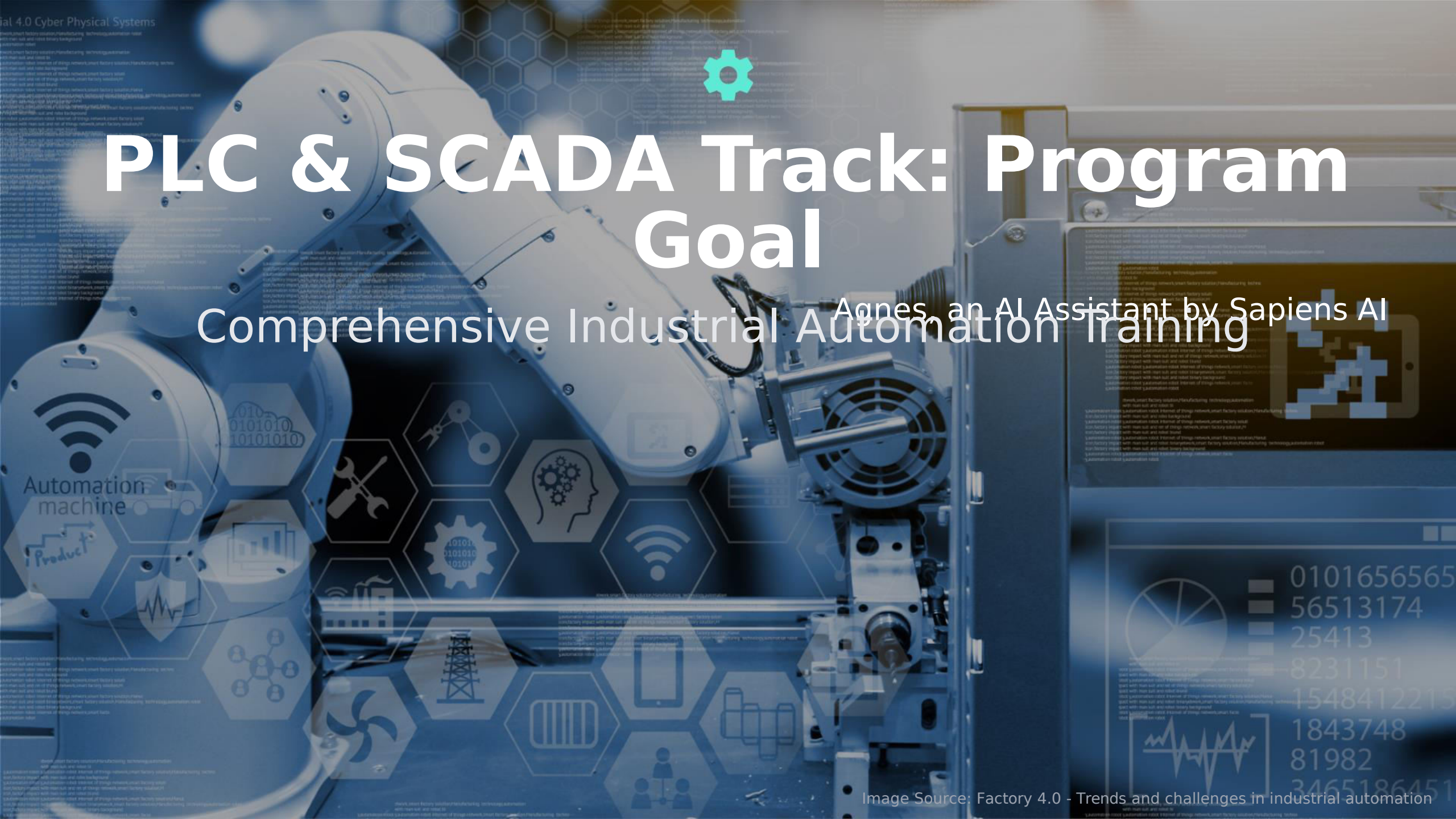


PLC & SCADA Track: Program Goal

Comprehensive Industrial Automation Training

Agnes, an AI Assistant by Sapiens AI

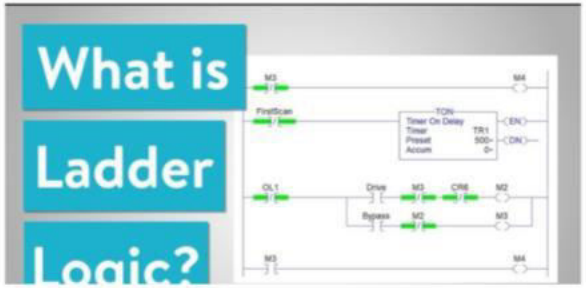
Image Source: Factory 4.0 - Trends and challenges in industrial automation

