

Volume 6, Issue 1

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# R&D Newsletter

## Indian Institute of Technology Kanpur



IIT Kanpur to lead projects on Air Quality and Water Quality Monitoring under Research Initiative for Real Time River Water and Air Quality Monitoring (WAQM) by IUSSTF

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### Highlight of the Issue

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Display of Vibhram

Indian Control Conference 2018

Institute Lecture - December & January

Major Flagship Programs at BiIncubator

Recent Major Projects

A success of FlexE Center

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## Display of Vibhram at the Army day

The High Efficiency Dissimilar Coaxial Helicopter design called "Vibhram", a novel helicopter design by a team of post graduate students Karthik S. (Team leader, Mtech), Rahul Ramanujam (Team technical leader, PhD), Ramdas (PhD), Diksha Aggarwal (MTech), Sakshi Gupta (MTech), Avinash Shet (MTech), Vishesh Kumar Singh (MTech), and Naba Kishore Routray (MTech) from Aerospace Engineering Department, IIT Kanpur, was showcased at Army Technology 2018 to Chief of Army Staff on January 8<sup>th</sup> in New Delhi. It was then shortlisted and displayed on Jan 15<sup>th</sup> on Army day for Honorable Prime Minister of India in New Delhi.



This work was carried out under the guidance of Prof. Abhishek and Prof. Venkatesan. This innovative new design had earlier won third prize in the graduate category of 34<sup>th</sup> Annual Student Design Competition organized by the American Helicopter Society (AHS) in August 2017. The design was appreciated by Army top brass include Chief and Vice-Chief of Army Staff. This design has resulted in a new configuration for helicopters which is predicted to consume 5% to 20% less power than any existing helicopter concept in the world.

## A Design Concept Paper cleared the first stage of the 'Unmanned Aerial System Flight and Payload Challenge'

A design concept paper submitted by a team of students of Aerospace Engineering department and guided by Professor Abhishek recently won the first stage of "the Unmanned Aerial Systems Flight and Payload Challenge" organized by National Institute of Standards and Technology (US Department of Commerce) and Public Safety Communications Innovation Accelerator (USA). The team comprised of Mr Ankur Duhoon (Research Engineer), Mr Sagar Setu (PhD ), Mr Nidhish Raj (PhD ) and Mr Karthik. S. (M.Tech). Approximately 50 teams across the globe participated in this challenge, of which ten teams have been selected to go to next stage.

The challenge was inspired by the shortcoming of current Unmanned Aerial Systems (UAS) used in the public safety realm, which is payload versus flight time. Vertical takeoff and landing (VTOL) UAS provide many different mission capabilities, but their flight time is limited. The payload capacity, energy source and flight time are linked through design trade-offs that can be optimized for efficiency and flexibility. This challenge requires to keep the UAS and its payload airborne for the longest time possible to support first responders' communication technology on the ground while they conduct their search. The advancement of UAS research will help search and rescue operations support payloads for

wireless communications or other life-saving goods to save lives.

The award money of US \$20,000/- for the first round will be used to design, fabricate and demonstrate the proposed design from the concept paper which consists of a tandem rotor helicopter design with approximate all up weight of 25 kg with ability to lift 10 kg payload and fly for at least 1 hour with the constraint of the entire vehicle fitting in a box of 6ft. x 4ft. x3 ft. dimension. The final leg of the competition involving flight test demonstration would happen in May 2018 in USA.



## Indian Control Conference 2018, ICC 2018

The fourth Indian Control Conference held at IIT Kanpur during January 4<sup>th</sup> to 6<sup>th</sup>, 2018. The first day of the conference was devoted to tutorials by academic as well as industrial speakers, A total of 64 papers both in control theory and practice were presented in the last two days. Dr Girish Deodhare, Programme Director, Aeronautical Development Agency, Prof. Ali Jadbabaie, Massachusetts Institute of Technology and Prof. Rajesh Rajamani, University of Minnesota delivered the plenary talks in the conference.



This conference had representation from ten countries including Australia, Brazil, France, Germany, India, Ireland, Japan, Switzerland, United Kingdom, and the United States of America. The conference was financially supported by BRNS, CSIR, IITK, ISRO, SERB, and TEQIP, as well as three industries, namely Honeywell, Mathworks, and Quanser.

## Institute lecture (December 2017 - January 2018)

### Prof. Arie Ben-Naim

*Hydrophobic-Hydrophilic Phenomena in protein folding*



Prof. Arie Y. Ben-Naim is currently Professor Emeritus at the Hebrew University of Jerusalem. He is well known for his major contributions to the theoretical and experimental aspects of general theory of liquids and solutions. His noted publications and books contributed to the better understanding of theory of structure of water, aqueous solutions, and hydrophobic-hydrophilic interactions.

