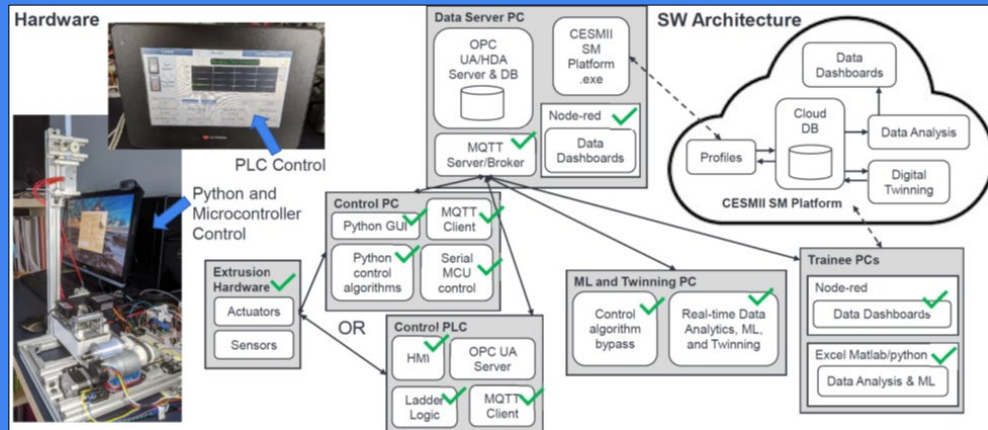


**PROJECT CASE STUDY**  
Factory 4.0  
Educational Toolkit



## CESMII drives Smart Manufacturing curriculum development

### PROJECT LEAD

Penn State University

### PROJECT TEAM

MIT

### PROJECT OBJECTIVE

The goal of this project is to develop an instrumented bench scale extrusion kit and platform that can be integrated into education modules (labs, projects, etc.).

[MORE ON CESMII.ORG](https://www.cesmii.org)

### BENEFITS TO OUR NATION

By equipping its workforce with the skills needed to excel in advanced manufacturing technologies, American manufacturers will become more competitive in the global marketplace. This heightened competitiveness translates into economic growth, job creation, and higher wages for American workers. The adoption of smart manufacturing practices reduces operational costs and resource consumption, contributing to a more sustainable and environmentally friendly industrial sector. Investing in smart manufacturing training not only empowers American workers but also bolsters the country's position as a leader in the manufacture of high-value, high-margin products.

### BENEFITS TO INDUSTRY

Smart manufacturing training offers significant advantages to the manufacturing industry. By educating the workforce on cutting-edge technologies like the Industrial Internet of Things (IIoT), automation, and data analytics, manufacturers will unlock new levels of productivity, quality, and efficiency. Trained workers are adept at optimizing processes, reducing waste, and predicting maintenance needs, resulting in cost savings and enhanced competitiveness. Smart manufacturing training of engineering students fosters innovation and adaptability, positioning the manufacturing sector for sustained growth and success in the digital era.

# PROJECT DESCRIPTION

## TECHNICAL APPROACH

Creation of a smart laboratory-scale extrusion process model and simulator, to educate students on key aspects of Industry 4.0 themes including sensing, control, data acquisition, process simulation models, machine learning and prediction, and optimization through educational materials.

## ACCOMPLISHMENTS

- Developed open source dashboarding and monitoring software
- Developed open-source machine control software
- Developed model extrusion machine and accompanying control hardware
- Delivered Electro-Mechanical Engineering Technology Course to 17 Penn State undergraduates
- Developed 8-hour industrial training workshop curriculum

## DELIVERABLES

- Delivered Complete Factory 4.0 Educational Toolkit
- Delivered Complete Controls Software Package for Extrusion Process Model
- Delivered Complete Communications Software Package to connect PLC and Extrusion Process Model to the cloud
- Delivered Complete Data Analysis Software Package

## REUSABLE OUTCOMES / SM MARKETPLACE

- Factory 4.0 Educational Toolkit
- Controls, Communication and Data Analysis Software Packages
- 8-hour Industry 4.0 Training Workshop

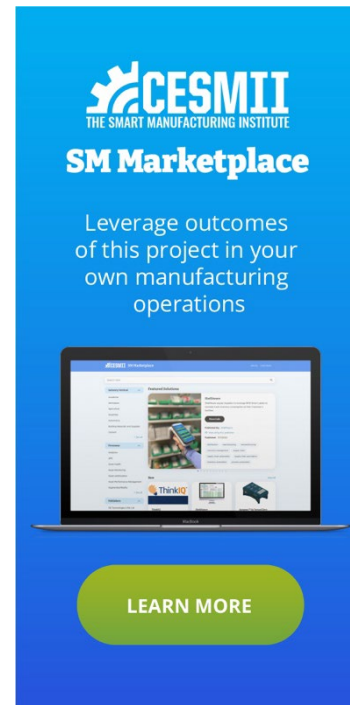
# RESULTS

## 17

Delivered pilot Electro-Mechanical Engineering Technology course to 17 Penn State undergraduates.

## 8 hours

Developed 8-hour Industry 4.0 industrial training workshop.



The banner features the CESMII logo (The Smart Manufacturing Institute) at the top. Below it, the text 'SM Marketplace' is displayed in a large, bold font. Underneath, a message reads: 'Leverage outcomes of this project in your own manufacturing operations'. A laptop screen shows a dashboard with various charts and data. At the bottom, a green button with the text 'LEARN MORE' is centered.

## PROJECT DETAIL

Budget Period: BP2 – BP3  
Submission Date: 10/15/2020  
Sub-Award (contract) Number:  
4550 G WA310  
SOPO: 236

## FOR MORE INFORMATION CONTACT

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