# R&D
# NEWSLETTER

## <u>Message from the Director</u>

I am delighted to share with you the latest edition of IIT Roorkee's R&D Newsletter, a reflection of our institute's unwavering commitment to research excellence and innovation. In today's dynamic landscape, the role of research is more critical than ever. At IIT Roorkee, our faculty and scholars continue to address real-world challenges—ranging from sustainability and healthcare to critical digital technologies—through cutting-edge, interdisciplinary work. The diverse research projects highlighted in this edition underscore the depth, relevance, and impact of our ongoing efforts.

We are proud of the strides made in forging industry and global collaborations, securing competitive funding, and translating ideas into societal value. I extend my appreciation to all contributors and encourage the community to keep pushing boundaries.

Together, let us continue to strengthen IIT Roorkee's legacy as a hub of transformative research.

Prof. K.K. Pant
Director, IIT Roorkee

## From the Desk of the Dean, SRIC

This edition of the R&D Newsletter highlights the wide spectrum of sponsored research and pioneering initiatives that are strengthening the innovation ecosystem at IIT Roorkee.

At IIT Roorkee, research is envisioned as a bridge between innovation and impact where new ideas evolve into solutions that shape society and mankind. The projects featured in this letter reflect not only depth but also a vision of societal transformation, powered by a dynamic alliance of government agencies, industry partners, and global collaborators. Together, these projects shall illuminate the path toward a resilient and innovative future.

The Sponsored Research & Industrial Consultancy (SRIC) Office remains committed to fostering an environment that ensures the best possible administrative support for all stakeholders. By continuously streamlining procedures and processes, we continue to build a research ecosystem that empowers innovation and accelerates impact.

On behalf of IIT Roorkee, I offer my sincere gratitude to our funding agencies for their trust and sustained support. Equally, I commend our faculty members, researchers, and staff whose unwavering dedication and intellectual rigor keep IIT Roorkee at the forefront of transformative discovery.

Together, we can propel research that widens the horizons of science, delivers measurable benefits to society, and ignites the curiosity of the next generation.

Prof. Vivek Kumar Malik
Dean, Sponsored Research & Industrial Consultancy
IIT Roorkee

## ASSESSMENT OF ENVIRONMENTAL FLOWS IN THE GHAGHRA AND GOMTI RIVER BASINS

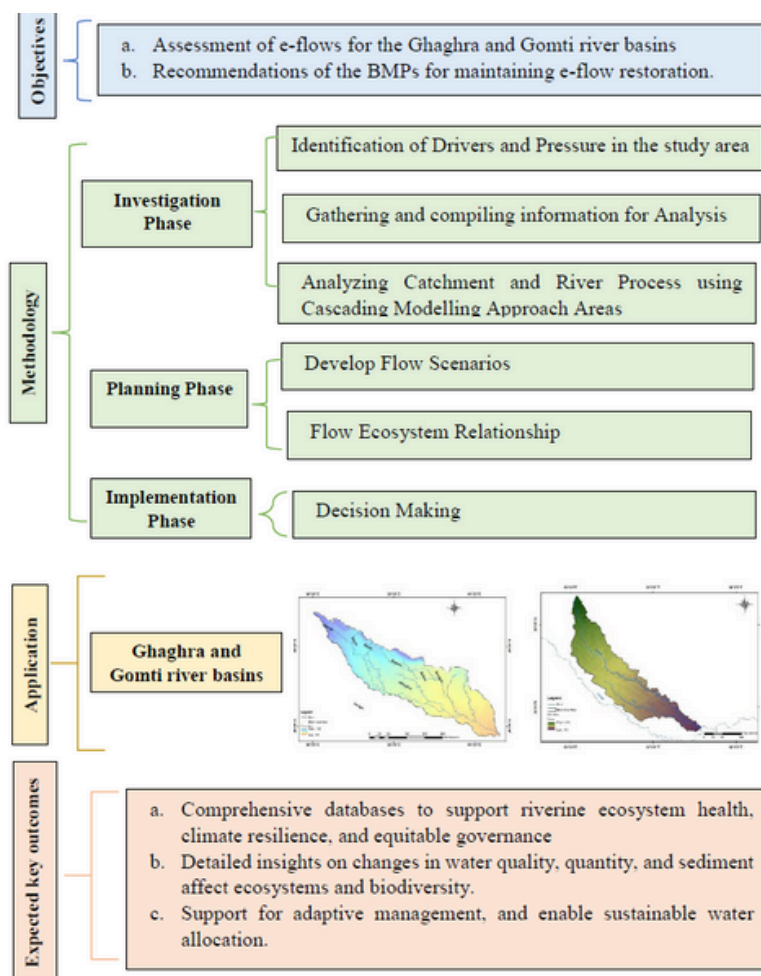**PI-Prof. Ashish Pandey**
**Water Resources Development and Management**

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**Co PI-**
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**Prof. Basant Yadav**
**Prof. Mohit P. Mohanty**
**Prof. Kritika Kothari**
**Prof. Anshul Yadav**
**Prof. Ellora Padhy**

**Water Resources Development and Management**

The project aims to assess environmental flows in the Ghaghra and Gomti river basins. To achieve the objectives of the project, key activities include identifying environmental drivers and pressures, compiling and analyzing data through a cascading modelling approach to understand catchment and river processes, and developing flow-ecosystem relationships and scenarios to inform decision-making. The expected outcomes of the project include comprehensive databases to support riverine ecosystem health, climate resilience, and equitable governance. It will also provide detailed insights on how changes in water quality, quantity, and sediment affect ecosystems and biodiversity, support adaptive management, and enable sustainable water allocation. The methodology is scalable and offers climate-adaptive strategies for flow regulation and stakeholder decision-making.



**Objectives**
a. Assessment of e-flows for the Ghaghra and Gomti river basins
b. Recommendations of the BMPs for maintaining e-flow restoration.

**Methodology**
- **Investigation Phase**
  - Identification of Drivers and Pressure in the study area
  - Gathering and compiling information for Analysis
  - Analyzing Catchment and River Process using Cascading Modelling Approach Areas
- **Planning Phase**
  - Develop Flow Scenarios
  - Flow Ecosystem Relationship
- **Implementation Phase**
  - Decision Making

**Application**
- Ghaghra and Gomti river basins

**Expected key outcomes**
a. Comprehensive databases to support riverine ecosystem health, climate resilience, and equitable governance
b. Detailed insights on changes in water quality, quantity, and sediment affect ecosystems and biodiversity.
c. Support for adaptive management, and enable sustainable water allocation.

