

Cleyton Shelton Virtual Conveyor System Capstone

Problem Domain

Modern factories rely on conveyor systems to move products efficiently, but **real-world testing and training is costly and risky.**

There is a need for a **fully virtual conveyor system** that allows users to:

- Control conveyors safely via virtual control stations
- Monitor system status in real time through an HMI
- Simulate complex conveyor interactions without physical equipment
- Test, optimize, and train operators before deploying in a real factory

Features & Requirements

Key Features (9 Total)

1. PLC-Based Conveyor Control

- Develop ladder logic using Studio 5000
- Control motors, sensors, and safety interlocks
- Ensure logical sequencing of conveyor operations

2. Conveyor Emulation

- Model the conveyor system in Emulate3D
- Simulate motor behavior, sensors, and material flow
- Synchronize emulation with PLC ladder logic

3. Virtual Control Stations

- Build interfaces in FactoryTalk View
- Enable start/stop, speed control, and monitoring of conveyors
- Update conveyor status in real time

4. Real-Time HMI Dashboard

- Display conveyor states using Ignition
- Show motor status, sensor readings, and alarms
- Provide a visual overview of the system

5. Conveyor Sequencing

- Implement multiple conveyor lines and junctions
- Automate routing of products between conveyors
- Test sequencing logic in Emulate3D simulation

6. Emergency Stop & Safety Logic

- Add E-stop and safety interlocks
- Ensure any faults immediately stop conveyors
- Integrate alarms and notifications into HMI

7. User Interaction

- Allow users to control conveyors via FactoryTalk View
- Enable switching between control stations without disrupting operation
- Provide clear feedback for operator actions

8. System Integration

- Synchronize PLC ladder logic, Emulate3D simulation, FactoryTalk controls, and Ignition HMI
- Ensure real-time updates across all platforms
- Test reliability under different scenarios

9. Documentation & Reporting

- Maintain full project documentation
- Include PLC logic diagrams, HMI screenshots, and simulation results
- Prepare presentation/demo materials for final review

Development Roadmap

Product Development Roadmap

Sprint 1 Deliverables

1. PLC Ladder Logic

- Implement basic conveyor control (start/stop, motor control, sensors)
- Define I/O addresses for integration with Emulate3D and HMI

2. Emulate3D Conveyor Model

- Build initial 3D conveyor model
- Connect motors, sensors, and PLC I/O
- Run first simulations to test basic logic

3. Virtual Control Stations

- Create FactoryTalk View interface
- Implement start/stop buttons and status indicators
- Test connectivity to PLC

4. Real-Time HMI Dashboard

- Design Ignition dashboard for conveyor overview
- Connect to PLC or Emulate3D tags
- Display motor and sensor status

Sprint 2 Deliverables

5. Conveyor Sequencing

- Implement multi-line conveyor routing
- Test automated product flow in simulation

6. Emergency Stop & Safety Logic

- Add E-stop buttons and interlocks
- Integrate alarms in HMI
- Ensure safety scenarios halt conveyors properly

7. User Interaction Enhancements

- Allow switching between control stations
- Provide clear operator feedback
- Test multi-user scenarios in FactoryTalk

8. Full System Integration

- Ensure PLC, Emulate3D, FactoryTalk, and Ignition are fully synchronized
- Test end-to-end conveyor operations
- Debug communication issues and timing discrepancies

9. Testing, Documentation & Final Polishing

- Perform complete system testing
- Fix bugs and optimize performance
- Prepare documentation, diagrams, and presentation/demo materials

Questions?