DST-INTEL-IUSSTF WAQM MISSION PROGRAM

Collaborative Research on River Water and Air Quality Monitoring (WAQM)

Recognizing the need for developing the online River Water and Air Quality Monitoring (WAQM) systems in the frontier areas of sensor technology, data communication and data analysis, the Department of Science and Technology, Govt. of India (DST) and Intel Corporation (Intel®) have collaborated to jointly initiate a research program titled "Research Initiative for Real-Time River Water and Air Quality Monitoring", soliciting research proposals from Academic/Research Institutions and providing grant-in-aid support to the selected project(s). The aim of this initiative is to develop key technologies for sensing, communication and analysis of large-scale data collected from autonomous networks of perpetual/long-lived sensor nodes, followed by integration and deployment for water and air quality monitoring in real-time. The program is being administered by the binational Indo-US Science and Technology Forum (IUSSTF). After a comprehensive review, two projects each in Air and Water Quality Monitoring have been selected for the award.

The goal of this research is to enable the development and eventual deployment of low-cost, low-power, autonomous wireless sensor networks to provide a fine-grained view of several critical water and air quality metrics over large geographic areas (cities, rivers, watersheds etc.). These online sensor networks for river water and air quality monitoring will provide the pre and post remedial interventions, real-time factual data. This real-time data will significantly further strengthen and complement the missions of national priority like Namami Gange Program and others by serving as critical data feeders for pre and post treatment analysis.

The program has offered a unique opportunity for the academia and industries across the two nations to collaborate and develop End-to-End Internet of Things IoT-based Air and Water Quality Management (WAQM) solution. It is envisaged to develop tools and constituent blocks than will enable end-to-end water and air quality monitoring systems on smart, networked, low cost, low power sensor nodes with large scale cloud-based data analysis.

Four Research Vectors (RV) identified are as below:

1. Sensing and sense making at the edge
2. Novel energy harvesting technologies
3. Ultra-low-power wireless networking
4. Distributed analytics and sense making

Such networks may also eventually replace the current paradigm of environmental quality management via localized stations. The development of such an IoT-based solution will require innovations in sensor technology for miniaturized platforms for continuous, always-connected multi-modal sensing, ultra-low power radios for efficient communication and energy harvesting technologies to enable very long or perpetual operation of sensor nodes. These key blocks will need to be woven together by a data analytics framework that spans edge devices, gateways and cloud-based analytics, to enable drawing inferences and sense-making in a low-latency manner.

The development of such an end-to-end solution composed of several individual research elements can also potentially impact environmental quality monitoring systems in diverse contexts such as urban, domestic and industrial settings.

Supported by

Department of Science & Technology
Govt. of India

In partnership with

IUSSTF
Indo-US Science and Technology Forum

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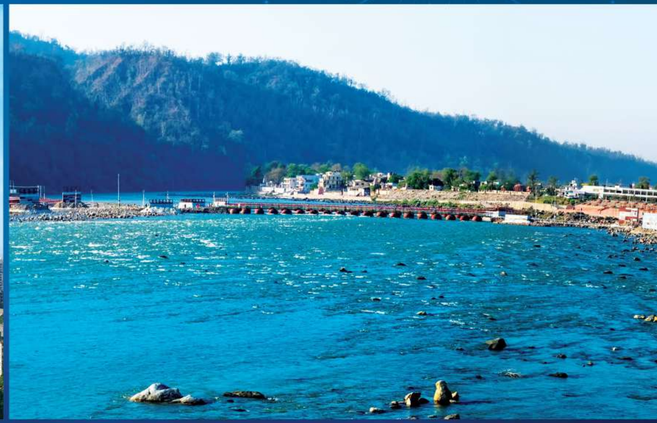
AWARD OF DST-INTEL MISSION PROJECTS

Collaborative Research on River Water and Air Quality Monitoring



HIGHLIGHTS OF AWARDED PROJECTS

A short summary of the four projects selected for the award is as below:

Air Quality Monitoring

(i) Streaming Analytics Over Temporal Variables From Air Quality Monitoring (SATVAM)

- The project aims to collect air quality information sustainably, nation-wide, and at a low cost to allow policy makers and citizens to deploy data-driven control and preventive mechanisms.
- The focus is on low-cost PM 2.5 sensors, Ozone, NO_x and SO_x sensors; concentrated photovoltaic conversion backed up by Li-ion battery based storage. Together, the idea is to integrate the entire hardware, communication and software stack, from local sensing to distributed analytics, to offer a comprehensive solution.
- The project will demonstrate an air quality monitoring test bed that has been in field-deployment for 12 months across two sites, and would be able to report and visualize scientifically validated PM 2.5 and gas measurements from 40 point-locations in real-time. After successful scaling up to 60 locations, the replication could result in monitoring 500 cities and towns across India.

Collaborating Institutions, India

BANGALORE

Industrial Partner: Respirer LivingSciences

Collaborating Institutions, USA

Duke UNIVERSITY

(ii) High Resolution Air Quality Monitoring and Air Pollutant Data Analytics

- The project aims to develop and validate a low-cost sensor system coupled with improved techniques of sampling and calibrations to develop the air quality index and identify sources of pollutants with focus on vehicular pollution.
- The project will test 15 low-cost monitoring systems coupled with IoT devices for CO_x, SO_x, NO_x, volatile organic compounds (Benzene, Toluene & Formaldehyde), PM 2.5 and PM10 etc.

Collaborating Institutions, India

BANGALORE

Collaborating Institutions, USA

Water Quality Monitoring

(i) Aquatic Autonomous Observatory (Niracara Svayamsasita VedhShala - NSVS)

- The project aims to design and develop low-cost, multi-parameter water quality platforms with auto-sampling capabilities.
- The system would measure critical parameters such as dissolved oxygen, conductivity, temperature, nutrients, carbon-di-oxide and select heavy metals.
- A novel energy harvesting system integrating solar panel, piezo electric system and micro wind turbine, is envisaged.
- The system will comprise of Controller, Energy Harvesting System and Sensor Interface.

Collaborating Institutions, India

Industrial Partner: KRITSNAM TECHNOLOGIES

Collaborating Institutions, USA

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(ii) Integrated Low-Cost Water Sensors for Real-Time River Water Monitoring and Decision-Making (SensorWarn)

- The project aims to develop sensors for Chemical Oxygen Demand (COD), microbial indicators and water flow which can be used for determining water quality parameters as well as water flow characteristics in a river; integrate commercial sensors for obtaining water quality parameters with above-developed sensors using integrated ASIC chip; and integrate real-time data for developing an early warning system.
- The project will result in deployment of prototype model devices in a test bed for large scale replication.

Collaborating Institutions, India

nist BERHAMPUR

NEERI NAGPUR

Industrial Partners: azasiczen sunmoksha

Collaborating Institutions, USA

UC RIVERSIDE

MICHIGAN STATE UNIVERSITY

NJIT New Jersey Institute of Technology