# GAN POWER AMPLIFIER TO DELIVER ONE WATT PER MM AT F BAND

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**SPONSOR: TELECOMM CENTRES OF EXCELLENCE, INDIA**

The next-generation of communication systems such as 6G networks will require solid state power amplifiers (SSPA's) operating at higher RF bands such as F-band (90-140 GHz). These SSPA's will be necessary at the transmitter side of the network; they will amplify the signals to be transmitted to ensure the signal reach a reasonable distance. Now, the Atmanirbhar Bharat initiative promises to develop these technologies indigenously to minimize the import cost and dependency on global traders. So far, there is no report of power amplifier delivering an output power in Watts/mm (W/m) range for the 6G frequency bands. Among several competitive candidates, GaN high electron mobility transistor (or GaN HEMT) is a promising device to implement SSPA's. GaN HEMTs offer a larger breakdown voltage, higher output impedance thereby minimizing the matching network losses. Most importantly, high sheet charge (commonly referred to as 2DEG) leads to high output current densities thereby producing higher output power (in W/mm) in 5G bands (up to mm-wave). Therefore, GaN is likely to be a highly competitive player even at D/F-bands; the power gain of GaN SSPA's are likely to be higher than other candidates such as InP HBTs or SiGe BiCMOS. This project is aimed to demonstrate one of the first F-band SSPA using GaN HEMTs. For this, we will use the commercially available GaN HEMT tape-outs.

# GRID READINESS FOR EV: ENABLERS AND TECHNOLOGICAL DEVELOPMENTS (GREET)

**PI-Prof. Ramanuja Panigrahi**
**Co-PI Prof. N P Padhy**
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This proposal aims to develop a comprehensive and future-ready EV ecosystem, addressing technological, societal, and policy challenges. A critical component of the project is the integration of EV infrastructure with the power grid. This involves assessing the impact of large-scale EV adoption on grid stability, power quality, and protection. The project emphasizes using EVs as storage systems capable of offering ancillary grid services such as frequency regulation and load balancing through Vehicle-to-Grid (V2G) and Grid-to-Vehicle (G2V) operations. Additionally, a robust cybersecurity framework will be developed to protect against vulnerabilities in the interconnected EV charging networks. The project includes a field-validation phase to ensure the practical applicability of its solutions.

**SPONSOR: ANUSANDHAN NATIONAL RESEARCH FOUNDATION (ANRF)**

## RIS-ENABLED HYBRID RF/VLC SYSTEM FOR IMPROVING QOE

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To address the limitations of overcrowded radio frequency (RF) bands and enhance indoor connectivity, hybrid RF/Visible Light Communication (VLC) systems have emerged as promising solutions. These systems combine the high capacity of VLC with the reliability of RF links. In this work, we aim to develop and prototype efficient switching techniques to reduce delay and ensure seamless connectivity in hybrid RF/VLC systems. Additionally, we explore the use of reconfigurable intelligent surfaces (RIS), including mirror- and metasurface-based panels, to improve signal reflection and link reliability, thereby enhancing users' Quality of Experience (QoE) in dynamic indoor environments like shopping malls, hospitals, airports, corporate offices, etc.

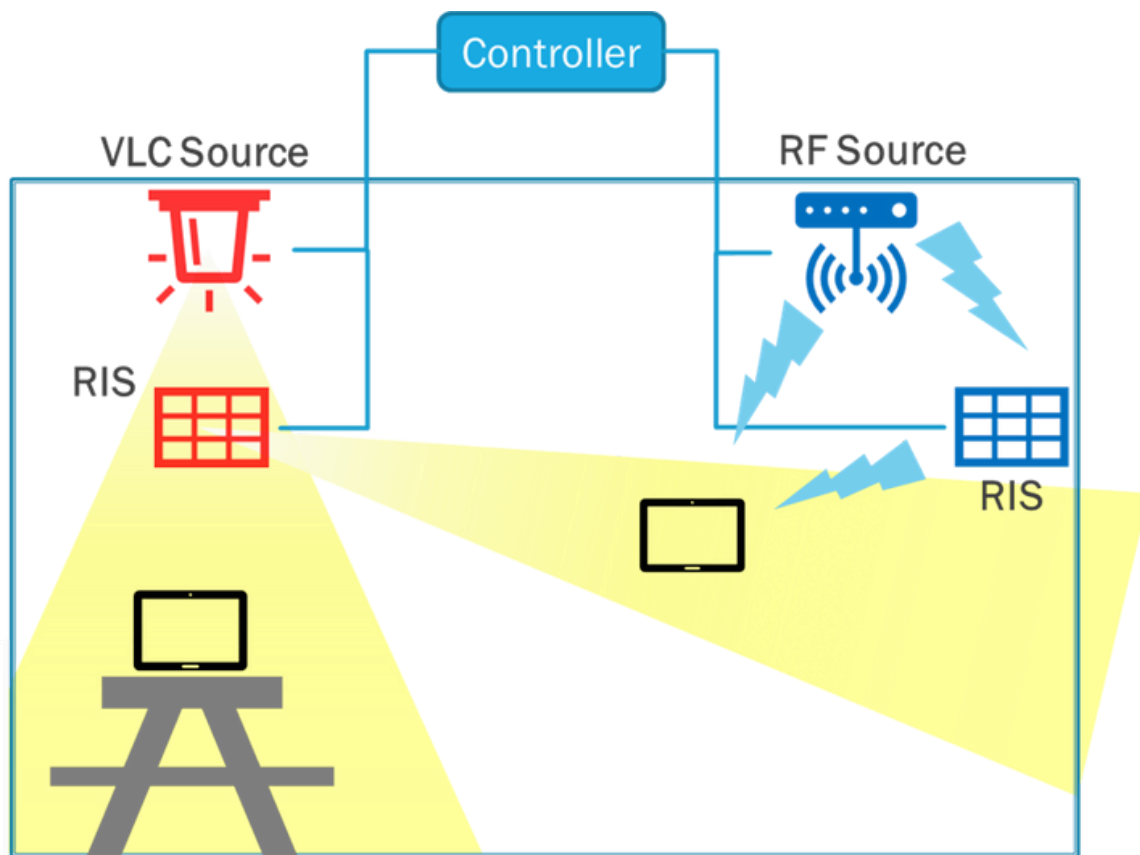**SPONSOR: DEPARTMENT OF TELECOMMUNICATION (DOT)**



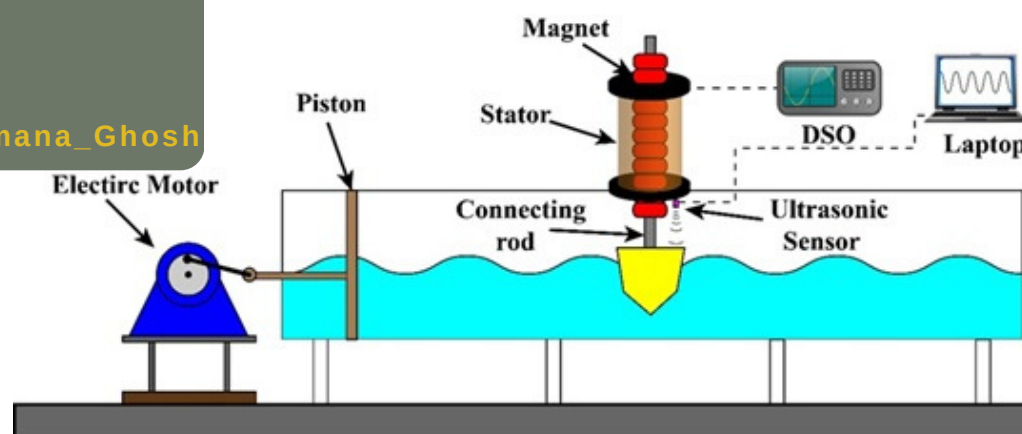Fig: A Schematic of the Proposed RIS-Enabled Hybrid RF/VLC System.

