CO_2 into useful resources, this innovation reduces greenhouse gas emissions and supports a circular economy. It represents a practical step towards achieving carbon neutrality and addressing the pressing challenges of climate change.

Patent: Nil

Relevant Industries: Chemical Manufacturing, Energy Production, Construction Materials, Agriculture (Fertilizers from CO_2-derived chemicals)

Inventor: Dr. Srimanta Pakhira (spakhira@iiti.ac.in), Department of Physics and Centre for Advanced Electronics

Low-cost Unmanned System for Atmospheric and Pollutants Profiling

A UAV-based vertical atmospheric profiling system is developed, contributing towards the low-cost alternatives for pollution and atmospheric measurements. The sensor-integrated UAV platform is capable of onboard processing in near real-time, providing valuable input for the management and mitigation of pollution without needing costly ground infrastructures. This platform will also provide in situ atmospheric boundary layer measurements with high spatial and temporal resolution, suitable for meteorological applications and research. The system will be useful in wind energy, smart city and air quality monitoring among other application areas. Currently, we are at TRL 6, demonstrating technology in various environments.

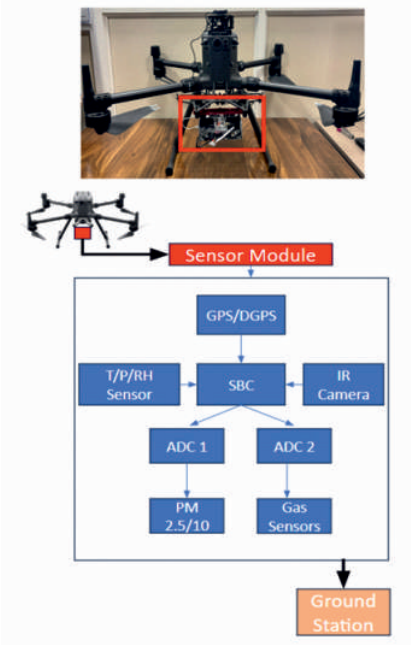
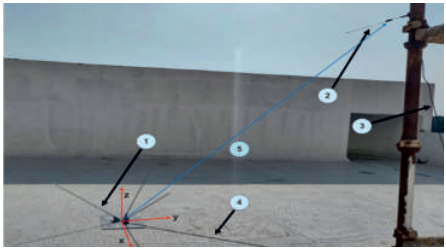


Fig: The top figure shows the developed prototype of the sensor onboard the UAV and the bottom figure illustrates the complete framework.

Patent: Nil
Relevant Industries: Space Industry, Smart Cities, Mining, Pollution Management
Inventors: Mr. Ranjan Kumar, Mr. Vaibhav Tyagi and Dr. Saurabh Das (saurabh.das@iiti.ac.in), Department of

Passive Radio Source Localisation System

Determining the direction of arrival (DoA) of electromagnetic signals at a radio antenna sensor is challenging due to interference, noise, and multiple signal superposition. Limited sensors and resources add to the complexity. We propose the Snapshot Averaged Matrix pencil method DoA (SAM-DoA) and ML-based DoA (ML-DoA) algorithms for passive radio source localization using tri-axial orthogonally co-located antennas. These algorithms were tested in simulations and practical scenarios (DOA: 10.1007/s10686-023-09897-6). Hardware design and prototyping are ongoing. Accurate DoA solutions benefit 5G, IoT, satellite communication, radar systems, and emergency services, reducing electromagnetic pollution and advancing technology and societal well-being.



(Image of practical verification from our published article DOI: 10.1007/s 10686-023-09897-6)

Figure 9: An image describing the experimental arrangement where, (1) is the Fabricated tripole antenna, the red arrows denotes the reference axis (x, y, z) and (2) is the synthetic source constitutes of a monopole and a RF generator (Keysight N5173B) set at frequency of 72 MHz and power of 10 dBm. (3) shows the RF line which connects monopole and RF generator. The data from the tripole at (1) is carried by RF line shown by (4) and is received using a DSO (Keysight Infinium DSO9254A). (5) indicates line of sight of the source which is at located at Az/El - ~41°/~51° from the reference axis displayed in the image.

Patent: Nil
Proposed Relevant Industries: Communication, Space and Defence Industries
Inventors: Harsha Avinash Tanti, Prof. Abhirup Datta (abhirup.datta@iiti.ac.in), Department of Astronomy, Astrophysics and Space Engineering

Compressed Colored Bi-layered Bricks

The manufacturing of red-colored fired bricks harms the environment, leading to bans in many Indian states. Eco-friendly gray fly ash bricks lack aesthetic appeal, and synthetic colors increase costs. Researchers at IIT Indore developed low-cost "Compressed Colored Bi-layered Bricks" using inherently colored dimensional stone waste. Millions of tons of such waste from regions like Dholpur, Jaisalmer, Kota, and Makrana were blended with steel industry slag and chemical binders to create an M-10 grade colored composite. These bi-layered bricks, costing less than ₹5 each, save 35% in costs by eliminating plaster and paint, ideal for low-cost building infrastructure.

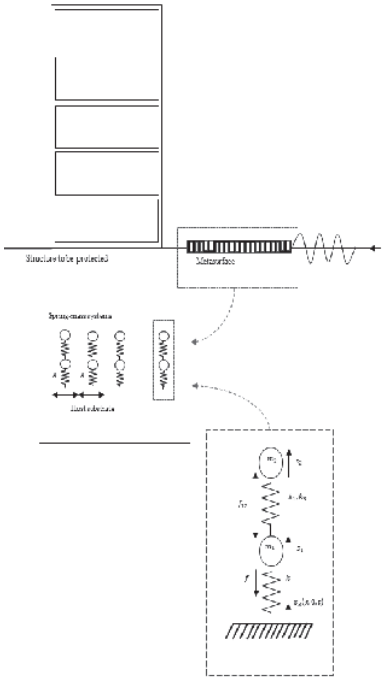
Patent: Nil

Proposed Relevant Industries: Brick Manufacturing, Paver Block and Precast Product Manufacturing Industry

Inventors: Vivek Gupta, Prof. Sandeep Chaudhary (schaudhary@iiti.ac.in), Department of Civil Engineering

Controlling of Surface Seismic Wave using META Surfaces

Metasurfaces are used to manipulate seismic waves, reducing earthquake damage. A novel design involves an array of nonlinear two-degree-of-freedom spring–mass systems mounted on a nonlocal elastic substrate. Combining nonlinearity, a double mass system, and nonlocal elasticity, the design reveals Rayleigh wave dispersive properties. A dual spring-mass system creates two frequency band gaps, transforming surface waves into shear waves at cut-off frequencies. Hardening nonlinearity confines high-frequency waves, while softening nonlinearity produces broader band gaps. Optimized metasurface designs using springs, beams, and plates can protect bridges, tunnels, buildings, and monuments, offering cost-effective solutions for energy harvesting and earthquake impact mitigation.



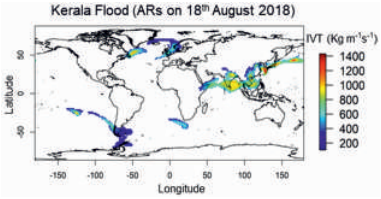
Patent: Nil

Proposed Relevant Industries: Gas & Oil Industry, Nuclear Power Plants, Mining Companies & Civil.

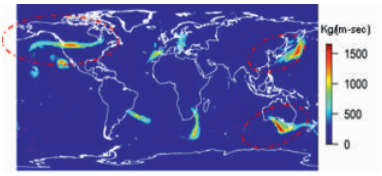
Inventors: Manasa Bhat, Dr. Santanu Manna (santanu@iiti.ac.in), Department of Mathematics

Data-driven Solution to Enhance Climate Resilience and Mitigate The Impacts of Hazards

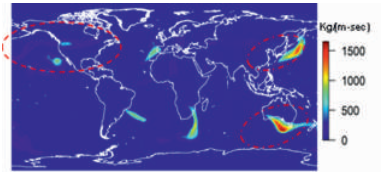
The developed technology aims to predict atmospheric rivers (ARs) using Deep Learning Models to mitigate their impacts. With global extreme weather events rising due to climate change, the study introduces a pioneering framework integrating climate risk assessment and addressing multi-sectoral impacts. Advanced AI-driven early warning systems predict ARs and mitigate effects like floods, enhancing disaster preparedness. At Technological Readiness Level (TRL) 4, the work demonstrates progress in AR characterization, modeling, and validation, with practical application potential. This research revolutionizes disaster preparedness by proactively addressing extreme precipitation, contributing to climate resilience and safeguarding sectors like agriculture and energy against escalating threats.



(b) ARs observed at a time



(c) ARs Predicted through Convolutional Autoencoder



(a) Kerala flood (b) ARs observed at a time © ARs Predicted through Convolutional Autoencoder

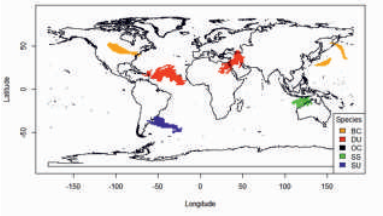
Patent: Under Process

Proposed Relevant Industries: Since ARs lead to extreme floods, a better understanding of AR impacts and prediction could be beneficial for the farming industry, regional and national water resources managing bodies, Disaster management bodies, etc.

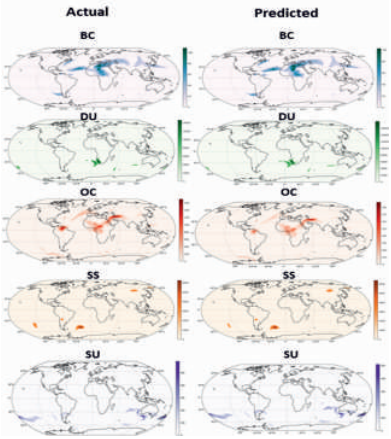
Inventors: Shivam Singh, Prof. Manish Kumar Goyal (mkgoyal@iiti.ac.in), Department of Civil Engineering

Spatio-temporal Distribution, Detection, and Prediction of Aerosol Atmospheric Rivers (AARs) on a Global Scale

The developed technology focuses on detecting and predicting Aerosol Atmospheric Rivers (AARs) of key aerosol species and their seasonal climatology using Artificial Intelligence (AI) and Machine Learning (ML). With 6.7 million premature deaths and $2.9 trillion in annual economic costs from air pollution, aerosol pollution poses global challenges, impacting health, the environment, and Sustainable Development Goals (SDGs). The study employs AI&ML-based detection algorithms and convolutional auto-encoder models for accurate real-time AAR prediction. At Technological Readiness Level (TRL) 4, this research advances aerosol pollution mitigation, enabling improved forecasting, seasonal climatology analysis, and enhanced resilience against air quality challenges.



Detected AARs of key species



Predicted AARs of key species at an arbitrary time step

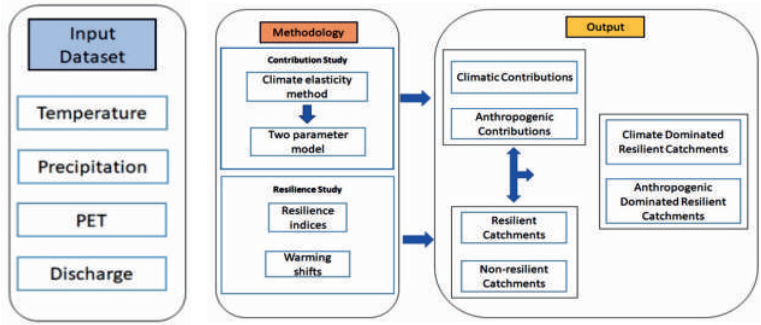
Patent: Under Process

Proposed Relevant Industries: Metropolitan City Authorities, Public Health Officials, Forestry Management Authorities, Pollution Control Boards.

Inventors: Kuldeep Singh Rautela, Shivam Singh, Prof. Manish Kumar Goyal (mkgoyal@iiti.ac.in), Department of Civil Engineering

A Novel Process on Quantification of Hydrologic Resilience Potential and its Attributions

The developed technology assesses the impact of anthropogenic stress and climatic variability on catchment hydrology and resilience using the adjusted elasticity index. Addressing challenges in sustainable watershed management due to climate change, it introduces a novel approach for evaluating hydrological resilience at river basin scales. This percentile-based model, at Technological Readiness Level (TRL) 4, is spatiotemporally independent, robust, and validated for implementation. It quantifies mean annual water balance dynamics under diverse environments, aiding hydrology research, stakeholders, and policymakers. The technology predicts hydrologic responses to climatic disturbances, offering a versatile tool for sustainable water resource management and addressing global warming challenges.

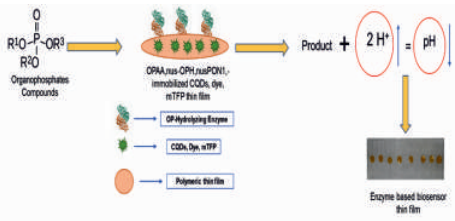


A method for measuring hydrological resilience of a region in response to anthropogenic activities and climatic changes

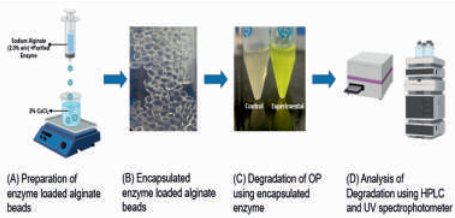
Patent: Filed, Indian Patent Application No. 201921037336
Proposed Relevant Industries: Risk Management, Disaster Management
Inventors: Jhilam Sinha, Dr. Jew Das, Prof. Manish Kumar Goyal (mkgoyal@iiti.ac.in), Department of Civil Engineering

Recombinant Organophosphate Hydrolyzing Enzyme Immobilized Composites for The Detection and Degradation of Organophosphates Compounds

This invention deals with developing and using recombinant OP hydrolyzing enzymes for detection and degradation. OP hydrolyzing enzymes used in this invention are and their immobilized matrices which will aid the process of detection and degradation of Organophosphate compounds. The enzymes are immobilized on the polymer based thin films/nano-micron size carriers having pH responsive properties.



Schematic representation of detection of OP compounds through OP hydrolyzing enzyme immobilized pH sensitive fluorophores based biosensors



Schematic workflow of immobilization of recombinant enzyme and degradation of EP using immobilized beads

Patent: Filed, Indian Patent Application No. 202321038508
Proposed Relevant Industries: Agriculture Sector
Inventors: Tanmay Vyas, Surbhi Jaiswal, Prof. Prashant Kodgire (pkogire@iiti.ac.in), Dr. Abhijeet Joshi (abhijeet.joshi@iiti.ac.in), Department of Bioscience & Bioengineering

Flexible Electronics & Nanotechnology

Multichromatic Superhydrophobic Fluorescent Carbon Quantum Dots for AI-Enabled Anti-Counterfeiting and Coating Applications

The technology involves the synthesis of solid-state carbon dots (CDs) using thesolvothermal method with an objective to achieve superhydrophobic and fluorescence properties. These four distinct fluorescent nanomaterials CDs (Green (YG), Yellow (CR), Orange (YR), and Red (APC)) revealed the exceptional contact angles of 158°, 172°, 154°, and 160°. Inspired from these properties, these CDs have been applied in fingerprint detection without using any additives with 90±1% accuracy using a custom Python program. Additionally, the CDs have been used to create superhydrophobic coatings on cotton textiles and mild steel, enhancing their durability and resistance to moisture. This innovation presents versatile applications in forensics, textile manufacturing, and material protection.

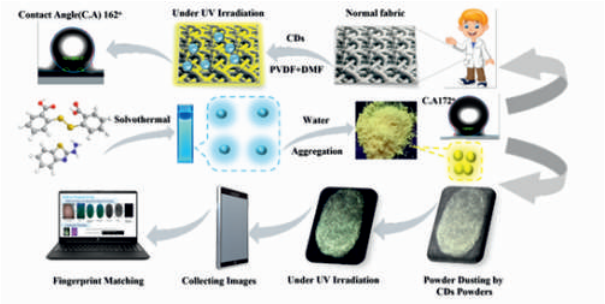


Figure: Illustration the process of the solid-state CR-CDs and their application in the field of coating application as well as in the development of fingerprint detection.

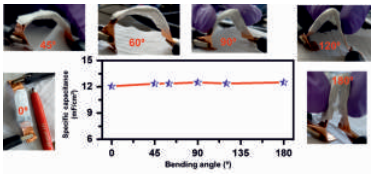
Patent: Filed, Indian Patent Application No. 202421055635

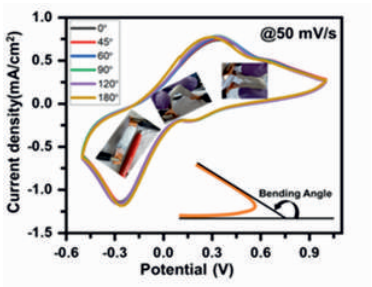
Relevant Industries: Textile Manufacturing, Electronics and Optoelectronics, Biomedical Engineering and Healthcare, Sensing Technologies and Security Systems, Renewable Energy and Power Solutions

Inventor: Dr. Mrigendra Dubey (mdubey@iiti.ac.in), Department of Metallurgical Engineering and Materials Science, Subham Garg

Supercapacitive All-Inorganic Nano Metal-Oxides' Complex: A 180o Super-Bendable Asymmetric Energy Storage Device

Flexible supercapacitors with high specific capacitance and 100% retention at maximum bending angles are ideal for real-life applications. A prototype 180° super bendable supercapacitor ($Co_3O_4//WO_3$) demonstrates high specific capacitance, power, and energy density. Complementary redox activity of electrode materials enhances electrolyte ion mobility, improving device performance. Detailed electrochemical analysis confirms superior charge storage due to this redox activity. Published in J. Mater. Chem. C, 2023, 11, 16000–16009, the work highlights potential applications in wearable electronics and energy storage. These flexible devices represent significant advancements for the energy storage industry, ensuring durability and efficiency in various conditions.





Patent: Nil

Proposed Relevant Industries: Wearable Electronics, Electric Vehicles, Electronic Textiles. etc.

Inventors: Love Bansal, Dr. Rajesh Kumar (rajeshkumar@iiti.ac.in), Department of Physics

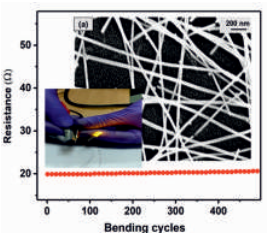
AgNW Based Electrode and its Application in Photodetector

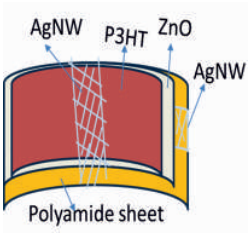
The increasing demand for flexible optoelectronic devices necessitates flexible transparent conducting electrodes (FTEs). While indium tin oxide (ITO) is widely used for its high conductivity and transparency, its high cost and brittleness limit its suitability for flexible substrates. Therefore, alternative materials for FTEs are sought.

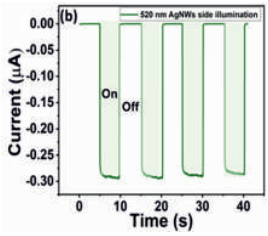
This AgNW based Flexible electrode gives highly flexibility, solution processable, transparency and conductivity, SPR effect and has application in wearable electronics.

Flexible self bis hybrid Photodetector is self bias UV-Vis detection, high photosensitivity ~105 in self bias mode. The current TRL of the Technology is 3.

Flexible photodiodes have a positive impact on society by enhancing healthcare monitoring through wearable technology, promoting inclusivity in accessible devices, contributing to environmental sustainability in electronics.







Patent: Under process
Proposed Relevant Industries: Flexible Electronics, UV-Vis Photodetector
Inventor: Prof. Vipul Singh (vipul@iiti.ac.in), Department of Electrical Engineering

Development of Low Cost, Flexible and High Responsivity UV Dosimeter

Exposure to UV rays can cause premature aging of the skin and signs of sun damage such as Premature aging and other skin damage. UV rays can also cause skin cancer, Immune system suppression, Cataracts and other eye damage.

The uniqueness of the Solution lies in:

Flexible Al substrate:

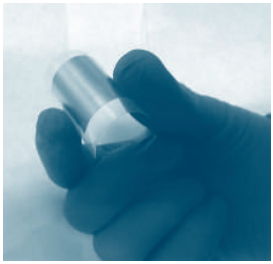
1. Application in wearable Sensors
2. Piezoelectric effect

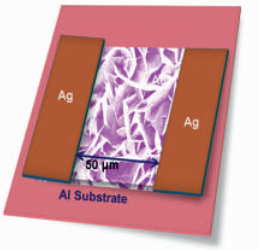
Growth of ZnO nanowalls: Highly sensitivity to UV radiation

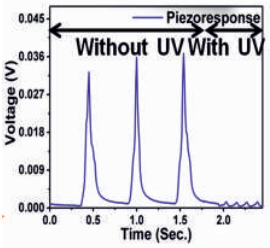
High photosensitivity and Responsivity of 349 and 265 mA/W @ 0.1 V applied bias.

The current TRL of the Technology is 3.

UV dosimeters are used in industries where workers are exposed to UV radiation, such as welding, healthcare (UV sterilization), and laboratory settings. They help ensure that exposure levels comply with safety regulations.







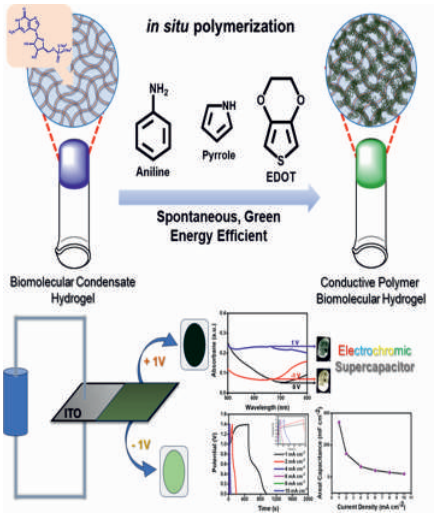
Patent: Nil

Proposed Relevant Industries: Flexible Electronics, UV Photodetector

Inventor: Prof. Vipul Singh (vipul@iiti.ac.in), Department of Electrical Engineering

Conductive Polymer Embedded Biomolecular Hydrogels (CPBHS) and Method Thereof

Conductive Polymer Hydrogels (CPHs) mimic soft tissue mechanics, water-rich 3D scaffolds, and tunable electrical properties. A nucleotide condensate matrix-assisted in situ polymerization method enables synthesizing CPHs using small monomers (aniline, pyrrole, ethylenedioxythiophene). Unlike prefabricated matrices, the biomolecular matrix enhances biocompatibility for biomedical applications. The scalable, energy-efficient process allows polymerization of three conductive polymers (polyaniline, polypyrrole, PEDOT) within a single Guanosine monophosphate matrix using water-soluble organic acids. Polyaniline hydrogels exhibit excellent electrochromic supercapacitor behavior with areal capacitance of 236 $mFcm^{-2}$. These hydrogels serve as smart, printable materials for biosensors, health monitoring, bio-printable scaffolds, tissue engineering devices, and more.



Patent: Filed, Indian Patent Application No. 202321083824

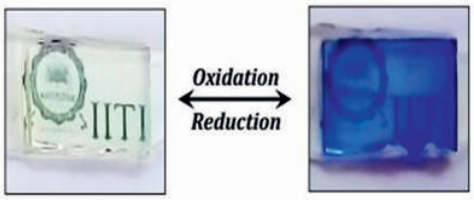
Proposed Relevant Industries: Numerous Global Companies, Including Indian Startups, are Actively Developing Conductive Hydrogels for Electrophysiological Applications

Inventors: Suryakamal Sarma, Nishita Jain, Dr. Tridib Kumar Sarma (tridib@iiti.ac.in), Department of Chemistry

Flexible Electrochromic Smart Windows

The developed heat shielding electrochromic device filter heat when in transparent (optically) state, unlike available device which filters IR but becomes opaque to the visible spectrum.

b. Compatible for making flexible device on PET/Plastic substrates as well. The device saves energy required to maintain the heat in a building/car The current TRL of the technology is 3. Such windows will be of immense use for the Smart City projects.



Patent: Nil
Proposed Relevant Industries: Automobile and Infrastructure
Inventors: Anjali Chaudhary, Prof. Rajesh Kumar (rajeshkumar@iiti.ac.in), Department of Physics

A Low-Cost, Portable IoT-Enabled NO_2 Gas Sensor System with Enhanced User Safety

The technology addresses poor selectivity towards target gases, lack of real-time monitoring, and the absence of remote alert systems for toxic gas concentrations. The solution includes large-scale synthesis of advanced quantum 2D materials that are selective and sensitive towards target gases, with operation at room temperature. An Android/iOS application enables real-time monitoring, and a resistance readout circuit is integrated with a GSM module for remote alerts via SMS and phone calls. The technology is at Technological Readiness Level (TRL) 7. This system aims to prevent gas tragedies like Bhopal and Visakhapatnam by providing timely alerts to avoid catastrophic incidents.

Patent(s): Granted, Indian Patent No. 435803; Granted, Indian Patent Application No. 202321052277

Proposed Relevant Industries: Steel Manufacturing, Toxic Gas Sensor Manufacturing Unit, Environmental Monitoring

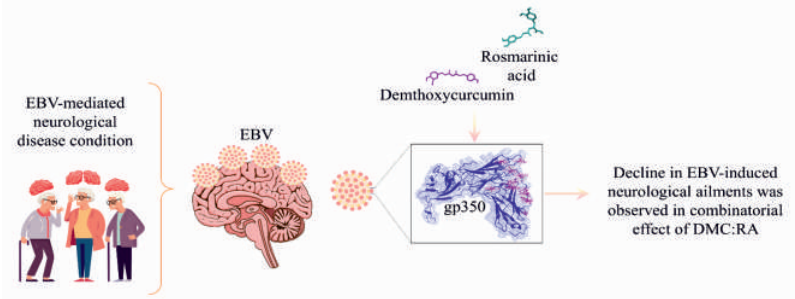
Inventors: Chandrabhan Patel, Prof. Shaibal Mukherjee (shaibal@iiti.ac.in), Department of Electrical Engineering

Healthcare
(Including Devices and Digital Health)

A Composition for the treatment of Epstein-barr Virus Mediated Brain Diseases and its Method of Preparation

Epstein-Barr Virus (EBV) infects approximately 90% of the global adult population and is associated with various cancers (e.g., nasopharyngeal carcinoma, gastric cancer, Hodgkin's lymphoma) and neurological disorders such as Multiple Sclerosis and Alzheimer's disease. Despite its widespread impact, there are currently no effective drugs or vaccines targeting EBV. Efforts to develop vaccines targeting EBV envelope glycoprotein gp350, a critical protein for viral attachment to host cells via the CD21 receptor, have been unsuccessful.

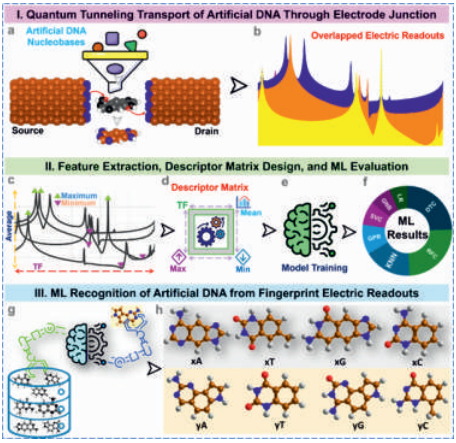
This invention identifies phyto-compounds with potent anti-gp350 activity as novel therapeutic agents against EBV. Through in silico screening, demethoxycurcumin and rosmarinic acid were identified as lead compounds demonstrating strong binding affinity to gp350. Among these, demethoxycurcumin exhibited profound inhibitory effects on gp350 function. These findings were validated through in vitro assays and animal models, confirming their antiviral efficacy, safety, and potential for clinical application. The use of these phyto-compounds offers a natural, side-effect-free alternative to synthetic antivirals, addressing the unmet need for effective anti-EBV drugs. By targeting gp350, these compounds block viral entry into host cells, preventing infection and reducing disease progression. This innovation presents a groundbreaking approach to managing EBV-related diseases and infections.



Patent(s): Filed, Indian Patent Application No. 202521003721
Relevant Industries: Pharmaceuticals
Inventor: Dr. Hem Chandra Jha (hemcjha@iiti.ac.in), Ms. Annu Rani (annuranisheoran@gmail.com), Mr. Pranit Hemant Bagde (phd2201171007@iiti.ac.in), Department of Biosciences and Biomedical Engineering

Machine Learning Recognition of Artificial DNA Sequence with Quantum Tunneling Nanogap Junction

Artificially synthesized DNA has immense potential to revolutionize biotechnology, genetics, and DNA-based data storage. Accurate and rapid electrical identification of these synthetic DNA molecules is essential for their practical applications. This developed technology demonstrates a new approach for accurately identifying synthetic DNA nucleobases using quantum tunneling transport and machine learning. By analyzing how these nucleobases interact within model nanogap devices, unique electric conductance signals were captured, and the underlying molecular properties influencing these signals were analyzed. Further, machine learning models enabled precise and reliable predictions, showcasing the feasibility of electrical recognition of artificial DNA. This breakthrough has far-reaching implications in genetic research, synthetic biology, and next-generation data storage technologies.



The above image shows the quantum tunneling transport through artificial DNA nucleobase electrode nanogap junction and step-by-step machine learning (ML) workflow for the recognition of artificial DNA.

