MIE1050: DESIGN OF INTELLIGENT SENSOR NETWORKS

Formerly MIE1453HF: Introduction to Sensors and Sensor Networks

Course Instructor: Ardevan Bakhtari, PhD

This course will provide students with practical knowledge on sensor network design including sensor selection, calibration, digitization, and digital signal processing. Students will be introduced to theory and operation of various sensor technologies and their applications. Commonly used transducers such as chemical, mechanical, and magnetic as well as the more advanced organic and nuclear transducers are discussed. This course will also cover linear and non-linear multi-parameter calibration. Digitization, and a survey of digital signal processing techniques will be discussed with practical application of commonly used digital filters. Special focus will be placed on optimal design of sensor networks and multi-sensor data fusion. There will be a design project to enforce the lessons learned in class on sensor calibration and digital signal processing.

COURSE BREAKDOWN

Introduction to Sensing Principles:
This is an introduction to the field of sensors and sensor networks.

- Sensors vs transducers
- Types of sensor
- Commonly used sensors for various applications
- Sensor networks

Sensor Characteristics

- Static and Dynamic characteristics
- Linear and non-linear calibration
- Response and recovery time of first and second order systems

Signal Conditioning and Digitization
Signal digitization and recording

- Digital noise filtration
    1. Introduction to digital filters
    2. State-Space Filters
    3. Frequency-domain filters

Signal Processing and Interpretation

- Pattern Analysis
- Classification
- Dimensionality Reduction

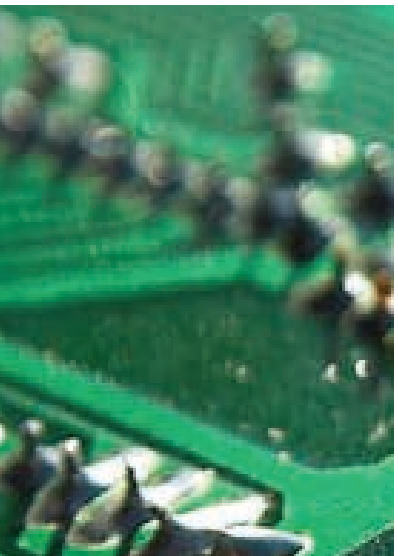
Sensor Fusion

- Spatial and Temporal Data Fusion
- Conditional Probability and Fuzzy Logic

Sensor Network Optimization

- Complimentary vs. redundant sensor architecture
- Dynamic sensor optimization
- Wireless sensors and IOT devices

Course Project
Students are provided with a sensor platform that includes a variety of sensors to measure temperature, humidity, pollutants, noise, and EMF. Students must develop a device that will measure and recognize various environmental parameters. Students must utilize lessons learned in the course including sensor calibration, digital signal processing, and signal interpretation to complete the project.



Course Marking Scheme
Project 60%
Assignments 40%

Project Marking Scheme
Proposal 20%
Final Report 20%
Final Demonstration 20%

Course Video: https://youtu.be/FWoX4RVmGhE