## PROTOTYPE DEVELOPMENT OF A POINT ABSORBER WAVE ENERGY CONVERTER FOR FIELD TESTING

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In recent decades, there has been intensifying interest in harnessing power from the sea waves using wave energy converters. One of the wave energy converter is point absorber. It consists of a float and a power take-off mechanism. Float interacted with sea waves, and its movement is further converted to electricity using a collection of different devices known as power take off system. Present project involves making of prototype for Indian conditions and to test it under control environment. Simultaneous survey of locations, understanding of cost involvement in deployment, techno economic feasibility etc are also to be addressed in this project.



## DOUBLE LAYERED SPIKE STEM NUCLEOCAPSID PROTEIN NANOPARTICLES GUIDED DEVELOPMENT OF PAN-BETA CORONAVIRUS VACCINE

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Despite the implementation of massive vaccination campaigns using a plethora of diversified vaccines worldwide against SARS-CoV-2, multiple new SARS-CoV-2 variants are constantly emerging, which jeopardize the vaccinal-induced immunity and cause breakthrough infections. Although there are no confirmed reports of MERS-CoV and SARS-CoV-1 in India but the risk of transmission cannot be ruled out. Therefore, as part of pandemic preparedness, we must be prepared with a broadly-protective vaccine against these betacoronaviruses. The goal is to develop a broadly protective or pan-betacoronavirus vaccine by harnessing the combined strengths of these proteins in inducing two types of immune responses. Combining the nanoparticle fabrication of these two highly conserved proteins of betacoronaviruses would likely impart several crucial attributes essential for advancing the development of a pan-betacoronavirus vaccine. Furthermore, the abiotic characteristics of protein nanoparticles proposed in this study are likely to enable storage without dependence on a cold chain, ensuring a more flexible and cost-effective production of a potent vaccine

# CV-QKD SEEDED QUANTUM NOISE STREAM CIPHER ENCRYPTION: CODESIGN USING ADVANCED MODULATIONS

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Securing communications at the physical layer is crucial. Quantum Key Distribution (QKD) protocols can securely generate and distribute keys between remote users for their use in encryption algorithms such as AES or one-time pads. However, the classical encryption solutions are either breakable or inefficient for high-speed data encryption.

In this project, we will develop a co-packaged quantum secure communication system product that will have two specific objectives: i) generation, and distribution of Continuous Variable QKD (CV-QKD),

and ii) quantum encryption with Advanced Modulation techniques while providing highly secure data transmission at high data rates in current telecom networks.
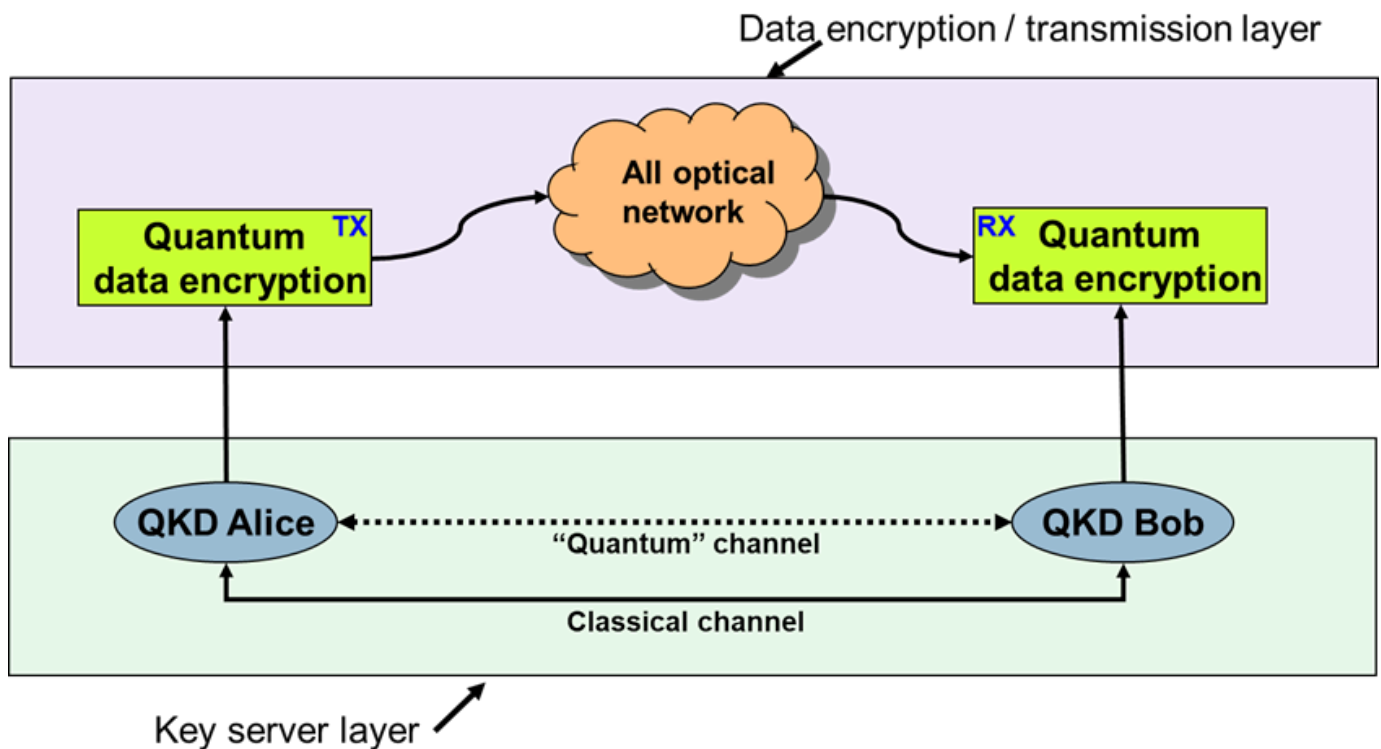
The figure shows our proposed technology, which has two components: i) generation of CV-QKD and ii) quantum-noise stream cipher. CV-QKD is a specific type of QKD protocol that relies on continuous properties of quantum systems, such as the quadrature amplitudes of light, to encode and exchange information. We propose CV-QKD-based secure communication system because it can achieve higher key generation rates using classical cheaper equipment compared to DV-QKD system. Further, we will utilize a quantum noise-based Y-00 (also known as AlphaEta) encryption protocol, wherein the communicated data stream is hidden under the quantum noise, which could be phase or amplitude noise.

