Indo/US Collaborative Research Grants

National Science Foundation of US and Technology Innovation Hubs of India

Title: Modeling Energy Behavior in Educational Buildings using IOT and Sensing Technology
Indian PI: Prof. Chirag Deb, Prof. Arnab Jana, Indian Institute of Technology Bombay, India
US PIs: Prof. Rishee K Jain, Stanford University, US.

Low-energy buildings are crucial for achieving a net zero future. The Government of India has prioritized reduction of the energy demand of existing buildings and enhancement of efficiency of new construction. Factors affecting a building's energy demand include materials, design, climate, and occupant behavior, but until recently, these have been analyzed separately. With the advent of wireless sensors, IoT devices, and data analytics, efforts are being made to integrate these factors. An understanding of the climate-energy-occupant nexus in buildings will help us in accurately constructing a digital-twin, which will further help in exploring energy conservation measures. There remains a gap in the development of such a platform. Bridging this gap to develop a pathway for low energy and emission buildings is imperative in the context of increasing global temperature due to climate change and the high rate of building construction in developing countries like India. **The proposed project aims to assess and improve the operational energy consumption in education buildings which represent an important building type. This project will test and analyze a cyber-physical modeling platform that can drive sustained energy savings in educational buildings while maintaining decent levels of occupant comfort.** The project entails deployment of indoor environmental quality (IEQ) and heat flux sensing technology, the data obtained from which will be coupled with energy simulation tools to develop a digital-twin of the case study indoor spaces. Further, machine learning models will be trained on acquired and simulated data to learn the energy consumption patterns. These models will be employed to test various energy efficient, occupant-driven scenarios in educational buildings. Energy savings, enhanced occupant comfort, satisfaction, and productivity, and the creation of valuable datasets on energy and occupant preferences are some expected outcomes of the project. Also, the framework has scope for being scalable to campus-wide applications, with the possibility of developing adaptive cyberphysical systems in the form of a product or application for optimized controls, which can be transformative as we move towards green campuses worldwide.