Volume 10, Issue 3

December 2022

R&D Newsletter

Indian Institute of Technology Kanpur

IIT Kanpur displayed

12 R&D projects at IInvenTiv 2022 - p3

Highlights

- R&D News
- Technology Transfer
- Recent Major Projects

R&D News

MoU Signed with NEDO

An MoU was signed with **New Energy and Industrial Technology Development organization** (NEDO) to support the implementation of the study for the LCA Analyses of Hybrid Electric Vehicles VIS-a-vis Internal Combustion Engine Vehicles and Electric Vehicles in India.

MoU Signed with DRDO

DRDO exchanged MoU for setting up **DRDO Industry Academia Center of Excellence** with IIT Kanpur in the presence of Hon'able Raksha Mantri Shri Rajnath Singh at DefEXPO22 in Gandhinagar. The center at IIT Kanpur will focus on advanced materials and flexible electronics.

IIT Kanpur won the **National Award for e-Governance** (Silver Award) from the Department of Administrative Reforms & Public Grievances, Ministry of Personnel, Public Grievances & Pensions, Government of India under the category 'Outstanding research on Citizen Centric Services by Academic/Research Institution' of the National Awards for e-Governance Scheme 2021-2022.

Mr. Ajay Dubey (BT/CHE/1980) and his wife, Mrs. Rooma Dubey, have generously donated Rs two Crores towards the establishment of "**Rooma & Ajay Dubey Healthcare Innovation and Ideation Program**" (HII) at IIT Kanpur. The program will support student start-ups in developing innovative solutions and technologies in medical care.

Institute Lecture (August 2022 - November 2022)

Prof. Rao R. Tummala
Role of IITs in the emergence of electronics in India

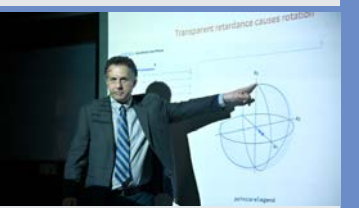
Dr. Koenraad Elst
Out of India: the necessary alternative to the Aryan invasion theory

Dr. Ruchir Puri
Engineering the future of software with AI

Mr. Rahul Gautam
Helping India Sleepwell – life story of an IIT Kanpur Chemical Engineer

Dr. Anil K. Rajvanshi
Nation Building, Junoon and Happiness

Shri Lalit M Kapoor
Five pillars of health



Prof. Arvind Verma
Criminal justice in India: reality & Possibility

https://www.iitk.ac.in/dord/outreach-2/institute-lecture-series

IIT Kanpur's participation at inter IIT Research fair IInven Tiv 2022

An inter IIT research fair "**IInven Tiv**" was organized at IIT Delhi on October 14 and 15, 2022, to bring together key stakeholders from the industry, government institutions and academia to collaborate, exchange ideas, learn and innovate. The event was inaugurated by Union Minister of Education and Minister of Skill Development & Entrepreneurship, Shri Dharmendra Pradhan.

Around twenty three IITs participated in this event and displayed seventyfive technologies. Along with students, IIT alumni from around the world, faculty from different CFTIs, and scientists from DRDO, ISRO, CSIR, and ICAR and representatives from the Confederation of Indian Industry (CII), Federation of Indian Chambers of Commerce & Industry (FICCI), and National Association of Software and Service Companies (NASSCOM) participated.

IIT Kanpur displayed twelve technologies which include High efficiency compact VTOL UAVs, Brain Computer Interface (BCI) based hand exoskeleton for neuro-rehabilitation of stroke patients, Methanol (M15/ M85) Fueled Two-Wheeler, Design & development of adaptive intelligent pipe health monitoring robots for fuel transportation systems, Low Cost, Anti-counterfeiting labels, Instant water quality probe, Hand-held tool-based soil health monitoring of Agricultural Land, Adaptive routing for physical delivery services, Indigenous 5G/5Gi network solution, Real-time Air Quality Monitoring and TacVibes- A Novel Watch for the Visually Impaired. Two technologies namely Drone and 5G test bed were chosen as showcase technologies. IIT Kanpur had the highest number of projects at this event.