Core Topics Overview

Introduction to PLCs

- Specialized industrial computers for control.
- Efficiently monitor and manage equipment.
- Operation based on custom programming.

Industrial Computers **Equipment Control** **Custom Programming**



Ladder Logic Programming

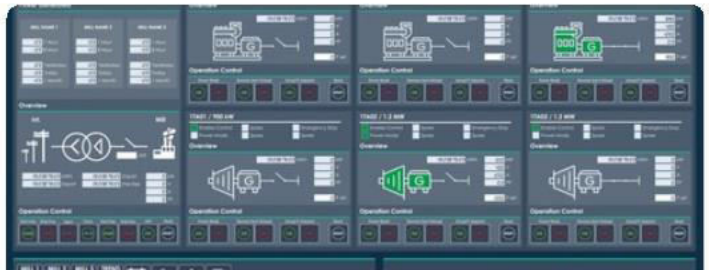
- A foundational, graphical PLC language.
- Mirrors electrical circuit diagrams for intuition.
- Crucial for control logic and troubleshooting.

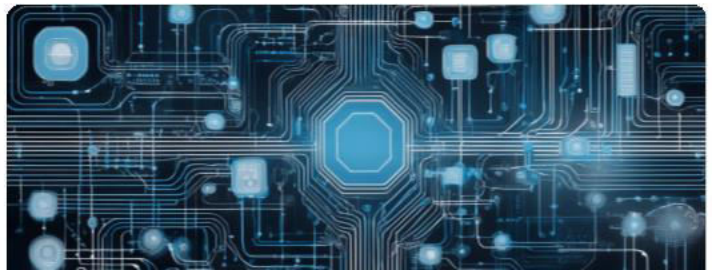
Graphical Language **Circuit Analogy** **Troubleshooting**

SCADA System Architecture

- Centralized control and data acquisition.
- Real-time monitoring of industrial processes.
- Manages data acquisition and process flow.

Centralized Control **Data Acquisition** **Process Monitoring**





Phase 1: Foundational & Core Concepts (Online)

Online Delivery Overview

2 Months

Dedicated Online Delivery for Comprehensive Theoretical Understanding.

PLC Fundamentals & Ladder Logic

PLCs: Industrial computers central to controlling and monitoring equipment via custom programming, forming the backbone of automated processes.

Ladder Logic: A graphical programming language, visually structured like electrical circuit diagrams, fundamental for control logic.

Industrial Computing | Graphical Programming

SCADA & HMI Principles

SCADA Systems: Enable centralized control and real-time monitoring of industrial processes, crucial for comprehensive operational oversight.

HMI Principles: Focus on designing intuitive Human-Machine Interfaces for seamless operator interaction and data visualization.

Centralized Control | Intuitive Interfaces

Industrial Communication Protocols

Exploration of standardized protocols that facilitate robust data exchange and ensure interoperability among diverse

Software Simulation Exercises

Hands-on application of theoretical knowledge through realistic software-based simulations.

Provides a safe and controlled

Month 1: PLC Fundamentals & Basic Ladder Logic (Weeks 1-2)

~~Week 1~~

PLC Basics & Software

~~Week 2~~

PLC I/O & Ladder Logic

Understanding Industrial Automation & PLCs

Introduces PLCs as specialized industrial computers for controlling equipment, covering their history, architecture (modular vs. compact), and types for various applications.

Industrial Control | System Architecture

Navigating PLC Programming Environments

An overview of dedicated software platforms for PLC programming, guiding through initial setup, project creation, and basic configuration for hands-on exercises.

