

# I4.0 TEACHER PROFESSIONAL DEVELOPMENT PROGRAM CAPSTONE DETAILS



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## Outcomes

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- Advanced Manufacturing Systems Approach and Integrating Industry 4.0
  - Demonstrate the ability to program industrial automation components
  - Demonstrate the ability to perform basic integration of industrial automation components
- Experience and Implement Industry Relevant Capstone projects with Students
  - Embed I4.0 PBL into existing or new Automation and Robotics programs
- What is Industry 4.0?
  - Methods for teaching I4.0 related concepts and topics
  - Consumer Industry 4.0 Example
  - Identify and list the nine key technology pillars in the Industry 4.0 (4th Industrial Revolution), cyber-connected ecosystem.
  - Understand the “digital thread” concept of Industry 4.0
  - Summarize the importance of Cybersecurity in the Industry 4.0 ecosystem.
  - Discuss a few examples of Autonomous Robotics use in the real-world.
  - Describe the use of Augmented Reality / Virtual Reality (AR/VR) in training/education.
  - Summarize the use of Simulation/Digital Twins in manufacturing design activities.
  - Describe what Systems Integration / EOS means in the Industry 4.0 ecosystem.
- Student engagement in the classroom
  - Apply student engagement and course delivery methods
  - Identify the three types of interaction that students will experience throughout your course
  - Utilize the backward design process to create lesson plans and activities
  - Recognize opportunities for active learning across various types of course content
  - Create a strong course communication policy
  - Recognize how a Learning Management System can aide course communication

- Develop a plan to provide timely feedback to students on assessments

## Capstone Project

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### INTEGRATION OF FERRIS WHEEL (PLC), FANUC ROBOT, CONVEYOR, SENSORS, ACTUATORS

#### TOPICS/PROJECTS:

0. Shapes lab from FANUC cert, have PLC tell robot which one to run (example during Monday Tuesday) Make into PBL?
1. PLC to Conveyor (or Light stack, air cylinders...etc.) (with sensors, actuators)—Project 1A
2. Robot to PLC or machine mockup—Project 1B
3. Robot, PLC and Conveyor or Ferris Wheel—Project 2 (ties project 1A and 1B together)
4. Robot to Conveyor (with sensors, actuators)—Optional?? Could be a good project because it will show how to use Digital I/O with the Robot. (configuration, use...etc.)

#### LABS WILL USE PRE-CREATED FILES THAT:

- have the communications setup between the Robot and PLC.
- Conveyor, sensors, outputs (lights), actuators will be prewired/ connected to PLC.
- Step by Step instructions (instructor material)
- For Robot to PLC—Project 1B the system will utilize a conveyor that will be pre-configured (wired to PLC, setup on cart...etc.). The system will also utilize fixtures for picking and placing parts.

#### TEACHERS WILL LEARN THE FOLLOWING:

- how to change IP addresses (PLC and Robot)
- how to identify the tags used for communicating...etc. (PLC)
- I/O setup in Robot
- Communications setup in PLC/ Robot
- I/O can be hardwired or networked
- Controlling EOAT
- Programing Positions for moving parts (frames, Robot I/O.... etc.)
- Background information on the communication setup between the Robot and PLC (IP address, terminology, topology, mac address, subnet, ping.... etc.)

#### DETAILS FOR EACH PROJECT:

1. PLC to Conveyor (with sensors, actuators)—Project 1A
  - a. Outcome of project is to....
    - i. Teachers will: create project, add I/O modules, create Alias tags, set path, and create simple program to control conveyor base on sensor status, actuators (air cylinders).