Patent(s): Filed, Indian Patent Application No. 202421104096
Relevant Industries: Disease diagnosis, DNA data storage, Biotechnology, Personalized medicine, Synthetic Genomics technology
Inventor: Prof. Biswarup Pathak (biswarup@iiti.ac.in), FNASc, FRSC

Fused Pyridine Derivatives as Anticancer and Antimicrobial Agents and Processes for the Preparation thereof

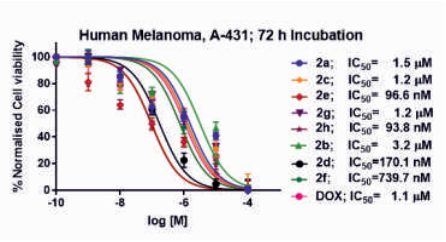


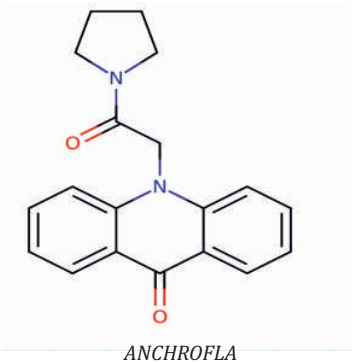
Figure. Dose-response curves of pyridine fused heterocycles 2a-2f for inhibition of human melanoma or skin cancer

Cancer therapy seeks to deliver drugs selectively to cancer cells, minimizing off-target toxicity and reducing recurrence risks. We have developed new methodology for the synthesis thieno, thiazolo, and benzothienopyridine derivatives with hitherto unknown structures that act as protein antagonists and agonists, showing promise as next-generation anticancer or antimicrobial agents. Using a novel, efficient one-pot, metal-free approach, we have synthesized biologically active fused thieno[3,2-c], thieno[2,3-c], benzo[4,5]thieno[3,2-c]pyridine-, benzo[4,5]thieno[2,3-c]pyridine-, and thiazolo[4,5-c]pyridine-based systems. In the presence of a base, various heterocyclic aldehydes were transformed into corresponding sulfur fused aza-heteroaromatics through an imine-mediated tandem condensation-heteroannulation process. Our compounds demonstrated potent anticancer activities with IC_{50} values in the low nM range (≥97 nM) and kinase inhibition ranging from 1.95 µM to 12.10 µM against LIMK2, CDKs, and Aurora kinases. Additionally, thieno[3,2-c] and benzothieno[3,2-c]pyridines derivatives have demonstrated promising anti-microbial activity against gram-negative Escherichia coli (E. coli). These molecules, with enhanced selectivity and reduced side effects, could serve as anticancer and antimicrobial agents against multidrug-resistant strains by targeting bacterial DNA replication. Our methodology and new molecules lay a foundation for designing drug families with improved pharmacokinetic and pharmacodynamic properties, offering a pathway towards affordable and effective anticancer and antimicrobial therapies.

Patents: Filed, Indian Patent Application No. 202421085134
Relevant Industries: Pharmaceutical Industries for Healthcare
Inventors: Prof. Venkatesh Chelvam (cvenkat@iiti.ac.in), Department of Chemistry

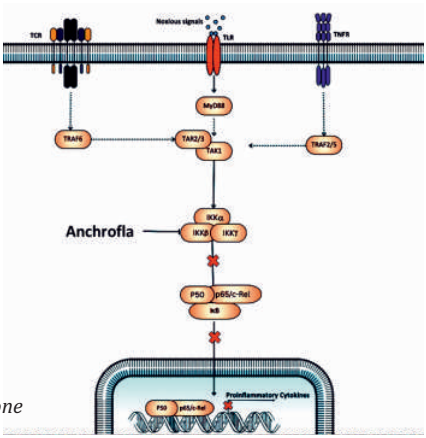
ANCHROFLA and method thereof to address the IKKβ-mediated chronic inflammatory signaling

Chronic inflammatory diseases affect over 41 million people annually. Current treatments often exhibit suboptimal efficacy and severe side effects. Thioridazine, an antipsychotic drug, was repurposed as a potent anti-inflammatory agent (Baig et al., 2018), but it has also been reported to have cardiotoxic activity through hERG K (+) channel binding. To address this issue, we identified a molecule named ANCHROFLA using a structure-based approach. Preclinical studies demonstrated that ANCHROFLA inhibits inflammatory response by inhibiting IκB kinase β (IKKβ) activity without affecting the hERG K (+) channel activity. Therefore, ANCHROFLA offers a safer and effective alternative for mitigating inflammatory responses in chronic inflammatory diseases.



ANCHROFLA

10-(2-oxo-2-pyrrolidin-1-ylethyl) acridin-9-one



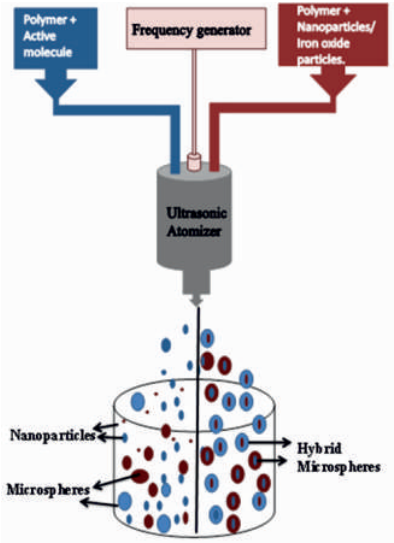
Patent(s): Filed, Indian Patent Application No. 202421099306

Relevant Industries: Pharmaceutical

Inventors: Prof. (Dr.) Mirza S Baig (msb.iit@iiti.ac.in), Department of Bioscience and Biomedical Engineering (BSBE)

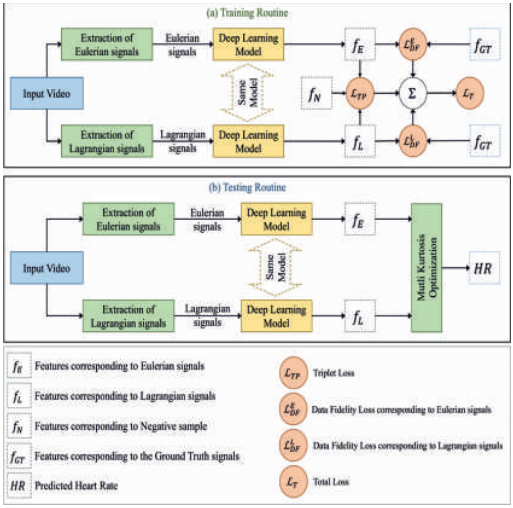
Ultrasonic Atomizer Based Method for Development of Biodegradable Anticancer Nanoparticles, Microspheres and Hybrid Micro-particles

The present invention relates to a method for synthesizing anticancer nanoparticles, and more particularly relates to a method of synthesizing nanoparticles, microspheres and hybrid micro particles loaded with anticancer drug using an ultrasonic atomizer for theranostic applications. The particles produced using this method have great potential in cancer chemotherapy.



Patent: Granted, Indian Patent Application No. 201921015731
Proposed Relevant Industries: Pharmaceuticals
Inventors: Ms. Bhavana Joshi, Mr. Gaurav Pandey, Dr. Abhijeet Joshi (abhijeet.joshi@iiti.ac.in), Department of Bioscience & Bioengineering

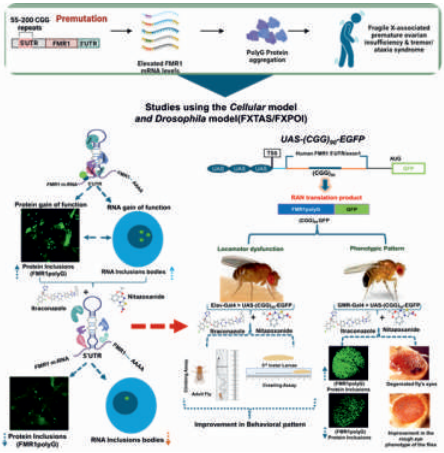
Robust Remote Photoplethysmography Estimation By Denoising Eulerian and Lagrangian Pulse Signals Using Contrastive Learning



The technology addresses the challenge of non-contact heart rate (HR) estimation from facial videos, overcoming limitations of traditional contact-based methods like pulse oximeters, which are unsuitable for continuous monitoring and risky for neonates, burn victims, and infectious patients. By combining Lagrangian and Eulerian methods with contrastive learning, it improves accuracy under variable lighting, motion artifacts, and camera focus. Validated at Technological Readiness Level (TRL) 5 in controlled environments, it enables safer, more comfortable HR monitoring for vulnerable populations and infectious cases. Additional applications include face anti-spoofing, deep-fake detection, and mental health analysis, advancing personalized healthcare and public health safety.

Patent: Filed, Indian Patent Application No. 202221043505
Proposed Relevant Industries: Healthcare, Forensics, Security Monitoring
Inventors: Anup Kumar Gupta, Lokendra Birla, Dr. Puneet Gupta (puneet@iiti.ac.in), Department of Computer Science and Engineering

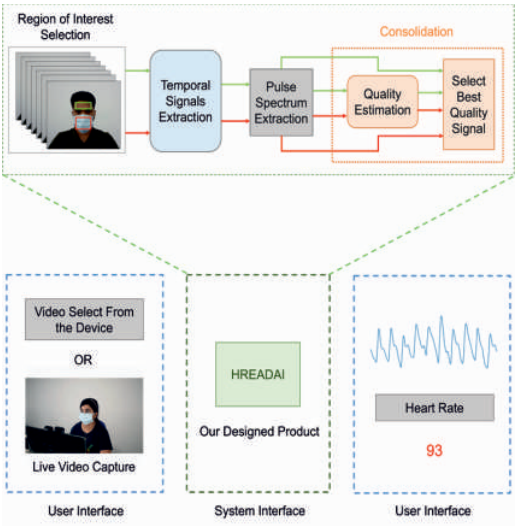
Innovative Dual Drug Formulation Counters FMR1Poly-G Protein Toxicity in Fragile X-associated Tremor/Ataxia Syndrome (FXTAS) and Fragile X-Associated Primary Ovarian Insufficiency (FXPOI)



FXTAS and FXPOI are neurodegenerative disorders caused by elevated CGG repeats, leading to toxic RNA foci and protein accumulation via RAN translation. To develop targeted therapies against FXTAS/FXPOI, our research focused on a key structural basis and identified a combinatorial complex of Itraconazole and Nitazoxanide drug molecules. The complex selectively binds to the CGG repeats, corrects splicing defects, reduces toxic protein buildup, and mitigates disease symptoms, highlighting their promise as therapeutic agents for FXTAS/FXPOI. Our study on repurposing of FDA molecules highlights the exceptional efficacy of the complex of FDA-approved drugs in addressing such repeat expansion disorders at the molecular level; it merges novel pharmacological approaches with critical insights into neurodegenerative diseases.

Patent(s): Under process
Relevant Industries: Pharmaceuticals
Inventor: Prof. Amit Kumar, Biosciences and Biomedical Engineering

System, Apparatus and Method for Heart Rate Determination of Individuals Wearing Face

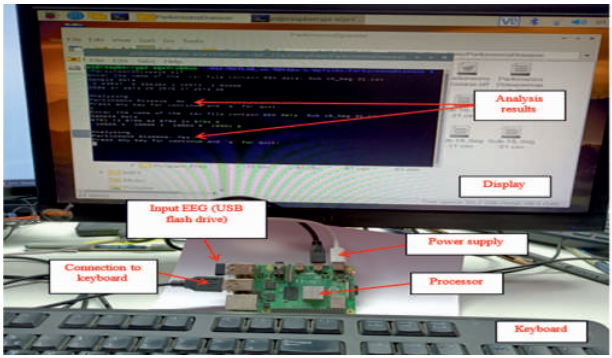


The widespread use of face masks during pandemics hinders traditional heart rate (HR) monitoring methods relying on facial video analysis. This technology estimates HR remotely, analyzing video from both non-occluded facial regions and mask-covered areas. It consolidates data from both regions to improve accuracy. Validated at Technological Readiness Level (TRL) 5 in controlled environments, it ensures functionality and reliability. Ideal for healthcare settings, public places, and outbreaks, the non-invasive approach enhances comfort and reduces health risks. Additionally, it supports applications like face anti-spoofing, deep-fake detection, and mental health monitoring, advancing remote and accessible health monitoring solutions.

Patent: Filed, Indian Patent Application No. 202321071568
Proposed Relevant Industries: Healthcare, Forensics, Security Monitoring
Inventors: Trishna Saikia, Anup Kumar Gupta, Dr. Puneet Gupta (puneet@iiti.ac.in), Department of Computer Science and Engineering

Automated Parkinson's Disease Detection System using EEG Signals

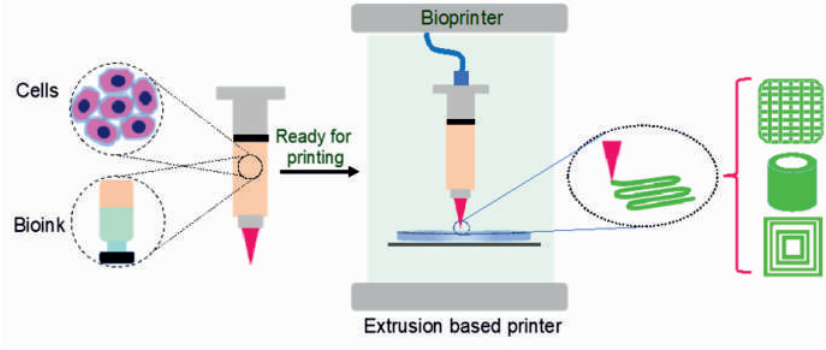
Parkinson's disease has affected almost 10 million people globally, with over 1 million cases reported annually in India. Early detection is critical, but no definitive imaging or biological markers exist. A system using multichannel EEG data for prediction is proposed. It employs multivariate iterative filtering (MIF) for signal decomposition, phase-space representation (PSR) for higher-dimensional analysis, and a pre-trained classifier for EEG segment classification. A GUI application, developed on a Raspberry Pi board, offers standalone Parkinson's detection. Tested with real-time EEG data, it achieves Technology Readiness Level (TRL) 8. Cost-effective and reliable, it supports telemedicine, aiding rural healthcare and reducing travel burdens.



Patent: Filed, Indian Patent Application No. 202221027358
Proposed Relevant Industries: Smart Healthcare Industries
Inventors: Kritiprasanna Das, Prof. Ram Bilas Pachori (pachori@iiti.ac.in), Department of Electrical Engineering

Novel 3D-printing Biomatrix Ink: A Double Cross-linked Self-healable Hydrogel for Cell Culture Applications

BioMatrix Ink, composed of non-animal derived synthetically cross-linked components, is ideal for 2D/3D cell culture and extrusion-based bioprinting. Its nanofibrous network mimics the extracellular matrix, supporting cell growth, signaling, and proliferation. Tailored for specific applications, it can be used in 3D models, cell cultures, bioprinting, and sustained drug release. Supplied as a powder, it rehydrates with aqueous solutions, including commercial media. Advantages include reproducibility, easy handling (quick gelation without extreme conditions), tunability (adjustable viscosity for alternative techniques), printability (shear-thinning and thixotropic), and biocompatibility (validated with human fibroblasts, stem cells, osteoblasts), ensuring consistent, cell-friendly, and versatile usage.



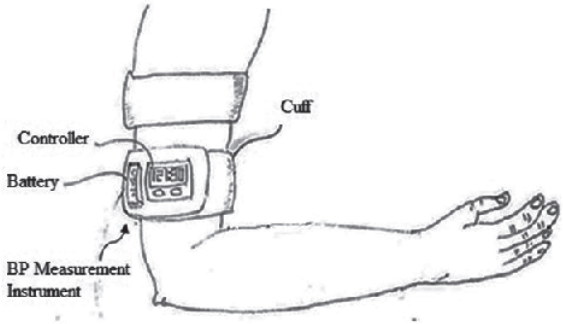
Patent: Indian Patent Application No. 202417103775, Filed, UK Patent Application No. 2210605.8

Proposed Relevant Industries: Healthcare Sector, Additive Manufacturing

Inventors: Prof. Deepak M. Kalaskar, Prof. Apurba K. Das (apurba.das@iiti.ac.in), Department of Chemistry

A Standalone, Portable Apparatus for Automatically Measuring Blood Pressure with Remote Monitoring

Self-measurement of blood pressure (BP) predicts target organ damage, cardiovascular events, and mortality. Common cuff-based methods include the Korotkoff (auscultatory) and oscillometric methods. Mercury sphygmomanometers, though the gold standard for auscultatory measurement, pose environmental concerns and require trained personnel. Limitations include observer bias and lack of precision in oscillometric methods. This invention aims to develop a portable, user-friendly device for automatic BP measurement using the Korotkoff method. Key features include a patient-centric approach, compact design, and enabling self-measurement anytime. The prototype has been rigorously tested, and ongoing work focuses on optimizing usability for widespread adoption.

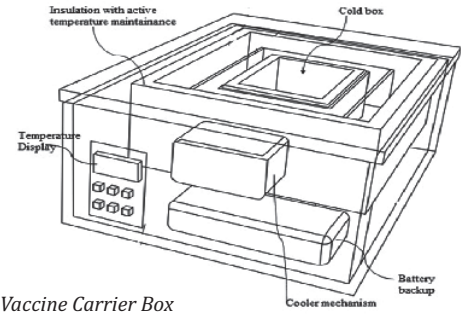


Automatic Blood Pressure Measurement

Patent: Granted, Indian Patent Application No. 202021032245
Proposed Relevant Industries: Healthcare Industry, General Population
Inventors: Arjun Singhal, Mayank Maroliya. Adarsh Singh, Prof. Devendra Deshmukh (dldeshmukh@iiti.ac.in), Department of Mechanical Engineering, Dr. Shilpa Raut (shilparaut@iiti.ac.in), Health Centre, IIT

A Vaccine and Biological Material Carrier Box

Immunization is crucial for preventing vaccine-preventable diseases, requiring reliable vaccine transportation. Traditional insulated containers relying on ice packs often face temperature fluctuations, disrupting vaccination schedules. This innovation introduces a self-contained, portable vaccine carrier with an anti-freeze mechanism, maintaining stable temperatures without ice packs. Tested rigorously, the carrier ensures 2–8°C for over 40 hours, even in varying conditions. Future plans include WHO certification and field experiments. This solution enhances immunization programs by providing reliable, temperature-controlled storage for vaccines and biological materials, benefiting healthcare workers in subcenters and villages, particularly during door-to-door campaigns.



Vaccine Carrier Box

Patent: Granted, Indian Patent No. 416164

Proposed Relevant Industries: Health Care Industry, Bioscience and Biomedical Research Industry

Inventors: Dr. Abhay Gaidhane, Sawangi Meghe, Dr. Shilpa Raut (shilparaut@iiti.ac.in), Health Centre, Prof. Devendra Deshmukh (dldeshmukh@iiti.ac.in), Department of Mechanical Engineering

Kit for Screening of early phase detection of Epstein Barr Virus induced Alzheimer's disease

Neurodegenerative diseases, including Alzheimer's disease (AD), lead to progressive neuronal loss and impaired bodily functions like balance, movement, and speech. From 1990 to 2019, AD and dementia prevalence increased from 7,236.38 to 51,624.19 globally. Pathogens like Epstein-Barr virus (EBV) significantly contribute to these diseases. Numerous studies have reported that EBV proteins like EBNA1, EBNA3A, LMP1, LMP2A, BZLF1, gp350 and BNLF-2a are associated with AD and Multiple sclerosis (MS). This invention identifies a 12-amino-acid peptide from EBV glycoprotein-M (gM) that initiates amyloid beta-42 (Aß42) aggregation, accelerating AD progression. The gM peptide shows aggregation properties comparable to Aß42 and elevates AD markers, aiding in virus-mediated AD models for therapeutic testing.

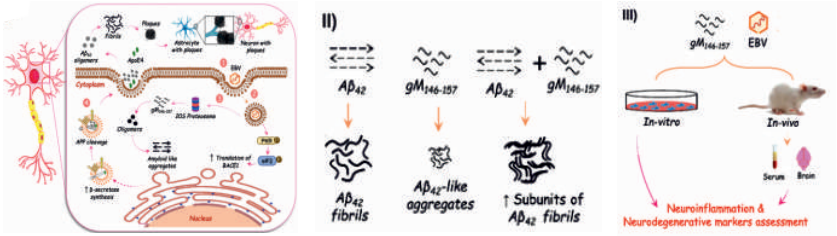
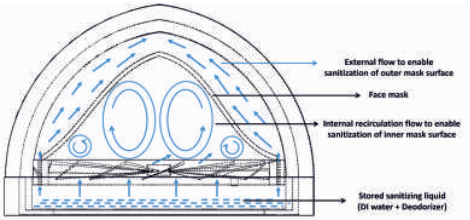


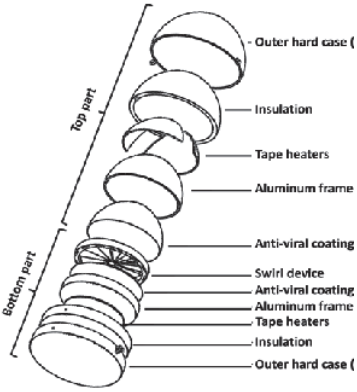
Illustration of possible details of technology for EBV-mediated Alzheimer's disease.

Patent: Granted, Indian Patent Application No. 202121032715
Proposed Relevant Industries: Pharmaceuticals
Inventors: Dr. Hem Chandra Jha, Dr. Deeksha Tiwari, Dr. Annu Rani (hemcjha@iiti.ac.in), Department of Biosciences and Biomedical Engineering

A Sanitization Device for a Protective Article

The device is a sanitization unit designed to store and sanitize protective articles like face masks using heat and moisture. It heats masks to 60-65°C with 80-85% relative humidity for effective sanitization. Structured as a portable storage unit, it protects masks from the external environment and minimizes contagion transmission. Compact and easy to handle, it enables in-situ sanitization, making it highly portable for users. This environmentally friendly solution promotes mask reusability, reducing the carbon footprint. The device combines functionality with portability, offering a practical and sustainable approach to mask sanitization.

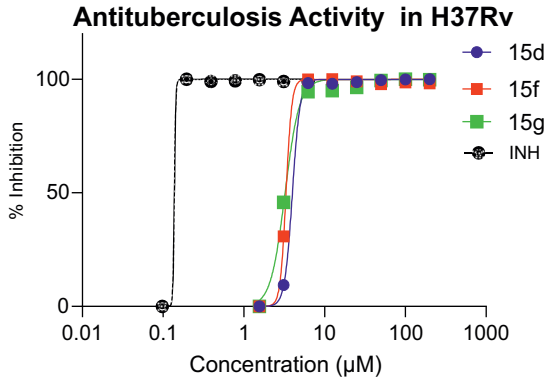




Patent: Granted, Indian Patent No. 440833
Design Registration: Indian Patent Provisional Application No. 202221041778
Proposed Relevant Industries: Healthcare Industry
Inventors: Dr. Ankur Miglani (amiglani@iiti.ac.in), Prof. Pavan Kumar Kankar (pkankar@iiti.ac.in), Department of Mechanical Engineering

Small Molecule Drugs for Treatment of Tuberculosis

Tuberculosis (TB), caused by Mycobacterium tuberculosis (Mtb), remains a leading cause of death globally. The World Health Organization (WHO) reported 480,000 new multidrug-resistant TB (MDR-TB) and 100,000 rifampicin-resistant TB (RR-TB) cases, with 50% occurring in China and India. Current anti-TB treatment lasts 6-9 months, but MDR and XDR-TB require years of second-line toxic drugs, with high failure and mortality rates. Incomplete treatment often leads to relapse. To address this, we synthesized over 150 novel antibacterial pyridine-based compounds, currently patented and copyright-protected in the USA and India. These compounds showed potent antimycobacterial activity at low micromolar concentrations and are now in preclinical in vivo studies for MDR and XDR-TB therapy.



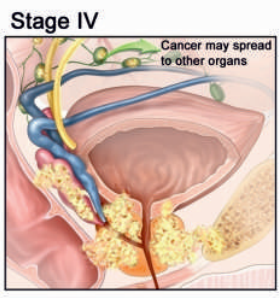
Patent: USA Patent, US 11,427,596 B2, Indian Patent, IN 366986

Proposed Relevant Industries: Healthcare

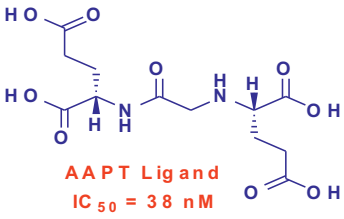
Inventors: Dr. Chelvam Venkatesh (cvenkat@iiti.ac.in), Dudhe P., Krishnan M. A., Sonawane A., Department of Chemistry

Early Diagnosis and Treatment of Prostate Cancer

Tuberculosis (TB), caused by Mycobacterium tuberculosis (Mtb), is a leading cause of death globally. The WHO reports 480,000 new multidrug-resistant TB (MDR-TB) and 100,000 rifampicin-resistant TB (RR-TB) cases, with 50% in China and India. Current treatment for MDR and XDR-TB requires several months to years with toxic drugs, leading to high failure rates. We have synthesized over 150 novel antibacterial compounds, including pyrrollopyridines and indolopyridines, patented in the USA and India. These compounds target the acyl carrier protein domain of pks13, inhibiting mycolic acid formation. Five compounds show potent antimycobacterial activity, currently undergoing preclinical in vivo studies.



Prostate Cancer



PCa Inhibitor

Patents: Filed, Indian patent Application No. 201821044594; USA Patent Application no. 16695851.

Proposed Relevant Industries: Healthcare

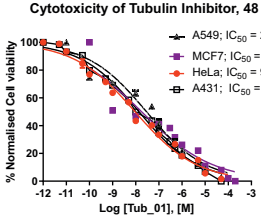
Inventor: Dr. Chelvam Venkatesh (cvenkat@iiti.ac.in), Sengupta S., Krishnan M. A., Pandit A., Department of Chemistry

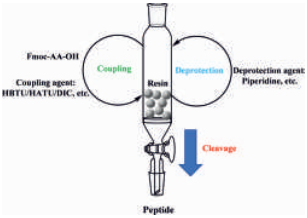
New Small Molecule Peptides for Treatment of Cancer

Prevalence of cancer worldwide and challenges in cancer treatment urge researchers to develop new and potent anticancer drugs. Anticancer drug potency and factors such as availability, ease of synthesis, serum stability, selectivity, pharmacodynamic and pharmacokinetic properties plays a crucial role in determining the clinical success of a drug.

Tubulin inhibitors such as tubulysin M is one of the most potent anticancer agents (IC50 of 0.02 nM) known to kill the cancer cells by inducing apoptosis. But the natural abundance of these inhibitors is very low, and the structural complexity escalates the challenges for its laboratory synthesis. We have developed a technology to design and synthesize a library of novel tubulin inhibitors which possess similar amino acid interactions as compared to natural inhibitors.

Recent human clinical trial studies questioned the physiological stability of tubulin inhibitors due to its reduced efficiency in antitumor activity. This was overcome by employing 4-amino thiazole-2-carboxylic acid and unnatural β-amino acids as components of the inhibitors to avoid hydrolysis by proteases. As proof of concept, several tubulin derivatives were chemically synthesized in our laboratory, examined on human cancers of breast, skin, lung, and cervix and found to be active in 9-29 nM concentrations. The new inhibitors are protected with intellectual proprietary rights in USA and India. The inhibition potency of the inhibitors would further be evaluated in vivo for treatment of variety of cancers.





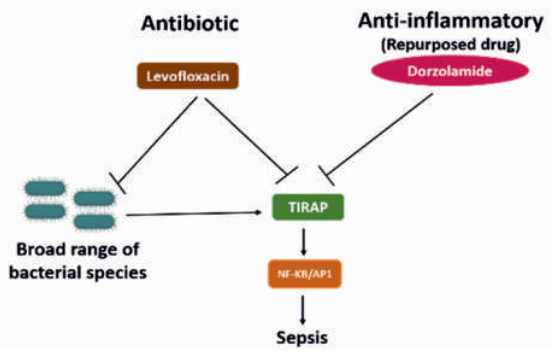
Patents: Granted, Indian patent Application No. 202021036140; Granted, USA patent, US 11,518,786 B2

Proposed Relevant Industries: Healthcare

Inventor: Dr. Chelvam Venkatesh (cvenkat@iiti.ac.in), Pandit A., Ramesh B. Reddy, B.R. Yadav, K. Roy, D. Pathak B. Department of Chemistry

A Composition for Sepsis and Method Thereof

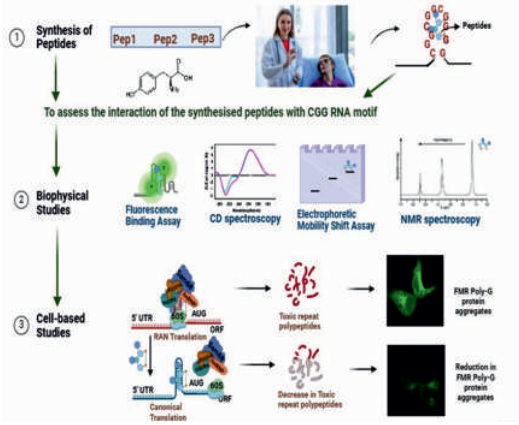
Sepsis, caused by microbial infections, impairs vital organs like the lungs and kidneys. Despite many therapeutic agents being tested since the 1980s, few have been successful, and no specific approved treatment exists. We propose a novel combination of levofloxacin, a broad-spectrum antibiotic, and dorzolamide, an anti-inflammatory drug, to address both bacterial killing and organ healing in sepsis. Preclinical studies are complete, and a Phase 1 clinical trial is planned. The invention is patented under reference E-137/6170/2023/MUM, application number 202321038927. New drugs for sepsis could save lives, reduce hospital stays, and address antimicrobial resistance challenges.



Illustrates composition and working process of the composition of the present invention.