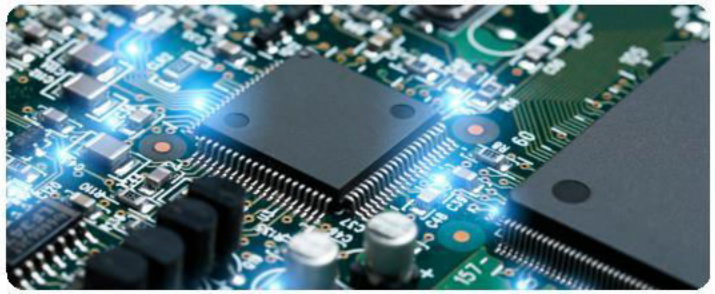
Software Interface | Project Configuration

Inputs & Outputs: Bridging PLC to Reality

Demystifying Ladder Logic Programming

Month 1: Advanced PLC Concepts & Troubleshooting (Weeks 3-4)

Timers & Counters Applications

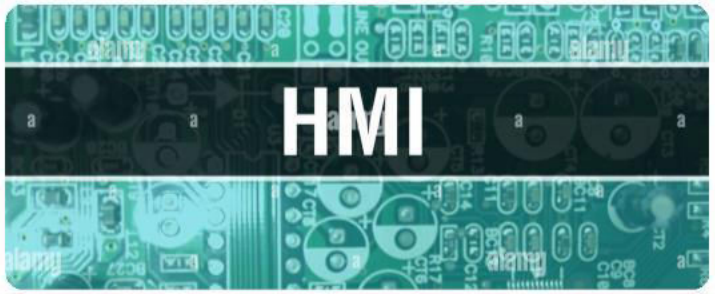


Timers (TON, TOF, RTO): Implement precise time-based control for sequences like motor startups or process delays.

Counters (CTU, CTD): Manage events, batches, and production quantities for accurate process monitoring and part tracking.

Time-Based Control | Event Counting | Sequential Logic

Data Management in PLCs



Data Types & Addressing: Understand data types (Boolean, Integer, Real) and how PLCs organize and access data in memory.

Data Manipulation: Learn essential instructions for moving, comparing, and performing arithmetic operations on data.

Memory Organization | Data Integrity | Arithmetic Logic

Modular Programming with POUs

Understanding POUs: Use Programs, Functions (FCs), and Function Blocks (FBs) to structure complex PLC projects logically.

Benefits of Modularity: POUs enhance code reusability, improve program readability, simplify debugging, and facilitate team-based development in large-scale automation systems.

Code Reusability | Enhanced Readability | Scalable Design

Essential PLC Troubleshooting Techniques

Learn critical methods for diagnosing and resolving issues in PLC systems to ensure operational

Month 2: SCADA & HMI Design Principles (Weeks 5-6)

Learning Progression

Week 5
SCADA Intro & Arch.

Week 6
HMI Design & Apps

Understanding SCADA Systems

Introduction to SCADA

A system for centralized control and real-time monitoring of large-scale industrial processes, gathering and presenting data from field devices.

Centralized Control | Real-time Monitoring | Large-scale Ops

SCADA System Architecture

Comprises the MTU (Master), RTUs/PLCs (Remote), Communication Network, HMI (Interface), and Historian (Database) for a complete control loop.

Distributed Control | Data Logging | Interconnected Devices

HMI Design & Best Practices

Introduction to HMI

A digital dashboard that translates complex process data into intuitive graphical representations, enabling operator interaction and control.

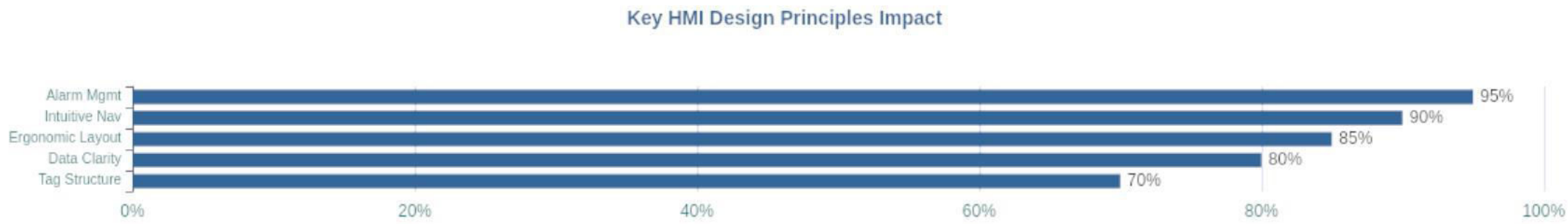
Intuitive Control | Real-time Display | Operator Efficiency

HMI Design & Tag Management

Focuses on user ergonomics, logical navigation, and effective alarm management. Tag management links HMI objects (buttons, gauges) to PLC data points.