### Prof. Paula Richman

*What happens when Ravana moves to the Center?*



Prof. Paula Richman is Emeritus William H Danforth Professor of South Asian Religions at Oberlin College, Ohio, USA. She is a well-known scholar of the Ramayana tradition which consists of the Sanskrit epic and its numerous Indian language versions. She has received a Guggenheim Fellowship and several grants from the National Endowment for the Humanities and the American Institute of India Studies.

### Prof. Parrinello Michele

*Title: Fluctuations and rare events*



Prof. Michele Parrinello is currently Professor at ETH Zurich, and the Università della Svizzera italiana Lugano, Switzerland. He is known for his many technical innovations in the field of atomistic simulations and for a wealth of interdisciplinary applications ranging from materials science to chemistry and biology. He has been awarded the 2011 Prix Benoist, the 2017 Dreyfus Prize and many others prizes.

For more Info: <http://www.iitk.ac.in/dord/institute-lecture-series>



# BioIncubator

## IIT KANPUR

LIFE TO IDEAS, IDEAS TO LIFE



## Promoting Bio-entrepreneurship at IIT Kanpur through Funding, Mentoring and Prototyping

In the Bio-Industry sector, IIT Kanpur has established its identity by formally establishing a 'BioIncubator' to nurture bio-based start-ups/ideas. The Bio-incubator at IITK, offers a whole gamut of incubation facilities and services to the prospective entrepreneurs and intrapreneurs to convert their innovative ideas into commercially viable products. This effort is supported by BIRAC (Biotechnology Industry Research Assistance Council).

BioIncubator, IIT Kanpur has three flagship programs

### **BIG (Biotechnology Ignition Grant), IIT Kanpur as partner institute**

This a flagship program offered by BIRAC for budding entrepreneurs to convert their ideas into functional prototypes. BioIncubator, SIIC, IIT Kanpur acts as a partner for disbursement of funds. Anyone, individual or start-up, with a commercial idea can apply. Proposals are called twice a year, in the month of January and July. It's a grant-in-aid upto Rs 50 Lakh and every bio-entrepreneur must avail.

### **BioNEST (Bioincubators Nurturing Entrepreneurship for Scaling Technologies)**

It's a grant-in-aid given to BioIncubator, SIIC, IIT Kanpur for facility expansion and creation of a 'In-house MedTech Centre'. Using this fund BioIncubator is also going to conduct multiple conclaves, collaborative hospital visits, competitions and training programs for Bio-entrepreneurs in MedTech domain.

### **SEED Fund (Sustainable Entrepreneur and Enterprise Development Fund)**

This is also another flagship scheme by BIRAC to financially support bio-startups. It provides capital assistance upto Rs 30 Lakh to startups against equity (depending on case-case basis). This fund can act as a bridge between company's initial investment (personal, friends and family) and angel/VC investment round. Terms for this grant are negotiable and lenient for startups.

The team at BioIncubator are happy to help and support any commercial bio-based ideas.  
for more information mail at [bioincubator@iitk.ac.in](mailto:bioincubator@iitk.ac.in)

## Recent Project

# Design, Retrofitment and Development of Methanol Fuelled Large Bore Engine for Locomotive, Marine, and Power Generation Applications



PI: Prof. Avinash K Agarwal, Dept. of Mechanical Engineering

Co-PI: Prof. Tarun Gupta, Dept. of Civil Engineering

Sponsor: Department of Science & Technology

Indian Railways consumes about 3 billion liters of diesel per year, and the annual diesel bill is more than INR 15000 Crores. Engine exhaust pollutants, efficient energy usage and stringent emissions regulations are the main driving forces for exploring the use of Methanol for locomotive/ marine/ power generation sectors in India. In this project, Engine Research Laboratory (ERL), IIT Kanpur and Research Designs and Standards Organization (RDSO) are working closely to develop world's first methanol fuelled locomotive engine. The work has been planned in several phases, and this project supports the first phase of evaluating technical feasibility of developing a methanol locomotive, including finalizing the fuel induction technology. The technology/prototype developed in this project will be applicable to the Marine and Power Generation sectors as well. Methanol is considered to be one of the most favourable new fuels for locomotive/ marine/ power generation sectors.

It can be used in a turbocharged, port-fuel-injected, large bore engine relatively easily compared to road transport vehicles/ engines. Existing locomotives produce significant particulate emissions. If these old engines are fueled with methanol, these harmful particulate emissions can be reduced significantly without using any exhaust gas after-treatment technology.