## DEVELOPMENT OF DEEP LEARNING BASED LONG RANGE INFRARED TARGET DETECTION TRACKING TARGET DETERMINATION ALGORITHMS AND THEIR HARDWARE IMPLEMENTATION

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The combination of an autocratic military establishment equipped with nuclear-capable ballistic missile technology poses a significant threat to India's defense infrastructure and critical national assets. While active sensors, such as radar-based detection and tracking systems, are currently available, they are likely to be compromised in combat situations. In contrast, infrared sensor technology, which operates passively, offers a distinct advantage. Consequently, there is an urgent need to develop algorithms for the proactive detection of ballistic missile launches, including trajectory analysis, impact prediction, launch point estimation, target determination, and classification. The primary focus of this project will be on ballistic missiles, with the algorithms designed to detect and track the infrared signature of missile plumes. The system would be capable of tracking multiple targets simultaneously, utilizing advanced algorithms and real-time video processing techniques. To achieve this, deep learning-based artificial intelligence, with its self-learning capabilities, will be employed in the development of these algorithms

**SPONSOR: INSTRUMENTS RESEARCH & DEVELOPMENT ESTABLISHMENT, DRDO, DEHRADUN**

## DEVELOPING MAGNESIUM ALLOY BASED TEMPORARY ORTHOPEDIC IMPLANTS COATED WITH HYDROXYAPATITE BY PLASMA SPRAYING

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**Co PI- Prof. Partha Roy**

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Bone fractures are a growing concern due to aging populations and rising injuries. Traditional metal implants like titanium and stainless steel are non-degradable, requiring secondary surgeries and posing risks of corrosion and inflammation. Biodegradable implants, particularly magnesium-based ones, offer temporary support and degrade in sync with bone regeneration, eliminating the need for implant removal. However, rapid degradation in body fluids compromises Mg's structural integrity. Surface engineering, especially plasma spray coating, can control degradation and enhance performance. Yet, coating ceramics on low-melting Mg substrates is challenging due to potential distortion. This research focuses on overcoming these issues to commercialize Mg-based implants.

**SPONSOR: DEPARTMENT OF BIOTECHNOLOGY (DBT)**

## DESIGN IMPLEMENTATION OF ORBITAL ANGULAR MOMENTUM ANTENNAS WITH EXTREMELY HIGH PURITY FOR SPECTRUM EFFICIENCY ENHANCEMENT

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**SPONSOR: TELECOM CENTER OF EXCELLENCE, NEW DELHI**

Electromagnetic waves with Orbital Angular Momentum (OAM) property offer a promising solution for enhancing 6G communications by enabling high-capacity, spectrum-efficient data transmission. These beams carry data on multiple orthogonal OAM modes, allowing multiplexing of several data streams over the same frequency without overlapping. This significantly boosts spectral efficiency and overall network capacity. Additionally, OAM beams also have many other advantages due to their unique radiation properties. Their compatibility with millimeter-wave and terahertz bands aligns with 6G's goal of ultra-high-speed, low-latency communication. By exploiting the spatial domain, OAM beams can support massive device connectivity and facilitate reliable, high-throughput links in next-generation wireless networks. As antennas are a crucial part of any wireless communication systems, it is essential to design the antennas that can generate OAM beams with extremely high purity – yet is highly challenging. This project aims to design high-purity OAM antennas that can serve the demands of future 6G communication systems.
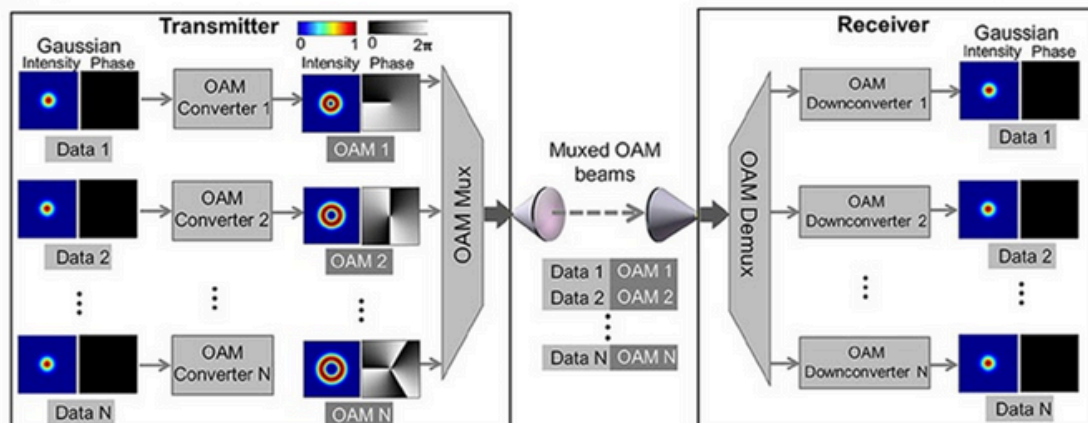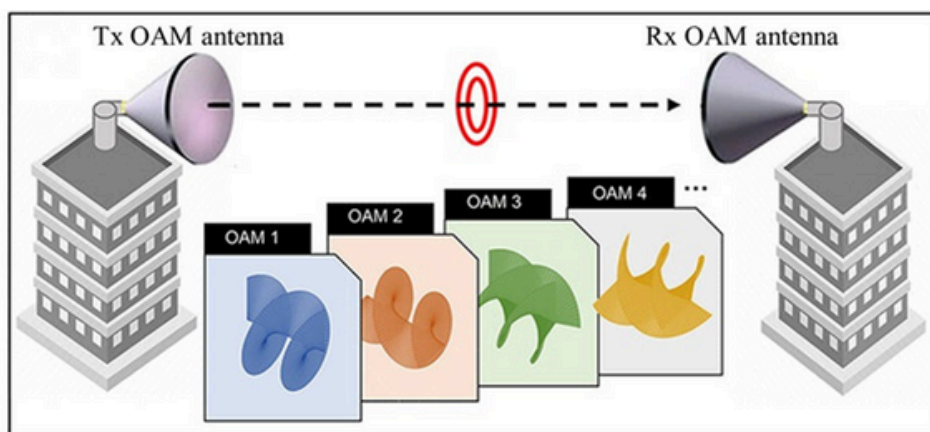




Transmission and reception of multiple OAM beams having different modes through multiplexing/demultiplexing for spectrum efficiency enhancement

## DEVELOPMENT OF AN ADAPTIVE AI MODEL FOR LANDSLIDE EARLY WARNING USING AN-IN-HOUSE DEVELOPED WSN-IOT MONITORING SYSTEM IN DARJEELING AND SIKKIM HIMALAYA

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**Co PI- Prof. R.D. Garg (Civil Engineering)**