2. Robot to PLC—Project 1B
  - a. Outcome of project is to....
    - i. Create a handshaking program between the robot and PLC (Connection between the Robot and PLC will be setup already). The program should trigger the robot to perform different jobs. (Example: pick part off conveyor and place in bin A, or Pick part from bin B and place on Conveyor...)
3. Robot, PLC and Conveyor or Ferris Wheel—Project 2
  - a. Outcome of PLC to Robot and Ferris Wheel is to establish a basic program that will have the robot load and unload the Ferris wheel trainer.
    - i. The PLC will move the Ferris Wheel into position, then signal the robot to pick the part and load it into the system. The robot will then move back and tell the PLC that its process is complete, and the system will then move to next step. It will also unload the system in a similar fashion and then repeat. A similar project can also be complete utilizing the conveyors used in Project 1A.
4. Robot to Conveyor (with sensors, actuators)—Optional?? Could be a good project because it will show how to use Digital I/O with the Robot. (configuration, use...etc.)

#### **SCHEDULE:**

##### **Monday Afternoon**

Two lecture groups – One for PLC and robot, second one for PLC and Conveyor  
 Labs related to integrating A & R technology  
 PLC and Robot --Group 1A  
 PLC and Conveyor --Group 1B  
 Two Groups of 8?

##### **Tuesday Morning**

Two lecture groups – One for PLC and robot, second one for PLC and Conveyor  
 Labs related to integrating A & R technology  
 Two lecture groups  
 PLC and Robot --Group 1B  
 PLC and Conveyor --Group 1A  
 Two Groups of 8?

##### **Capstone Project Wednesday Afternoon**

Project 1A
 

- Group A

 Project 1B

- Group B

**Capstone Project Thursday Morning**

Project 1A

- Group B

Project 1B

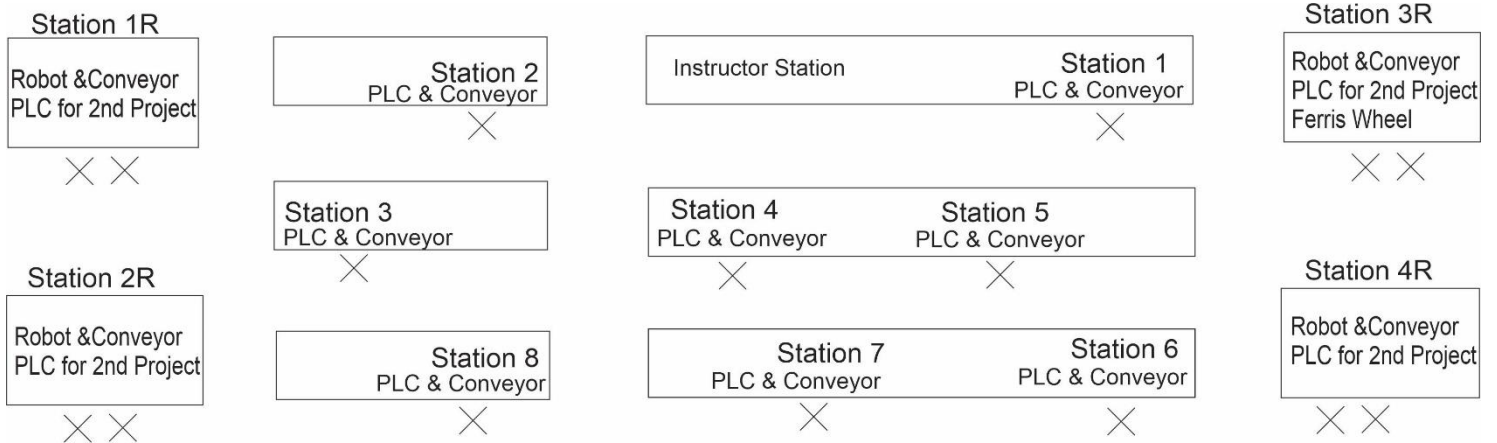
- Group A

**Capstone Project Thursday Afternoon**

PLC, Robot, Ferris Wheel/ Conveyor

Putting system together

Only have one Ferris wheel, could be a bottleneck.



## Funding Attribution

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