Inauguration of i-Ghat

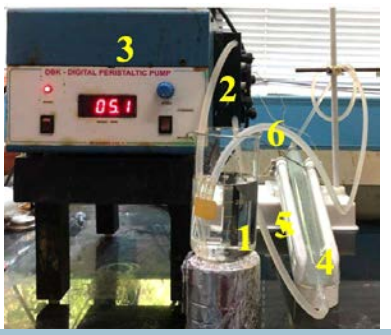
IIT Kanpur incubated startup Acquafront Infrastructure Private Limited (AIPL) has developed "i-Ghat." in which a state-of-the-art floating charging station allows the battery-powered electric boats to use captured solar energy through the RCC-based floating solar grid. The innovation uses renewable energy with zero air & noise pollution.

Hon'ble Deputy Chief Minister of Uttar Pradesh, Shri Keshav Prasad Maurya inaugurated this first-of-its-kind facility, "i-Ghat," at Kada Ghat, Kaushambi. The project is supported by NTT DATA under its CSR initiative.

Technology Transfer

IIT Kanpur bags **STEM Impact Awards 2022** for "Impactful Technology Transfer activities." Being awarded the second time, the Institute has been recognized for the socio-economic impact created with the impactful technology transfer of the invention - Portable Soil Testing Device, named '*Bhu-Parikshak*', at an award ceremony that took place at the India Habitat Centre, New Delhi on November 16, 2022.

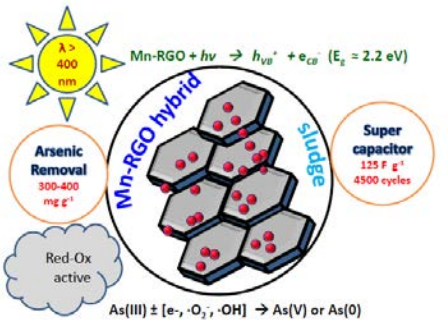
Portfolio of Technologies for waste-water solutions



TITLE: Development of Continuous Reactor having Glass Bead Coated with Defective TiO_2 for efficient Photocatalytic Degradation of Emerging Pharmaceutical Pollutants in Wastewater Effluent

Inventors: Dr. Raju Kumar Gupta, Mr. Prasenjit Kar, Dr. Deepanshu Aggarwal, Dr. Pratyush Jain

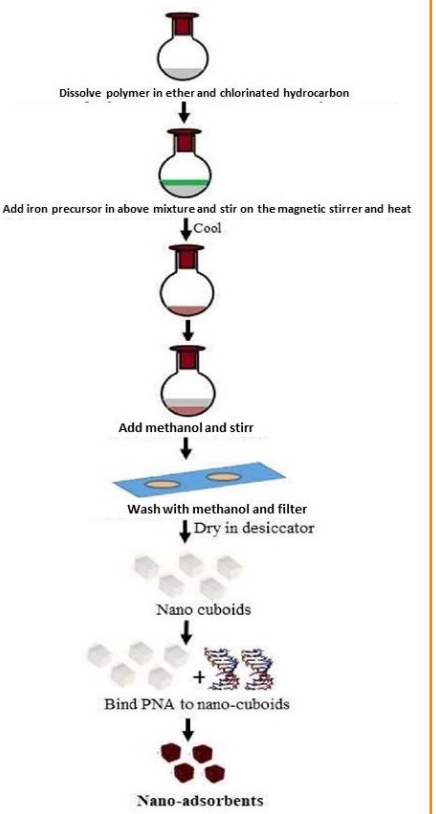
IPA No: 202011007915

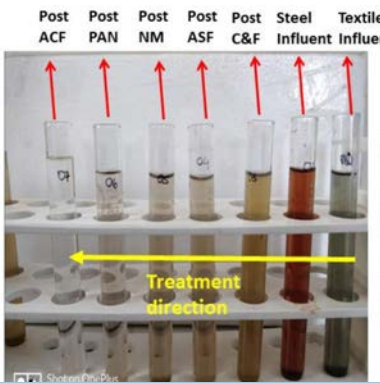


TITLE: Mn-Al-Fe Impregnated RGO Hybrid Composites for Arsenic Remediation with Redox and Photo-catalytic Synergism and Sludge as Possible Super-capacitor

