Schneider Electric | RMIT UNIVERSITY

SCHOOL OF SCIENCE, ENGINEERING, & TECHNOLOGY

INDUSTRIAL SEMI-AUTOMATED MACHINE DEVELOPMENT

HANDS-ON PLC, MOTION CONTROL, AND MECHATRONIC SYSTEM INTEGRATION WITH IIOT ENABLED

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PROJECT BACKGROUND & MOTIVATION

Weatherproof Isolator Switch

2026 demand requires **408,935 units** representing (in product value) **56.5 billion VND**

The majority of assembly process relies on manual work, creating dependency on

- **operator consistency**
- **manual handling**
- **repeated inspection**

42.2 hours of line downtime since Jan 2026 caused by operator skill gap

A semi automated industrial machine is necessary to improve repeatability, reduce manual dependency, support stable quality performance, and protect production capacity for current and future demand.

OBJECTIVES

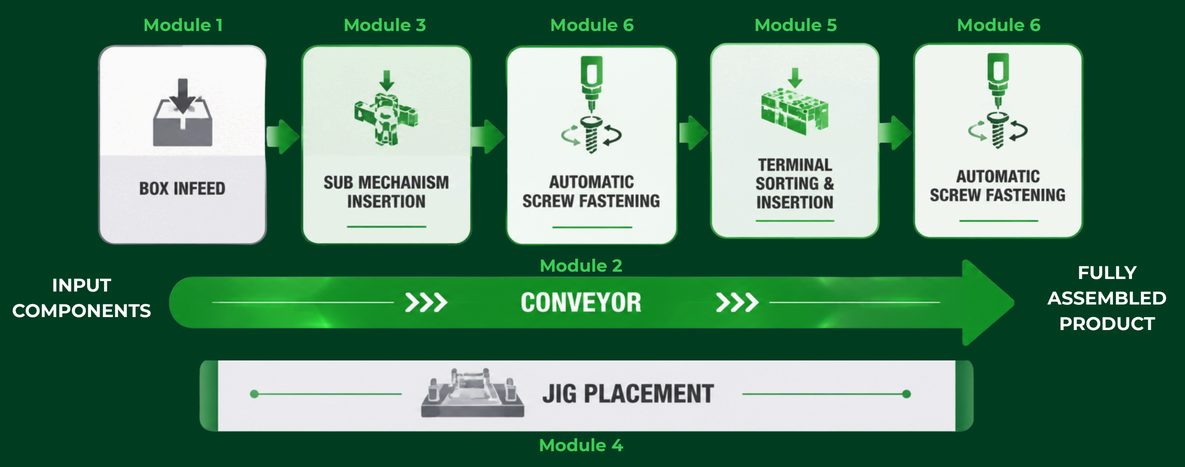
The machine configuration is expected to free **1 worker from the assembly per cell per shift**, allowing him/her to be reassigned to another task elsewhere in the factory

By freeing 1 worker per cell per shift, 3 shifts per day, 2 cells every shift, the projected annual saving in labour costs is **420 million VND**

The machine is expected to have a payback period of **2 years**

The cycle time of the box assembly is expected to be reduced by **30%** from **20s** to **14s**

DESIGN METHODOLOGY



DESIGN METHODOLOGY (CONTINUED)

1. RESEARCH EXISTING AUTOMATED MACHINES

The team reviewed existing automated equipment across the SEMV factory to identify effective mechanisms, reusable features, and relevant design practices. Consultations with factory engineers helped refine the concept and ensure the proposed solution was effective, safe, and ergonomically suitable.

2. THEORETICAL PROCESS DESIGN

During the detailed design phase, the team developed a complete 3D model of the machine assembly. Material selection, structural strength, manufacturing feasibility, and component lead times were evaluated to produce a practical and reliable design.

3. DOCUMENTATION & PROJECT PROPOSAL

Detailed equipment and procurement lists were prepared, covering standard components such as grippers, actuators, screw feeders, the SCARA robot, electrical devices, and PLC I/O modules. Custom parts, including the frame, cabinets, extrusions, plates, and sheet-metal components, were also documented and reviewed with the industry supervisor before procurement.

Project approved?