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In the Indian scenario, various States in NW Himalaya, NE Himalaya, Western Ghats, and Eastern Ghats region are extremely prone to rainfall-induced landslides. Multiple landslide monitoring systems have been developed to mitigate risk associated with landslides in global scenarios; however, the existing technologies have several limitations. For example, they are very non-reliable, less energy efficient, and costly; therefore, they are not optimal for replicability. They are now-warning systems, not early warning systems. Therefore, developing and validating suitably appropriate AI models for landslide early warning (LEW) is pertinent by installing a ground-based WSN-IoT measurement system in these climatic regions. Such systems may provide a more reliable early warning for the benefit of society compared to a conventional system installed in every climatic zone.
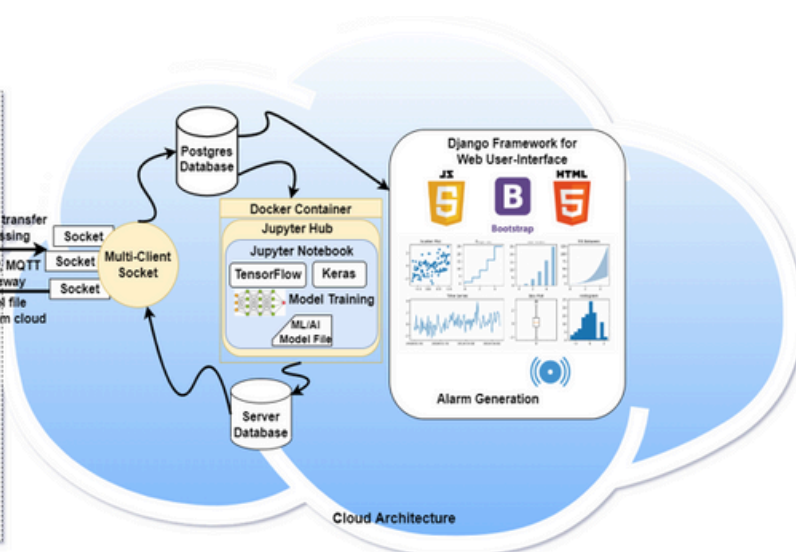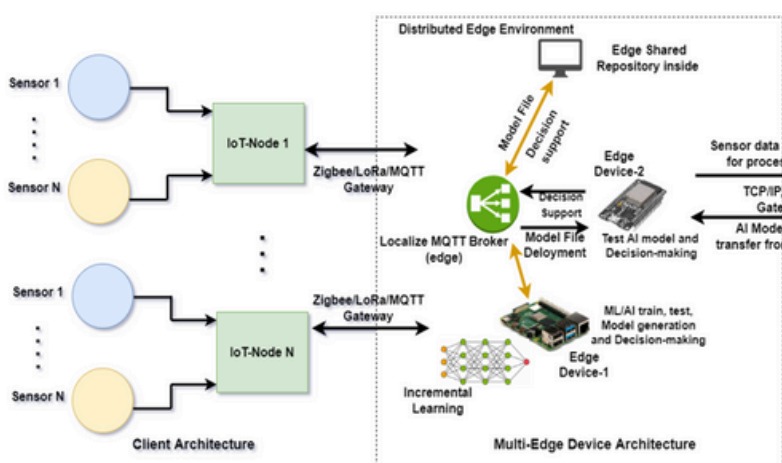
## NEXT GEN RICE : GENONE EDITED TRANSGENE FREE VALUE ADDED INDICA RICE

**PI-Prof. Harsh Chauhan**
**Co PI- Debabrata Sircar**

**Bioscience and Bioengineering**

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Carotenoids are precursors of Vitamin A. Vitamin A deficiency is prevalent in Indian sub-continent. Orange color cauliflower, different from normal white cauliflower, is observed within the natural population. On studying more about this orange cauliflower, it was found out that it contains higher amounts of carotenoids (pigments responsible for orange color), which is due to change in the OR gene (a cysteine rich DNAJ protein) of the orange cauliflower. Detailed studies revealed the insertion of nucleotide bases, which alters the protein structure resulting in carotene accumulation and leading to orange color. Subsequently, the altered OR gene is also shown to accumulate carotenoids accumulation in other crops like melon, potato, Arabidopsis, and Sorghum. In this project we will do CRISPR based genome editing to increase grain carotene contents in elite Indian varieties of rice for enhanced seed carotene content.
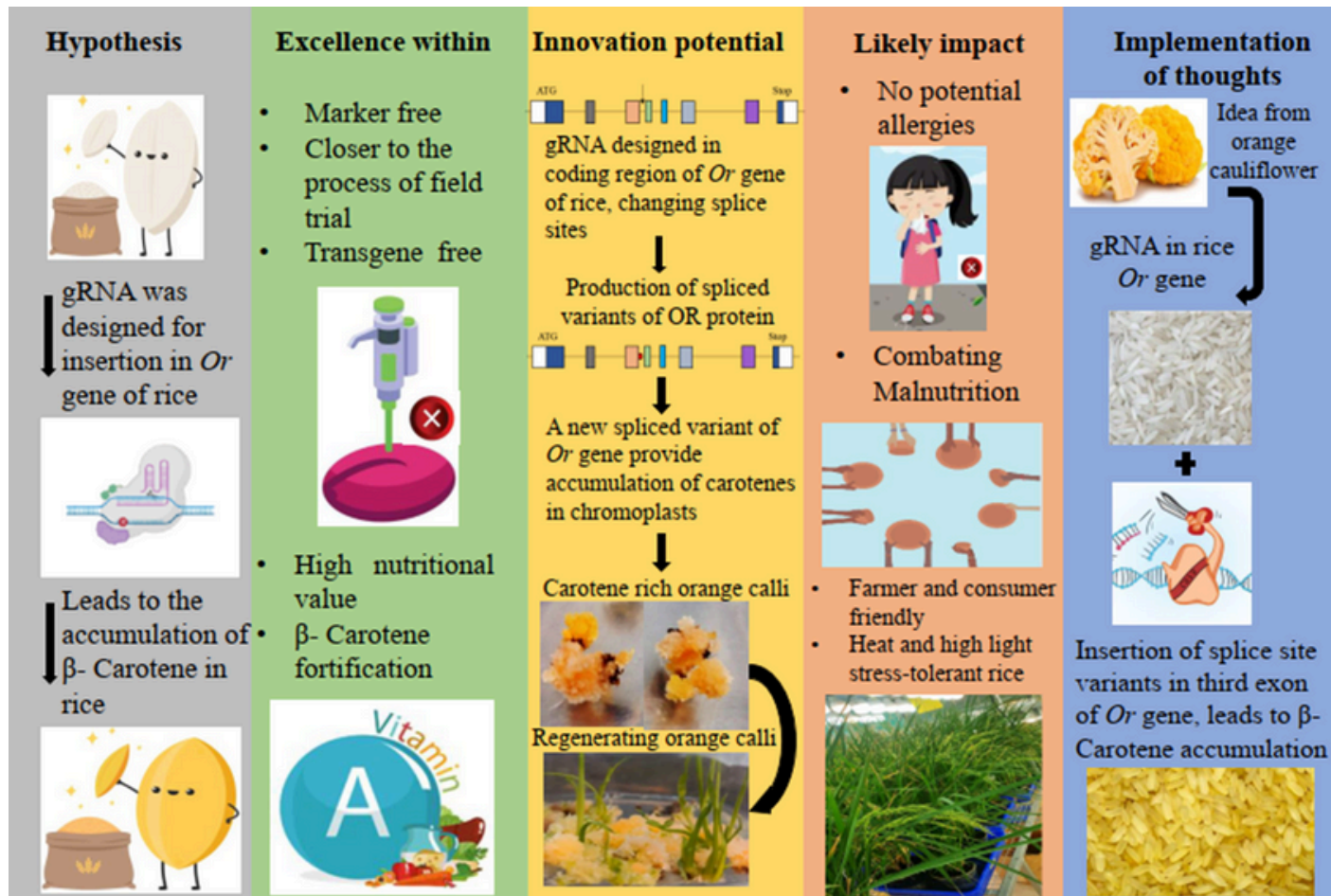
# CARBON BUDGET AND ECO-HYDROLOGICAL DYNAMICS OF SELECTED HIMALAYAN HIGH-ALTITUDE GRASSLANDS AND THEIR CARRYING CAPACITY