The objective of the current project is to develop kits for retrofitment on the existing engines, and also make design changes for manufacturing new efficient engines, which can comply with stringent emission norms. This research will give new directions for the future locomotive/ marine transportation in India. Finally, this project will put forward new technology and a prototype locomotive engine for the Indian Railways.



*ALCO251 locomotive engine at RDSO Lucknow for Methanol Conversion*

Collaborator: Research Designs and Standards Organisation (RDSO), Lucknow

## Center for Energy Regulation - Strengthening Regulatory Research & Network in the Power Sector

PI: Prof. Anoop Singh, Dept. of Industrial Management & Engineering

Sponsor: Department for International Development (DFID), Government of UK



The Centre for Energy Regulation (CER), to be set up under the project on "Strengthening Regulatory research and network in the power sector", is an initiative to enhance regulatory research and networking in the Indian power sector. The Centre addresses the need to supplement regulatory research and knowledge base to understand and analyze the key issues in the Indian power sector while working in close cooperation with Electricity Regulatory Commissions (ERCs), electric utilities and academia. It also aims to develop networks with institutions in India and abroad. The Centre seeks to contribute

towards policy and regulatory advocacy based on regulatory research utilising its knowledge base. The Regulatory Knowledge Base, comprising of a database and learning tools, would enable the stakeholders in understanding the regulatory process in the sector and make informed decisions. A set of structured activities under the expert guidance of national and international experts would provide a platform for exchange of ideas and produce measurable outcomes.

more @ <http://cer.iitk.ac.in>

## Recent Project on Air Quality Monitoring

# Streaming Analytics over Temporal Variable from Air Quality Monitoring (SATVAM)



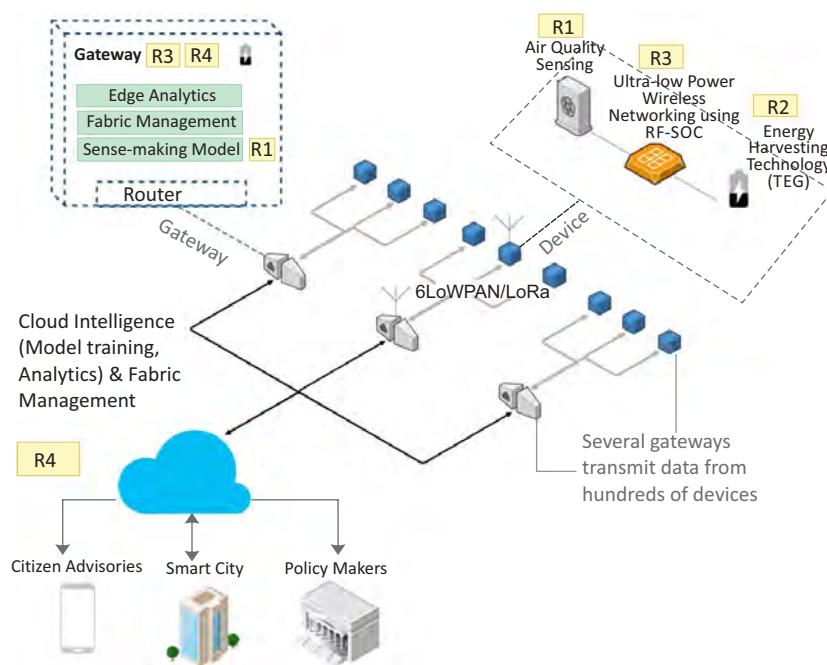
PI: Prof. SN Tripathi, Dept. of Civil Engineering/  
Centre for Environmental Sc. & Engineering

Co-PI: Prof. Jishnu Bhattacharya, Dept. of Mechanical Engineering

Sponsor: Indo-US Science & Technology Forum (IUSSTF)

**R**eal-time Low-cost Air Quality monitoring is a crucial need in India – both from environmental engineering as well as from a public health perspective. Currently, the Air Quality monitoring equipment used in India is extremely costly as well as data from those stations are not usually available in real-time. At the core of the Real-time Air Quality Monitoring is building a low-power and low-cost sensor and data transmission unit. Prof. Tripathi and Satvam team have already built a PM2.5 monitoring unit and have been field testing it for past 18 months. Further research & development is actively underway on this product to include other air pollution parameters like Ozone, Volatile Organic Carbon, NOx & SOx gases. There is also research underway to make these units power sufficient by using Photo-Voltaic / Thermo Electric Generating power source.

