CE6011 - Smart buildings and automation

Credit Distribution: C:9 L:3 T:0 P:0 E:0 O:6 TH:0

Course Type: Theory

Description: Develop a basic understanding of what are smart buildings and the hardware and software technologies that make them possible.

Course Content: Introduction to smart buildings: Modern definitions that focus on building performance and takes into account the expectations of users are briefly discussed. Building Automation Hardware: controllers, sensors, actuators, communication network: Hardware technologies that are essential for implementing automated building systems are explained. Building Automation Software, Communication protocols, Building Management Systems (BMS), Facilities Management Systems: Protocols such as BACNET and KNX that are based on international and open standards are introduced. Steps involved in configuring a control system and the methodologies used for programming are explained. Features of BMS commonly found in commercial and office buildings are discussed. Integration of facilities management operations with intelligent control is also briefly covered. Control strategies and algorithms: Differences between open and closed loop control are highlighted. Conventional algorithms such as PID are discussed. More modern strategies using multi-objective optimization are introduced Application to lighting control: Use of light sensors and occupancy sensors for dimming control is explained. Active control of day lighting and shading devices such as light shelves, light pipes, mirror ducts are discussed. The advantages and challenges in the use of automated systems such as window blinds are brought out. Application to air conditioning: The use of active technologies for improving the performance of air conditioning and ventilation systems is discussed. Global optimization of water-cooled chiller system is presented to illustrate the idea that system performance can be enhanced only through a holistic approach. Pre-cooling strategies, energy recovery wheels, thermal storage systems and dehumidification technologies are used as examples of active technologies in energy efficient air conditioning. Other applications: Security, access control, fire safety, elevators: CCTV and IP cameras are used as examples for introducing surveillance and monitoring techniques. Modern access control systems using RFID and biometrics are introduced. Integration of fire alarm system with other building systems is discussed. Energy Management Systems: Techniques for predicting and monitoring the energy consumption of buildings are covered. Artificial Intelligence, Machine learning, Optimization and Data Analytics in the control of building systems: This part covers recent developments in the application of AI research to building system

Text Books

- Shengwei Wang, Intelligent buildings and building automation, Spon Press, 2010

Reference Books

- Derek Clements-Croome, Intelligent Buildings: Design Management and Operation, 2004.
- Jim Sinopoli, Smart Buildings, Spicewood Publishing, May 23, 2006.
- Jim Sinopoli, Smart Building Systems for Architects, Owners, and Builders, ButterworthHeinemann; 1 edition, 2009.

Prerequisite: NIL