User-Centric Design | Operational Clarity | Data Structuring

Impact Factors in Effective HMI Design



Sources: [LinkedIn] Basics of PLC, SCADA, DCS and HMI | [Medium] What is PLC HMI SCADA programming? | [Powertechmax] PLC SCADA HMI Automation | Images: [Freepik], [Shutterstock]

Month 2: Industrial Communication & Process Control (Weeks 7-8)

Weekly Focus

Week 7

Industrial Communication Protocols

Week 8

Process Control & Project Scoping

Importance of Industrial Communication Protocols & OSI Model

Crucial for Automation: Industrial communication protocols are the backbone of modern automation, enabling seamless data exchange between diverse devices (PLCs, HMIs, sensors, actuators, SCADA systems) and ensuring efficient, synchronized operation.

OSI Model in Industrial Context: The OSI model provides a conceptual framework for understanding how network layers interact. In industrial settings, it helps diagnose connectivity issues, ensures interoperability, and facilitates secure data flow across complex control networks.

Data Exchange | Network Standard | System Integration

Serial Protocols

Point-to-point or multi-drop communication over serial lines, often used for simpler, robust connections.

Ethernet-based Protocols

Leverage standard Ethernet for higher speeds, greater data volumes, and IT integration.

Process Control Basics

Strategies to regulate industrial processes and maintain desired setpoints.

Image Sources: 117,300+ Automation Technology Stock Videos...; Automated Conveyor Belt System Industrial Production Line...
Content Sources: What is a PLC? Programmable Logic Controller; Basics of PLC, SCADA, DCS and HMI

Phase 2: Industry Immersion & Integrated Project (Offline)

Month 3: 1 Month Intensive Offline Phase

The Immersion Experience

Applying Concepts on Actual Hardware

- Translate theoretical knowledge into tangible skills on industrial-grade PLCs, HMIs, and SCADA systems.
- Focus on live wiring, configuration, programming, and troubleshooting.

Hardware Integration **System Troubleshooting**

Direct Mentorship & Skill Development

- Receive personalized guidance and real-time feedback from experienced professionals.
- Develop critical thinking and adaptive problem-solving skills for dynamic industrial challenges.

Personalized Guidance **Problem-Solving**

Month 3: Hardware Integration & Troubleshooting (Weeks 9-10)

~~Week 9~~
PLC Hardware, I/O Mapping, Wiring

~~Week 10~~
PLC-HMI/SCADA Comm, Troubleshooting

PLC Hardware Mastery & Physical Practice

Foundational Hardware Setup

Explore PLC components, power requirements, and master fundamental wiring practices according to industrial safety standards.

PHYSICAL ASSEMBLY | ELECTRICAL SAFETY | WIRING STANDARDS

Program Deployment & I/O Mapping

Link PLC addresses to physical terminals, download ladder logic programs to hardware, and verify successful data transfer.

Integrated System Communication & Diagnostics

Hardware Communication Setup

Configure communication links between physical PLCs and HMI/SCADA systems using industrial protocols for seamless data exchange.

CONNECTIVITY | PROTOCOL CONFIG | DATA FLOW

Real-time System Monitoring

Observe live process data on HMI panels, validating data integrity and learning to interpret visual trends for performance monitoring.

Month 3: Conveyor Belt Mini Project (Week 11)

Key Inputs

Start/Stop Buttons: For operational control to initiate and halt conveyor movement.

E-Stop (Emergency Stop): Critical safety input for immediate system shutdown in hazardous conditions.

Photoelectric/Proximity Sensors: For precise detection and positioning of items on the belt.