Patent: Filed, Indian Patent Application No. 202321038927
Proposed Relevant Industries: Pharmaceuticals
Inventors: Rajat Atre, Rahul Sharma, Prof. Mirza S Baig (msb.iit@iiti.ac.in), Department of Bioscience & Bioengineering

Homoaromatic Peptides Mitigate FMR Poly-g-protein-mediated Toxicity and Alternative Splicing Defects in Fragile X-associated Tremor/ataxia Syndrome (FXTAS)



RNA regulates biological functions, but repeat expansion in certain nucleotides causes neurodegenerative disorders like Fragile X-associated tremor/ataxia syndrome (FXTAS) and Fragile X-associated primary ovarian insufficiency (FXPOI). Expansion of CGG in the FMR1 gene results in toxic RNA foci, pre-mRNA splicing defects, and non-AUG translation (RAN), producing toxic FMR Poly-G protein aggregates. The number of affected patients is increasing, with limited awareness in India. Homo-aromatic Tyrosine-based peptides Pep1, Pep2, and Pep3 target FMR Poly-G aggregates, offering high specificity, biological activity, low toxicity, and biocompatibility. These peptides have been tested on FXTAS-cellular models with positive results and can be developed for drug and delivery systems.

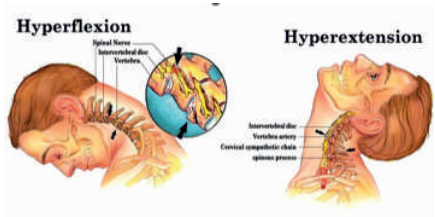
Patent: Under Process

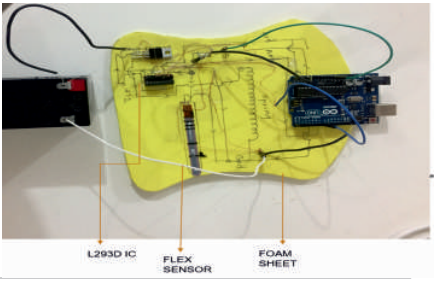
Proposed Relevant Industries: Pharmaceuticals

Inventors: Mr. Krishna Singh, Dr. Tapas Ghosh, Prof. Amit Kumar (amitk@iiti.ac.in), Department of Biosciences and Biomedical Engineering, Prof. Apurba K. Das (apurba.das@iiti.ac.in), Department of Chemistry

SMA Based Smart Cervical Collar

The cervical collars market is shifting towards soft collars, moving away from rigid ones once widely used for spinal injuries. Most neck injuries today don't require rigid collars, leading hospitals and healthcare associations to adopt soft collars. The demand is driven by rising neck pain, cervical spondylitis, aging populations, and neck injuries from sports and defense. Soft collars use piezo sensors to capture strain between the neck and collar, automatically adjusting pressure. They are made with shape memory alloys and a microcontroller, using a feedback mechanism to reduce the effort in monitoring correct wearing practices.





Patent: Granted, Indian Patent Application No. 201721008038

Proposed Relevant Industries: Healthcare Industry Defense Sector Sports and Fitness Industry

Inventors: Dr. Shilpa Raut, Senior Medical Officer, Prof. Palani I. A. (palaniia@iiti.ac.in), Department of Mechanical Engineering

IoT-enabled Smart Absorbent Material and Sanitary Device

Currently, 61.4% of Indian menstruating women feel embarrassed about periods (The Hindu, 2023). To address this, Laser-induced graphene (LIG) and thin metal electrodes in sanitary pads offer a solution for leakage detection due to their absorptive and conductive properties. Integrated into replaceable pads, these electrodes detect biofluid via resistivity changes without skin contact. The system connects to an IoT device on the waist, providing vibrational feedback. The device alerts users to period initiation, leakage, or saturation, signaling when to replace the pad. This low-cost technology, currently at TRL 6, can also be applied to adult diapers for broader use.

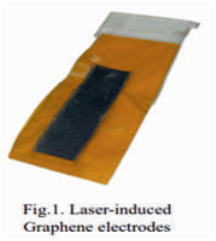


Fig.1. Laser-induced Graphene electrodes

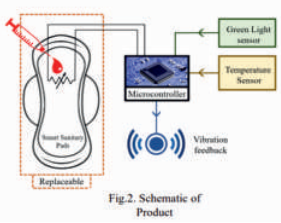
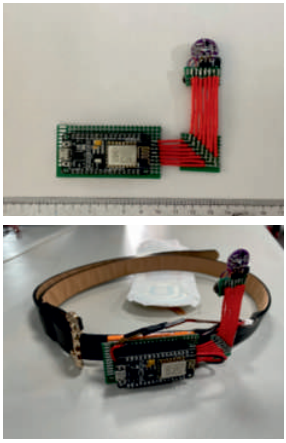


Fig.2. Schematic of Product

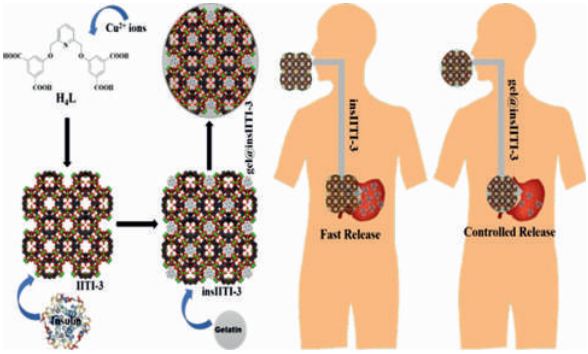


Prototype developed

Patent: Filed, Indian Patent Application No. 202321067853
Proposed Relevant Industries: Healthcare Sector
Inventors: Kailaash Pandiyan, Aditi T, Pragya Singh, Kanishka Goyal, Ayushi Agrawal, D J Mistry, Prof. Palani I A (palaniia@iiti.ac.in), Department of Mechanical Engineering

Role of Gelatin Coating With Copper-based Metal-organic Framework For Controlled Insulin Delivery

Diabetes affects around 552 million people worldwide, with type 1 diabetes (T1DM) and type 2 diabetes (T2DM) being the main types. Insulin therapy is critical for managing these conditions, though the current delivery systems (syringe, pen, pump, inhaler) face limitations like cost, invasiveness, and inconvenience. Oral insulin delivery is beneficial but hindered by low bioavailability. The invention of copper Metal-Organic Framework (IITI-3) shows a high surface area of 1026.5 m^2/g and pore diameter of 3.413 nm. Insulin encapsulation in IITI-3 with gelatin coating ensures controlled release. Gelatin improves biocompatibility and delivery efficiency, offering a promising solution for insulin administration.



Synthesis of IITI-3 using new linker, Insulin encapsulation within IITI-3, coated with gelatin and their drug delivery release phenomenon (Adapted with permission ACS Materials Lett. 2023, 5, 4, 1100–1108. Copyright 2023, American Chemical Society).

Patent: Under process
Proposed Relevant Industries: Pharmaceutical, Biotechnology and Healthcare
Inventor: Shaikh M. Mobin (xray@iiti.ac.in), Department of Chemistry

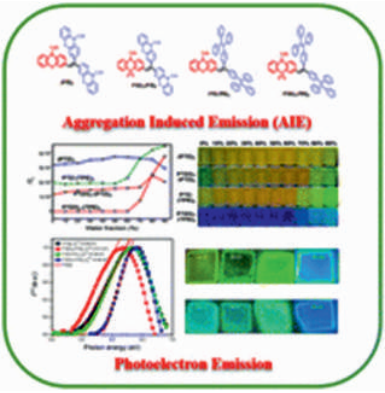
Room Temperature Phosphorescence

Room temperature phosphorescence (RTP) has attracted great attention for the scientific community for their wide applications in optoelectronic devices. However, these materials are still very scarce, partially due to the unclear mechanism and lack of designing guidelines.

Phenothiazine boronic ester derivatives were developed and investigated for RTP. The materials are easy to prepare and cost effective.

The technology is currently in the large scale manufacturing.

The RTP materials are used in light-emitting diodes, anti-counterfeiting, sensors, and bioimaging. Therefore these materials are directly going to benefit for energy and health sectors.



Source: doi.org/10.1039/D3TC03921H

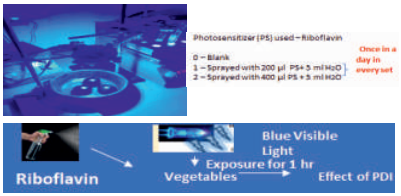
Patent: Nil
Proposed Relevant Industries: LED and Health Sectors
Inventor: Prof. Rajneesh Misra (rajneeshmisra@iiti.ac.in), Department of Chemistry

An Alternative To Cold Storages- Development of A Portable Kit for Visible Light Photo Dynamic Inactivation of Microbes on Food Surfaces From Ultraviolet Towards Visible Light: A Sustainable Future

Cold storage contributes to environmental damage through greenhouse gas and carbon emissions. To address this, solutions are needed to reduce emissions and make the global food cold chain sustainable. Current approaches focus on energy efficiency and refrigeration emissions. Due to rising cold storage costs for small and marginal farmers, alternative storage methods are essential. We propose using Photodynamic Inactivation (PDI) of microbes as an alternative for storing vegetables and grains in cold storage, providing a more sustainable option to mitigate the financial burden on farmers while reducing environmental impact.

Photodynamic Inactivation Towards Microbes

2nd Phase with 1st Phase Expt.



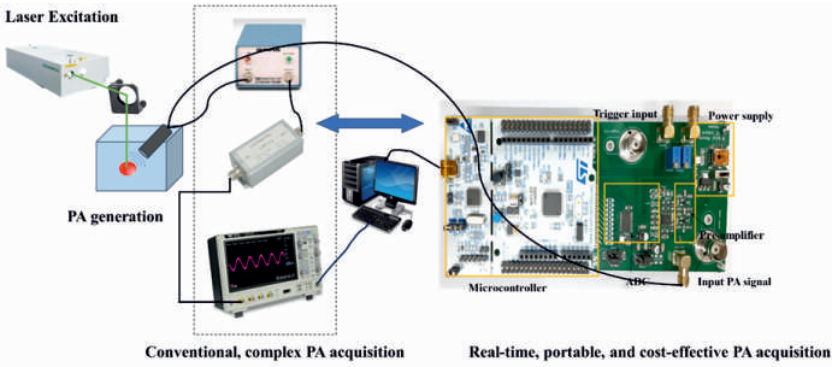
Patent: Flied, Indian Patent Application No. 202421010243

Proposed Relevant Industries: Agriculture Sector, Healthcare Sector, Food Industries etc.

Inventors: Niladri Sekhar Roy, Dr. Debayan Sarkar (sarkard@iiti.ac.in), Department of Chemistry

Fast Cancer Screening Device for Early-stage Cancer Diagnosis, using a Quantitative Photoacoustic Spectral Response Technique

Medical diagnostics are essential for effective treatment and recovery, with a focus on early diagnosis over the past two decades. The photoacoustic (PA) technique, a non-invasive approach, offers high sensitivity and accuracy. This research develops a cost-effective PA screening tool for early-stage cancer detection, targeting remote areas with limited medical facilities. The project utilizes a compact pulsed laser diode (PLD) based PA system for optical design. Field investigations at AIIMS Bhopal showed its potential to differentiate malignant and fibrocystic changes from normal fatty tissue in breast disease. The technology is at TRL 5, with the cost of the developed instrument under 1 Lac, compared to >70 Lac for conventional instruments.



Patent: Granted, Indian patents Application No. 202221056741, 202221050788
Proposed Relevant Industries: Healthcare Sector
Inventors: Suhel Khan, Prof. Srivathsan Vasudevan (svasudevan@iiti.ac.in), Department of Electrical Engineering

Developed Rapid Non-invasive Diagnostic Kits (TB-RAP) for Tuberculosis

Tuberculosis (TB) infects 10 million people and kills 1.5 million annually. Existing diagnostic kits are costly, time-consuming, and less sensitive, leading to undetected cases. To address this, we developed the non-invasive, rapid, precise, and affordable TB diagnostic kit, "TB-RAP," which detects TB from saliva or sputum samples within hours without requiring trained personnel. The technology is under clinical validation using TB patient samples (TRL 6). The TB-RAP kit enables early, fast, and specific diagnosis of TB, helping to prevent the further spread of the disease while reducing the need for trained manpower.

TB-RAP KIT
Schematic representation of TB-RAP Kit

"S"- Saliva or sputum sample "T": Test Sample "C": Positive control

Patent: Under Process
Proposed Relevant Industries: Healthcare Sector
Inventor: Prof. Avinash Sonawane (asonawane@iiti.ac.in),
Department of Biosciecnes and Biomedical Engineering

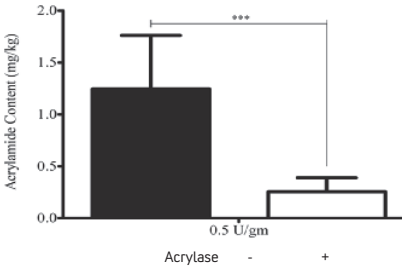
Development of Acrylase Formulation to Reduce Acrylamide Carcinogen Formation in Processed Food Products

An increased consumption of processed food has resulted in sharp increase in the incidences of cancer development in human being. Studies have shown that cooking of starch and carbohydrate rich food products at high temperature produces a carcinogen called "Acrylamide", which increases risk of cancer development in humans.

We have developed thermostable "Acrylase" enzyme formulation, which reduced more than 90% acrylamide production in processed food products such as French fries, buns, bread and bakery products after treatment with Acrylase enzyme. Product formulation done for the technology (TRL 6).

Acrylase will reduce acrylamide production in widely consumed processed food products, thus will reduce risk of cancer development and improve quality of human life.

Acrylamide containing processed food

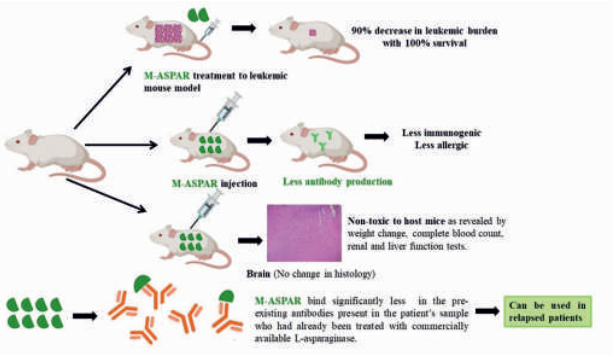


Treatment with "Acrylase" reduced 90% acrylamide production in processed foods

Patent: Under Process
Proposed Relevant Industries: Food Sector
Inventor: Prof. Avinash Sonawane (asonawane@iiti.ac.in),
Department of Biosciecnes and Biomedical Engineering

Novel M-ASPAR Drug to Improve Treatment of Primary and Relapse Blood Cancer

L-asparaginase is commonly used for treating Acute Lymphoblastic Leukemia (ALL), but it causes serious side effects like allergies, neural disorders, blood clots, and toxicity to organs. Additionally, its success in treating relapse ALL is limited. We have developed the novel M-ASPAR drug, which significantly reduces side effects and improves therapeutic efficacy. M-ASPAR, currently in Phase I/II clinical trials (TRL 8), is nontoxic to the kidney, liver, spleen, brain, and bone. It has shown the ability to kill 90% of cancerous cells and achieve 100% survival in cancerous mice, offering a promising treatment option for relapse ALL.

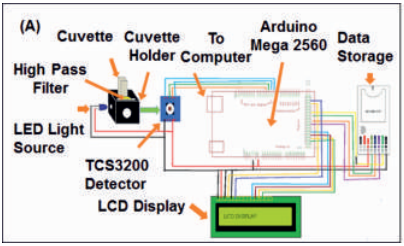


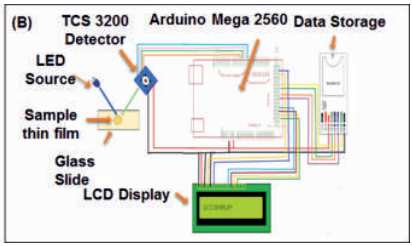
Acute Lymphoblastic Leukemia (ALL) is treated using a combination of drugs that includes L-asparaginase as a major component. However, administration of L-asparaginase causes serious side effects and the therapeutic efficacy of L-asparaginase is significantly reduced in relapse ALL patients. We have developed novel M-ASPAR drug which is nontoxic to kidney, liver, spleen, brain, bone. M-ASPAR killed 90% cancerous cells and 100% survival of cancerous mice was observed.

Patent: Granted, Indian Patent No. 365651
Proposed Relevant Industries: Healthcare Sector
Inventor: Prof. Avinash Sonawane (asonawane@iiti.ac.in),
Department of Biosciences and Biomedical Engineering

Portable Biosensing System and Method for Milk Spoilage and Adulteration Detection

This invention relates to the a portable biosensing system and method for milk spoilage and adulteration detection. The invention provides a color sensor-based device that is interfaced with the Arduino controller tested using a ratio-metric fluorescent assay. The computational coding in Arduino enables us to read the red-green-blue (RGB) parameters and display them on the liquid crystal display panel. The fluorescent responses were compared against a commercial fiber optic spectrometer. The processed data can be sent providing real-time information of milk quality to the buyer so that it helps to overcome the illegal practices during processing, packaging, and transportation.



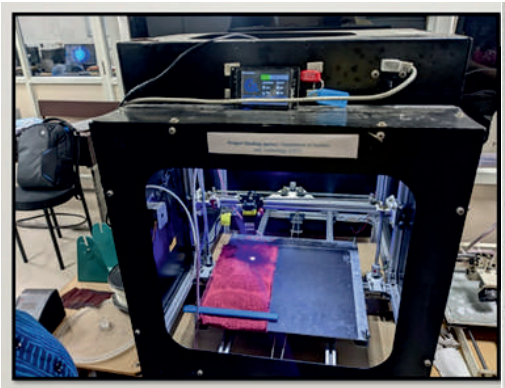


Patent: Filed, Indian Patent Application No. 202121023242
Proposed Relevant Industries: Milk Manufacturers and Distributors
Inventors: Sandeep Choudhary, Tanmay Vyas, Abhijeet Joshi (abhijeet.joshi@iiti.ac.in), Department of Bioscience & Bioengineering

Manufacturing
(Including Smart, Advance and Industry 4.0)

Low-cost Laser printer for printing Geographical Index and QR code on fabrics

Geographical indexing of fabric refers to categorizing or organizing fabrics based on their place of origin or the cultural, historical, and traditional characteristics tied to specific regions. This concept is commonly applied in the textile industry to identify fabrics that are unique to a particular geographic area. Benefits of Geographical Indexing in Fabric: Cultural Preservation, Authenticity, Economic Support. We have a Developed a low-cost laser printer for printing for printing QR code and GI index on the fabric without damaging the fabric. Initially trails where attempted on Maheswari and chandari silks.



LOGO Printing Setup with Diode Laser (405 nm)

Patent: Under Processes

Proposed Relevant Industries: Textile

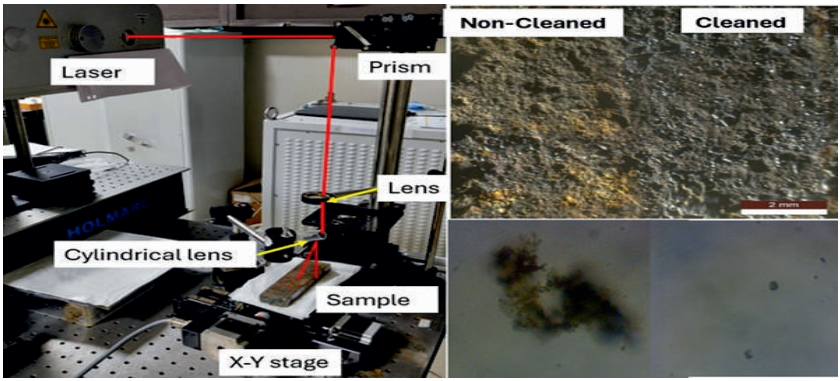
Inventors: Prof. Palani I.A. (palaniia@iiti.ac.in), Prof. Suhas S Joshi, Dr. Anshu Sahu, Ms. Sunitha, Department of Mechanical Engineering

Laser Cleaning of Biofouling from Ship Hull

Biofouling (growth of algae, and mussels on ship hull) increases the flow resistance of ship, resulting in fuel consumption and CO_2 emissions. Mechanical cleaning damaged the hull coating. Hence, laser-based cleaning is an alternative effective approach to clean ship hulls.

Blue and Green lasers with varying energies were used for irradiating on the larger area of the hull surface. Further, cleaned reactive surfaces restrict the growth of the marine organism.

Industries that benefited are Marine and Shipbuilding, Automotive, Manufacturing and Metalworking, Cultural Heritage Preservation etc.



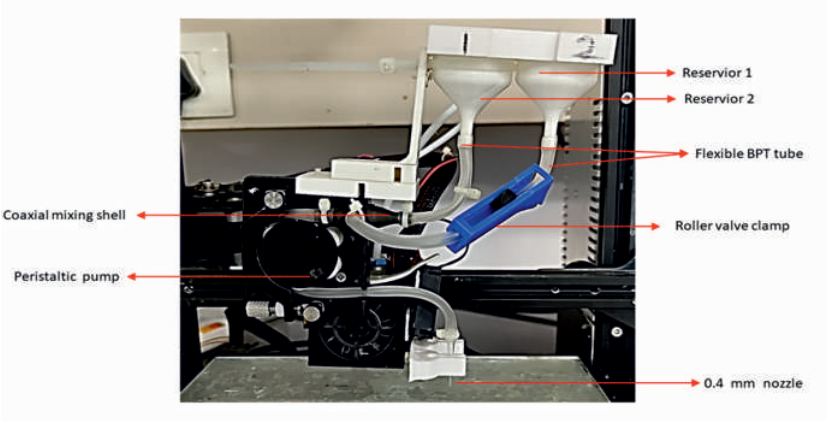
Patent: Nil

Proposed Relevant Industries: Marine and Shipbuilding, Automotive Industry, Energy Sector, Manufacturing and Metalworking, Aerospace Industry, Cultural Heritage Preservation

Inventors: Dr. I. A. Palani (palaniia@iiti.ac.in), Dr. Kiran Bala, Dr. Nandini Patra, Mr. Rohit Pandya, Mr. Amit Nabira, Department of Mechanical Engineering

System and Method for Direct Ink Writing

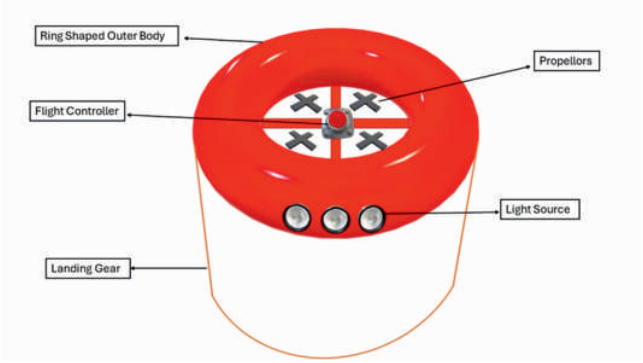
This invention advances Direct Ink Writing (DIW), a 3D printing method for creating complex structures using viscoelastic inks. It introduces a dynamic system for altering composite composition during printing, addressing deposition inconsistencies with a stepper motor-based peristaltic pump integrated into an Ender-3 printer. This innovation ensures precise, reliable flow control, enabling fabrication of intricate parts with large composite material. The system's versatility allows the fabrication of detailed architectures for diverse applications, overcoming limitations of existing methods. With real-time control and enhanced precision, this invention significantly improves DIW's capabilities for advanced design and manufacturing.



Patent: Filed, Indian Patent Application No. 202321079655
Proposed Relevant Industries: Additive Manufacturing
Inventor: Dr. Girish C. Verma (girish.verma@iiti.ac.in), Department of Mechanical Engineering

Design of Industrial Illumination Drone with Obstacle Avoidance

The project proposes an industrial drone designed for targeted illumination, replacing traditional torch-mounted caps used by laborers. This innovative solution enhances visibility and safety, offering adaptability for challenging environments by precisely directing light where needed. Unlike conventional drones used for cargo or surveillance, this concept reimagines drones as dynamic lighting sources, optimizing industrial work conditions. Currently in the ideation stage, the project emphasizes collaboration, funding, and ethical considerations for development. Beyond industry, it highlights creative drone applications, setting new standards and showcasing their potential to improve safety, productivity, and technological progress across various sectors.



Patent: Nil

Proposed Relevant Industries: Manufacturing, Infrastructure Development, Construction

Inventors: Dr. Devesh Mishra, Dr. Sumit Gautam (sumit.gautam@iiti.ac.in), Department of Electrical Engineering

A Method and Apparatus for Transferring Heat from Stationary/ moving Surfaces Using Impingement Jet

This invention focuses on the thermo-fluidic characteristics of impinging jets, specifically examines the heat transfer of stationary and moving surfaces. It includes stepper motors, ball screws, sensors, nozzle, and thermal imaging device that captures high-resolution temperature data in real-time. The technology overcomes existing limitations on the infrared thermal imaging during jet impingement cooling for complex dynamic systems. It can be used in various industrial applications namely, metallurgical processing, paper drying, textiles, electronics cooling and aerospace. Beyond industrial applications, it can be used for predictive modeling for thermal systems, paving the way for sustainable, energy-efficient technologies with broader societal benefits.

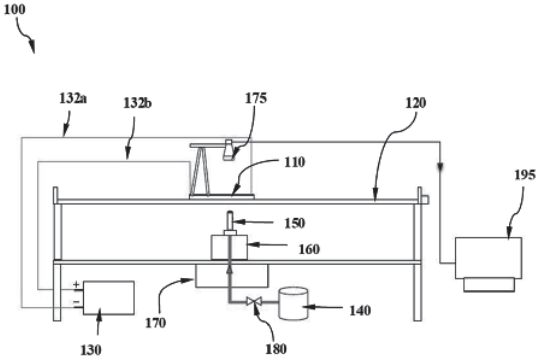
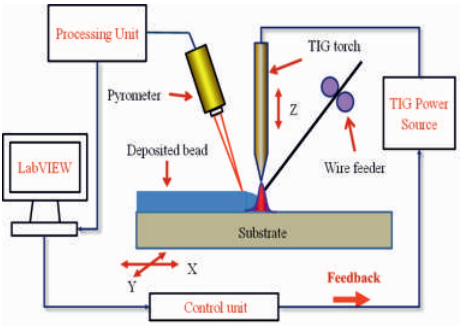


Figure 1

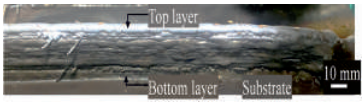
Patent: Granted, Indian Patent No. 471000
Proposed Relevant Industries: Metallurgical Processing Industries, Steel Industries, Paper and Textile Industries
Inventors: Avadhesh Kumar Sharma, Akash Kumar Jain, Mayank Modak,
Prof. Santosh Kumar Sahu (sksahu@iiti.ac.in), Department of Mechanical Engineering

In-Situ Temperature Monitoring and Feedback Control in the Wire Arc Additive Manufacturing Process

Gas tungsten arc welding (GTAW) is widely used in surface hardening and additive manufacturing due to its versatility and cost-effectiveness. To address the decline in skilled operators caused by harmful radiation, a novel automation technology was developed. This system uses a ratio pyrometer to monitor and regulate temperature (400-1600 °C) during wire arc additive manufacturing (WAAM). Programmable control of the GTAW power source is achieved by replacing the foot pedal with electronic circuitry and a feedback control system using LabVIEW software. Validated in laboratory settings, this technology improves stability and bead quality, demonstrating proof of concept at TRL 4.



Schematic for temperature monitoring and control for wirearc additive manufacturing.

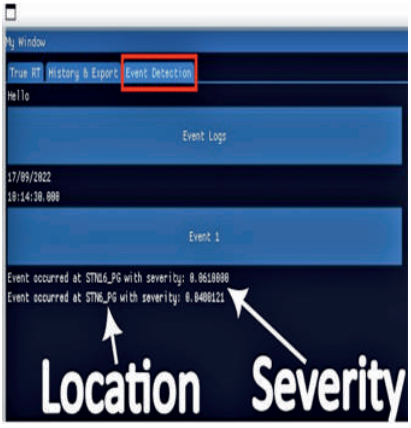


Temperature-dependent feedback control for the multilayer deposition with the moving heat source at a deposition speed of 0.15 m/min, wire feed speed of 2.5 m/min, and setpoint temperature of 1250 °C for 1–5 layers, (b) temperature controlled multilayer deposited wall.

Patent: Nil
Proposed Relevant Industries: Aerospace and Medical Implants.
Inventors: Anas Ullah Khan, Dr. Yuvraj K Madhukar (yuvrajmadhukar@iiti.ac.in), Department of Mechanical Engineering

Wide Area-Monitoring of the Indian Electricity Grid for Enhanced Visibility

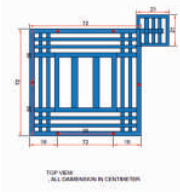
The proliferation of measurement devices provides granular, real-time data which can be used for optimizing grid operations. Our Make-in-India software offers a cost-effective alternative to expensive, non-customizable foreign solutions for power grid monitoring. Currently at TRL4, it features C++ algorithms for detecting grid events, real-time data visualization, and offline analytics. Tested on a Real-Time Digital Simulator, it includes concealed backend computations, an interactive GUI, and visual alarms to reduce critical grid failures. By automating grid analytics and lowering operator cognitive load, the technology enhances efficiency and prioritizes rural areas during load shortages, delivering scalable and reliable grid management solutions.

