

# Developing Security Education Materials for Future Advanced Manufacturing Engineering Workforce

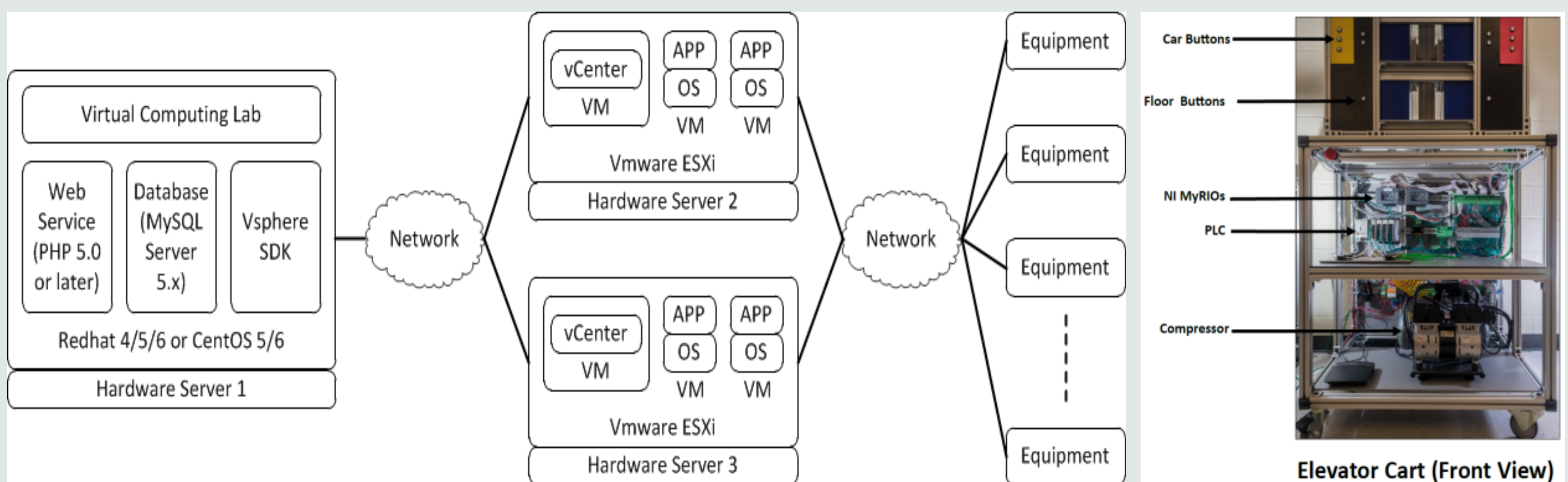
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## 1. Objectives

- Design a comprehensive suite of course modules and hands-on exercises for security education in advanced manufacturing systems (AMS);
- Contribute to the establishment of an education and training pipeline for equipping manufacturing workforce with network and information security knowledge;

## 2. Motivations

- In 2016, attacks on Industrial Control Systems (ICS) increases about 2000%;
- Cyber-security of advanced manufacturing systems (AMS) has raised significant interest from both investigators and general public;
- Limited educational materials or hands-on learning resources are available for security education in AMS;
- A serious challenge for the training of qualified workforce to fill tens of thousands of positions in the fast evolving manufacturing industry;



## 3. Materials

- Three course modules on “Overview of Advanced Manufacturing System and its Security (AMS)”, “Infrastructure Security and Reliability of AMS”, and “Data Security in AMS” are developed;
- Experiment platform includes PLC and MyRio controlled elevator and robotic arms;
- Hands-on exercises include DoS attacks on equipment reservation, side channel attacks on manufacturing task privacy, and compromising MyRIO control channel confidentiality;

## 4. Adoption and Evaluation

- The materials are adopted in “Instrumentation and Controls” (Engineering School) and “Principles of Information Security and Privacy” (School of Computing) at UNCC;
- More than 130 hours of student experimentation time on the platform;
- 24 undergraduate students participate in the class sessions;
- Evaluation instruments include surveys and quiz;
- The project is a part of a series of projects supported by NSF, DoL, and DoE;