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Amid escalating climate change, Himalayan grasslands face threats from land degradation, overgrazing, habitat fragmentation, and invasive species. Covering over 55% of the Himalayan region, these fragile ecosystems are highly sensitive to changing rainfall and temperature patterns. A critical research gap exists in simultaneously quantifying carbon sequestration and hydrological fluxes under current and future climate scenarios. This project tracks hydrological fluxes through integrated field measurements and modelling, focusing on water movement and transformation in the landscape. The goal is to comprehensively understand rainfall-runoff relationships and water-carbon interactions with an emphasis on hydrological processes. Findings will support stakeholders in sustainable management, climate adaptation, and ecosystem resilience in the Himalayas.
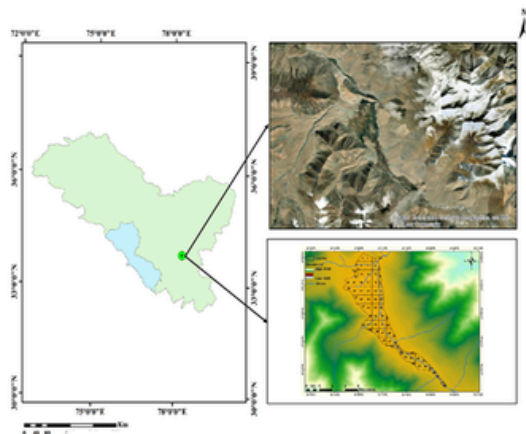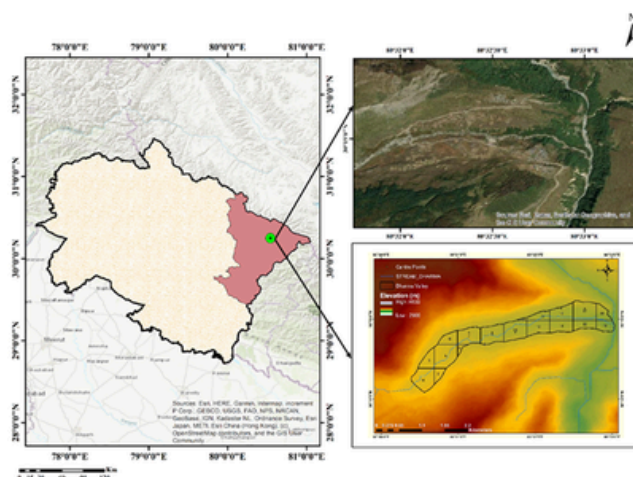
Changthang Valley, Ladakh
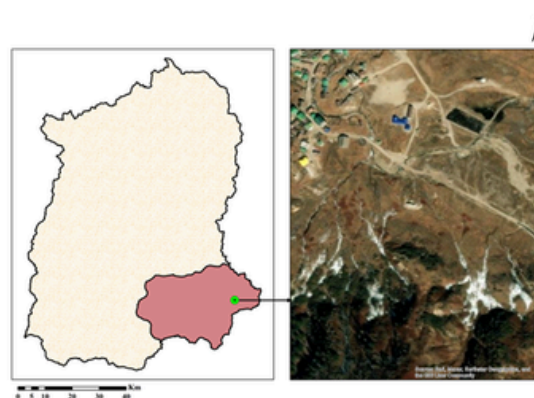


Nathang Valley, Sikkim



Darma Valley, Uttarakhand

# DESIGN AND DEVELOPMENT OF A WEARABLE DEVICE WITH A COMPUTATIONAL MODEL SYSTEM FOR REAL TIME DETECTION OF MILD HEAD AND NECK INJURIES FOR SUBSEQUENT CLINICAL INTERVENTION

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Head and neck injuries due to blunt trauma are a critical health concern. Early-time diagnostics hold the key to the management of these injuries. Currently, technology is not available to characterize the mechano-clinical cascade after blunt trauma. This leads to difficulty in establishing a relationship between mechanical insult and the resulting clinical cascade. We plan to develop a system consisting of a wearable device and a computational human head-neck model to characterize the mechano-clinical cascade after blunt trauma. A wearable device will provide data in real-time regarding mechanical insult experienced by the head and neck. The device will also provide a location where an accident has happened; this information will be used to alert emergency responders. The data obtained from a wearable device will be fed to a computational model to predict potential injury regions. The proposed technology will be a first-of-a-kind for timely primary care and early-time diagnostics of blunt trauma.
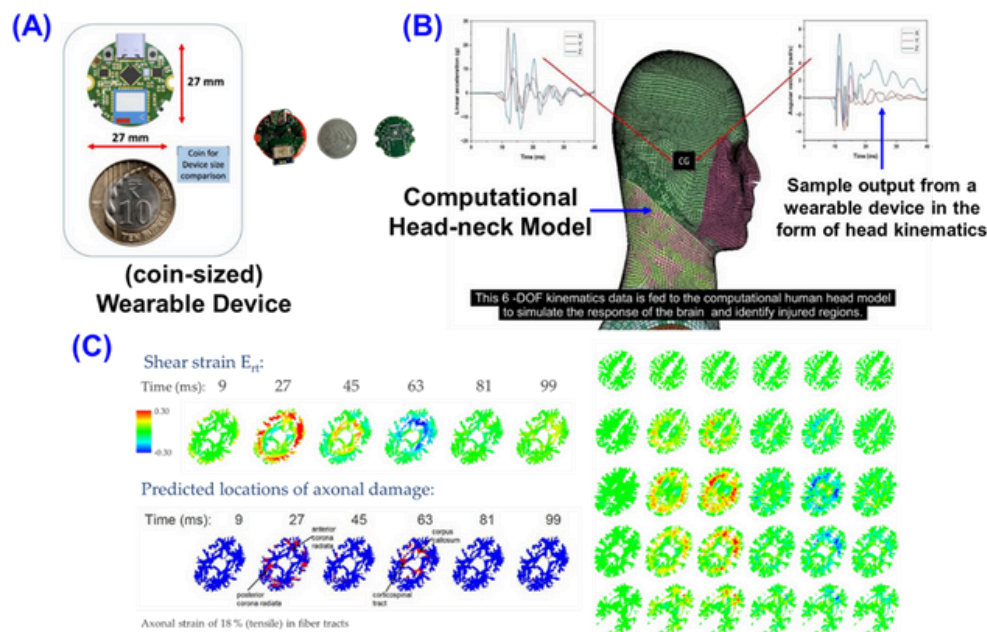
Proposed system to characterize mechano-clinical cascade after blunt trauma. (A) Picture depicting the schematic and photograph of a wearable device. A wearable device will provide data in real-time regarding mechanical insult experienced by the head and neck. The device will also provide a location where an accident (incident) has happened. The data obtained from wearable device (i.e., mechanical loads) will be fed to (B) a finite-element-based computational model of the human head-neck to predict potential injury or critical regions of the brain and spinal cord. (C) Sample output from the computer simulation depicting locations and extent of injury to the brain tissue for the reconstructed blunt-trauma case.