NO → Revise proposal with industry supervisor, identify why it was not approved, then return to Step 2.

YES

4. BUILD MACHINE & INSTALLATION

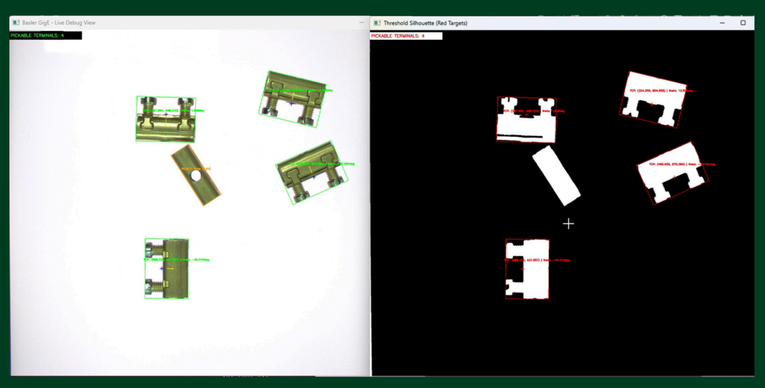
The machine will be manufactured and installed in collaboration with the SEMV industry supervisor and engineering team. PLC control and AI vision programs in EcoStruxture, Machine Expert and Python will then be integrated and tested to verify operation, optimize cycle time, resolve faults, and prepare the system for long-term industrial use.

CURRENT STAGE

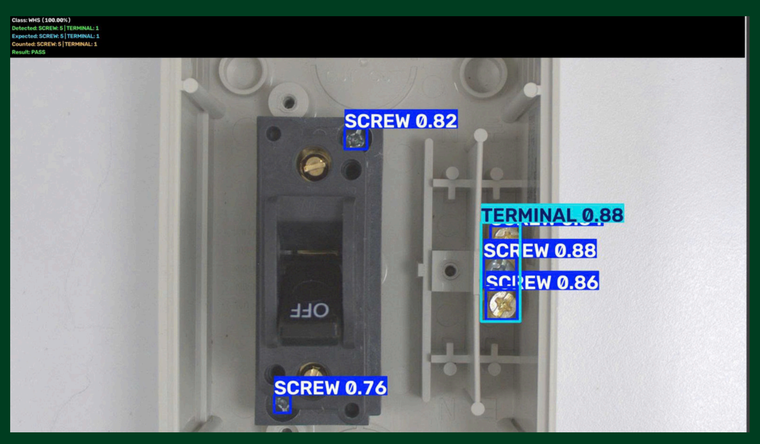
5. TESTING, VALIDATION, CALIBRATION & HANDOVER

Final testing will confirm that the machine meets all functional and performance objectives. The team will validate system operation, complete the required calibrations, address any remaining issues, and hand over the machine together with the relevant technical and operational documentation.

EXPERIMENTAL RESULTS



The vision system successfully identified and outputted terminal orientation and pickability using the backlit surface simulating the flexible feeder bed, classifying side-lying terminals as pickable and the upright terminal as not pickable.



The product validation model was trained on sample product images and detected that the sub-mechanism and 2 screws, the terminal and its 1 screw are fully assembled, confirming a complete box assembly and producing a PASS result.

CONCLUSION

Developing a semi-automated production machine within a constrained timeline highlighted the challenges of moving from design to manufacturing, assembly, and system integration. **Integrating mechanical, robotic, pneumatic, vision, and PLC systems** required continuous problem-solving and adaptation to real-world constraints.

While the complete system could not be fully implemented within the project timeframe, the experience provided invaluable **hands-on engineering exposure and insight into how industry manages design, manufacturing, suppliers, integration, and project constraints.**

FUTURE WORKS

Future work will focus on completing **manufacturing, system integration, PLC commissioning, robotic and vision integration, and production-cycle validation.** Further development should also improve reliability, cycle time, safety, and operator interaction.

Further iterations should incorporate lessons learned throughout the project, particularly **early design validation, revision control, manufacturing lead-time planning, subsystem testing, and clearer coordination between engineering disciplines.** With additional development time, the completed system could be refined toward a reliable production-ready solution and provide a stronger foundation for future industrial automation projects.