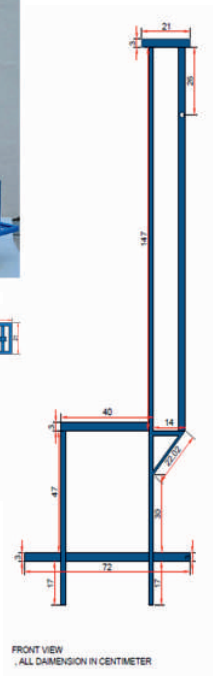


Patent: Granted, Indian Patent Application No. 202321014760
Proposed Relevant Industries: Electrical Utilities
Inventors: Adnan Iqbal, Prof. Trapti Jain (traptij@iiti.ac.in) Department of Electrical Engineering

Portable Integrated Stand for Constant and Falling Head Permeability Apparatus

The permeability test is crucial in geotechnical engineering for understanding soil properties. Traditional wall-mounted equipment lacks flexibility, posing challenges for use in diverse and remote settings. The innovative apparatus addresses these issues with a unique design, precise controls, and a user-friendly interface for efficient water flow measurement and test monitoring. Its portable, flat-surface setup eliminates the need for wall mounting, enhancing adaptability, space efficiency, and cost savings. This device enables reliable permeability testing in various environments, including remote sites. Now at TRL-8, the technology is ready for implementation in industries and academia, offering consistent and practical solutions.

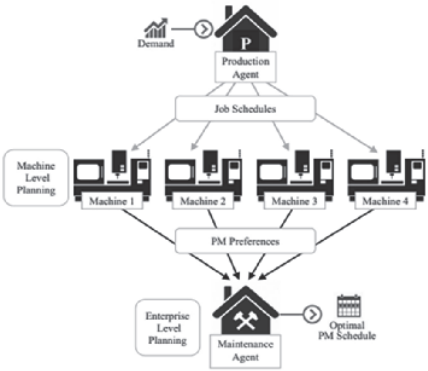




Patent: Register Design No.393005-001 at IPO
Proposed Relevant Industries: Manufacturing
Inventors: Monika Dagliya, Nitin Tiwari, Dr. Neelima Satyam (neelima.satyam@iiti.ac.in), Department of Civil Engineering

Method and System for Providing Smart Communications for Distributed Operations Planning in an Industrial Network

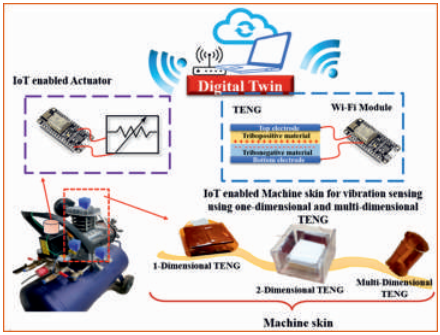
This invention relates to a method and system of providing smart communications for distributed operations planning in an industrial network. More particularly, the present disclosure relates to a novel communication method facilitating intelligent communications and decision making for distributed operations planning, such as, but not limited to, maintenance scheduling, production scheduling/sequencing, inventory management, quality control etc., within the industrial network. The novel communication method helps in making faster, autonomous and more-informed decisions under dynamic conditions within any industrial environment.
A software solution using this invention for industrial decision making is currently under development.



Patent: Filed, Indian Patent Application No. 201621007003
Proposed Relevant Industries: Any Manufacturing Industry
Inventors: Namit Agrawal, Miroojin Bakshi, Kartikeya Upasani, Prof. Makarand S. Kulkarni, Dr. Vibhor Pandhare, Prof. Bhupesh Kumar Lad (bklad@iiti.ac.in), Department of Mechanical Engineering

Design and Development of Triboelectric Nanogenerator-Based Machine Skin Integrated with Smart Actuator for Digital Twin Development

Diagnostics play a vital role in detecting machine defects. Advancing Industry 4.0 to 5.0, a customizable "Machine Skin" with self-energizing smart sensors is proposed for conventional machinery. Using an IoT-enabled Triboelectric Nanogenerator (TENG), it detects vibration anomalies and sends data to a Digital Twin for analysis. This enables condition monitoring, predictive maintenance, and alerts. The system includes a closed-loop mechanism with an IoT-enabled actuator to adjust the machine's RPM, preventing failures and ensuring uninterrupted production. The technology, at TRL 2-3, offers cost-effective solutions for industries in developing nations to transition toward smart manufacturing.

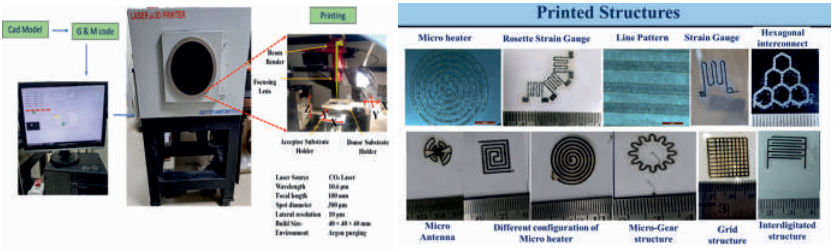


Schematic of the Machine skin and actuator on the air compressor incorporated with its Digital Twin

Patent: Filed Indian Provisional Patent Application No. 202421017372
Proposed Relevant Industries: Manufacturing, Heavy Industries
Inventors: Diksha Jaurker, Prof. Suhas S Joshi, Dr. Vibhor Pandhare, Prof. Palani I.A. (palaniia@iiti.ac.in), Department of Mechanical Engineering

Implementation of Laser Decal Transfer Towards Laser μ-3D Printing

In microfabrication, μ-3D printing combines laser direct writing and additive manufacturing for maskless printing of micron-scale 3D structures. Using thin films as feed material, it fabricates multimaterial structures, including metals, polymers, and alloys, without altering material properties. This technology addresses limitations of screen and inkjet printing, such as nozzle clogging and instability, enabling the production of microelectronics components like meta-antennas, bandpass filters, and strain gauges with a minimum thickness of 2 μm. At TRL-8 and ready for commercialization, the Laser μ-3D printer advances the fabrication of sensors and actuators, meeting the growing demand in electronics industries.



Laser μ-3D Printer developed in-house at IIT Indore

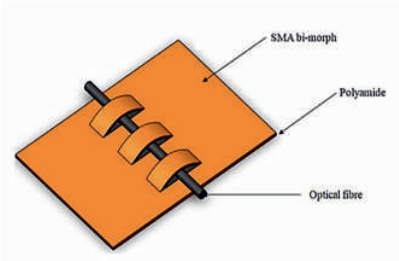
Patent: Filed Indian Patent Application No. 202221022267

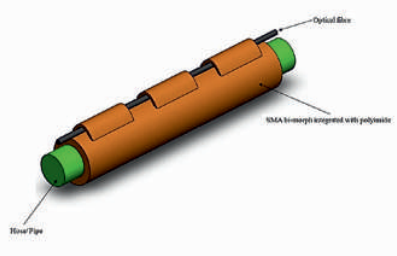
Proposed Relevant Industries: Microfabrication, Semiconductor Printing, Flexible Electronics

Inventors: Dr. Anshu Sahu, Prof. Vipul Singh, Prof. Palani I.A. (palaniia@iiti.ac.in), Department of Mechanical Engineering

Strained SMA Bimorph & Spring Based Condition Monitoring System for Fluid Leak Detection in Hydraulic Hoses SMA

Monitoring temperature in hydraulic packs used in heavy industry is challenging. A sensor system focuses on detecting and monitoring fluid leakage in hydraulic hoses. The sensor uses a shape memory alloy (SMA) bimorph with clamps and an optical fiber. Wrapped around the hose, it detects fluid leakage by measuring bending loss in the optical fiber, caused by temperature-induced changes in the SMA's shape. Leakage is monitored via resistance changes in strained SMA wires. An IoT-enabled controller displays leakage status through a mobile app. The technology has reached Technology Readiness Level (TRL) 4.

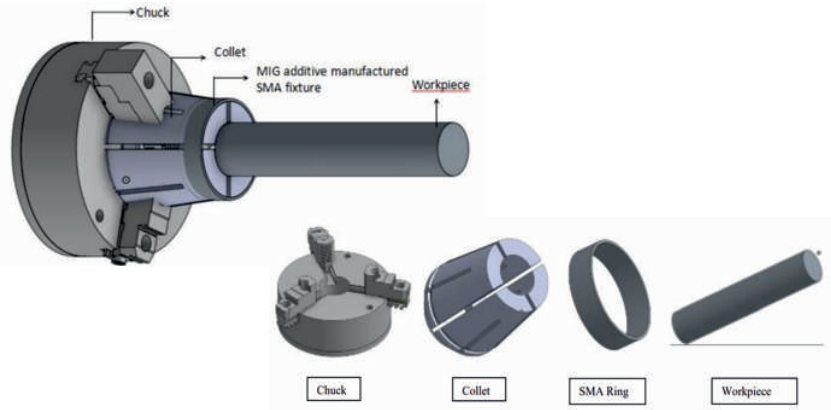




Patent: Granted, Indian Patent Application No : 202221022267
Proposed Relevant Industries: Automobile, Ship building, Heavy and Manufacturing Industries
Inventor: Prof. Palani I.A. (palaniia@iiti.ac.in), Department of Mechanical Engineering

Metal Inert Gas (MIG) Based Additive Manufacturing Technique For Fabricating Shape Memory Alloy Ring

Vibrations during machining generate frictional heat, causing thermal expansion, machine wear, and wobbling, leading to dimensional errors and poor surface finish. Shape-memory alloys (SMAs) can dampen vibrations by dissipating heat energy. NiTi SMAs, known for their shape memory effect and pseudoelasticity, are ideal for structural vibration control. They are produced using methods like powder metallurgy, thermal spray, and plasma melting, but MIG additive manufacturing offers strategic advantages. This technology is nearing TRL 5, promising enhanced vibration control and improved machining quality.



Patent: Granted, Indian Patent Application No. 201721007136

Proposed Relevant Industries: Proposed Relevant Industries: Manufacturing and Machine tool industry, Heavy industry

Inventors: Prof. Bhupesh K Lad (bklad@iiti.ac.in), Prof. Palani I.A. (palaniia@iiti.ac.in), Department of Mechanical Engineering

Non-Contact Technology for High Quality Finishing of Bevel Gears

A novel twin complementary cathode gear concept was developed for non-contact electrochemical honing (ECH) of bevel gears, with a machine (Fig. B) for processing 20MnCr5 alloy, commonly used in automotive applications. Continuous or pulsed DC power enables pulse-ECH (PECH), which outperformed ECH, achieving up to DIN 6 gear quality. Plasma nitriding further enhanced PECH performance. The technology, at TRL 4-5, offers a sustainable, environmentally friendly, and cost-effective solution for high-quality finishing, improving bevel gear performance and service life.

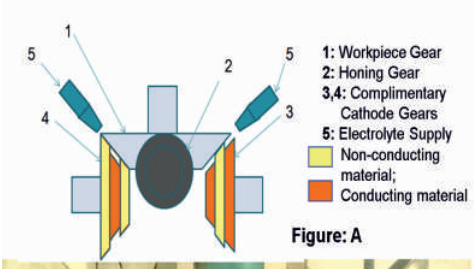


Figure: A

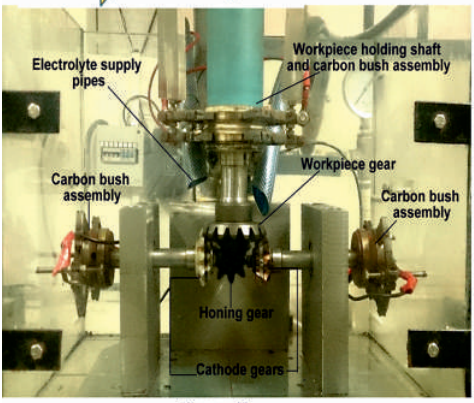


Figure: B

Patent: Nil

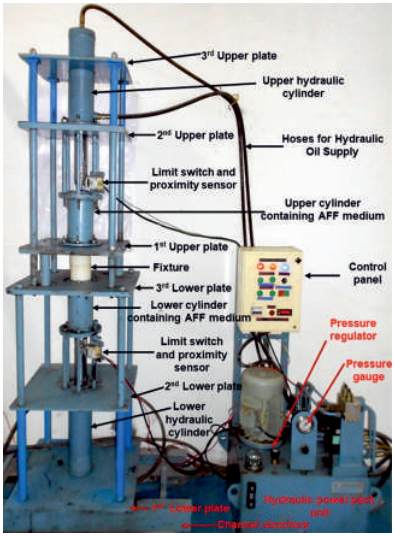
Proposed Relevant Industries: Automobile, Marine, Avionics, Home Appliances, and any Industry using and/or testing of Gears

Inventors: Javed Habib Shaikh, Sunil Pathak, Prof. Neelesh Kumar Jain (nkjain@iiti.ac.in), Department of Mechanical Engineering

Abrasive Flow Finishing Machine for High Quality Finishing of Cylindrical and Conical Gears

There are challenges in imparting high quality finish of cylindrical and conical gears.

An Abrasive Flow Finishing (AFF) machine and fixtures have been developed for high-quality finishing of spur, helical, and bevel gears, using a putty of molding clay, silicon carbide abrasives, and silicone oil. The process improves gear quality to 7 DIN standard, supports simultaneous finishing of multiple gears, and is being explored for additively manufactured parts. Laser texturing before AFF enhances gear finishing performance. With a TRL of 3-4, the process is sustainable, flexible, safe, and cost-effective, emitting no harmful substances. The machine costs Rs. 5 Lacs, significantly cheaper than commercial models priced at Rs. 70 Lacs.



Patent: Nil

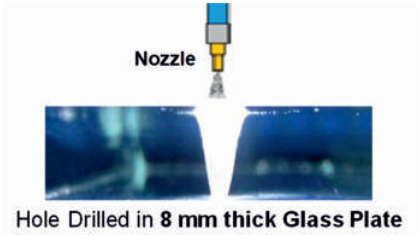
Proposed Relevant Industries: Automobile, Marine, Avionics, Home Appliances, and any Industry using and/or testing of Gears

Inventors: Anand Petare, Prof. I.A. Palani, Prof. Neelesh Kumar Jain (nkjain@iiti.ac.in), Department of Mechanical Engineering

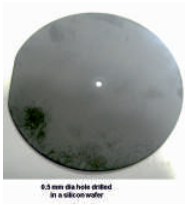
Micro-Controlled 3-Axis Machine for Abrasive Jet Machining (AJM) Process brittle materials.

An innovative, cost-effective machine for machining thin ceramics using the AJM process has been developed. It features micro-controlled three-axis movement and efficient abrasive-air mixing via line vac. The machine drills 0.5 mm diameter holes in 200-micron thick silicon wafers and 5–10 mm thick glass plates. It also supports controlled sandblasting to enhance material fatigue strength. With a TRL of 4-5, this flexible and safe machine costs only ₹1 lakh, significantly cheaper than commercial alternatives (₹35+ lakhs). It is ideal for machining thin ceramics, semiconductors, and brittle materials.

Front View and Side View of the Developed AJM Machine



0.5 mm dia hole drilled in a silicon wafer



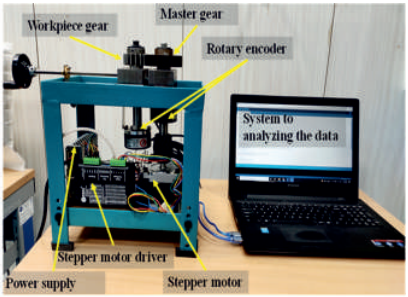
Patent: Nil

Proposed Relevant Industries: All the Industries that Require Machining of very thin Ceramics and Semi-conductors, and Highly Brittle Materials

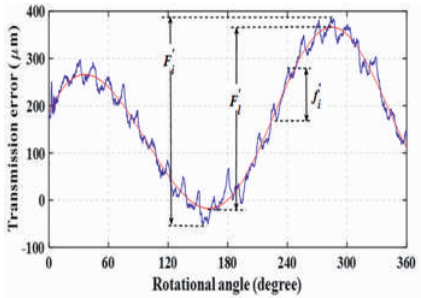
Inventors: Prasad Kulkarni, Pratik Bagal, Devkant Singh, Prof I.A. Palani, Prof Neelesh Kumar Jain (nkjain@iiti.ac.in), Department of Mechanical Engineering

Single Flank Roll Tester for Functional Performance of Cylindrical Gears

A compact, economical, Arduino-programmed single flank roll tester has been developed to evaluate Total Transmission Error, Tooth-to-Tooth Transmission Error, and Total Pitch Error of cylindrical gears using a rotary encoder, stepper motor, and power supply. With a TRL of 4-5, this device costs Rs. 80,000 compared to Rs. 35 Lacs for commercial alternatives. Data is easily acquired via a pen drive and analyzed using an MS Excel program. Accurate and portable, it is nearly ready for industry transfer, offering a cost-effective solution for gear testing.



Photograph of the Developed Single Flank Roll Tester



Sample Results from Single Flank Roll Tester

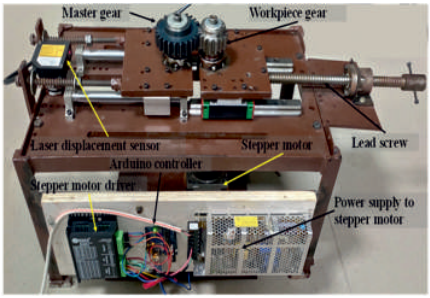
Patent: Nil

Proposed Relevant Industries: Automobile, Marine, Avionics, Home Appliances, and any Industry using and/or testing of Gears

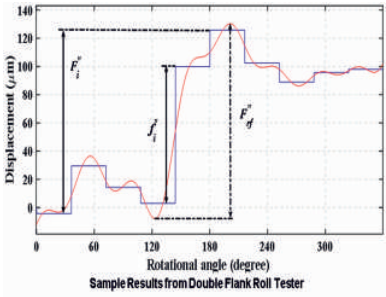
Inventors: Dr. Vivek Rana, Prof Neelesh Kumar Jain (nkjain@iiti.ac.in), Department of Mechanical Engineering

Double Flank Roll Tester for Functional Performance of Cylindrical Gears

A compact, economical double-flank roll tester for cylindrical gears has been developed, using Arduino, a laser displacement sensor, a lead screw, and a stepper motor. It measures Total Composite Error, Tooth-to-Tooth Composite Error, and Radial Runout with high accuracy. Costing ₹90,000 compared to ₹25 lakh for commercial equipment, it offers significant savings. Data can be acquired via a laptop or PC using a pen drive. With a Technology Readiness Level (TRL) of 4-5, it is nearly ready for industrial transfer, providing a portable, innovative solution for gear testing.



Photograph of the Developed Double Flank Roll Tester



Sample Results from Double Flank Roll Tester

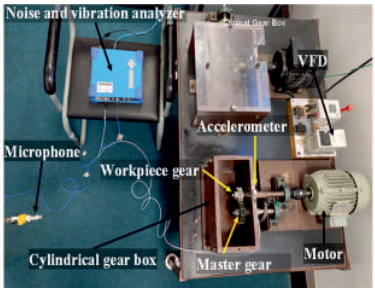
Patent: Nil

Proposed Relevant Industries: Automobile, Marine, Avionics, Home Appliances, and any Industry using and/or testing of Gears

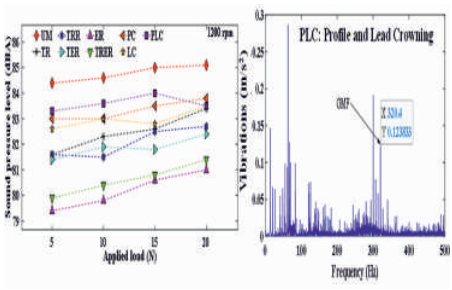
Inventors: Rajat Kasliwal, Anand Petare, Prof. Neelesh Kumar Jain (nkjain@iiti.ac.in), Department of Mechanical Engineering

Noise and Vibrations Test Rig for Cylindrical and Conical Gears

This technology analyzes noise and vibrations in conical and cylindrical gears. A compact test rig has been developed to measure vibrations and noise in the frequency and time domains under varying speeds and loads. It identifies noise sources using a Noise and Vibration Analyzer, accelerometers, microphones, and a sound intensity probe. The system employs separate motors for cylindrical and conical gears, controlled by a Variable Frequency Drive (VFD). With a TRL of 3-4, this equipment is cost-effective (Rs. 2 Lacs vs. Rs. 40 Lacs commercially) and compact, offering precise data acquisition for gear performance analysis.



Photograph of the Developed Test Rig for Noise and Vibrations



Sample Results for Noise and Vibration Signals

Patent: Nil

Proposed Relevant Industries: Automobile, Marine, Avionics, Home Appliances, and any Industry using and/or testing of Gears

Inventors: Gaurav Kumar, Rahul Kashyap, Anand Parey, Prof. Neelesh Kumar Jain (nkjain@iiti.ac.in), Department of Mechanical Engineering

Non-Contact Flank Modification Technology for Spur Gears

A novel non-contact machine (Fig. 1a) using the pulsed electrolytic dissolution (PED) process was developed to apply five spur gear flank modifications: tip relief, root relief, end relief, flank crowning, and profile crowning. This required five specialized cathode gears (Fig. 1b). The machine can apply any single modification, combinations, or all five simultaneously. Experiments showed reduced flank surface roughness, elimination of hob cutter marks and cracks, and improved functional performance. Modified gears exhibited lower noise and vibration compared to unmodified ones. Additionally, five theoretical models were developed to predict each type of flank modification.

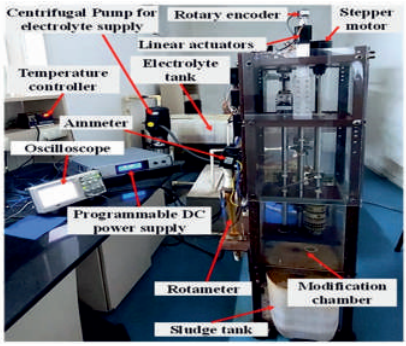


Fig. 1a

Fig. 1b

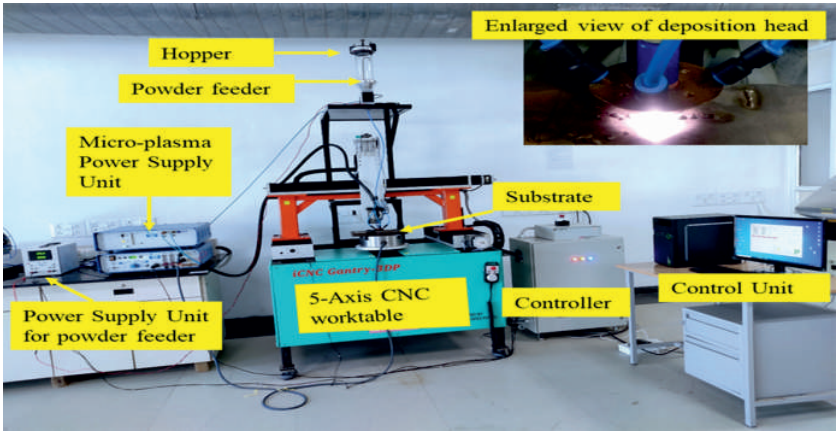
Patent: Granted, Indian Patent No. 484056

Proposed Relevant Industries: Automobile, Marine, Avionics, and any industry using gears

Inventors: Vivek Rana, Sunil Pathak, Prof. Neelesh Kumar Jain (nkjain@iiti.ac.in), Department of Mechanical Engineering

μ-Plasma based Additive Manufacturing Technology for Metallic Materials

An additive manufacturing machine for metallic materials uses micro-plasma transferred arc with a maximum current of 20 A and power of 440 W. It features 5-axis CNC control and supports deposition materials in powder, wire, or combined forms. It manufactures materials like Ti6Al4V alloys, Co-Cr-Mo-based knee implants, Inconel 625 superalloys, tool and die materials (e.g., Stellite, P20), and Ni-Ti shape memory alloys. It enables micro-joining of thin sheets (<3 mm) of stainless and mild steel. Additionally, it develops high/medium entropy alloys, shape memory, and functionally graded materials.



Patent: Granted, Indian Patent No. 464408

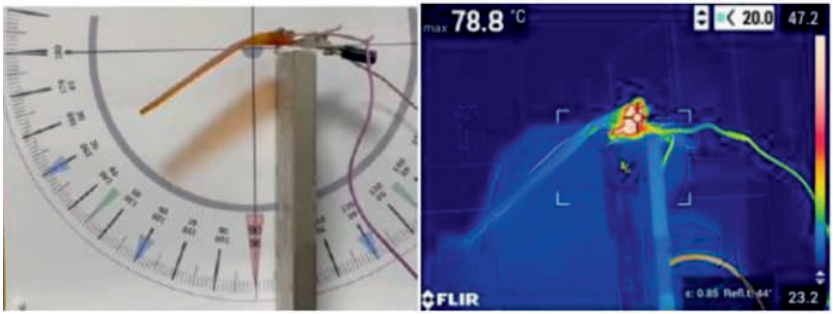
Proposed Relevant Industries: Coating, Cladding, and Industries using AM for Metallic Materials

Inventors: Mayur S Sawant, Pankaj Kumar, Prof. Neelesh Kumar Jain (nkjain@iiti.ac.in), Department of Mechanical Engineering

Robotics, Sensors & Actuators

SMA-based bioinspired water strider robot and method thereof

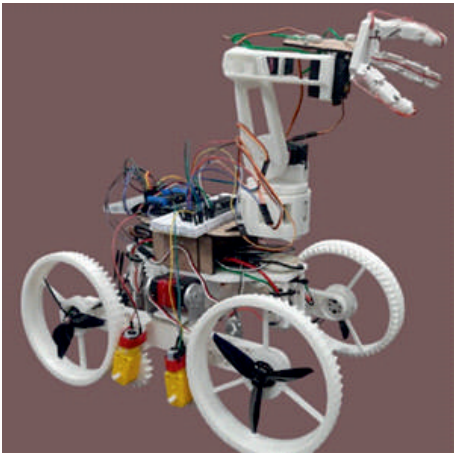
The primary object of the present invention is to overcome the drawbacks associated with prior art. Another object of the present invention is to provide SMA-based bioinspired water strider robot. Another object of the present invention is to provide an electrically controlled autonomous Crawling water strider Robot structurally constructed using origami techniques. Another object of the present invention is to provide an integrated biomimicking walking robot for various applications, including surveillance, face detection and face recognition. The system has a capability towards pipeline inspection, surveliaance.

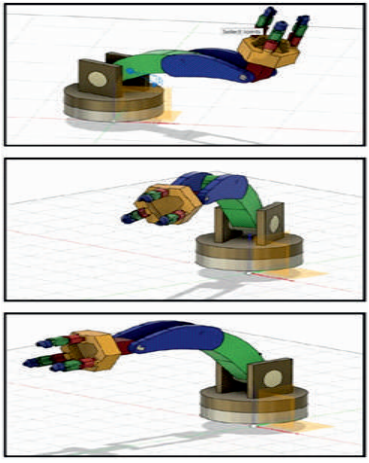


Patent: Filed, Indian Patent Application No. 202421046169
Proposed Relevant Industries: Defense and Industry 5.0
Inventors: Prof. Palani I.A. (palaniia@iiti.ac.in), Kailash Pandian, Kaushal Gangwar, Arruri Satwik, Department of Mechanical Engineering

Multi-Modal Drone with Gesture Controlled Shape Memory Alloy Actuated Robotic Arm

The primary goal of this project is to create a versatile unmanned system capable of seamlessly transitioning between aerial and ground mobility, offering enhanced operational flexibility in various mission scenarios such as disaster response, defence, and industrial applications. The drone integrates advanced morphing technology, high-torque servo motors for transformation, and a robotic arm actuated by SMA to enable tasks such as object retrieval and bomb defusal. This study explores the technical feasibility and design considerations involved in building a multi-modal system that combines the agility of aerial movement with the stability and precision of ground mobility.





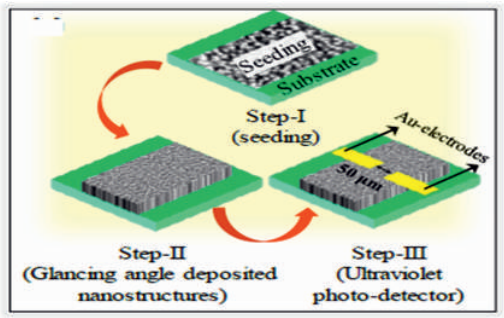
Patent: Under Processes

Proposed Relevant Industries: Warehouses, Automotive and defense

Inventor: Soham Mondal, Tejal R Uplenchwar, Krishna pal Tomar, Prof. Palani I.A. (Palaniia@iiti.ac.in), Department of Mechanical Engineering

Completely Visible-Blind Ultraviolet Photodetectors

Ultraviolet (UV) radiation spans 10–400 nm, shorter than visible light but longer than X-rays, with three bands: UV-A (315–400 nm), UV-B (280–315 nm), and UV-C (100–280 nm). The sun emits all UV bands, with UV-A and part of UV-B reaching Earth. Conventional UV detectors require expensive visible-light filtering. We developed a compact, highly sensitive UV photodetector that is visible-light-blind, fast, and uses pulsed laser deposition to create porous, crystalline ZnO thin films. Unlike prior designs, it ensures high sensitivity and purity. Applications include environmental studies, UV monitoring, and skin-tanning safety to prevent overexposure and related health risks.



