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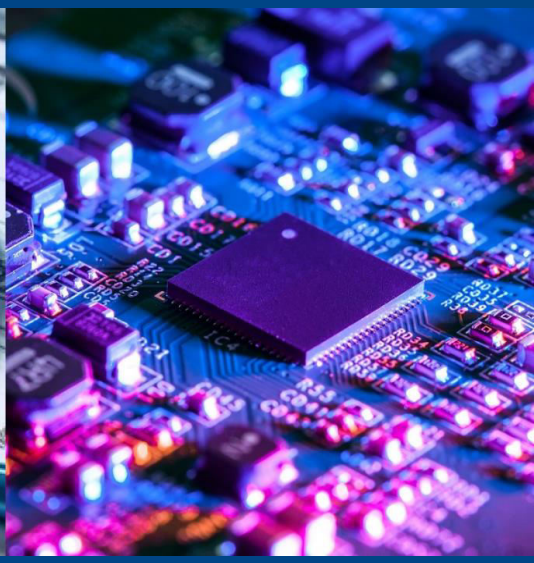

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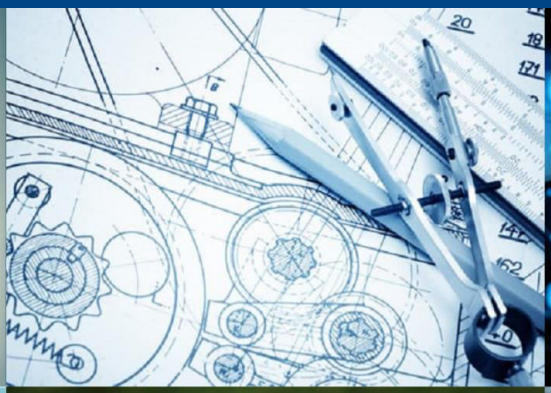

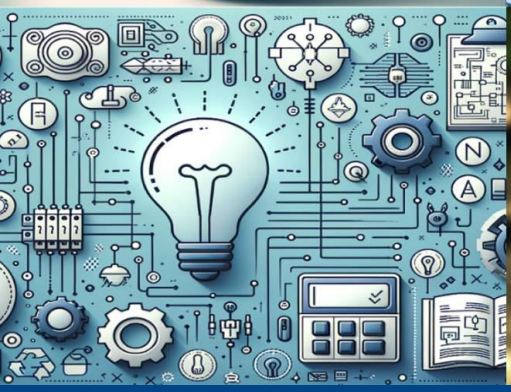

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A Review on Automation through PLC Panel Design in Industry

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I. INTRODUCTION

Industrial automation refers to the control of industrial processes by autonomous systems like PLCs (Programmable Logic Controllers), HMIs, and SCADA systems, minimizing human intervention. The importance of automation has grown significantly with industries aiming for efficiency, safety, precision, and cost-effectiveness.

This review evaluates a practical project conducted during a 3-month in-plant training at Vidhi Automation, Ichalkaranji, focusing on PLC panel assembly, wiring, and programming. The hands-on experience with Delta and Mitsubishi PLCs, along with software tools like WPLSoft and GX Works, offered deep insight into modern automation solutions.

II. LITERATURE REVIEW

The use of Programmable Logic Controllers (PLCs) in industrial automation has been extensively studied by multiple scholars and industry experts. The literature confirms their importance in enhancing efficiency, safety, and customization in manufacturing processes.

Mallikarjun Hudedmani (2019) – In his paper “A Study of Programmable Logic Controllers (PLC)”, he explored the structure and capabilities of PLCs in industrial environments. He highlighted the effectiveness of Ladder Logic in simplifying complex control operations and also stressed the importance of timers, counters, and sensors—elements also applied in this project for safety and sequencing.

R.K. Rajput (2016) – In Instrumentation and Control, Rajput delved into the integration of electrical components like SMPS, relays, and circuit breakers, along with instrumentation used for automation. His concepts on feedback control loops and industrial safety align with this project's emphasis on protection devices and real-time fault detection.

W. Bolton (2015) – A renowned authority in PLC education, Bolton’s book Programmable Logic Controllers systematically breaks down PLC architecture, programming standards (IEC 61131-3), and communication protocols. His explanation of I/O mapping and memory addressing is directly relevant to the PLC panel configuration done during the internship.

John W. Webb and Ronald A. Reis (2014) – In their text, they addressed practical PLC implementation in diverse sectors—HVAC systems, automated assembly lines, and energy management. Their approach to simulation-based debugging and remote monitoring reflects the same practices used in GX Works and WPLSoft in this internship.

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B.N. Das and P. Das (2017) – Their work focuses on electrical engineering fundamentals essential for any automation project. Their detailed treatment of relay logic, overload protection, and panel wiring provided foundational understanding necessary for handling live industrial panels safely.

Mitsubishi Electric Reports (2022) – The latest technical white papers describe the GX Works3 platform's ability to support multi-language logic design and remote editing. These features played a crucial role in programming Mitsubishi PLCs during the training, especially in modular logic creation and version control.

Delta Electronics India White Paper (2023) – Delta's documentation offers insight into modern compact PLCs with Ethernet support and IoT connectivity. Their emphasis on energy-efficient and scalable designs matches the project's objective of creating user-friendly, power-protected PLC panels with expandability for future upgrades.

III. METHODOLOGY

The training was divided into two main departments:

Wiring Department: Assembly of electrical control panels using tools like multimeters, cable cutters, and crimpers. Electrical safety and circuit understanding were crucial here.
Programming Department: PLCs were programmed using WPLSoft for Delta PLCs and GX Works for Mitsubishi systems. Ladder Logic and Function Block Diagram (FBD) were primarily used to design industrial control sequences.

-Each step followed a strict sequence:

Understanding client requirements.
Designing electrical schematics.
Selecting and configuring PLC hardware.
Programming logic based on process flow.
Testing and debugging using simulation and live connections.
Installation and handover.

IV. GENERAL DESIGN

-The general design of the PLC panels included:
Control System: Centered around a Delta or Mitsubishi PLC.
Input/Output Configuration: DI/DO and AI/AO modules were configured based on process needs.
Power System: SMPS provided 24V DC supply, with MCBs and relays for protection.
Communication: Enabled with VFDs, sensors, and SCADA systems via Ethernet, Profibus, or CANopen.

-Panel Features:

LED status indicators
Emergency stop buttons
Pilot lamps
Compact DIN rail layout
Cooling and ventilation mechanisms
All components were selected to support durability, accuracy, safety, and efficient diagnostics.

V. FUTURE SCOPE

-With rapid advancements in Industry 4.0, automation systems are expected to evolve with:

IoT-Enabled PLCs: Real-time cloud monitoring and diagnostics.
Smart Sensors: Self-diagnostic and adaptive sensors for predictive maintenance.
HMI Integration: Touch-screen control panels for intuitive operation.

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Modular Panels: For faster upgrade and maintenance.
Cybersecurity: Implementation of secure PLC protocols to protect industrial networks.
The project can be further enhanced by integrating SCADA systems and remote control capabilities using MQTT or OPC-UA protocols.

VI. CONCLUSION

The internship at Vidhi Automation provided critical insights into automation system development, especially in the design, programming, and testing of PLC panels. With the usage of industry-standard tools like WPLSoft and GX Works, and hands-on experience with Delta and Mitsubishi PLCs, the trainees were equipped with both technical and analytical skills.

The review of literature supports the application of programmable systems in enhancing industrial safety, reliability, and productivity. The knowledge gained not only helped in understanding automation but also laid the groundwork for advanced system design and integration.

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