



Project Proposal for Ph.D.

Project Details

Project Title	Calibration of low-cost particulate matter sensors for air pollution monitoring
Project Summary (Minimum 500 and maximum 2000 characters)	It is a fundamental right of all living beings to breathe uncontaminated air. Air pollution makes it unavailable to a large section of the population. Monitoring air quality in real time is the first step to mitigate the effects of air pollution. The current monitoring strategy is based on the use of expensive federal reference method (FRM) based monitoring stations which are not viable to be scaled to have a high spatio-temporal resolution of the pollution spread to identify hotspots and help with timely interventions for the affected regions. Low-cost air pollution sensors have the potential to fill in this gap if they can be calibrated to reduce the error in their measurements. Low cost sensors need to undergo field and lab testing for different climates in the Indian context to improve their accuracy. They need to be calibrated for higher humidity conditions. Different particle size distributions and understanding of the chemical composition in case of particulate matter (PM) may be of interest from their health effects point of view. There is also a need to find methods to estimate the PM density accurately. There is an urgent need to build such devices to be able to estimate the air pollution in real time. These sensor monitors can also be used as wearables for personal exposure modelling. These sensors can also help in understanding the effectiveness of air purification in indoor environments. These sensors can also be deployed as a sensor network to identify the best times and places for outdoor activity. The research would focus on one or more of these aspects in low cost PM sensor monitoring.

Ph.D. Supervisors

Role	Faculty	Academic Unit in IITD/Institute/University	Email ID (Official)
Supervisor 1	Prof. Jay Dhariwal	Department of Design	jay@design.iitd.ac.in
Supervisor 2	Prof. Seshan Srirangarajan	Department of Electrical Engineering	seshan@ee.iitd.ac.in

Project requirements (Student qualifications, experience required, etc.)

- Masters or Bachelors in Electronics, Optoelectronics, Design, Mechanical Engg., Physics or related discipline.
- Applicant with significant hands-on experience will be preferred. Knowledge of embedded systems, sensors, and optoelectronics will be desirable. Strong experimental and hands-on experience in embedded systems and capability of developing sensing systems at a hardware level, from components selection to PCB design, hardware debugging, integrating and field testing of the systems will be an added advantage.
- Understanding of aerosol science, air quality modeling and fluid flows would also help.

Source of fellowship/funding

(CSIR/UGC/DBT/ICMR/ICAR/NEET-PG/DST-INSPIRE/IRD/FITT Project details, if any)

FIRP Project/JRF/etc.,

Role of Faculty Members involved:

Dr. Jay Dhariwal has expertise in mechatronics-based prototyping, CFD based modeling, indoor air quality modeling, mathematical modeling, big data analytics, and geographic information systems (GIS).

Dr. Seshan Srirangarajan has worked extensively in wireless sensor networks with specific focus on localization, tracking, and event detection. He has also worked on sensor fusion techniques, optimization, and machine learning for various applications.

Both faculty members will jointly supervise the PhD student. The interdisciplinary nature of the project and the complimentary skills of the PIs are crucial to meet the desired outcomes in the project.