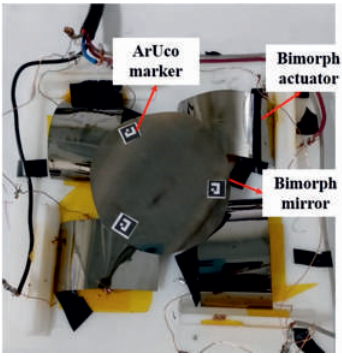
Patent: Nil

Proposed Relevant Industries: UV photodetectors are widely used in the industrial area (flame detectors, fire alarm systems, extreme UV lithography), Environment studies, national security (missile defense, explosives detection, forensic analysis), in fields such as medicine (UV imaging, protein analysis, and DNA sequencing) or biology m(biological agent detection), and when dealing with environmental issues (ozone detection, air pollution determination, disinfection, and decontamination).

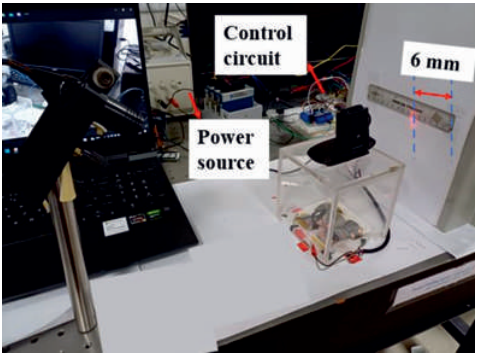
Inventor: Prof. Krushna R. Mavani (krushna@iiti.ac.in), Department of Physics

Shape Memory Alloy Flexible Smart Mirrors for Opto-Mechatronics Applications

Conventional Fast Steering Mirror (FSM) technologies like Piezoelectric Transducers (PZT) and voice coil actuators face limitations such as high weight, complexity, and power consumption. Shape Memory Alloy (SMA) thin film bimorphs offer a lightweight, efficient alternative, reducing complexity and fragility. An SMA-based Stewart platform, using four electrically actuated bimorph arms, provides three degrees of freedom: rotational motion about the x and y axes and translational motion along the z-axis. Fabricated with Nitinol on a Kapton Polyimide substrate, the bimorph regains shape after actuation. Camera-based feedback ensures precise control, enabling effective laser beam steering for advanced applications.



Flexible mirrors in the form of Stewart platform

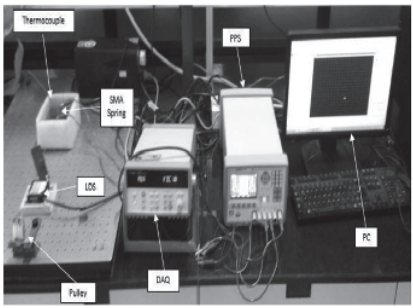


After actuation

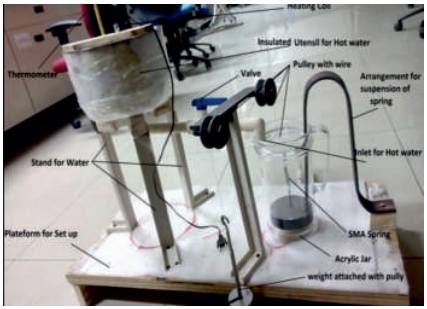
Patent: Granted, Indian Patent Application No.202321055165
Proposed Relevant Industries: Optics, Precision Manufacturing Related Industries
Inventors: Kaushal Gangwar, Prof. Palani I.A. (palaniia@iiti.ac.in), Department of Mechanical Engineering

Thermo-mechanical Test Bench for Reliability Estimation of Shape Memory Alloy (SMA) Springs

Shape memory alloys (SMA) are smart materials that return to their original shape upon heating (80–130°C). This shape memory effect makes them ideal for industrial actuators. SMA springs exhibit rapid responses during the initial thermo-mechanical cycles but may fail with repeated actuation, risking machinery breakdown. Reliability in repeated use is crucial for their industrial applications. A developed system predicts SMA spring reliability and supports small displacements. The technology is at TRL level 6, highlighting its readiness for real-world implementation.



Testbed for Electrical Actuation of SMA

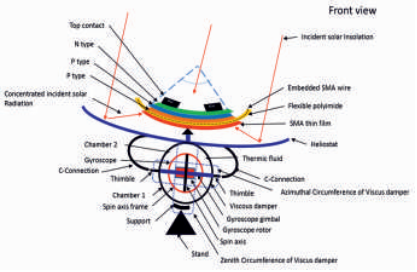


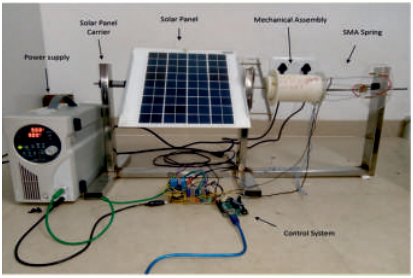
Testbed for hot water actuation of SMA

Patent: Granted, Indian Patent Application No. 201621007005
Proposed Relevant Industries: Aerospace, Automobiles, Robotics, Machine Tool, Civil Constructions, Biomedical and Defence Equipment
Inventors: Prof. Bhupesh K Lad (bklad@iiti.ac.in), Prof. Palani I A (palaniia@iiti.ac.in), Department of Mechanical Engineering

A Dual Axis Continuous Solar Tracking System Using Shape Memory Alloy Bimorph Based Solar Panel

Solar panels, a key energy source, currently capture only about 40% of solar energy due to fixed positioning based on latitude, season, and local conditions. Their efficiency drops significantly as the sun's angle shifts away from perpendicular. Research on solar tracking aims to address this, with advanced methods using smart materials and passive energy systems. These materials can enhance energy capture while reducing active energy use in traditional systems. Coupled with flexible panels, they minimize shedding loss and improve efficiency. A dual-axis synchronous tracking system using smart materials has reached Technology Readiness Level (TRL) 6, promising improved solar energy utilization.





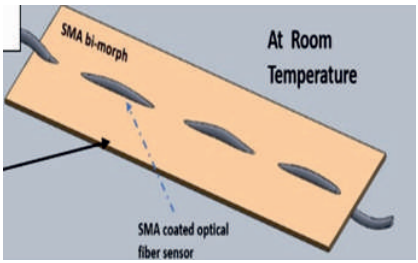
Patent: Granted, Indian Patent Application No. 201721026063

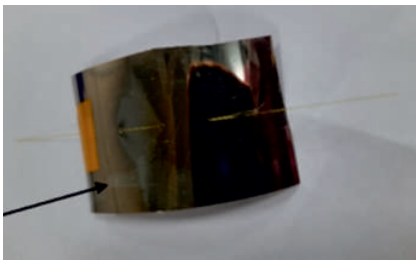
Proposed Relevant Industries: Solar Panel, Energy Sectors, Semiconductor Printing, Flexible Electronics

Inventors: Prof. Vipul Singh (vipul@iiti.ac.in), Department of Electrical Engineering, Prof. Palani I. A. (palaniia@iiti.ac.in), Department of Mechanical Engineering

SMA Coated Optical Fiber Sensor for Cryo Temperature Sensing

The SMA coating on optical fiber induces bending at low temperatures, causing signal attenuation, which highlights the fiber's sensitivity. Embedding SMA-coated fibers in SMA bimorphs enhances this bending, improving sensitivity. This novel, cost-effective technique relies solely on the bending of SMA-coated fibers, offering an alternative to conventional FBG-based cryo-sensors. It holds great promise for low-temperature sensing and structural monitoring in space systems, leveraging advanced smart materials like shape memory alloys. This method provides a competitive, user-friendly platform for developing innovative optical fiber sensors for low-temperature applications.

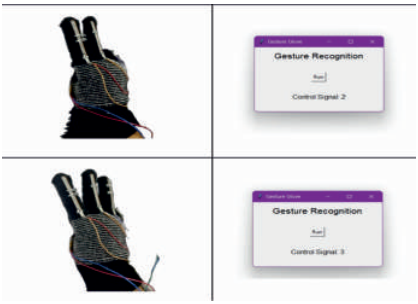




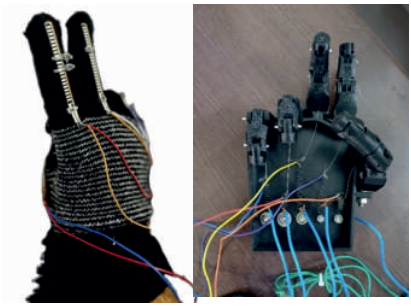
Patent: under process in collaboration with ISRO
Proposed Relevant Industries: Space Related industries, Industries dealing with low Temperatures
Inventor: Prof. Palani I.A. (palaniia@iiti.ac.in), Department of Mechanical Engineering

Design and Development of a Gesture-based SMA-actuated Robotic Hand for Human-machine Interface

Bomb disposal remains a significant defense challenge, risking soldier safety. This project proposes a hand gesture-based human-machine interface (HMI) using a glove with flex sensors to control a shape memory alloy-actuated robotic hand. The system captures user gestures, interpreted by a machine learning algorithm to enhance recognition accuracy, and wirelessly transmits commands to the robotic hand. This closed-loop design incorporates visual feedback, ensuring precise operation. Despite limited exploration in defense applications, the technology is at TRL-5 and ready for deployment. This innovative approach aims to improve safety and efficiency in bomb disposal operation.



Gesture Control



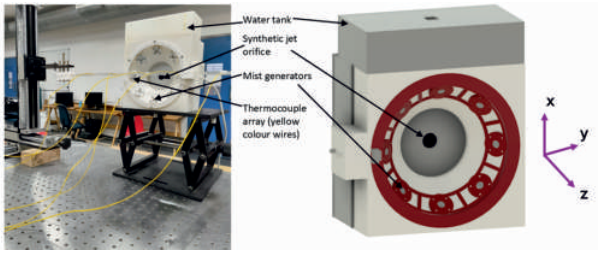
Man machine interface with Robotic Hand

Patent: Filed Indian Patent Application No. 202421051320
Proposed Relevant Industries: Defense and Industry 5.0
Inventors: K.A. Vyvaswath, Mr. Arpit Singh, Prof. Palani I.A. (palaniia@iiti.ac.in), Department of Mechanical Engineering

Smart Cities & Infrastructure
(Including Smart Mobility)

A portable Evaporative Cooler based on a Synthetic Jet

Cooling is necessary for maintaining human comfort because it directly affects health, safety, productivity, and overall well-being. The evaporative cooling technology is popular in India because of the hot and dry climate for a more extended period of the year. The drawbacks of the available evaporative cooler include the inefficient mixing of water vapor in the air, high power consumption, and ample space required. To overcome this problem, we propose a cooling and mixing method based on synthetic air jets and evaporative coolers. The synthetic jet creates an airflow from the orifice in the form of a jet with high momentum. As the synthetic jet utilizes surrounding air to generate the air jet, it doesn't need an external mass flow source. Now, the water in the form of fine droplets (mist) is mixed with the flow of synthetic air jet, which creates a cooling effect through evaporation. The proposed invention can significantly reduce the temperature of the air by up to 9 °C when the surrounding air temperature is ~27 °C. An even higher drop in temperature is expected during the summer.



Synthetic jet-based Evaporative Cooler

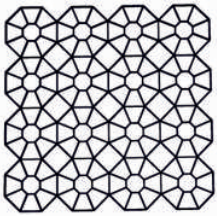
Patent(s): Under process

Relevant Industries: Symphony Limited, Bajaj Electricals, Usha Fan, Alfa Fans, Eminent Systems

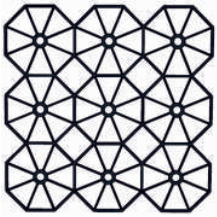
Inventor: Dr. Harekrishna Yadav (krishnpme@iiti.ac.in), Department of Mechnaical Engineering

Multiaxial Concentric Octagonal Geogrid (MCOG) and Multiaxial Diamond Anchored Octagonal Geogrid (MDAOG)

New geogrids are required to address the significant challenges in managing the massive volumes of crushed stone aggregates needed for India's extensive road network. Recent research has led to the development of two innovative geogrids: the Multiaxial Concentric Octagonal Geogrid (MCOG) and the Multiaxial Diamond Anchored Octagonal Geogrid (MDAOG). These geogrids, inspired by nature and iconic architecture, feature unique octagonal geometries and distinct aperture shapes, offering superior performance over existing designs. These address climate change, stone aggregate scarcity, and waste management issues. These advancements promise to enhance the durability and efficiency of infrastructure projects, and support sustainable development goals.



Multiaxial Concentric Octagonal Geogrid (MCOG)



Multiaxial Diamond Anchored Octagonal Geogrid (MDAOG)

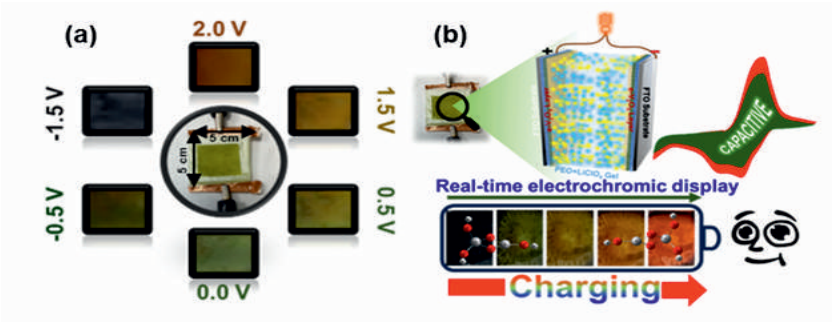
Patent(s): MCOG, Design Number: 429180-001 (Granted), Patent Application Number: 202421066554, MDAOG, Design Application Number: 429181-001, Patent Application Number: 202421066553

Relevant Industries: Civil Engineering, Construction and Geosynthetics Related Industries

Inventor: Dr. Ramu Baadiga (baadigaramu@iiti.ac.in), Department of Civil Engineering

Stoichiometrically Optimized Electrochromic Complex $[V_2O_2+\xi(OH)_3-\xi]$ Based Electrode: Prototype Supercapacitor with Multicolor Indicator

The systematic structure modification of metal oxides is becoming more attractive for improving their practical color-modulating energy storage performance. Here, the ability of a theoretically pre-optimized, stoichiometrically tuned oxide-hydroxide complex of porous vanadium oxide, namely $[V_2O_2+\xi(OH)_3-\xi]\xi=0:3$ for multifunctional electrochromic supercapacitor application has been demonstrated. The multifunctional electrode shows a high charge storage property as well as good electrochromic properties. When assembled in a solid-state symmetric electrochromic supercapacitor device, it exhibits an ultrahigh power density, high energy density, and high specific capacitance. A prepared prototype device displays red when fully charged, green when half charged, and blue when fully discharged.



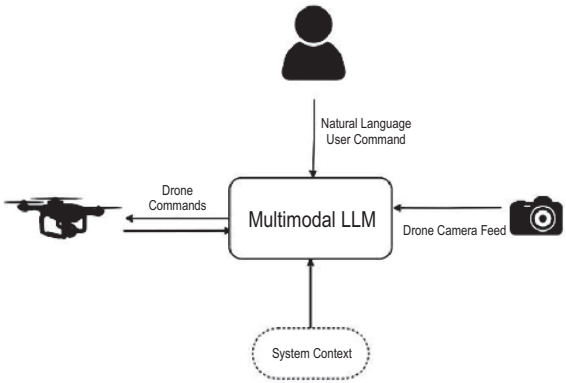
Patent: Granted, Patent Number: 556843

Proposed Relevant Industries: Automobile and Constructions

Inventors: Love Bansal, Bhumika Sahu, Deb Kumar Rath, Prof. Rajesh Kumar (rajeshkumar@iiti.ac.in), Department of Physics

PromptPilot: Drone Control using Multimodal AI

PromptPilot introduces a novel approach to UAV control using multimodal AI, enabling autonomous execution of complex tasks through simple text inputs and live video feeds. A transformer-based multimodal LLM parses user-provided natural language queries and real-time drone footage into executable machine-readable code. This method enhances UAV application versatility while reducing the technical expertise needed for operation, and it can perform complex tasks like dynamic object tracking autonomously. A locally hosted web interface allows seamless interaction with the drone, offering live video streaming and control through intuitive chat-based commands or precise manual navigation via keyboard arrow keys, making UAV control more accessible and powerful.



Patent: Under Process

Proposed Relevant Industries: Surveillance and security, agricultural and site inspection

Inventors: Tarun Balaji, Sunku Vineet, Dr. Vivek Kanhangad (kvivek@iiti.ac.in), Department of Electrical Engineering

Drone-AI Technology for Wide-Area Crowd-Counting in Surveillance and Security Applications

Crowd management in smart cities is critical to ensuring safety and security, with automated crowd counting playing a crucial role. This drone-based technology addresses challenges in wide-area crowd counting. It uses a frame extraction algorithm to generate non-overlapping images of the crowd through a systematic aerial approach. The total crowd count is estimated by summing up the counts of the people in these frames. The prototype, field-tested in real environments, delivers accurate results. By estimating crowd density, this technology can aid in managing large crowds and preventing stampedes, thereby enhancing public safety in crowded spaces.

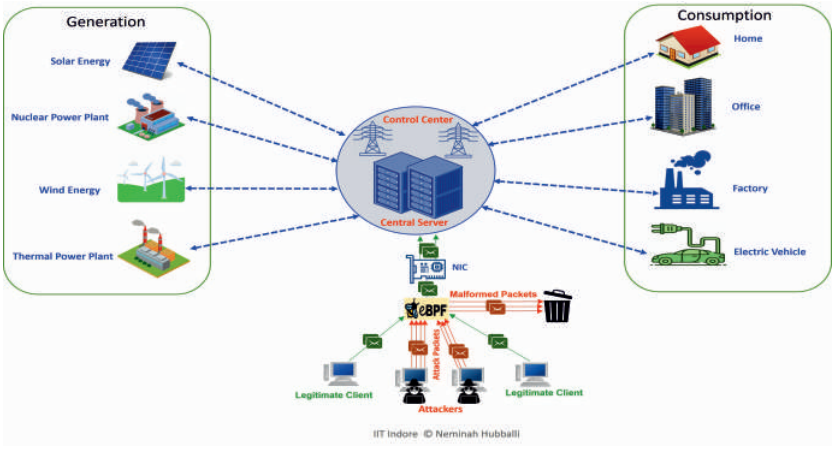
Patent: Under Process

Proposed Relevant Industries: Law Enforcement Agencies and Large Event Organizers

Inventors: Harshwardhan Chaube, Harsh Bardhan, Siddharth Singh Savner, Dr. Vivek Kanhangad (kvivek@iiti.ac.in), Department of Electrical Engineering

GridProtect: Protecting the Electrical Grid Networks from Resource Depletion Cyber Attacks

Modern electric grids use Information and Communication Technology (ICT) for data exchange via TCP/IP networks. Communication protocols like Modbus and IEC-104 enable this process. A resource depletion attack, a Denial-of-Service variant, can overwhelm control centers with random application-layer messages, threatening grid safety. To counter this, we implemented custom screening code at programmable Network Interface Cards (NICs) to filter packets not adhering to protocol standards. By dropping illegal Modbus and IEC-104 packets at the NIC level, the solution significantly conserves control center resources, including CPU cycles and memory, ensuring the grid's resilience and security.



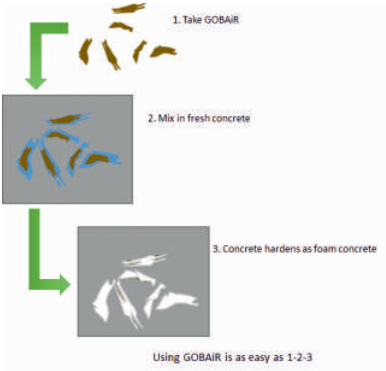
Patent: Nil

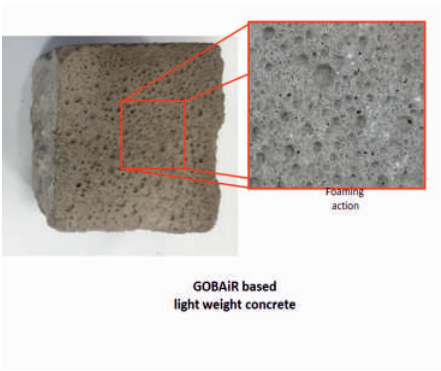
Proposed Relevant Industries: Powergrid

Inventor: Dr. Neminath Hubballi (neminath@iiti.ac.in), Department of Computer Science and Engineering

GOBAiR - A Novel Cow Dung Based Foaming Agent For Developing Low Cost Sustainable Light Weight Construction Materials

India has over 5.3 million stray cattle, a problem that can be addressed by high value commercialization of cow dung. GOBAiR, an innovative cow-dung-based foaming agent, offers an eco-friendly, cost-effective alternative to chemical foaming agents for lightweight concrete and bricks. GOBAiR eliminates autoclaving, reduces production costs and enables on-site manufacturing of bricks and blocks with light weight and thermal insulation. Block prepared with GOBAiR are stronger (12–14 MPa), lighter (density of 1400 kg/m^3), and 24% cheaper than alternatives. At TRL 4-5, GOBAiR supports sustainable construction, improves energy efficiency, enhances GRIHA/LEED scores, and creates economic incentives to support stray cattle management.

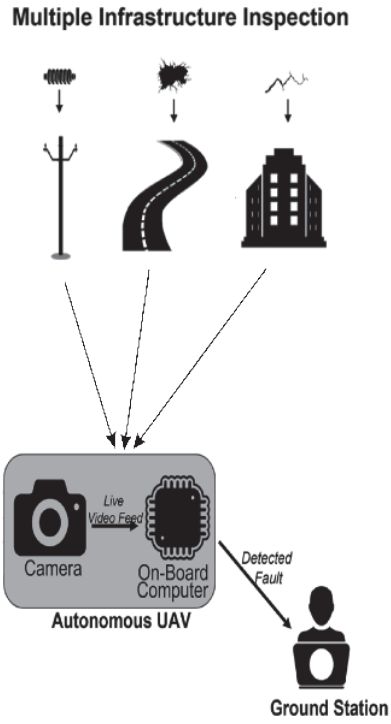




Patent: Flied, Indian Patent Application No. 202421010279
Relevant Industries: Gaushalas; Precast Light Weight Concrete Manufacturers; Fly ash Brick Manufacturer; AAC Block Manufacturer
Inventors: Sanchit Gupta, Prof. Sandeep Chaudhary (schaudhary@iiti.ac.in), Department of Civil Engineering

UAV Based Crack Detection in Infrastructures Using AI-ML

With growing demands for reliable infrastructure safety, traditional inspections face challenges of efficiency and risk. We developed an autonomous two-stage fault detection algorithm (2SA) for infrastructure inspections, employing a master-slave mechanism for fault classification across electrical, road, and civil categories. This system achieves ~93% accuracy with a 90 ms recognition time and integrates with drones for remote inspections. Prototyped with sensors like cameras and LiDAR, the lightweight system streamlines inspections while reducing risks to human inspectors. Current efforts aim to enhance redundancy, versatility, and communication protocols, ensuring safer, faster, and more reliable infrastructure assessments.



Patent: Under Process

Proposed Relevant Industries: Manufacturing, Infrastructure Development, Construction

Inventors: Prof. Abhirup Datta (abhirup.datta@iiti.ac.in), Kumar Sheshank Shekhar, Harsha Avinash Tanti, Department of Astronomy, Astrophysics and Space Engineering

Semiconductors

The Semiconductor Revolution for Powering Smart Cities and Sustainable Infrastructure

Semiconductors are the heart of modern technology and play a crucial role in developing smart cities and infrastructure. The fundamental need for integrated circuits, sensors, and communication systems is vital for smart cities and infrastructure. For example, semiconductors are used in solar panels to generate renewable energy, LEDs for energy-efficient lighting, and sensors to monitor environmental parameters like air quality. In smart mobility, semiconductors power electric vehicles (EVs), enable advanced driver-assistance systems (ADAS), and support vehicle-to-infrastructure (V2I) communication, ensuring safer and more efficient transportation. Additionally, semiconductors play a crucial role in data processing and storage for smart grids, traffic management, and IoT-based applications. Their versatility and efficiency make them indispensable for building sustainable and interconnected urban environments.

Patent(s): Nil

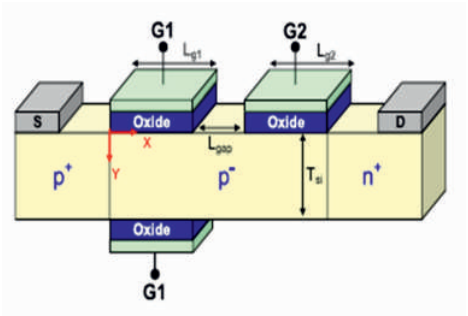
Relevant Industries: Wide bandgap Semiconductors, 2D Semiconductors, Fuel Cells, Batteries

Inventor: Dr. Srimanta Pakhira (spakhira@iiti.ac.in), Department of Physics and Centre for Advanced Electronics

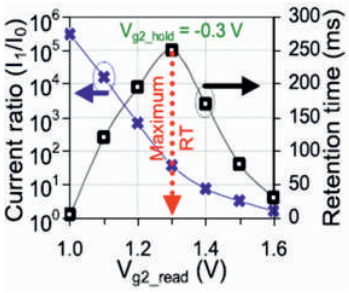
Multiple Gate Tunneling Field Effect Transistor Device for Capacitorless Dynamic Memory

The claimed architecture has three distinct independent gate terminals of which two gates (electrically connected) are at the front and back interfaces of the intrinsic region. The second front gate is used to create electrically induced potential well for the charge storage, an essential feature of capacitorless (1T) dynamic memory.

Portable electronic gadgets including smart phones and Internet of Things (IoT) deployments require cloud services for which high-density and cost-effective DRAM is essential. A versatile mobile system-on-chip necessitates a matching DRAM capability to serve the needs of the society.



Schematic illustration of multiple gate tunneling field effect transistor for application as capacitorless dynamic memory.



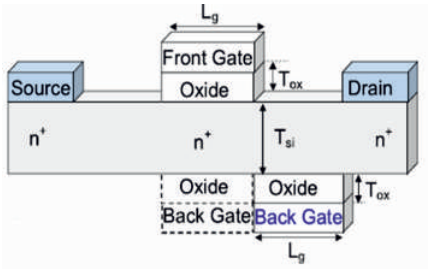
Retention time and current ratio as a function of bias applied at gate-2 during read bias of the capacitorless DRAM.

Patent: Granted, Indian Patent Application No. 201621007078
Proposed Relevant Industries: Semiconductor Industry
Inventors: N. Navlakha, Prof. Abhinav Kranti (akranti@iiti.ac.in), Department of Electrical Engineering

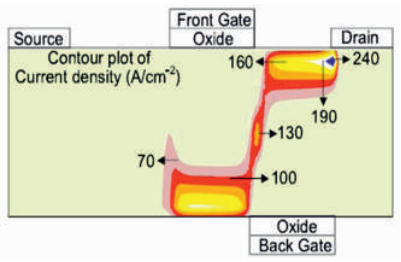
Multiple Gate Junctionless MOSFET (Metal Oxide Semiconductor Field Effect Transistor)

The present invention discloses a multiple-gate Junctionless Metal Oxide Semiconductor Field Effect Transistor (JLMOSFET) capable of super steep/sharp transition from off-state to on-state at very low operating/supply voltage through misalignment between front and back gates.

The functionality of electronic gadgets is governed by transistors which switch from low to high state. This switching of current by a decade requires at least 60 mV of gate bias. A reduction in the gate voltage translates into lower power consumption and energy efficient circuits and systems, which will be beneficial logic circuits.



Schematic illustration of misaligned front and back gates in junctionless transistor for steep current switching.



Current density contour highlighting the advantages of misaligning front and back gates in junctionless transistor.

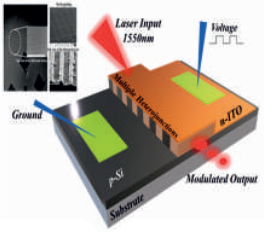
Patent: Granted, Indian Patent No. 431061
Proposed Relevant Industries: Semiconductor Industry
Inventors: M. Gupta, Prof. Abhinav Kranti (akranti@iiti.ac.in), Department of Electrical Engineering

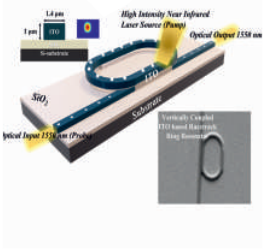
Semiconductor Heterojunction Technology for Chip-scale Photonic Devices

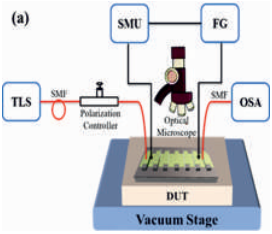
We are utilizing semiconductor heterojunctions for realizing chip-scale devices with a cost-effective fabrication approach. The technology is also helpful for building bio-chemical sensors.

The technology for semiconductor heterojunctions has been developed over the years for electrically and optically tunable photonic devices e.g. The epsilon near zero in ITO has been achieved with engineered processing of ITO and number of devices based on Si-ITO heterojunctions have been developed. Proof-of-concept Devices have been developed.

The technology can be utilized to make sensing devices for early optical detection of (protein biomarkers causing) deadly diseases.