# DEVELOPMENT OF WIDE BANDGAP SEMICONDUCTORS BASED HIGHLY EFFICIENT POWER ELECTRONICS SYSTEMS FOR ELECTRIC VEHICLE

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**Prof. Siba Patro**

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**Electrical Engineering**

This mission mode project sponsored by 'ANRF's MAHA EV Program' aims to design and develop a 120kW, bi-directional electric vehicle (EV) dc fast charger. The envisioned system enables advanced Vehicle-to-Grid (V2G), and Grid-to-Vehicle (G2V) applications. The system is planned to be designed in collaboration with an industry partner to ensure commercial viability, high efficiency, and optimal cost. This project will produce an indigenously developed bi-directional EV charger to support India's G2V infrastructure and expand V2G capabilities. Further, a part of this project is also aimed at designing and development of SynRM-drive for the self-reliant EV powertrain.
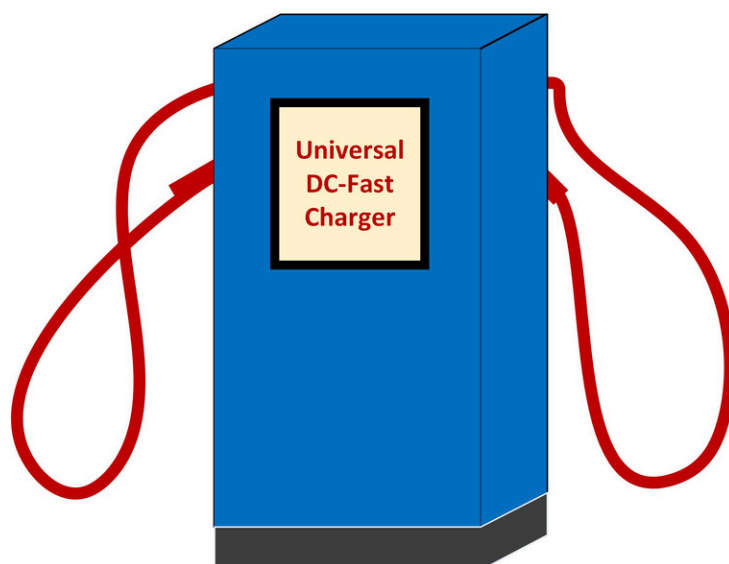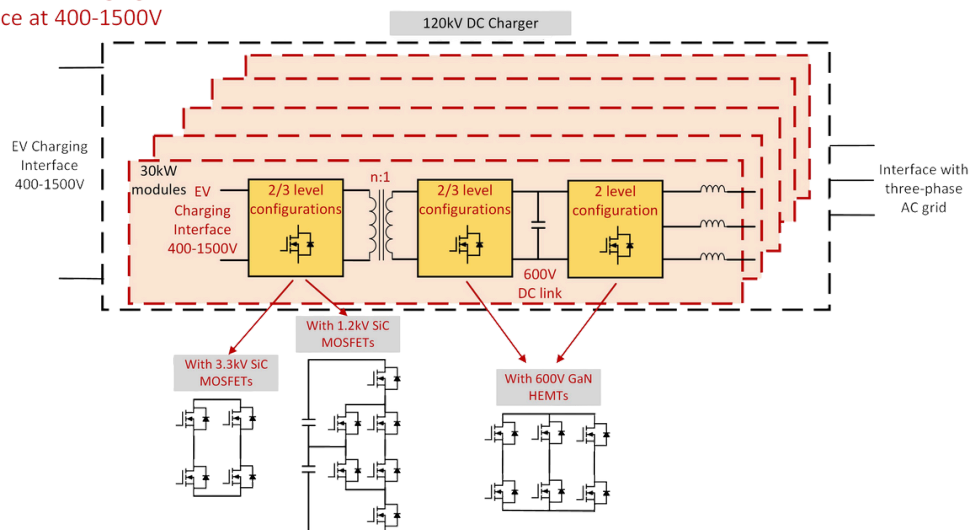
Fig. Architecture of the proposed 120kW DC fast charging system.

# SOME OF MAJOR COLLABORATIONS

- International Water Management Institute
- Papswap Centre For Public Policy
- Incheon Free Economic Zone Authority, Republic of Korea AND World Smart Cities Forum, United Kingdom
- Dedicated Freight Corridor Corporation of India Limited
- Queen's University, Canada
- Banas Dairy
- NTPC
- AHODS Technologies Private Limited
- Shri Govindram Seksaria Institute of Technology & Science, Indore
- Swadshi Shodh Sansthan
- University of Adger
- Indira Gandhi National Tribal University
- IIT (ISM) Dhanbad
- Engineering Staff College of India (Institute of Engineers India)
- Sardar Vallabh Bhai National Institute of Technology, Surat
- Indian Institute of Technology, Ropar
- Uttar Pradesh Skill Development Mission, Lucknow
- Gujarat Power Corporation Limited
- Interviewbit Software Services Private Limited, Scaler
- Indep Field Coy -Officer Commanding Indian Army
- ICIMOD, Nepal
- Himalayan Environmental Studies and Conservation
- Yali Mobility Private Limited
- Haridwar Natural Gas Pvt. Ltd.
- GRID-INDIA
- Hello PM LLP
- G B Pant University of Agriculture & Technology, Pant Nagar
- Forum of Regulators
- AARTI Foundation
- Uttarakhand Metro Rail and Urban Infrastructure Corporation Limited
- Global Foundries

# SOME OF MAJOR COLLABORATIONS

- THDC India Limited, Rishikesh
- Centre for Materials & Electronics Technology
- Karo Sambhav Private Limited
- Bharat Petroleum Corporation Limited
- Kerala Rural Water Supply & Sanitation Agency
- Geovale Services, Kolkata
- Airport Authority of India
- Kerala Forest Research Institute, Peechi
- Gramin Krishi Mausam Sewa, IMD
- Attero Recycling Private Limited
- Central Electricity Authority
- Atotech Development Center Pvt. Ltd.
- F3 Biotechnology Private Limited
- Shiv Nadar Institution of Eminence
- Maa Shakumbhari University, Saharanpur
- National Institute of Technology- Hamirpur
- IISS, Bhopal
- Command Area Development & Water Management Wing, Ministry of Jal Shakti