Inventors: Dr. Kamal Krishna Kar, Dr. J. Ramkumar, · Mr. Yaswanth Kumar Penke, Mr. Amit Kumar Yadav, · Ms. Iram Malik, Ms. Alekha Tyagi

IPA No: 201911002684





C&F: Coagulation and flocculation
ASF: Activated sand filter
NM: Nanomat of ZnO (Photocatalysis)
ACF: Activated carbon filter
PAN: Pan filter

TITLE: Method and Apparatus for the Treatment of Industrial Wastewater

Inventors: Mr. Pankaj Singh Chauhan, Mr. Aditya Choudhary, Dr. Urmila Brighu, Dr. Shantanu Bhattacharya

IPA No: 202111015994

TITLE: A Packed Bed Microbial Fuel Cell (MFC) to Treat Wastewater in Continuous Mode

Inventors: Ms. Komal Pandey, Dr. Nishith Verma, Ms. Priyanka Gupta, Mr. Shiv Singh

IPA No: 202111038920

TITLE: Synthesis of cubic Nanothylakoids for selective removal of antibiotics and metal resistant bacteria from wastewater

Inventors: Prof. Niraj Sinha, Dr. Archana Raichur

IPA No: 202111061161

Recent Projects

Capacity building for human eesource development in Unmanned Aircraft System (Drone & Related Technology)

PI: Prof. Abhishek

Co-PI: Prof. Mangal Kothari

Dept. of Aerospace Engineering

Sponsor: Ministry of Electronics And Information Technology (MeitY)

MeitY has initiated a unique nationwide program on capacity building for Unmanned Aerial Systems (UAS) technology with focused interdisciplinary collaboration across various Academic Institutions, Training Centers and Skilling Bodies.

The objective of this programme is to build a strategic network for Human Resource Development in UAS and related areas over a period of five years to achieve: (a) Institutionalization of a collaborative ecosystem through identified Resource Centre (RC) and Participating Institution (PI) (b) Enhance capacity & capabilities of select institutions in identified Work Themes (WTs) (c) Foster development of competent human resources at various levels including Post Graduate & Graduate programs, Certificate programs, and Master Trainers in areas of UAS (d) Upgrade the knowledge and skills of Faculties (e) Promote entrepreneurial mindset through innovative interventions and (f) Nurture technical talent and ideation.

A two year degree program would also be launched from Department of Aerospace Engineering to develop and teach a curriculum that prepares students to be capable of conceptualizing ideas and providing engineering solutions in Unmanned Aerial System (UAS) technology and related areas. On completing the program, the student should be confident to venture into entrepreneurship or be ready to meet the requirements of the UAV industry. This is envisaged to be launched from the Academic Year 2022-23. As the programme is highly interdisciplinary, the department would leverage the expertise available for specific topics in other departments to address all the topics relevant to the program.

BIS-Academia Workshop

A day-long **BIS-Academia Workshop** on Standardization of Mechanical Testing and Powder Metallurgical Processes & Products was organized on November 22, 2022 under the aegis of Advanced Centre of Materials Science (ACMS) and Bureau of Indian Standards. The event was attended by about 100 participants that include faculty and staff members, research scholars and students.

Recent Projects

Developing affordable and AI-enabled handheld X-ray device for Tuberculosis Diagnosis

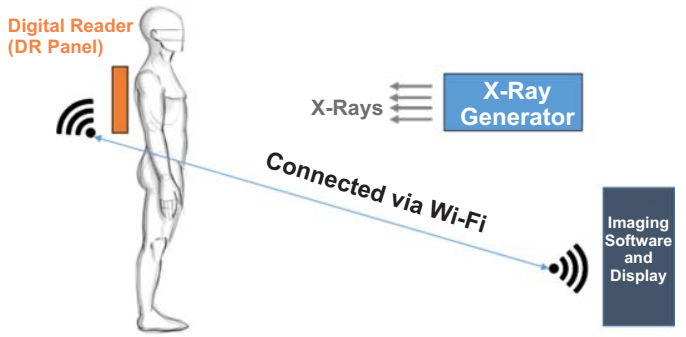



PI: Prof. Amitabha Bandyopadhyay
Dept. of Biological Sciences & Bioengineering

Co-PIs:Prof. J. Ramkumar, Dept. of Design
Prof. Aditya Kelkar, Dept. of Physics
Prof. Parthasarathi Sensharma, Dept. of Electrical Engineering