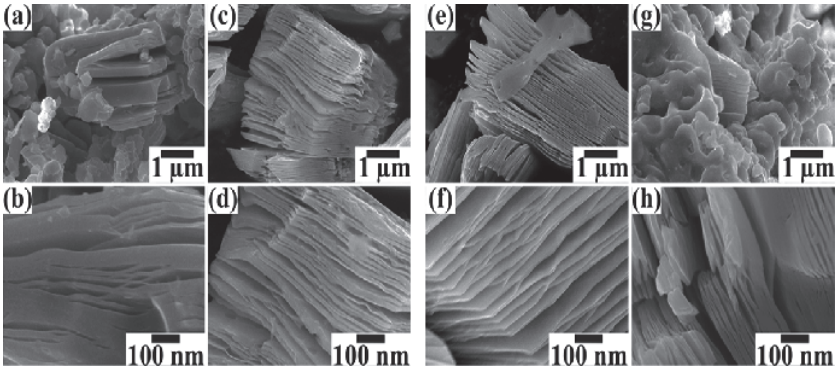




Patent: Published, Indian Patent Application No. 202321010734
Proposed Relevant Industries: Telecom Industry, Date Centres, Sensor Manufacturers
Inventor: Prof. Mukesh Kumar (mukesh.kr@iiti.ac.in),
Department of Electrical Engineering and Centre for Advanced Electronics

Mass Production of >99% Ti_3AlC_2 MAX Phase for High Quality 2D Layered MXene

The quality of MXene depends on MAX phase purity, which impacts its properties and applications. Traditional methods use costly high-vacuum techniques to obtain high-purity Ti_3AlC_2 MAX phase (~₹25,000–30,000 for 10 g). Our invention addresses cost and purity by synthesizing >99% pure MAX phase under ambient air pressure. This produces 2D Ti_3C_2 MXene nanosheets with high interlayer spacing and accordion-like morphology, offering excellent conductivity and stability for applications in hydrogen production, photovoltaics, energy storage, and more. This industrially feasible method reduces energy consumption, enabling large-scale production at lower costs. The technology's current TRL is 7.



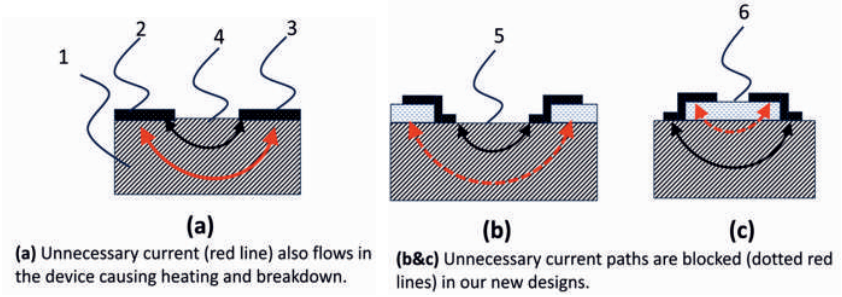
Patent: Granted, Indian Patent Application No. 202321043993

Proposed Relevant Industries: Semiconductor, Energy Storage and Conversation, Coating, Bio-related, etc.

Inventors: Ravindra Jangir, Ekta Choudhary, Prof. Rupesh S. Devan (rupesh@iiti.ac.in), Department of MEMS

Photoconductive Device for THZ Emission and Detection with Metal-semiconductor and Metal-insulator-semiconductor Contact Electrodes

Terahertz technology offers potential in imaging, spectroscopy, and telecommunication, but photoconductive THz devices need efficiency and cost improvements. Our metal-insulator-semiconductor (MIS) design enhances efficiency, electrical robustness, and reduces fabrication costs by cutting lithography layers from four to three. It also enables low-bandgap semiconductors like Ge to be used for device fabrication, making them compatible with cost efficient fibre lasers. Simulations are complete, with devices in fabrication and testing. To commercialize this innovation, THz-Innovations Pvt Ltd, a DPIIT-recognized startup, has been established at ACE IITI. Our invention aims to advance research and development in THz technology, driving broader applications and accessibility



(a) Unnecessary current (red line) also flows in the device causing heating and breakdown.

(b&c) Unnecessary current paths are blocked (dotted red lines) in our new designs.

Patent: Flied, Indian Patent Application No. 202321062886

Proposed Relevant Industries: Semiconductors

Inventors: Dr. Abhishek Singh (asingh@iiti.ac.in) CAE, Prof. Mukesh Kumar (mukesh.kr@iiti.ac.in), Department of Electrical Engineering

Design and Development of High Temperature Setup For Temperature Dependent Energy Band Gap Measurements for Semiconductors

Understanding the temperature-dependent band gap of semiconductors is crucial for applications in extreme conditions, including space. This setup, designed for ambient conditions without a vacuum, measures band gaps from 300K to 500K. Data obtained has been published in various research papers. With India's national semiconductor mission, this technology supports the manufacturing sector, promoting investment in scientific instrumentation. It provides valuable data for the semiconductor industry, aiding in selecting materials suitable for specific temperature ranges, thus enhancing research and industrial applications.

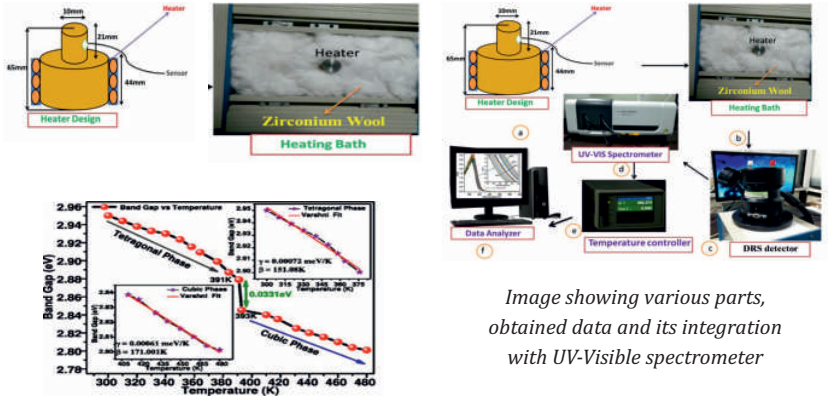


Image showing various parts, obtained data and its integration with UV-Visible spectrometer

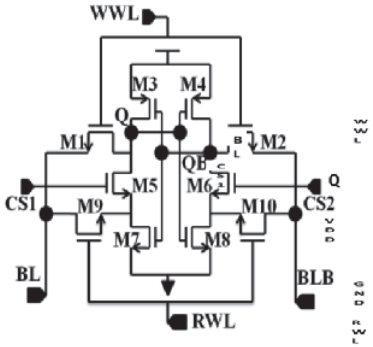
Patent: Nil

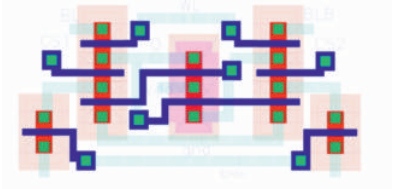
Proposed Relevant Industries: Scientific Instrumentation and Semiconductor Industry.

Inventor: Prof. Pankaj R. Sagdeo (prs@iiti.ac.in), Department of Physics

Low Leakage-high Stability Differential Positive Feedback Controlled 10T (DPFC10T) SRAM Cell

The proposed solution is a positive feedback-controlled 10T SRAM cell designed for low leakage power and enhanced read-write stability. Write and read operations are managed via WWL and RWL using access transistors M1-M2 and M9-M10. Positive feedback is controlled by NMOS transistors M5 and M6, activated by CS1 and CS2, improving speed, static noise margins, and leakage power. This innovation enhances energy efficiency in ULV devices, such as biomedical implants, enabling reliable data storage with minimal power. Its application in portable electronics reduces power demands and promotes sustainability, addressing critical challenges in energy-efficient, reliable, and sustainable technologies.





Proposed differential positive feedback controlled 10T (DPFC10T) SRAM cell (a) Schematic. (b) Layout

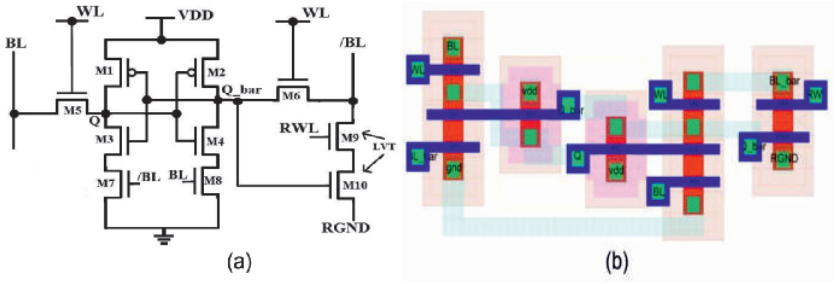
Patent: Granted, Indian Patent No. 370308

Proposed Relevant Industries: Industries Related with Semiconductor, FPGAs, Sophisticated Biomedical Instruments, Wireless Communication and Sensors

Inventor: Pooran Singh, Prof. Santosh Kumar Vishvakarma, (skvishvakarma@iiti.ac.in), Department of Electrical Engineering

An Ultra Low Power, Read Decoupled-Differential Write, 10T SRAM Cell with Higher Read/Write Noise Margin

SRAM design faces challenges due to continuous technology scaling, making it vulnerable to noise from process-voltage-technology variations. Cache memories often remain in standby mode, causing unwanted leakage power during subthreshold operation, demanding power consumption reduction. Technology scaling worsens SRAM density as the decreasing Iread/Ileak limits the cells per memory column. Conventional designs must be reconsidered for ultra-low voltage applications. Low-Vth devices enhance read performance, while threshold voltage techniques and stacking improve power consumption and stability. The proposed 10T SRAM cell reduces leakage power, improves read speed, and stability, making it suitable for ultra-low-power applications like wireless sensors, biomedical implants, and handheld devices.

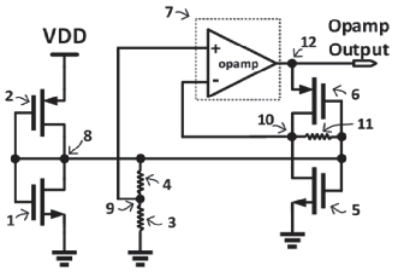


Proposed 10T SRAM cell (a) Schematic (b) Layout

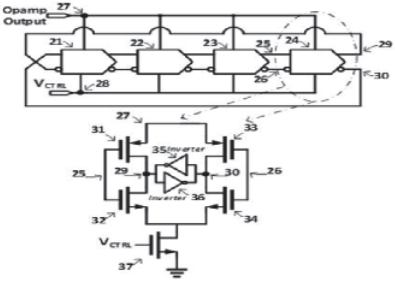
Patent: Granted , Indian Patent No. 358866
Proposed Relevant Industries: Consumer Electronics, Biomedical Applications, High Performance Computing etc.
Inventors: Vishal Sharma, Dr. Santosh Kumar Vishvakarma (skvishvakarma@iiti.ac.in), Department of Electrical Engineering

A Constant Transconductance Bias Device

A high-speed cleaner clock is essential for frequency synthesizers and clock-data recovery circuits in wireline and wireless communication. This invention introduces a constant transconductance (gm) bias device to reduce PVT variations in ring oscillators. Unlike MOS square-law dependence, it offers reliability in advanced CMOS nodes. A negative feedback system adjusts the inverter's supply voltage to mitigate PVT changes, stabilizing the oscillation frequency. The solution includes a reference voltage generator, an Op-Amp-based negative feedback loop, and a VCO. This on-chip system ensures supply-independent biasing, enabling robust VCO frequency control across PVT variations.



The reference biasing generator circuit consisting of a self-biased inverter forming servo loop with transistor M1-M2.

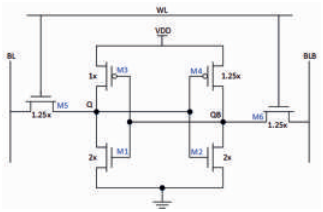


The architecture of the used VCO used in constant gm device.

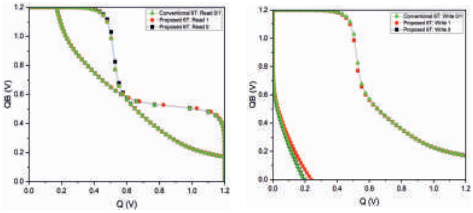
Patent: Published, Indian Patent Application No. 202321073981
Proposed Relevant Industries: Analog Devices
Inventors: Kumar Ravi, Nagulapalli Rajasekhar, Prof. Santosh Kumar Vishvakarma (skvishvakarma@iiti.ac.in), Department of Electrical Engineering

Power on Initialization of SRAM Cell for FPGA

Memory is a key component of electronic devices, with 6T SRAM widely used for its high speed, stability, reliability, and compatibility with CMOS technology. During startup or reset, SRAM cells often require initialization to a specific state, such as Zero State, which is critical for applications like testing. Traditional reset circuits consume significant power, especially with millions or billions of memory cells on a chip, increasing cost and testing time. An automatic power-on initialization mechanism is proposed, using a resized PMOS transistor to enhance energy efficiency, reduce delay, and simplify initialization. Validated via simulations, it offers potential for low-power applications like portable devices, FPGAs, and medical instruments.



Proposed asymmetric 6T SRAM design for self reset on power up.



Static noise margin (SNM) comparison of proposed asymmetric SRAM cell with standard SRAM cell at 1.2V supply

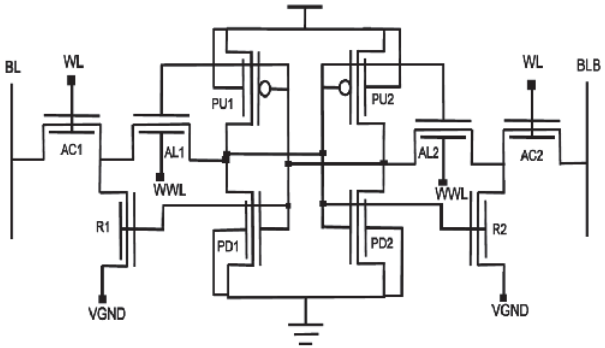
Patent: Under Progress

Proposed Relevant Industries: Advanced Micro Devices

Inventors: Narendra Singh Dhakad, Govindu Sathvik Reddy, Radheshyam Sharma, Prof. Santosh Kumar Vishvakarma (skvishvakarma@iiti.ac.in), Department of Electrical Engineering

Read Recharge (RRC) Based Process Variation Tolerant 10T SRAM cell

Stable, ultra-low-power on-chip SRAM is essential for higher reliability and extended battery life in modern SOCs. Designing SRAM in the sub-threshold regime addresses process variation tolerance and high-performance needs. Operating in this regime minimizes energy but reduces speed by three orders of magnitude and increases sensitivity to process variations. The proposed SRAM cell improves stability and read performance using a unique topology with two N-type FinFET transistors and a read recharge circuit (RRC). This prevents read failures, making it ideal for low-voltage, medium-frequency applications like biomedical implants and wireless sensing, potentially extending portable systems' lifespan beyond three years.

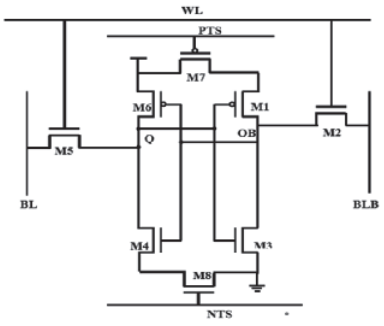


Read recharge based proposed RRC 10T SRAM cell with read write current paths

Patent: Granted, Indian Patent No. 413266
Proposed Relevant Industries: Semi Conductors, Chip Design
Inventors: Nandakishor Yadav, Prof. Santosh Kumar Vishvakarma (skvishvakarma@iiti.ac.in), Department of Electrical Engineering

P-N Tuned Differential 8T Static Random Access Memory (SRAM) Cell

SRAM design in the sub-threshold regime addresses the demand for ultra-low power embedded memories. Sub-threshold MOSFET operation minimizes energy but reduces speed and increases current sensitivity to process variations. Challenges like hold stability, write-ability, and read disturb worsen with MOSFET scaling. The 6T cell is prone to read disturb due to bit-line coupling, while the 8T cell mitigates this with decoupled feedback, achieving better read margins (560mV vs. 6T's read failures). Tuning reduces access conflicts, lowering WTP to 240mV (8T) and 270mV (6T). Improved SRAM efficiency enhances computing performance, supports sustainability, and accelerates AI applications like image recognition and NLP.



Proposed 8T SRAM Cell

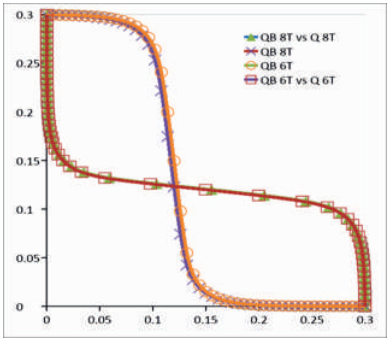


Fig: SNM for 8T vs 6T SRAM Cell

Patent: Granted, Indian Patent No. 406860
Proposed Relevant Industries: Semiconductors Chip Design
Inventors: Chandrabhan Kushwah, Prof. Santosh Kumar Vishvakarma (skvishvakarma@iiti.ac.in), Department of Electrical Engineering

High-Performance Double Gate Tunnel Field Effect Transistor For Low Power Applications

The developed technology introduces a lateral asymmetric channel (LAC) doping profile for double-gate tunnel field-effect transistors (DG-TFET) to enhance analog/RF performance compared to uniform doping (UD). Simulations show that the LAC profile, combined with an underlap (UL) feature, improves performance by increasing on-state current (Ion), lowering subthreshold swing (SS), and reducing gate-drain capacitance, thereby boosting cut-off frequency (ft). The UL feature also mitigates ambipolar behavior. With low leakage current and steep SS (<60 mV/dec), DG-TFETs are ideal for low-power system-on-chip (SoC) designs, including biomedical implants, mobile devices, and neural processors, especially at supply voltages below 0.5 V.

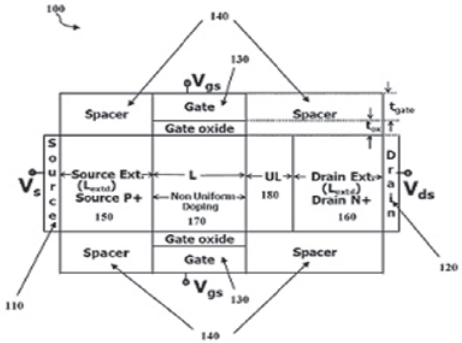


Figure 1

Patent: Granted, Indian Patent No. 388463

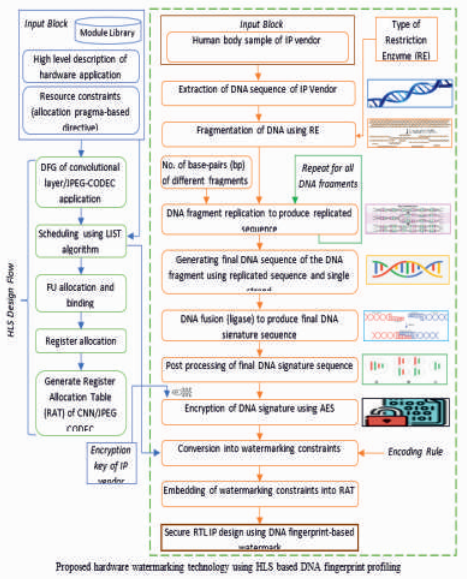
Proposed Relevant Industries: Biomedical Implants, Mobile Multimedia Gadgets, Neuro Signal Processors

Inventors: Vikas Vijayvargiya , Prof. Santosh Kumar Vishvakarma (skvishvakarma@iiti.ac.in), Department of Electrical Engineering

VLSI, Hardware Security

CAD Based DNA Fingerprint as watermark Countermeasure for Hardware Cybersecurity of VLSI applications cad based DNA Fingerprint as Watermark Countermeasure

The proposed technology presents a robust hardware watermarking framework by leveraging CAD based deoxyribonucleic acid (DNA) fingerprint profiling process for securing hardware intellectual property (IP) designs from the domain of multimedia, medical, machine learning and digital signal processing. The proposed technology facilitates computer-aided design (CAD) based automated generation and embedding of IP vendor's unique DNA fingerprint watermark as robust digital evidence into the hardware IP design. The embedded watermark as countermeasure against IP piracy and false IP ownership claim provides hardware cybersecurity of VLSI based hardware designs.



Proposed hardware watermarking technology using HLS based DNA fingerprint profiling

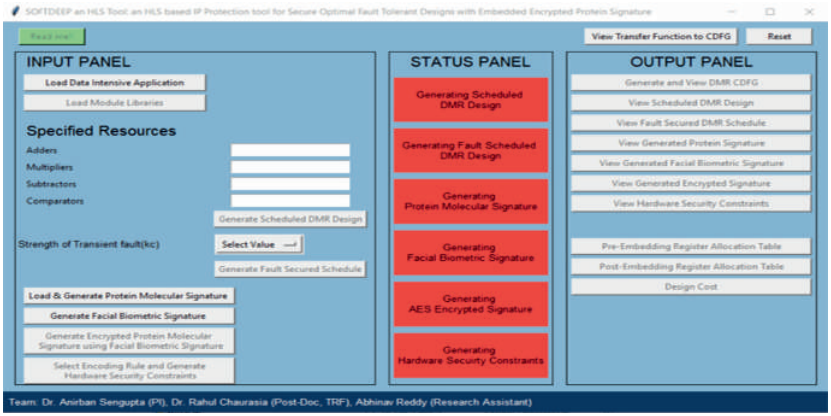
Patent: Granted, Indian Patent No. 543947

Proposed Relevant Industries: Security & VLSI

Inventor: Prof. Anirban Sengupta (asengupt@iiti.ac.in), Department of Computer Science and Engineering

SOFTDEEP: An HLS Based IP Protection Tool for Secure Optimal Fault Tolerant Designs with Embedded Encrypted Protein Signature

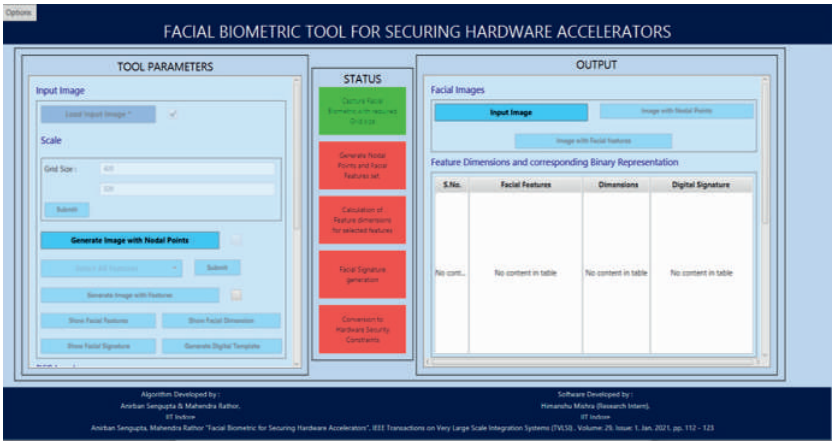
Prof. Anirban Sengupta and his team have developed a Molecular biometric based hardware security tool to simulate and analyse the design space exploration method producing secure design solutions for data intensive application frameworks with ability of k-cycle transient fault detection and/or error correction and detective control against piracy and false claim of ownership threats and generation of an optimal k-cycle transient fault detectable and /or fault correctable datapath processors with embedded protein biometric signature sample of an intellectual property (IP) vendor during high-level synthesis of integrated circuits (ICs).



Patent: Nil
Proposed Relevant Industries: VLSI, Hardware Security
Inventors: Rahul Chaurasia, Prof. Anirban Sengupta (asengupt@iiti.ac.in), Department of Computer Science and Engineering

Faciometric Hardware Security Tool

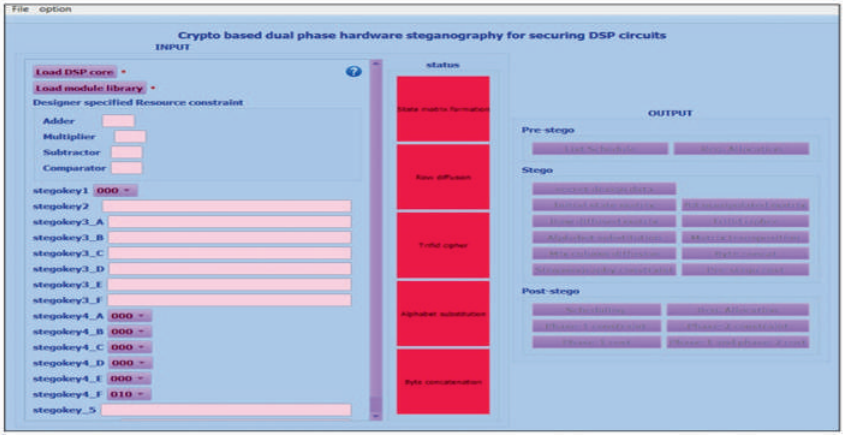
The Faciometric hardware security tool has been developed to simulate and analyze the functionality of facial biometric based approach for securing DSP hardware accelerators against piracy and false claim of ownership threats. The Faciometric hardware security tool accepts the DSP application input in the form CDFG along with the resource constraints. Further, it generates scheduling and registers allocation pre and post embedding facial signature constraints, onto the output window. The embedded facial signature in the hardware accelerator design can be used as a unique digital evidence to secure against piracy and false claim of ownership threats.



Patent: Nil
Proposed Relevant Industries: VLSI, Hardware Security
Inventors: Mahendra Rathor, Prof. Anirban Sengupta (asengupt@iiti.ac.in), Department of Computer Science and Engineering

Crypto-Steganography Tool

Crypto-Stego tool simulates and analyses the functionality of crypto-based steganography approach for securing DSP hardware accelerators against piracy and false claim of ownership threats. The Crypto-Stego tool accepts the DSP application input in the form CDFG along with module library and resource constraints. The tool shows all the intermediate steps of crypto-based steganography and the finally generated stego-constraints at the output. Further, it also generates scheduling and registers allocation pre and post embedded steganography constraints, onto the output window. The embedded steganography constraints in the hardware accelerator design can be used as digital evidence to secure against piracy threats.



Patent: Nil
Proposed Relevant Industries: VLSI, Hardware Security
Inventors: Prof. Anirban Sengupta (asengupt@iiti.ac.in), Mahendra Rathor, Department of Computer Science and Engineering

KHC-Stego Tool: Key-Triggered Hash-Chaining Driven Steganography Tool

KHC-Stego tool simulates and analyses the functionality of key-triggered hash-chaining driven steganography approach for securing DSP hardware accelerators against piracy and false claim of ownership threats. The KHC-Stego tool accepts the DSP application input in the form CDFG along with module library and resource constraints. The tool generates output of intermediate steps of key-triggered hash-chaining based steganography, finally generated stego-constraints, the security metric in terms of probability of coincidence, pre and post-steganography design cost. The embedded steganography constraints in the hardware accelerator design can be used as digital evidence to secure against piracy and false claim of ownership threats.

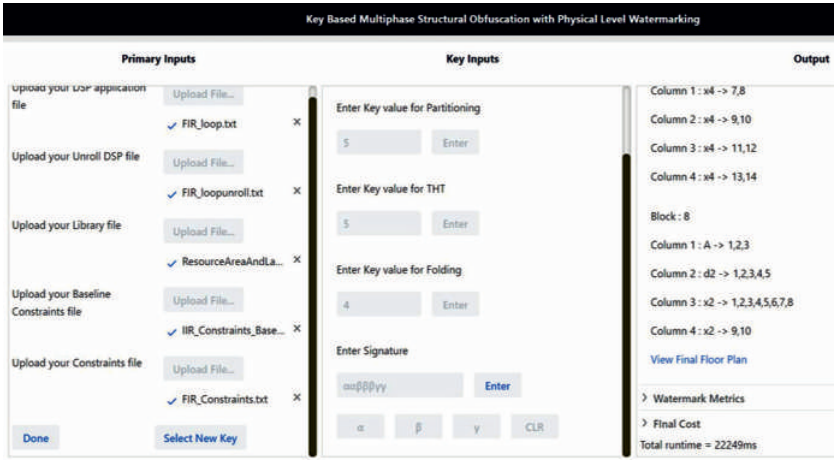
Patent: Nil

Proposed Relevant Industries: VLSI, Hardware Security

Inventors: Prof. Anirban Sengupta (asengupt@iiti.ac.in), Mahendra Rathor, Department of Computer Science and Engineering

KSO-PW tool -: Key-driven Structural Obfuscation and Physical Level Watermarking

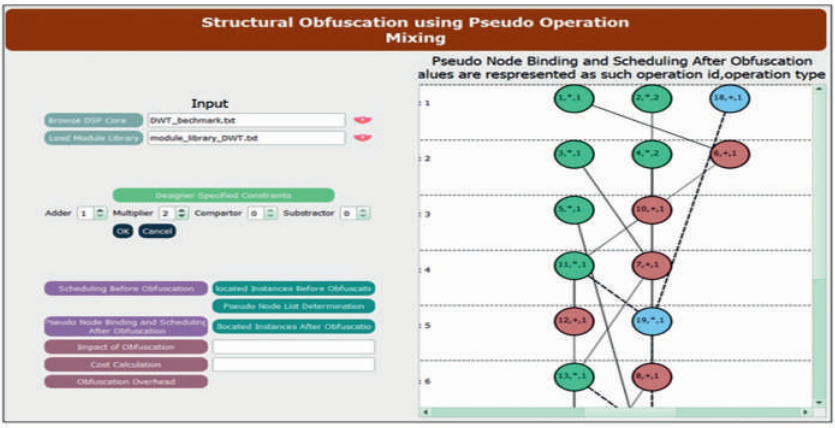
Prof. Sengupta and his team have developed a KSO-PW tool to simulate and analyse the functionality of Key-driven structural obfuscation and physical level watermarking approach for securing DSP hardware accelerators against reverse engineering, piracy and false claim of ownership threats. The KSO-PW tool accepts the DSP application input in the form CDFG along with module library file and resource constraints file. The tool generates outputs of all intermediate steps of structural obfuscation and watermarking approach and finally generated watermarked floorplan of the obfuscated design.