## OTHER RECENTLY REGISTERED PROJECTS OUTLAY OF 50 LAKHS AND ABOVE

| Principal & Co-Principal Investigator(s) | Title of Project | Sponsor Agency |
|---|---|---|
| Prof. Debabrata Sircar (BSBE)<br>Prof. Shriram Yadav (BSBE)<br>Prof. Nagendra Pathak (ECE) | Development of an AI-Control electronic nose sensor for monitoring apple aroma profiles during norvest and storgage: an easy to use non-destructive technology for assessing apple freshness and quality | DBT, New Delhi |
| Prof. Satyanarayan Rao (BSBE) | Discovering disease biomarkers using high resolution chromation dynamics | ANRF, New Delhi |
| Prof. Ranjana Pathania (BSBE) | Exploring niche-specific marine actinobacteria: uncovering novel antibiotics from rare actinobacteria | Ministry of Earth Sciences, New Delhi |
| Prof. Ketan Arora (CED) | Assessing the sustainable tunnel construction in the Indian Himalayas using tunnel boring machines (TBM) : Comprehensive experimental and machine learning (ML) approach towards resilient underground infrastructure | ANRF, New Delhi |
| Prof. Hemant Kumar (CED) | Characterizing the role of ground water in buffering the food energy water nexus against interannual climatic shocks through hydroeconomic modelling | ANRF, New Delhi |
| Prof. Mohd. Ashraf Iqbal (CED) | Development of Seismic protection systems based on composite seismic barriers against the impact of surfaces waves | DST, New Delhi |
| Prof. Komal Tripathi (ChED) | From catalyst Discovery to Process Intensification for sustainable aviation fuel from Biomass derived Bio-Oil and CO2 : A synergistic Experimental and data driven innovations | ANRF, New Delhi |
| Prof. Bharat Tandon (CY) | Manipulating the Degree of Freedom in multi functional deped semiconductor nanocrystals | ANRF, New Delhi |
| Prof. Ranjana Bisht (CY) | Photoredox- mediated organocatalysis for selective C-H functionalization/flourosulfonylation : unlocking SP3 and SP2 reactivity | ANRF, New Delhi |
| Prof. Ravi Yadav (CY) | Structurally constrained group 15 Compounds for bond activation and catalysis | ANRF, New Delhi |

## OTHER RECENTLY REGISTERED PROJECTS
## OUTLAY OF 50 LAKHS AND ABOVE

| Principal & Co-Principal Investigator(s) | Title of Project | Sponsor Agency |
|---|---|---|
| Prof. Rajat Sadhukhan (CSE) | Designing side channel attack resilient performance optimized quantum safe algorithms on FPGA and ASIC plot forms for secure and reliable end-to-end post-quantum communication (SPARQ) | ANRF, New Delhi |
| Prof. Chetan Gupta (CSE) | Massively parallel and Distributed algorithms for matrix multiplication | ANRF, New Delhi |
| Prof. Neetesh Kumar (CSE) | SAFECAV : Anti -Remote Hijacking and safety driven ADAS for connected Autonomous Vehicles through Zero trust container orchestration | ANRF, New Delhi |
| Prof. Awanish Pandey (CSE) | System and End-to-End tool for finoling and bridging performance gap of software using formal methods | ANRF, New Delhi |
| Prof. Amita Giri (ECE) | An EEG study on Brain Dynamics of Mind wandering based on personality differences for the mental well-being | ANRF, New Delhi |
| Prof. Ashish Kumar Chowdhary (ECE) | Engineering thermal emiters for next generation all day radiative cooling | ANRF, New Delhi |
| Prof. Ashish Kumar Chowdhary (ECE) | Tailoring Broad band Meta material Absorbers for ultra high resolution imaging at terahertz frequencies | ANRF, New Delhi |
| Prof. Parikshit Pareek (EED) | Secure EV-Rich Distribution Grid Operation Via Prior Data Fitep Networks | ANRF, New Delhi |
| Prof. Satish Bhelkhode (EED) | Universal Power Electronic Building Block (u-PEBB)-Assisted V2x-System with Enhanced Efficiency and power Density | ANRF, New Delhi |
| Prof. Ramanuja Panigrahi (EED) | Wide Bandgap Device based programmable pulse generator for clinical electroporation | ANRF, New Delhi |
| Prof. Sunil Bajpai (EQD) | Biomarker Constraints on major global extinction/evolutionary events preserved in terrestrial land marine sedimentary sequences of india | Ministry of Earth Sciences, New Delhi |
| Prof. Pradeep Srivastava(EQD) | Holobiome response and to past climate variability: clues from lakes of himalaya and its foreland | Ministry of Earth Sciences, New Delhi |

## OTHER RECENTLY REGISTERED PROJECTS
## OUTLAY OF 50 LAKHS AND ABOVE

| Principal Investigator & Co-Principal Investigator(s) | Title of Project | Sponsor Agency |
|---|---|---|
| Prof. C.S. Pant (HRED) | Harnessing hydrokinetic energy : enhancing darrieus turbine performance with advanced techniques (artificial neural network, numerical and experimental) | ANRF, New Delhi |
| Prof. Hemant J. Sagar(HRED) | Strategic evaluation & enhancement of supercavitation in SUV (Supercavitating underwater vehicles) | ANRF, New Delhi |
| Prof. Himanshu Jain(HRED) | Towards automatic blackstart of smart distribution systems using inverter based resources | CPRI, BANGALORE |
| Prof. Sonal Keshawrao Thengane Prof. Sanjeev Kumar Prajapati (HRED) | Trash is cash turning unmerch on table crop and forest residues into high value carbon negative fertilizers for regenerative farming in rural communities | DBT, New Delhi |
| Prof. Ashutosh Sharma (HYD) | Leveraging NCMRWF weather forecasts for enhanced stream flow fore casting with deep learning | IITM, Pune |
| Prof. Nitin Khandelwal (HYD) | Targeting antibiotics in the ganga river basin : monitoring geochemical fate, and nano enabled degradation using eco friendly redox active composites | ANRF, New Delhi |
| Prof. Anuj Bisht (HYD) | Sustainable processing of HCP alloy employing electric current assisted (ECA) phenomena | ANRF, New Delhi |
| Prof. Rajesh kumar Ulagamathan (CON) | Cost-effective scalable and reproducible 2D Hybrid Perovskites for high efficient Transistor and photodetector technologies | ANRF, New Delhi |
| Prof. Abhishek Nag (PHY) | Detection and synmetry study of chiral magnesium altermagnets | ANRF, New Delhi |
| Prof. Ashish Pandey Prof. Basant Yadav, Prof. Mohit P. Mohanty, Prof. Kritika Kothari (WRDM) | Resilient food and water systems under global change : An SDG driven approach for traditional/small rural communities | German Academic Exchange Services (DAAD) |

# IPR Statistics

| Number of Patents Filed | Number of Patents Published | Number of Patents Granted |
|:---:|:---:|:---:|
| 36 | 40 | 23 |

# R&D NEWSLETTER
## VOLUME 21

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