Sponsor: Indian Council of Medical Research (ICMR)

Tuberculosis (TB) is a curable disease, yet 1.5 million people die of TB each year. A vital strategy to ending TB is active case finding (ACF) through systematic screening for TB. Concordantly, the need to optimize the use of available tools to bend the curve toward ending TB is paramount. A proven tool for TB screening with continued room for optimization has long been chest radiography, given its high sensitivity and utility as a rule-in test.



Despite its importance, X-ray screening has historically been restricted by its immobile nature.

ICMR has granted this project of INR 4.60 crores to develop a completely indigenized, affordable, and AI-enabled handheld X-ray device. This handheld device will be battery-operated and can be packed into backpacks to be easily transported to hard-to-reach populations that currently face barriers to accessing healthcare services. Using handheld X-rays devices in conjunction with AI solutions that detect TB presents an opportunity to find TB cases even in the most remote settings.

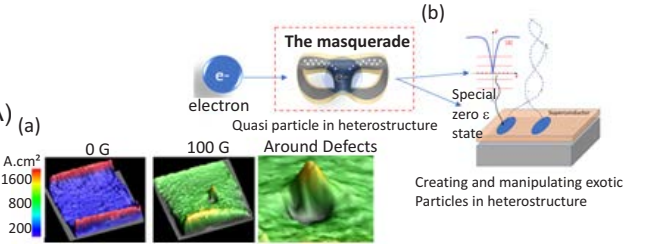
Collaborator: Lenek Technologies Private Limited

Co-PIs from Lenek Technologies Private Limited: Mr. Satyendra Chaudhary (Director), Mr. Anish Kaul (Director), Mr. Chirag Agrawal (Director), Mr. Sidesh Kumar (Director)

Building a unique Magneto-optical setup with capability for simultaneous imaging of electric current, magnetization & bulk transport measurement at low temperature with vector magnet for imaging strong correlation driven Topological Insulator & its heterostructures


PI: Prof. Satyajit Banerjee, Dept. of Physics
Co-PI: Prof. Ashish Garg, Dept. of Sustainable Energy Engineering
Sponsor: Science & Engineering Research Board (Under the scheme SUPRA)

A unique setup for imaging electric current distribution for application in the domain of advanced quantum materials and devices is developed at the Magneto-Optical imaging lab of IIT Kanpur. Redesigning of the system is ongoing, with a view to achieve enhanced sensitivity between room to cryogenic temperatures, and in low to very high magnetic field environments.



(a) Direct Imaging of electric current flow related to topological edge states in Bi_2Se_3 films and current distribution around defects. (b) Schematic overview of emergent novel exotic states hosted by new quantum materials/devices

Using this, the project aims to explore strong correlation driven physics in new Quantum materials like topological insulator (TI) and their heterostructures, hosting unexpected new quantum phases and phenomena's. Such systems potentially host robust new topologically protected quantum states which help avoid decoherence issues of quantum information bits. The development of the imaging technique to image electric currents down have already been demonstrated to few milli-Amperes.

Recent Projects

Ambient air quality Monitoring over Rural areas using Indigenous Technology (AMRIT)

