Introduction to Modern Industrial Automation

ISE 589-006
Fitts-Woolard Hall 02121

Fred Livingston, PhD (Thursday) 06:00 – 08:45 pm
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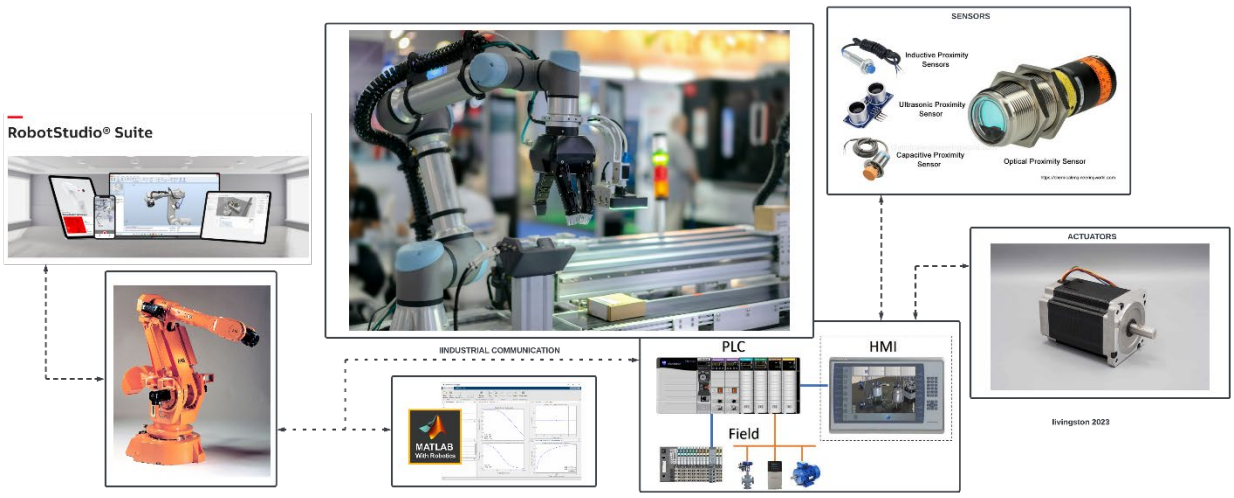
Office Hours: TBA

This course covers industrial automation theory and practice in the modern industrial environment. It is designed to give students a thorough understanding of industrial automation control systems, including programmable logic controllers (PLCs), robot manipulators, sensors, motor drives, and industrial networks to achieve Industrial 4.0. Industrial Automation applications must be developed and demonstrated with modern, data-driven manufacturing systems that collaborate in real time. For instance, a PLC-controlled assembly, combined with data acquisition industrial communication, such as via OPC UA technology, and robotics, such as a robot manipulator properly integrated into the IoT (Internet of Things). Through this collaboration, data can be released in the Core data model exchanged between systems and machines in different locations to provide new opportunities to increase productivity efficiently and cost-effectively. This course will provide the fundamental theory of modern industrial automation, including hands-on laboratory experience and a final course project.



GRADING

Homework Assignments - 10%

Laboratory Assignments(7) - 35%
Exam - 10%
Semester Project

- Proposal - 5%
- Literature Review - 5%
- Major Milestones (Project Plan) - 10%
- Final Report (Journal Proceeding) - 15%
- Demonstration - 10%

TOOLS

ABB Robotics
https://new.abb.com/products/robotics/robotstudio

MATLAB/Simulink
https://www.mathworks.com/products/industrial-communication.html
https://www.mathworks.com/products/control.html

Connected Component Workbench
https://www.rockwellautomation.com/en-us/capabilities/industrial-automation-control/design-and-configuration-software.html

COURSE OUTLINE

Module 1: Introduction
Module 2: Measurement Systems

- Sensors
- Data Acquisition
- Actuators
- System Modeling

Module 3: Introduction to Automatic Control

- PID (Proportional Integral Derivative Controller)
- Sequence Control
- PLC (Programmable Logic Controller)
- Distributive Controllers (Edge-Computing)
- Industrial Communication
- Safety

Module 4: Manipulators and End-Effectors

- Kinematics

- Trajectory
- ABB Robotic Manipulators
- Universal Robotic Manipulators

Module 5: Design Project

SCHEDULE