Operator Control | Safety Mechanism | Process Sensing

Key Outputs

Conveyor Motor: The primary actuator driving the mechanical motion of the belt.

Indicator Lights: Provide clear visual status feedback (running, stopped, fault).

Alarm Buzzer: Audible warning system to alert personnel to critical events or malfunctions.

Actuation | Visual Feedback | Audible Alert

Control System Development

Detailed PLC Ladder Logic: Creating comprehensive programs with sequential control, safety interlocks, and control algorithms.

HMI Development for Control: Designing user-friendly screens for interaction, data visualization, and manual overrides.

Logic Programming | User Interface | Control Algorithms

Project Definition

Design & Implement Conveyor Belt Control System

Control System | Material Handling | Automation

Hands-on Implementation

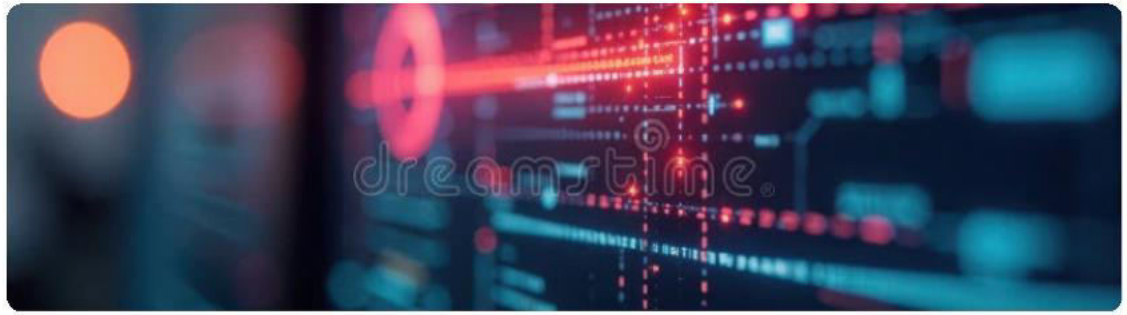
Intensive Design, Implementation, & Testing on Physical Hardware. This phase involves connecting all components, deploying code, and rigorously validating the system's functionality and safety on actual equipment.

System Integration | Functional Validation | Quality Assurance

Project Showcase & Career Launchpad (Week 12)

Week 12: Program Culmination & Future Pathways

Final Project Showcase: Innovation in Action



Functional System Demonstration

Participants present their final projects, showcasing fully functional systems with live demonstrations of PLC programming, HMI interfaces, and integrated control logic in action.

Live Demo | Problem Solving | System Integration

Engineering Documentation Excellence

Submission of comprehensive project documentation mirroring industry standards, including detailed design specifications, clean code, HMI layouts, and a Bill of Materials (BOM).

Design Specs | Code Quality | Resource Planning

Career Launchpad: Empowering Your Future

Essential Job Search Skills

Dedicated career workshops covering resume crafting, optimizing LinkedIn profiles for industry visibility, and mock interviews to present technical skills effectively.

Resume Building | Networking Profile | Interview Practice

Building Industry Connections

An invaluable networking session providing direct interaction with leading industry professionals to discuss career paths, gain insights, and explore opportunities.

Professional Links | Career Insights | Mentorship

Week 12 Focus & Outcome Distribution

Program Conclusion & Future Steps

Celebrating Your Achievement

You will receive a **Graduation Certificate**, formally recognizing your successful completion of this rigorous industrial automation program. This certification validates your comprehensive knowledge and enhances your credibility in the job market.

- Official Certification
- Validated Skills
- Industry Recognition

Launching Your Professional Journey

Graduates are equipped for diverse careers like Automation Engineer, PLC Programmer, or SCADA System Integrator. Your expertise in PLC, SCADA, and HMI systems makes you a highly sought-after professional in a rapidly expanding field.

- Career Opportunities
- High Demand Skills
- Industry Impact

Applying Practical Competencies

You now possess the skills to design, develop, and implement complex industrial control systems. Your mastery of troubleshooting for PLCs, SCADA, and HMIs will enable efficient resolution of real-world operational issues.

- Practical Design
- Diagnostic Expertise
- Operational Excellence