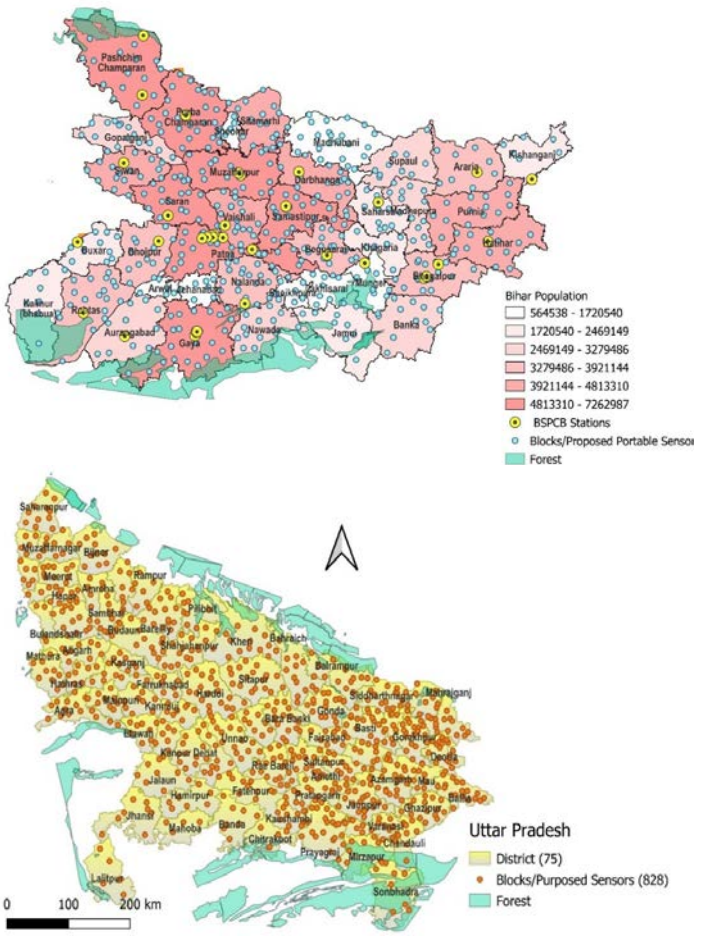
PI: Prof. Sachchida Nand Tripathi
Dept. of Civil Engineering

Sponsor: Open Philanthropy

Air pollution is an environmental threat that causes the mortality of more than a million people in India every year, as per the Disease Burden India report. Previously, Air Quality (AQ) research highlighted more insights about urban AQ in India, but more knowledge is needed about rural AQ.

This project aims to support rural AQ monitoring. The objectives of this project are to create micro airsheds within the different states to effectively manage the AQ at the district level by understanding the various sources' contributions. Furthermore, the rural AQ data from the project will be utilized for science and policy development for better rural AQ management plans to avoid adverse impacts on citizens' health.

Initially, the project aims to monitor the rural AQ over Bihar and Uttar Pradesh in collaboration with respective State Pollution Control Boards. The project will create the research facility using indigenous technology with the support of two start-ups: Respirer and Airveda.



Map with proposed portable Air Quality (AQ) sensor deployment in different blocks of different districts in Bihar and Uttar Pradesh for rural AQ monitoring.

Recent Projects

Indo-Italian Centre of Excellence for restoration and assessment of environmental impacts on cultural heritage monuments

PI: Prof. Mukesh Sharma
Co-PI: Prof. Anubha Goel
Dept. of Civil Engineering

Sponsor: Department of Science & Technology and Italian Ministry of Culture

The national monuments must be restored and maintained so that they last for many generations. The adverse impact on the monuments can be both from natural and anthropogenic occurrences. This requires repairs, reinforcement and restoration work to continue adopting modern technologies. It also requires that one understands the cause-effect relationship for the health of the monuments and heritage buildings. The potential damage to the historical monuments from air pollution can cause structural and aesthetic harm to the monuments.

The objective of this project is to undertake joint research activities by the Indian and Italian sides from academia, exchange of knowledge, and experience, train research scholars who will provide support for the relevant activities, identify the monuments requiring restoration and conservation work, and demonstrate restoration.

The proposed network of excellence is expected to achieve a long-term collaboration between India and Italy including the exchange of knowledge, experience, research and technology development, publications, and training of research scholars and post-doctoral fellows. The other outcomes include demonstrating monument conservation and restoration in India and Italy and study of the environmental impacts on monuments.

Participating Institutes

From India:
IIT Kanpur, Archaeological Survey of India and IIT Roorkee

From Italy:
Soprintendenza Archeologia, belle arti e paesaggio per il comune di Venezia e laguna (SABAP), Ca' Foscari University of Venice, The Istituto Centrale per il Restauro (ICR), and Nadir Srl "Plasma & Polymers.

Feedback/Suggestions

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