A big part of this project is also to do field calibration of these real-time air quality monitoring units. It is also planned to transmit the data using cloud computing in real time to enable real-time analytics on large amount data. SATVAM aims to bring a paradigm shift in real-time environmental and pollution monitoring for resource-constrained scenarios in India and can have a transformative and data-driven impact on the health and well-being of the population across the nation.



*System Architecture*

Collaborating Institution: Duke University, Durham

Academia Partner: Indian Institute of Technology, Bombay  
Indian Institute of Science, Bangalore

Industrial Partner: Respirer Living Sciences Pvt. Ltd., Mumbai

## Recent Project on Water Quality Monitoring

# Design & Development of Aquatic Autonomous Observatory (Niracara Svayamsasita VedhShala - NSVS)

PI: Prof. Bishakh Bhattacharya, Dept. of Mechanical Engineering

Co-PI: Prof. Indra Shekhar Sen, Dept. of Earth Sciences

Prof. Ketan Rajawat, Dept. of Electrical Engineering

Prof. Mangal Kothari, Dept. of Aerospace Engineering

Sponsor: Indo-US Science & Technology Forum (IUSSTF)



The impact of Environmental change on riverine ecosystem requires sustained observations of the river system. Of all ecosystem impacts, the quality of the water is a serious concern as it provides water security to billions of people. In the Indian subcontinent, cleaning and rejuvenating the health of the Ganges river ecosystem is the focal point of all river basin management plans. Currently, the scientific community faces the following challenges: (1) insufficient skilled man-power for water sample collection and analysis (2) inadequate time-series resolution (absence of real-time data) (3) absence of integrated data fusion (4) absence of on demand auto-sampling capability. The only way forward to address these challenges is to develop state-of-the-art in-situ river monitoring observatory that can provide real-time data. Such observatories produce not only high-frequency data that can be used as early warning systems in case of environmental disasters but also entrain local operators in state-of-the-art technology by making them responsible for the operation and maintenance of the sensing and sampling equipment.



The project has proposed to design and develop low-cost, multi-parameter, water quality platforms that would consist of several in-house developed sensors and auto sampling capability for durable and reliable real-time monitoring. The overall objective of this project is to deliver a low-cost, autonomous real-time water quality-monitoring platform with auto-sampling capabilities.

Some of the salient features of the platform:

- In-house developed array of water quality sensors and auto sampler
- Design and development of stable autonomous stationary platforms assisted by nos. of mobile sensing robots that can move up to 10 km from the stationary platform for data collection
- Wireless signal transmission system between the robots and the platform and the platform and the local workstation
- Versatile energy harvesting systems in modular form for extracting energy from vortex induced vibration as well as solar energy
- Real-time data transmission and
- Design, development and maintenance of a web-portal where the collected data will be available to the general public and the research community.

Collaborating Institution: Woods Hole Oceanographic Institution, USA

Industrial Partner: Kritsnam Technologies

## First batch of product manufactured in FlexE Centre shipped to a multinational company



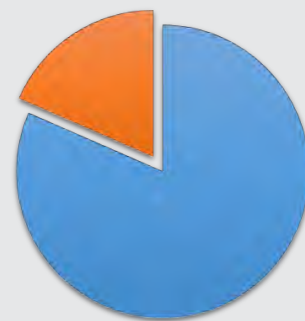
National Center for Flexible Electronics (FlexE Center) has developed one of the kind technology for detecting fake goods. One lakh labels of anti-counterfeiting tags, manufactured in the FlexE Center based on the research conducted in the Centre itself, were shipped to a multinational company on 8th January 2018.

This activity is being undertaken by Prof. Deepak Gupta, Department of Materials Sciences & Engineering under the auspices of the company "Transpacks Technologies" incubated in the Centre.

National centre for Flexible Electronics was established in 2014 with the objective of conducting research activities leading to manufacturing and an intense engagement with the industry. This achievement is a significant leap towards that direction.



**P**atent is considered to be one of the most significant criteria in the transformation of academic institute to international level. In the year 2016-17, total number of 53 patents were applied, out of which 12 patents were granted.



■ Patent Filed ■ Patent Granted

### Industry-Academia Collaboration

Online form for seeking technology/ research solutions

<http://www.iitk.ac.in/dord/query-form>

Search expertise by Technology Domain and/or by PhD/ M.Tech. Thesis Title

<http://www.iitk.ac.in/dord/search-faculty-expertise/>

Short term Industry Oriented Courses

<https://www.iitk.ac.in/dord/industry-oriented-courses>

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### Feedback/Suggestions

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