Patent: Nil
Proposed Relevant Industries: VLSI, Hardware Security
Inventors: Prof. Anirban Sengupta (asengupt@iiti.ac.in), Mahendra Rathor, Department of Computer Science and Engineering

POM-SO tool -: Pseudo Operation Mixing Based Structural Obfuscation Tool

Prof. Sengupta and his team have developed a POM-SO tool (pseudo operation mixing based structural obfuscation) to simulate and analyse the pseudo operation mixing based obfuscation approach for securing DSP hardware accelerators against reverse engineering (and Trojan insertion). The POM-SO tool accepts the DSP application input in the form CDFG along with module library and resource constraints. The tool shows intermediate steps of pseudo operation mixing and finally generated structurally transformed scheduled and resource allocated DFG at the output. This output can be used to generate a structurally obfuscated RTL design of a DSP application which can hinder reverse engineering.



Patent: Nil

Proposed Relevant Industries: VLSI, Hardware Security

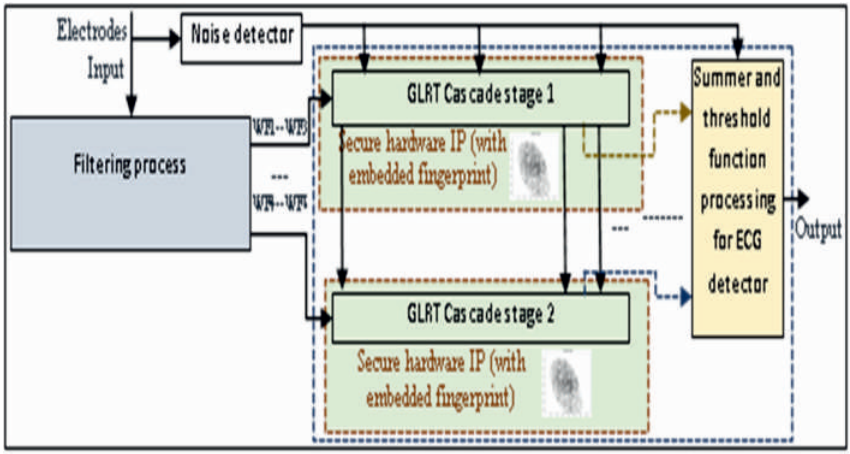
Inventors: Mahendra Rathor, Prof. Anirban Sengupta (asengupt@iiti.ac.in), Department of Computer Science and Engineering

Secure Hardware of GLRT Cascade Using Color Interval Graph Based Embedded Fingerprint for ECG Detector

(a) Presents the design methodology of generalized likelihood ratio test (GLRT) hardware intellectual property (IP) core for ECG detector.

(b) Presents a secure GLRT hardware IP core for ECG detector using fingerprint biometric-based hardware security methodology during High Level Synthesis.

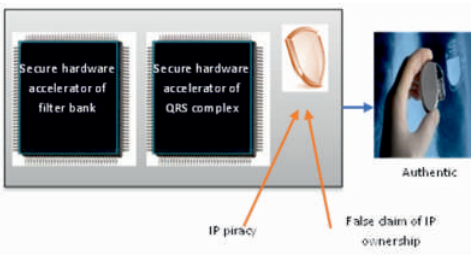
(c) Presents Color Interval Graph (CIG) framework and register transfer level (RTL) datapath of a secure GLRT hardware micro IP core and secure GLRT hardware cascade IP core.

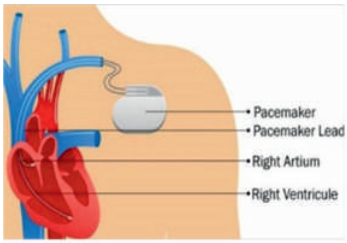


Patent: Granted Indian Patent Application No. 202321037433
Proposed Relevant Industries: Healthcare, Chip Design, Hardware Security
Inventor: Prof. Anirban Sengupta (asengupt@iiti.ac.in), Department of Computer Science and Engineering

A Hardware Security Method to Design Secure Hardware Accelerators for Cardiac Pacemaker

A novel hardware accelerator for filter bank and QRS complex detector for implantable cardiac pacemaker. A novel secure design flow with AES-256 for generating secure version of hardware accelerators for implantable cardiac pacemaker against IP piracy. This ensures robust security by enabling detection and isolation of pirated unsecured hardware accelerators before integration into implantable pacemakers, which otherwise may lead to fatal consequences for the patients. The proposed invention presents novel secure high level synthesis methodology that is capable to generate secure RTL datapath design for filter bank and QRS complex for implantable cardiac pacemaker.

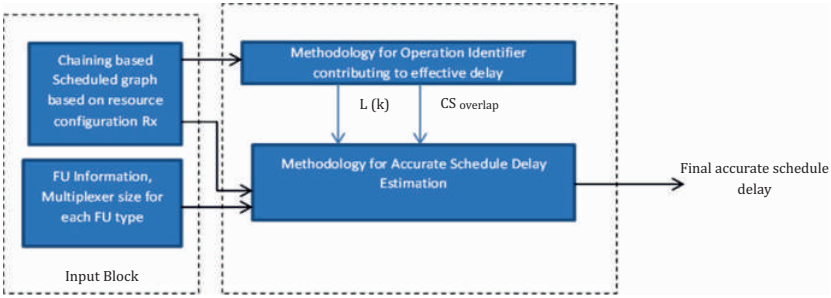




Patent: Filed, Indian Patent Application No. 202321036317
Proposed Relevant Industries: Healthcare, Chip Design, Hardware Security
Inventor: Prof. Anirban Sengupta (asengupt@iiti.ac.in), Department of Computer Science and Engineering

Improved Schedule Delay Estimation Process for Datapath During High Level Synthesis of Application Specific Processors

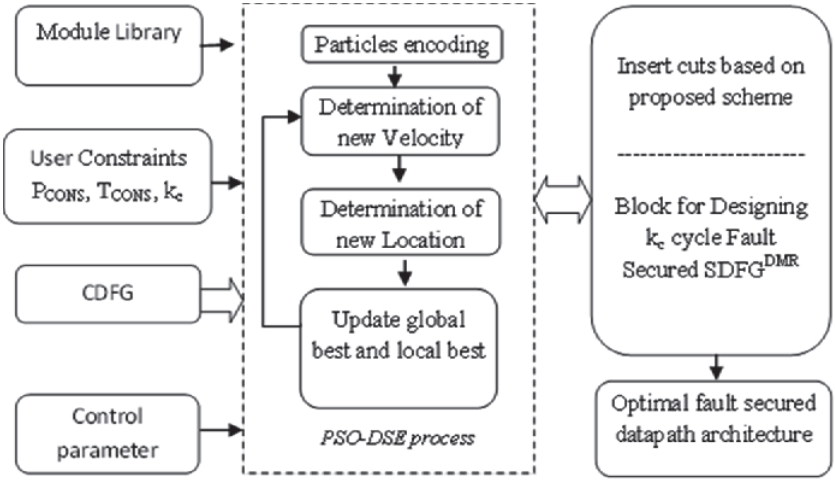
An improved schedule execution delay estimation process during high level synthesis of application specific processors is disclosed. In one implementation, a novel improved execution delay estimation methodology during scheduling in high level synthesis (HLS) for application specific processors is disclosed. Execution delay estimation from a schedule during HLS is normally determined by considering the delay of only the functional units in each control step. However, this estimated delay value from the schedule may not be a true indicator of the delay consumed by its equivalent datapath circuit. The present invention accurately estimates the schedule delay than existing techniques.



Patent: Granted, Indian Patent No. 458850
Proposed Relevant Industries: Chip Design, Hardware Security
Inventor: Prof. Anirban Sengupta (asengupt@iiti.ac.in), Department of Computer Science and Engineering

Design Space Exploration of Optimal KC-Cycle Transient Fault Secured Datapath System with Intelligent Cut Insertion

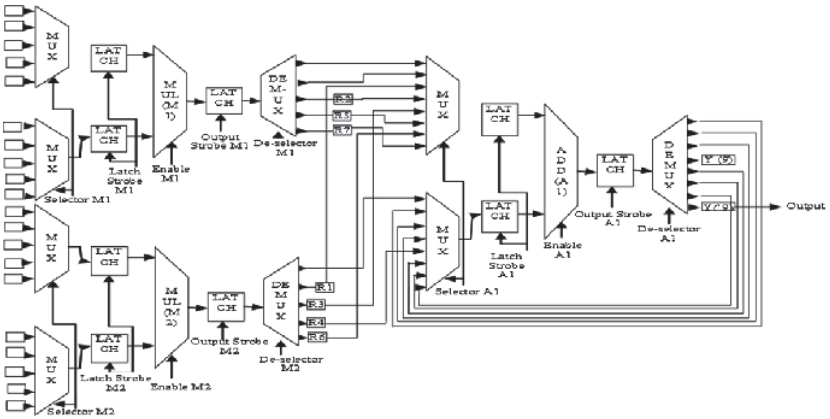
In one implementation, a mechanism for generating a user-friendly, economical, adaptable and simplified system for exploring/designing a kc cycle transient fault secured datapath circuit for transient single and multi-cycle faults based on user power/area and delay budget with module that intelligently/aptly applies cut insertion for delay reduction during high level synthesis, is disclosed. For achieving the same an apparatus is configured to design a kc cycle transient fault secured dual/double modular redundancy (DMR) system, for generating at least one scheduled data flow graph (SDFG) DMR systems.



Patent: Granted, Indian Patent No. 432435
Proposed Relevant Industries: Chip Design, Hardware Security
Inventor: Prof. Anirban Sengupta (asengupt@iiti.ac.in), Department of Computer Science and Engineering

Design Space Exploration of Optimal K-cycle Transient Fault Tolerant Datapath Based on Multi-Objective Power-Performance Tradeoff

The present invention discloses a system (apparatus) and method for design space exploration of an optimal single or multi cycle (k-cycle) transient fault detectable and /or error correctable data path which indicates design space exploration method producing design solutions with ability of k-cycle transient fault detection and/or error correction and generation of an optimal k-cycle transient fault detectable and /or fault correctable datapath that minimizes user specified power and delay (or performance) constraint, by detecting transient faults using a double/ dual modular redundancy (DMR)and/or correcting them using a double/ dual modular redundancy (DMR) with recovery circuit.



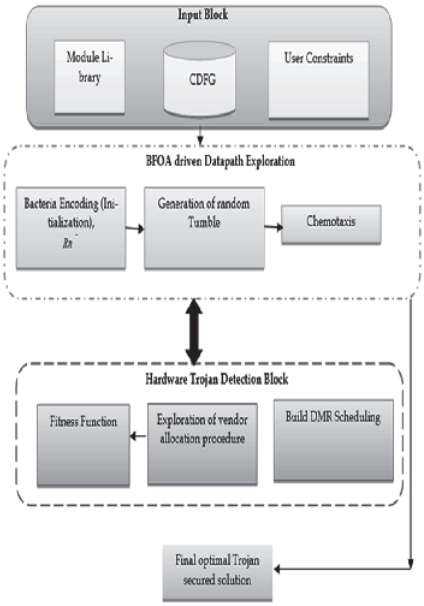
Patent: Granted, Indian Patent No. 392356

Proposed Relevant Industries: Chip Design, Hardware Security, Defense

Inventor: Prof. Anirban Sengupta (asengupt@iiti.ac.in), Department of Computer Science and Engineering

Design Space Exploration of an Optimized Hardware Trojan Detectable/Secured Datapath During High Level Synthesis

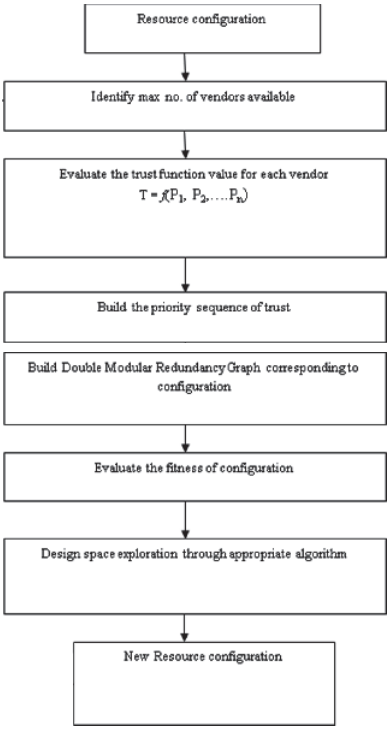
An evolutionary algorithm (EA) driven novel design space exploration (DSE) of an optimized hardware Trojan secured datapath based on user power-delay constraint during high level synthesis (HLS) is presented. The present invention provides DSE for hardware Trojan detection includes a problem encoding technique that enables exploration of efficient distinct vendor allocation as well as enables exploration of an optimized Trojan secured datapath structure. The exploration backbone for the present invention is bacterial foraging optimization algorithm (BFOA) which is known for its adaptive feature (tumbling/swimming) and simplified model.



Patent: Granted, Indian Patent No. 430067
Proposed Relevant Industries: Chip Design, Hardware Security
Inventor: Prof. Anirban Sengupta (asengupt@iiti.ac.in), Department of Computer Science and Engineering

Method and System for Automatic Fault Recovery and True Output Extraction During High Level Synthesis

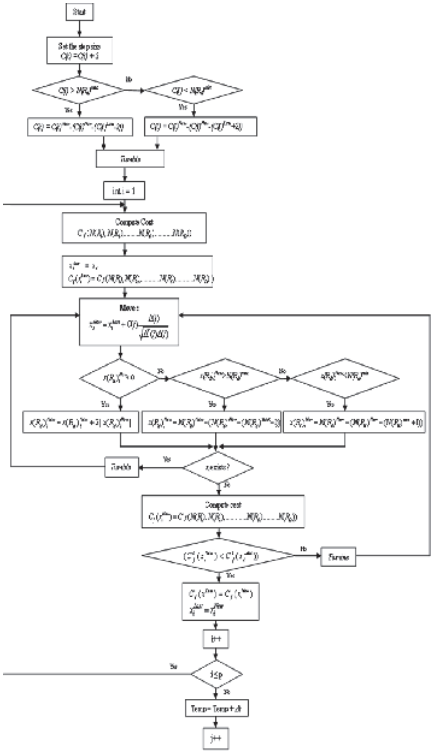
Systems and method for transient fault isolation, hardware Trojan fault detection/isolation and true output extraction during high level synthesis of at least one other system are disclosed. The present invention discloses an efficient and cost effective equivalent circuit system with Double Modular Redundancy (DMR) scheme to isolate a correct output. In one implementation, the present invention provides a system comprising at least one comparator means, at least one OR-ing means, and at least one multiplexer means.



Patent: Granted, Indian Patent No. 484338
Proposed Relevant Industries: Chip Design, Hardware Security
Inventor: Prof. Anirban Sengupta (asengupt@iiti.ac.in), Department of Computer Science and Engineering

Design Space Exploration System and Method There of Using A Bacterial Foraging Optimization Mechanism

An apparatus and method for automatically exploring a design space of an untimed CDFG during HLS, using a bacterial foraging optimization (BFO) mechanism, for designing or obtaining an application-specific processor is disclosed. The apparatus comprises of one or more processing unit(s) configured to: initialize bacterium position corresponding to resource configuration, wherein said bacterium are uniformly distributed over said design space; perform a chemotactic movement of said bacterium, by means of a specialized chemotaxis mechanism of said BFO, to enable change in position of bacterium from original or past position to new or present position.



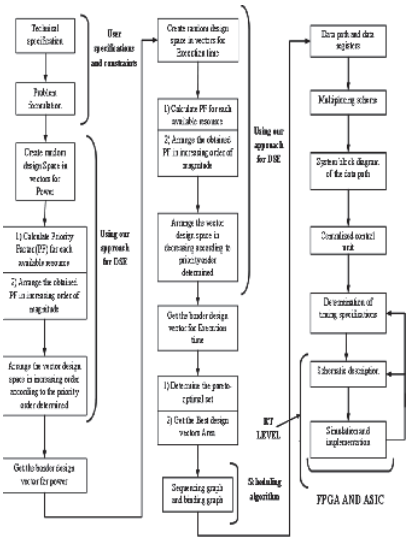
Patent: Granted, Indian Patent No. 366323

Proposed Relevant Industries: Chip Design, Hardware Security

Inventor: Prof. Anirban Sengupta (asengupt@iiti.ac.in), Department of Computer Science and Engineering

System and Methodology for Development of a System Architecture Using Optimization Parameters

Described embodiments relate to methods, systems and computer readable medium for developing a system architecture. Resources constraints are defined, where each resource constraint corresponds to a maximum number of a each kind of resources available to construct the system architecture. Constraint values for each of at least three optimization parameters are defined, which includes a final optimization parameter. A design space is defined as a plurality of vectors representing different combinations of a number of each kind of resource available to construct the system architecture. For each of the plurality of optimization parameters, a priority factor function is defined.



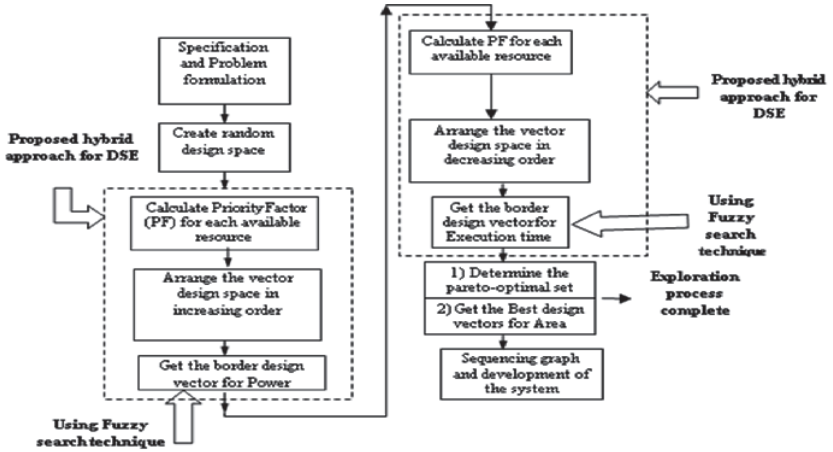
Patent: Granted, USA Patent No. 8,397,204

Proposed Relevant Industries: Chip Design, Hardware Security

Inventor: Prof. Anirban Sengupta (asengupt@iiti.ac.in), Department of Computer Science and Engineering

System and Method For Development of System Architecture

Methods, systems, and computer readable medium for developing a system architecture that involves defining resource constraints for kinds of resources and constraint values for optimization parameters, and defining a design space as variants, where each variant is a vector. Satisfying sets of variants are determined for optimization parameters by assigning membership values to each variant of a universe of discourse set and performing a fuzzy search of a universe of discourse set using the corresponding membership values. A set of variants is determined based on an intersection of the satisfying sets of variants.



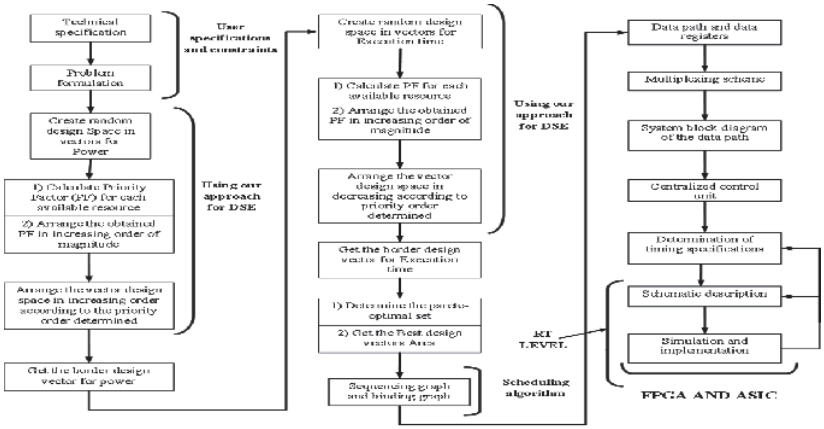
Patent: Granted, USA Patent No. 8,826,199 B2

Proposed Relevant Industries: Chip Design, Hardware Security, Defense

Inventor: Prof. Anirban Sengupta (asengupt@iiti.ac.in), Department of Computer Science and Engineering

System and Methodology For Development of A System Architecture Using Optimization Parameters

Described embodiments relate to methods, systems and computer readable medium for developing a system architecture. Resources constraints are defined, where each resource constraint corresponds to a maximum number of a each kind of resources available to construct the system architecture. Constraint values for each of at least three optimization parameters are defined, which includes a final optimization parameter. A design space is defined as a plurality of vectors representing different combinations of a number of each kind of resource available to construct the system architecture. For each of the plurality of optimization parameters, a priority factor function is defined.



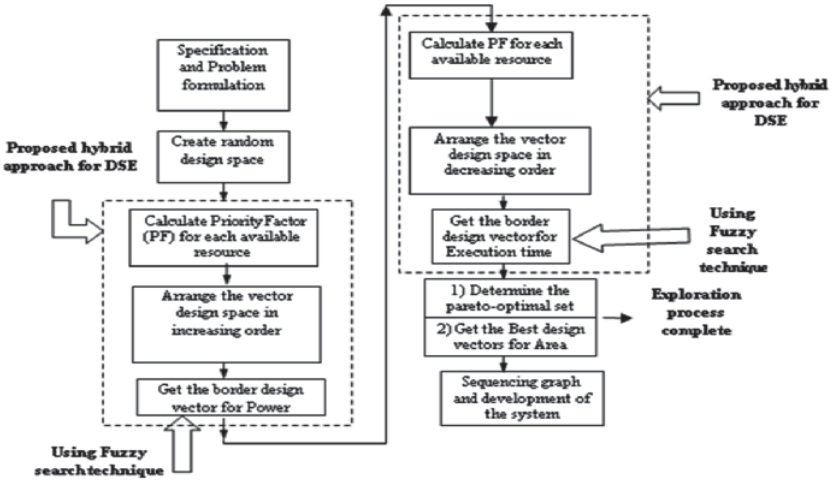
Patent: Granted, Candian Patent No. # CA2726091A1

Proposed Relevant Industries: Chip Design, Hardware Security

Inventor: Prof. Anirban Sengupta (asengupt@iiti.ac.in), Department of Computer Science and Engineering

System and Method for Development of System Architecture

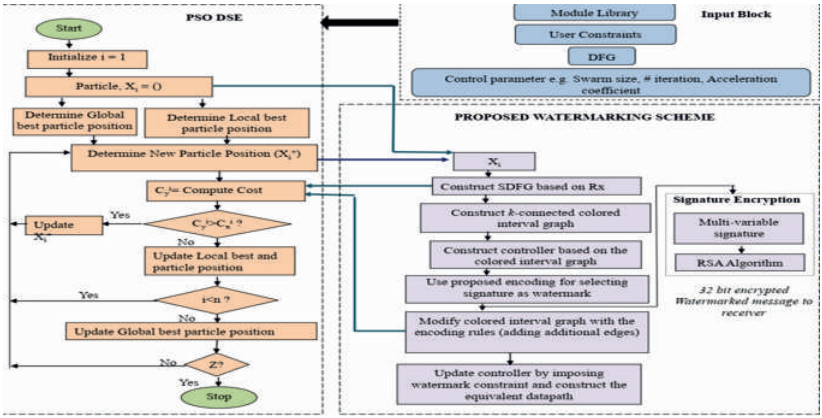
Methods, systems, and computer readable medium for developing a system architecture that involves defining resource constraints for kinds of resources and constraint values for optimization parameters, and defining a design space as variants, where each variant is a vector. Satisfying sets of variants are determined for optimization parameters by assigning membership values to each variant of a universe of discourse set and performing a fuzzy search of a universe of discourse set using the corresponding membership values. A set of variants is determined based on an intersection of the satisfying sets of variants.



Patent: Granted, Candian Patent No. # CA2741253A1
Proposed Relevant Industries: Chip Design, Hardware Security, Defense
Inventor: Prof. Anirban Sengupta (asengupt@iiti.ac.in), Department of Computer Science and Engineering

Embedding Watermark Based on Multi-Variable Signature Encoding at Behaviour Level for Reusable IP Core Protection

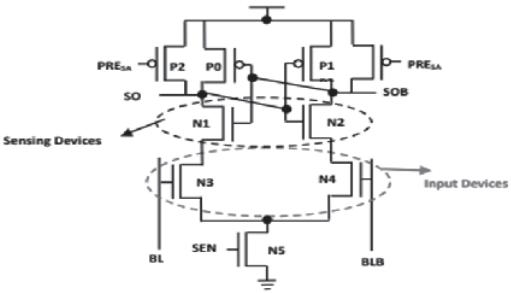
Disclosed is an embedding watermark during high level synthesis at behavior level for reusable IP core protection. In one implementation, the present invention generates low cost watermarking solution during high level synthesis (HLS) based on multi-variable signature encoding for security of reusable IP cores. The watermark generated by the proposed approach satisfies the following properties: (a) low embedding cost (b) robustness (c) low watermark creation time (d) strong proof of authorship (e) lower hardware overhead (f) fault tolerance. Comparison with similar technique revealed the present invention obtains watermarked solution with lower embedding cost with lesser storage overhead and creation/embedding time.



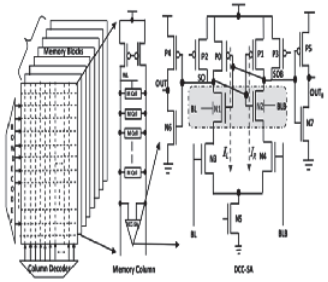
Patent: Granted Filed, Indian Patent Application No. 4466/MUM/2015
Proposed Relevant Industries: Chip Design, VLSI Industries
Inventor: Prof. Anirban Sengupta (asengupt@iiti.ac.in), Department of Computer Science and Engineering

Offset Compensated Data Sensing Technique For Low Energy Embedded SRAM

Continuous downscaling of technology has increased integration density and performance but also introduced process variations like random dopant fluctuation (RDF) and line edge roughness (LER), leading to SRAM read yield losses. This work proposes a Differential Current Compensated Sense Amplifier (DCC-SA) to address variability-induced failures in embedded SRAM. The DCC-SA dynamically adjusts overdrive potential to compensate for branch current mismatches, reducing bit-error-rate, energy consumption, and input-referred offset. It offers higher offset tolerance and a lower power-delay product, making it ideal for low-power IoT processors. Monte Carlo simulations confirm its robustness against process variations, highlighting its effectiveness and innovation.



Prior art, Conventional Current Latch Sense Amplifier



Proposed Differential Current Compensated Sense Amplifier

Patent: Granted, Indian Patent No. 394437
Proposed Relevant Industries: Semiconductors
Inventors: Dr. Bhupendra Singh Reniwal, Dr. Santosh Kumar Vishvakarma (skvishvakarma@iiti.ac.in), Department of Electrical Engineering

List of Patents of IIT Indore

Granted

No.s	Description	Faculty Name	Status of The Patent
1	Design Space Exploration System and Method Thereof using a Bacterial Foraging Optimization Mechanism	Dr. Anirban Sengupta	Granted
2	Design Space Exploration of Optimal K-cycle Transient Fault Tolerant Datapath Based on Multi-objective Power-performance Tradeoff	Dr. Anirban Sengupta	Granted
3	Method and System for Automatic Fault Recovery and True Output Extraction During High Level Synthesis	Dr. Anirban Sengupta	Granted
4	Improved Schedule Delay Estimation Process for Datapath during high level Synthesis of Application Specific Processors	Dr. Anirban Sengupta	Granted
5	Design Space Exploration of Optimal K--cycle Transient Fault Data-path System with Intelligent Cut Insertion Secured	Dr. Anirban Sengupta	Granted
6	Design Space Exploration of an Optimized Hardware Trojan Detectable/secured Datapath during high level Synthesis	Dr. Anirban Sengupta	Granted
7	Novel Mutant L-asparaginases	Dr. Avinash Sonawane	Granted
8	System and Method for sign Language Gesture Recognition	Dr. Aruna Tiwari	Granted
9	System and Method for Emergency Services	Dr. Vimal Bhatia	Granted
10	A Multi-frequency Based Transceiver	Dr. Vimal Bhatia	Granted
11	Multiple Gate Junctionless Mosfet (metal Oxide Semiconductor Field Effect Transistor)	Dr. Abhinav Kranti	Granted
12	P-N Tuned Differential 8T Static Random Access Memory (SRAM) Cell	Dr. Santosh K. Vishvakarma	Granted
13	Method, Device and Apparatus for Managing Phone/ device Profile Based on an Event	Dr. Vimal Bhatia	Granted
14	System and Method for Electrical Energy Conservation	Dr. Gourinath Banda	Granted
15	A Software Defined Radio Module to Perform an Inter-system Communication	Dr. Vimal Bhatia	Granted
16	Embedding Watermark Based on Multi-variable Signature Encoding at behaviour level for Reusable IP Core Protection	Dr. Anirban Sengupta	Granted
17	A Mechanism of 2PRP-PRR Planar Parallel Manipulator and a Method Thereof	Dr. Santhakumar	Granted
18	A Rehabilitation Robot for lower Limb Gait Therapy	Dr. Santhakumar	Granted
19	Method and System for Providing Smart Communications for Distributed Operations Planning in an Industrial Network	Dr. Bhupesh Kumar Lad	Granted
20	Thermo-mechanical Test Bench For Reliability Estimation of Shape Memory Alloy (SMA) Springs	Dr. I.A. Palani, Dr. Bhupesh Kumar Lad	Granted
21	A Multiple Gate Tunneling Field Effect Transistor Device for Capacitorless Dynamic Memory	Dr. Abhinav Kranti	Granted

22	A Six Degree of Freedom Parallel Manipulator in RPRS Configuration	Dr. santhakumar	Granted
23	Dual Ion Beam Sputtered Cost effective and Non-volatile Resistive Memory Devices	Dr. shaibal Mukherjee	Granted
24	An Ultra Low Power, Read Decoupled-differential Write, 10T SRAM Cell With Larger Read/write Noise Margin	Dr. Santosh K. Vishvakarma	Granted
25	Offset Compensated Data Sensing Technique for low Energy Embedded SRAM	Dr. Santosh K. Vishvakarma	Granted
26	Method and Appartus for low Complexity Natural Gradient Based OFDM Channel Estimator	Dr. Vimal Bhatia	Granted
27	Read Recharge (RRC) Based Process Variation Tolerant 10T SRAM Cell	Dr. Santosh K. Vishvakarma	Granted
28	Method and Apparatus for Detection of active taps location in OFDM System	Dr. Vimal Bhatia	Granted
29	Low Leakage-high Stability Differential Positive Feedback Controlled 10T (DPFC10T) SRAM Cell	Dr. Santosh K. Vishvakarma	Granted
30	High Performance Double Gate Tunnel Field Effect Transistor For Low Power Applications	Dr. Santosh K. Vishvakarma	Granted
31	A Metal Inert Gas (MIG) Based Additive Manufacturing Technique for Fabricating Shape Memory Alloy Ring	Dr. I.A. palani	Granted
32	A method of Fabricating Zinc Oxide Based Heterostructure for high Electron Mobility Transistor	Dr. Shaibal Mukherjee Dr. Abhinav Kranti	Granted
33	A Cervical Collar	Dr. I.A. Palani	Granted
34	A Method of Fabricating High Two Dimensional Electron Gas Density Yielding Zinc Oxide Heterostructure	Dr. Shaibal Mukherjee Dr. Abhinav Kranti	Granted
35	Ultrafast Electrical Testing System	Dr. Anbarasu	Granted
36	A method and Apparatus for Transferring Heat From Stationary/ moving Surfaces using Impingement Jet	Dr. Santosh Kumar Sahu Prof. S.C. Korea	Granted
37	Method and System for low power source Spectrum Sensing	Dr. Vimal Bhatia	Granted
38	A Fingerprint Acquisition System For Anti-theft Fingerprint Biometry and method Thereof	Dr. Vimal Bhatia	Granted
39	A dual Axis Continuous Solar Tracking System Using Shape Memory Alloy Bimorph Based Solar Panel	Dr. I.A. Palani	Granted
40	Essential Amino Acid Based Biodegradable and Biocompatible Nanoparticles for Bio Medical Imaging and Targeted Drug Delivery Applications	Dr. Sharad Gupta	Granted
41	Vertical Falling Film Gas Liquid Tower	Dr. Ritunesh Kumar	Granted
42	Hybrid Underwater Vehicle for Ocean Observations	Dr. Santhakumar Mohan	Granted
43	Wheelchair System with Brain Computer Interface and Gesture Recognition	Dr. Gourinath Banda	Granted

44	Strained SMA Bimorph & Spring Based Condition Monitoring System for Fluid Leak Detection in Hydraulic Hoses	Dr. I.A. Palani	Granted
45	A Method For Synthesizing Nanoparticle or Microsphere	Dr. Abhijeet Joshi, Dr. Sharad Gupta	Granted
46	Magnetic Field Assisted Micro-plasma Transferred Arc Powder Additive Layer Manufacturing Process	Prof. Neelesh Kumar Jain	Granted
47	Hybrid Mesoporous Composites Gas Sensors	Dr. Shaibal Mukherjee	Granted
48	Organo-acidified Zinc Oxide Carbon Monoxide Sensor	Dr. Shaibal Mukherjee	Granted
49	Π Congugated Compound For Resistive Switching, Device, and method of Fabrication	Dr. Apurba K Das	Granted
50	Metal-free, Solvent-free Synthesis of Fused-pyrido Hetrocycles: Biological Efficacy Against Cancer And Multi-drug Resistant Pathogens	Dr. Chelvam Venkatesh	Granted
51	Ultrasonic Atomizer Based Ultrafine Silk Nanoparticles with long shelf life for Targeted Drug Delivery and Diagnostics	Dr. Sharad Gupta	Granted
52	Catalyst for low Temperature Hydrogen Production	Dr. Sanjay Kumar Singh	Granted
53	Catalytic Process for Hydrogen Production From Polymeric Polyethylene Terephthalate (PET) Waste	Dr. Sanjay Kumar Singh	Granted
54	A Device for Assessment of Seed Pre-treatments	Dr. Vimal Bhatia	Granted
55	Third Generation Tubulysin Analogues and Process of Preparation Thereof	Dr. Chelvam Venkatesh	Granted
56	Spoof Recognition in an Ear Biometric System	Dr. Vimal Bhatia	Granted
57	Ultrasensitive Nitrogen Dioxide Sensor Based On S, N Doped Carbon Dot Functionalized Tungsten Oxide	Dr. Shaibal Mukherjee	Granted
58	Bio-chem-reactor for Biocementation and mehod Therof	Dr. Neelima Satyam	Granted
59	A Scalable System and method for Contact Tracing, Hotspot Detection and Safe Route Recommendation	Dr. Chandresh K. Mourya	Granted
60	Ground Improvement Technique Using Indigenous Bacteria for Biocementation of Expansive Soil Subgrades	Dr. Neelima Satyam	Granted
61	Swarf-based Substrata For Wire Arc Additive Manufacturing	Dr. Yuvraj Madhukar	Granted
62	A Vaccine and Biological Material Carrier Box	Dr. Shilpa Raut	Granted
63	Silicon Compatible Yttria-based Memristive Crossbar Array and a method of Fabrication Thereof	Dr. Shaibal Mukherjee	Granted
64	A Kit for Screening of Early Phase Detection of Epstein Barr Virus Induced Alzheimer's Disease	Dr. Hemchandra Jha	Granted
65	A Method of maintenance for High-performance Machineries Employing Axial Piston Pumps and Multiple Cylinders	Dr. Ankur Miglani	Granted
66	Cathode tool Design and Development for spur gear tooth Flank Modification by Electrochemical Machining	Prof. Neelesh Kumar Jain	Granted

67	A Sanitization Device for a Protective Article	Dr. Ankur Miglani	Granted
68	A Multi-wavelength Pulsed Laser Excitation Photoacoustic (PA) Screening Appratus	Dr. Srivatsan Vasudevan	Granted
69	A Wide Range Variable Resistance Readout Circuit	Prof. Shaibal Mukherjee	Granted
70	System and Method For Quantifying The Angular Stability Status of a Power Grid	Prof. Trapti Jain	Granted
71	A Molten Salt Solid-state Reaction-based Process to Obtain a high Purity Ti3alc2 Max Phase	Dr. Rupesh Devan	Granted
72	System and method for Monitoring and detecting leakage of Toxic Gases to Enable user alerts	Prof. Shaibal Mukherjee	Granted
73	Inchworm Inspired shape Memory alloy Bimorph-based Stewart platform For Opto-mechatronic system and method Thereof	Prof. I.A. Palani	Granted
74	Apparatus and methods for Noise-aware and Energy-efficient Pulse Ratevariability and heart rate variability Analysis	Prof. Ram Bilas Pachori	Granted
75	A method to control two dimensional electron Gas Mobility and Carrier Density of Oxide-based Heterostructure	Prof. Shaibal Mukherjee	Granted
76	Large-scale, Flexible Electrochromic Devices (ECDS) and its method of synthesis	Prof. Rajesh Kumar	Granted
77	A Standalone, Portable Blood Pressure Measurement Device with Remote Monitoring	Dr. Devendra Deshmukh Dr. Shilpa Raut	Granted
78	Stable Oxide-hydroxide Complex Based on Vanadium Transition Metal Oxide and Method Thereo	Prof. Rajesh Kumar	Granted
79	Secure Hardware IP of GLRT Cascade using color Interval Graph Based Embedded Fingerprint for ECG Detector	Dr. Anirban Sengupta	Granted
80	Process for Culturing Indigenous Bacteria for Treating Clays with Varying Plasticity to Improve Engineering Behavior	Dr. Neelima Satyam	Granted
81	A Smart Road Asset Management System and method Thereof	Prof. Aruna Tiwari (iisc)	Granted
82	System and method for Biometric Identification using ECG Signals,	Prof. Ram Bilas Pachori	2021106695 (auastralian Patent)
83	Modelling Calibration of Friction Parameters for Debris Flow	Dr. Neelima Satyam	2021106606 (australian Patent)
84	Integrated Mass Spring Damper and Liquid-circular Angular Accelerometer System for Structural Strength Analysis	Dr. Neelima Satyam	Granted

Under Examination

No.s	Description	Faculty Name	Status of The Patent
85	System and method for Speech-to-text Translation based on Continual Learning Technique	Prof. Chandresh Maurya	Under Examination
86	System and method for Summarization of Speech to text/speech translation	Prof. Chandresh Maurya	Under Examination
87	A system and method for end-to-end continual speech-to-speech translation	Prof. Chandresh Maurya	Under Examination
88	Method and apparatus for Recording, Archiving, Media Management and Playing Back of A Telephone Call	Dr. Vimal Bhatia	Under Examination
89	Low Cost Identification of Road Congestion for Traffic Management	Dr. Vimal Bhatia	Under Examination
90	System, Method and Apparatus for low Complexity Non-orthogonal Multiple Access (NOMA) Receiver for Mixed Constellation	Dr. Vimal Bhatia	Under Examination
91	Contrastive Learning of Eulerian and Lagrangian Signals for rempte PPG	Dr. Puneet Gupta	Under Examination
92	Method and system for detection and determination of Failure and downtime of a Fluid-powered system	Prof. Pavan Kankar	Under Examination
93	Nanophotonic Resistive switch based on Tapered Copper-silicon Structure with low Power and high Extinction Ratio	Prof. Mukesh Kumar	Under Examination
94	All Optical Modulation in Engineered Indium Tin Oxide Based Vertically Ring Resonator Employing Epsilon Near Zero State	Prof. Mukesh Kumar	Under Examination
95	A Modular Reactor for Manometric Apparatus Operable in Hydrogen Environment at high Pressures and Capable of Handling Powered/porous Nanomaterials	Dr. Shailesh Kundelwal	Under Examination
96	Apparatus, Systems and methods for Contextual Information Aware Physiological Parameter Analysis and Intelligent Human Disease Prediction and Diagnosis Networks	Prof. Ram Bilas Pachori	Under Examination

Published

No.s	Description	Faculty Name	Status of The Patent
97	A Universal Testing Machine for analysis of Physical Properties of The thin film sheets and method Thereof	Dr. I.A. Palani	Published
98	Green Synthesis of Biocompatible and near Infrared Active Iron Oxide Nanoparticle for deep tissue imaging and therapy	Dr. Sharad Gupta	Published
99	New small Molecule Inhbitors/ligands for early Diagnosis and therapy of Prostate Specific Membrane Antigen (PSMA+) Cancers and Neurodegenerative Diseases	Dr. Chelvam Venkatesh	Published

100	Enhancing Indocyanine Green's Bioimaging by Encapsulating in Virally -derived Nano Vessels	Dr. Debasis Nayak Dr. Sharad Gupta	Published
101	Development of Portable sensor based canine pregnancy detection system	Dr. Debasis Nayak Pro. Ram Bilas Pachori	Published
102	Engineered Nanophotonic Structure based on Electrically Controlled Composite Materials for Biochemical Sensing	Dr. Mukesh Kumar	Published
103	Wideband Power Divider Using Substrate Integrated Waveguide for Millimeter-wave Applications	Dr. Saptarshi Ghosh	Published
104	System and method for Predicting Parkinson's Disease	Prof. Ram Bilas Pachori	Published
105	Instrument to acquire real time Dynamic Photoacoustic signal and display Acoustic Spectrum (using high speed signal conditioning for Biomedical Tissue Diagnosis	Dr. Srivatsan Vasudevan	Published
106	Apparatus and methods for Noise-aware and Energy-efficient pulse rate Variability and heart rate Variability Analysis	Prof. Ram Bilas Pachori	Published
107	Apparatus, Systems and methods for quality-aware Energy-efficient Respiration Rate Estimation from Photoplethysmography (PPG) Signal	Prof. Ram Bilas Pachori	Published
108	Apparatus, systems and methods for quality-aware energy-efficient PPG signal analysis and Cardiovascular Disease Diagnosis and Prediction	Prof. Ram Bilas Pachori	Published
109	Development of Improved Ballistic Performance Concrete Slab by Incorporating Different Geometrical shapes as Reinforcement Subjected to Projectile Impact	Dr. Abhishek Rajput	Published
110	Novel Fdm-based 3D Printing with integrated direct ink writing mechanism	Dr. Girish Verma	Published
111	Portable and Iot-enabled uric acid sensor system for Point-of-care and Real-time Kidney function monitoring	Prof. Shaibal Mukherjee	Published
112	Real-time, portable, and Iot-enabled soil fertility and disease monitoring system	Prof. Shaibal Mukherjee	Published
113	Application of Synthetic Jet using flapping wings for thermal management and energy harvesting.	Dr. Harekrishna Yadav	Published
114	Tin Oxide Composites based activated Thin-film electrode For High-performance Thin-film Rechargeable Metal-ion Battery.	Dr. S. Chattopadhayay	Published
115	Multichromatic Superhydrophobic Fluorescent Carbon Quantum Dots for Ai-enabled Anti-counterfeiting and Coating Applications	Dr. Mrigendra Dubey	Published
116	Portable and Iot-enabled heavy metal Ion sensor system in water	Prof. Shaibal Mukherjee	Published

Filed

No.s	Description	Faculty Name	Status of The Patent
117	A Novel Process on Quantification of Hydrologic Resilience Potential and Its Attributions	Dr. Manish Kumar Goyal	Filed
118	A Novel E.coli L-asparaginase (ECA) Variant of Acute Lymphoblastic Leukemia (All)	Dr. Avinash Sonawane	Filed
119	Portable biosensing systems for milk spoilage and Adultration Deduction	Dr. Abhijeet Joshi	Filed
120	Laser Decal Transfer Based M-3D Printer	Dr. I.A. Palani	Filed
121	Myelin protein antigenic epitopes presented by Major Histocompatibility Complexes, A Driver to multiple sclerosis	Dr. Hem Chandra Jha	Filed
122	Constant Transconductance bias technique to reduce Pvt Variation in oscillators	Prof. Santosh Viswakarma	Filed
123	A Cost-effective synthesis of reduced Graphene Aerogels Doped with Titanium Nanoparticles for adsorption of gases	Dr. Shailesh Kundelwal	Filed
124	Method and System for Determining Spatiotemporal Characteristic and Predicting the state of Atmospheric Rivers (AR)	Dr. Manish Kumar Goyal	Filed
125	Medical Emergency Portable Stretcher	Dr. Ashish Rajak	Filed
126	Novel Synergistic Combination Therapy Based on Levofloxacin and Dorzolamide for the Treatment of Sepsis	Dr. Mirza S Baig	Filed
127	Recombinant Organophosphate Hydrolyzing Enzyme Immobilized Fluorescent Composites for the detection and Degradation of Organophosphates Compounds	Dr. Abhijeet Joshi	Filed
128	Security aware design methodology for designing secure hardware Accelerators for Implantable Cardiac Pacemaker	Dr. Anirban Sengupta	Filed
129	Antifungal and Antibacterial Hydrogel	Dr. Apurba K. Das	Filed
130	Iot-based smart Sanitary Pad for Menstrual Health Monitoring	Prof. I.a. Palani	Filed
131	Photoconductive Device for The Emission and detection with Metal-semiconductor and Metal-insulator-semiconductor Contact	Dr. Abhishek Singh	Filed
132	Respiratory Motion Phantom for Radiotherapy Treatment using moving Platform	Prof. Srivathsan Vasudevan	Filed
133	Homoaromatic Peptide Mitigate FMR Pol-g-protein Mediated Toxicity in Fragile X-associated Tremor/ataxia Syndrome (FXTAS)	Prof. Amit Kumar	Filed
134	Biomolecular Condensate Matrix Enabled Conductive Polymer Hydrogel: Versatile Insitu Oxidant Templating Preparation	Prof. Tridib K. Sarma	Filed
135	Novel Compound and method thereof to address the tirap Mediated Chronic inflammatory signalling	Dr. Mirza S Baig	Filed
136	A portable single grain dispenser	Dr. Ankur Miglani	Filed
137	Customizing Acceptor/donor type counter Ions for selective Enhancement of Electro chromic device performance parameter	Prof. Rajneesh Misra Prof Rajesh Kumar	Filed

138	A technique for designing curved frequency selective surface	Dr. Saptarshi Ghosh	Filed
139	Design and development of Triboelectric Nanogenerator-based Machine Skin Integrated with smart controller for Digital Twin Development	Dr. I.A. Palani	Filed
140	Thermoelectric Generator based Portable Power Generation Unit	Dr. Devendra Deshmukh	Filed
141	Design and Development of twin wire arc additive manufacturing based on Gas Metal Arc Welding (GMAW) method using two different power sources	Dr. Dan Sathiaraj	Filed
142	A targeted drug complex against Huntington's Disease (HD) and Spino Cerebellar ataxias (SCAS)	Prof. Amit Kumar	Filed
143	An Innovative Combination Drug for the treatment of Huntington's Disease and spino cerebellar ataxias (SCAS)	Prof. Amit Kumar	Filed
144	A Dual-drug Combination for the Treatment of Huntington's Disease (HD) and Spino Cerebellar Ataxias (SCAS)	Prof. Amit Kumar	Filed
145	Innovative Dual Drug Formulation Counters FMR Poly-g Protein Toxicity in Fragile X-associated Tremor/ataxia Syndrome (FXTAS), And Fragile X-associated Primary Ovarian Insufficiency (FXPOI)	Prof. Amit Kumar	Filed
146	Effective Dual Drug Complex Mitigates FMR Poly-g Protein Toxicity in Fragile X-associated Tremor/ataxia Syndrome (FXTAS)/fragile X-associated Primary Ovarian Insufficiency Syndrome (FXPOI)	Prof. Amit Kumar	Filed
147	Tailored Dual Drug Formulation for Targeting Protein Toxicity in Fragile X-associated Tremor/ataxia Syndrome (FXTAS)/fragile X-associated Primary Ovarian Insufficiency Syndrome (FXPOI)	Prof. Amit Kumar	Filed
148	System, apparatus, and method for heart rate determination of A user wearing a face mask	Dr. Puneet Gupta	Filed
149	System and method for detection of inter and intra Adulteration in Grain Sample	Prof. Ankur Miglani	Filed
150	Multi-user Downlink Noma Communication System and Method Thereof	Prof. Vimal Bhatia	Filed
151	System for Channel Estimation and method Thereof	Prof. Vimal Bhatia	Filed
152	Ontology-based Context Extraction and Scenario Generation System and method for Manufacturing Simulation	Prof. Bhupesh K. Lad Prof. Makarand S. Kulkarni	Filed
153	System and method for road Infrastructure monitoring using Ultrasonic Sensors	Prof. Vimal Bhatia	Filed
154	Gobair, a cow Dung-based Foaming agent and Resulting Lightweight Construction Materials Thereof	Dr. Sandeep Chaudhary	Filed
155	An alternative to cold storage: Development of Portable Kit for Visible Light Photdynamic Inactivation of Microbes on Vegetable	Dr. Debayan Sarkar	Filed
156	Sma-based Bioinspired Water Strider Robot	Dr. I.A. Palani	Filed

157	Design and Development of a Gesture-controlled Sma-actuated Robotic Gripper for Application in Explosive Disposal	Dr. I.A. Palani	Filed
158	Development of New Multiaxial Diamond anchored Octagonal Geogrid (MDAOG)	Dr. Baadiga Ramu	Filed
159	Development of New Multiaxial Concentric) Octagonal Geogrid (MCOG	Dr. Baadiga Ramu	Filed
160	Single-shot Compressed Optical-streaking Ultra-high-speed Photography (COSUP) With Simultaneous Referencing	Dr. Devendra Deshmukh	Filed
161	Benzothiazole-phenothiazine Derivative as a lung Cancer Therapeutics	Prof. Rajneesh Misra	Filed
162	Apparatus and method for Visualizing Preformed Fragments in Detonation Gas Cloud	Dr. Devendra Deshmukh	Filed
163	Artificial Intelligence Combined Transverse Tunneling Current Approach for Genome Engineering	Prof. Biswarup Pathak	Filed
164	A shear test system and method	Dr. Neelima Satyam	Filed
165	Self-healing Hydrogel, Uk Patent Application Number: 2210605.8, Date Of Filing: 20.07.2022	Dr. Apurba K Das	Filed
166	Design, Synthesis, and Biological Evaluation of Fused Thieno [3,2-c], Thieno[2,3-c], Benzo[4,5]thieno[3,2-c]pyridine-, Benzo [4,5]thieno[2,3-c]pyridine And Thiazolo[4,5-c] Heterocycles	Prof. Venkatesh Chelvam	Filed
167	Novel Compound Anchrofla and method Thereof to address The Ikkβ Mediated Chronic Inflammatory Signaling	Dr. Mirza S. Baig	Filed

Under Process

No.s	Description	Faculty Name	Status of The Patent
168	Multiphoton (two and three-photon) Excited Fluorescence for The Identification and Differential of X and Y- Chromome-bearing Sperms for Semen Sorting	Dr. Sharad Gupta	Under Process
169	Ingredients and methodology to develop shape stable and Flame Retarding Phase Change Composite for Thermal Management of Battery Modules	Dr. Santosh K. Sahu	Under Process
170	Oven-based synthesis and Modified selective precipitation purification for high aspect ratio and better purity of Silver Nanowires	Prof. Vipul Singh	Under Process
171	Sodium Rich Al Substituted P2/P3 Biphasic Cathode for Na Ion Batteries	Dr. Sunil Kumar	Under Process
172	A device for precision dispensing, sorting and quality indexing of both damaged and healthy grains, millets and Nuts.	Dr. Ankur Miglani	Under Process

173	Heat Curing based Vat-geopolymerization Based 3-D Printing Process	Dr. Sandeep Chaudhary	Under Process
174	System and method for Wide-area Crowd Counting using Drones and artificial intelligence	Dr. Vivek Kanhangad	Under Process
175	Wideband Polarization-insensitive multifunctional econfigurable frequency selective surface	Dr. Saptarshi Ghosh	Under Process
176	Inhibitory effect of Demethoxycurcumin and Rosmarinic Acid Against Glycoprotein 350 and Blocking Epstein-barr virus entry into brain compartment	Dr. Hemchandra Jha	Under Process
177	Biomimetic Stingray Inspired Robit for Underwater Microplastic Sampling	Dr. I. A. Palani	Under Process
178	Iot Management Protocol and Palteform for any Iot-device	Dr. Gourinath Banda	Under Process
179	Magnetic Field Driven Overpotential Reduction in Electrodeposited Ni-co and Ni-fe based electrodes for Green Hydrogen Production	Dr. Ajay Kumar Kushwaha	Under Process
180	Development of Tribo-electric Nanogenerator based shoe sole Energy Harvesting unit for Self-powered Microelectronics	Dr. I .A. Palani	Under Process
181	Design and development of CU Based SMA Bimorph Integrated SMA coated optical fiber sensor towards low temperature condition monitoring	Dr. I.A. Palani	Under Process
182	Artificial Intelligence (AI) Integrated Quantum Tunneling for Stereoselective and Regioselective Identification of Carbohydrate Isomers	Prof. Biswarup Pathak	Under Process
183	A Portable Evaporative Cooler based on a Synthetic Jet	Dr. Harekrishna Yadav	Under Process
184	Development of High-entropy cubic garnet solid electrolytes for solid state lithium batteries	Dr. Sunil Kimar	Under Process
185	High Voltage Earth Abundant Cathode for Na Ion Batteries.	Dr. Sunil Kimar	Under Process
186	Method and Fabrication of High Entropy Prussian Blue Analog for High Energy and High Power Density Sodium-ion Capacitor	Dr. Dhirendra K. Rai	Under Process
187	System and method for Drone Control Using Multimodal AI	Dr. Vivek Kanhangad	Under Process
188	Determination of Erosion and Entrainment Dynamics using a small-scale flume setup	Dr. Neelima Satyam	Under Process
189	Low Frequency Antenna Characterization System for Space Application	Prof. Abhirup Datta	Under Process
190	UAV based crack detection in infrastructures using AI-ML	Prof. Abhirup Datta	Under Process
191	Agri-genomics data Management Platform	Prof. Aruna Tiwari	Under Process
192	Peptide-nucleotide supramolecular Hydrogel with intrinsic Antibacterial, Antiviral and Anticancer Activities	Dr. Tridib Kumar Sarma	Under Process
193	Shape memory alloy based Deformable Adaptive Mirror and Actuators Array for Wavefront Correction	Dr. I.A. Palani	Under Process

Initiative for Transactional Research

Translational Research Fellowship: A step towards Lab to Land Ecosystem

To inculcate a translational research ecosystem among the students, a Translational Research Fellowship scheme has been initiated by IIT Indore. The main objective of the Fellowship is to encourage students who have developed technologies and are aspiring for upgrading the technology for potential commercialization under the respective faculty member's mentorship. This fellowship is open for undergraduate, post graduate and Ph. D. students who are on the verge of completing their degree. Five students have been awarded with Translational Research Fellowship till date.

S. No.	Inventors/Mentor	Title of the Technology	Domain
1	Mr. Rahul Chaurasia/ Prof. Anirban Sengupta	Design space exploration of secure optimal K-cycle fault tolerant data path processor with embedded encrypted protein molecular biometric during high level synthesis of integrated circuits (ICs)	Hardware Security
2	Mr. Gyanesh Patnaik/ Dr. Abhishek Rajput	Multilayer Hybrid Composite Armor System	Material for Defense
3	Mr. Chandrabhan Patel/ Prof. Shaibal Mukherjee	IoT enabled Ultrasensitive and Selective Gas Sensor	Smart sensors & Environmental Sustainability
4	Mr. Anikeit Sethi/ Prof. Aruna Tiwari	Intelligent surveillance system for Highway using novel deep-learning method	Smart City Infrastructure
5	Mr. Sanchit Gupta/ Prof. Sandeep Chaudhary	GOBAiR – a novel cow dung based foaming agent for developing sustainable light weight construction materials	Smart City Infrastructure & Environmental Sustainability
6	Mr. Mayank Kumar Singh/ Dr. Dhirendra K. Rai	Design and Development of Hybrid Sodium-Ion Capacitor for Electrochemical Energy Storage Applications	Battery, Energy Storage
7	Mr. Rahul Dev Mishra/ Prof. Mukesh Kumar	Nanophotonic Devices for Switching and Sensing Applications	Smart Sensors
8	Mr. Milan Jena/ Prof. Biswarup Pathak	Development of an Artificially Intelligent (AI) Nanopore for Rapid DNA Sequencing	Artificial Intelligence based DNA Sequencing

S. No.	Inventors/Mentor	Title of the Technology	Domain
9	Dinesh/ Dr. Harekrishna Yadav	Synthetic jet with smart material for energy harvesting and enhanced cooling	Thermal management
10	Suresh Kumar Pandey/ Prof. Mukesh Kumar	Plasmonic Tunable Absorber for Image Enhancement - Visible Imaging Conversion from IR Imaging	Nanophotonics
11	Harsha Avinash Tanti/ Prof. Abhirup Datta	Low frequency antenna characterization system for space application	Antenna Measurements, Testing, Surveying, Communication, RF Instruments, Antenna

Technologies Licensed to Industries/Adopted by Start-ups

Technologies licensed to Industries

S. No.	Name of Inventor	Title of the Technology	Domain
1	Prof. Aruna Tiwari	Ground Water Management App	Agriculture
2	Prof. Sandeep Chaudhary	Compressed Coloured Bi-layered Bricks	Infrastructure
3	Prof. Santosh Kumar Sahu	A Novel Shape Stable and Flame Retarding Phase Change Composite for Thermal Management	Smart Material for Batteries
4	Prof. Sanjay K. Singh	Catalysts for Low Temperature Hydrogen Production	Energy Sector

Technologies adopted by Start-ups

S. No.	Name of Start-up	Faculties & Students	Domain
1	Scas Technology	Mr. Gopal, Prof. Santosh K. Vishwakarma	Semi Autonomous Drones for Monitoring & Identification with AI features.
2	Help Yourself	Dr. Tarun Verma, Dr. Hem Jha	Diagnostic Kit for Early Detection of Malignant Transformation of Oral Submucous Fibrosis
3	QuanTechL2M Private Limited	Chandrabhan Patel, Dr. Shaibal Mukharjee	Quantum Technologies for IoT, AI and Machine Learning based Applications
4	SMART I-FAB Technology Pvt. Ltd	Dr. Ashish Shukla	Customizable Mask
5	Vedblockchain Systems Pvt. Ltd	Dr. Gourinath Banda	Applied Blockchain Technology for Billing Solutions

S. No.	Name of Start-up	Faculties & Students	Domain
6	Biotech Anant Garde	Dr. Mobin Shaikh	Construction of Smart Bandages for Wound Healing
7	Tera Source Pvt. Ltd	Dr. Abhishek Singh	Terahertz Devices
8	Fourier Imagine Pvt. Ltd	Dr. Devendra Deshmukh, Dr. Yogeshwar N. Mishra, Mr. Devashish Chorey	Consultancy and Technology Development
9	Digitraws Pvt Ltd	Dr. Gourinath Banda	Digital Transformation of web stack
10	Chemgreen Pvt Ltd	Dr Debayan sarkar	Contracted Research
11	Tulsi Tech	Neha Maheshwari, Prof. Santosh K. Vishwakarma	Semiconductor Chip Design and capacity building
12	Techwarium India Private Limited	Prof. Bhupesh Kumar Lad	Industry 4.0
13	Syncphasor AI Private Limited	Adnan Iqbal, Prof. Trapti Jain	Industry 4.0

A Handbook of

Ideas, Innovations & Technologies of IIT Indore

February 2025

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