VELAMMAL INSTITUTE OF TECHNOLOGY

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ANNA UNIVERSITY

PROGRESS THROUGH KNOWLEDGE

BACHELOR OF ENGINEERING

IN

MECHATRONICS ENGINEERING

INTERNSHIP EXPERIENCE REPORT

15th JULY 2024 – 15th AUGUST 2024

AT

CDCE AUTOMATION AND ROBOTICS

CDCE

SUBMITTED BY

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ACKNOWLEDGEMENT

We are expressing my prime gratitude to the LORD ALMIGHTY and OUR PARENTS for giving us the confidence and strength for the successful completion of this internship.

We want to express our gratitude to our outstanding Principal, **Dr. N. Balaji**, who provided us with constant backing, insightful comments, and approval of our internship.

We want to extend our gratitude to **Dr. S. Soundararajan**, the vice principal, for his vital guidance, valuable feedback, and encouragement for the internship, which were all which have made a significant contribution to its accomplishment.

We are grateful to our head of the department, **Dr. D. Magesh Babu** for each and every assistance of him, backing, and counsel for getting the internship fulfilled.

We sincerely thank **Dr. B. Madhu** for his guidance and support in helping us connect with the admin department, which made our internship possible. His encouragement and assistance mean a lot to us.

MOHANKANTH B
PRAKASH R S

1. INTRODUCTION

We had the privilege of completing our internship at CDCE Automation and Robotics, a company recognized for its expertise in the field of industrial automation and robotics. Throughout our internship, we were exposed to various aspects of the industry, including electrical wiring, assembly and fabrication, CAD design, and automation programming. This internship provided us with hands-on experience and practical knowledge, enabling us to apply theoretical concepts learned during our academic studies to real-world scenarios.

The primary purpose of this internship was to bridge the gap between academic learning and industry practices. It was designed to equip us with the technical skills and professional competence required to excel in the field of industrial automation. By working on real-time projects and under the guidance of experienced professionals, we gained insights into the complexities and challenges of the industry. The internship also aimed to enhance my understanding of the various domains within automation and robotics, thus preparing us for future roles in this rapidly evolving sector.

The exposure to multiple disciplines, such as electrical engineering, mechanical fabrication, design, and automation, provided a holistic view of the interconnectedness of these fields. Moreover, it reinforced the importance of teamwork, problem-solving, and continuous learning, which are essential skills in any professional environment. This report is structured to provide a detailed account of our internship experience at CDCE Automation and Robotics. It begins with an overview of the company and the objectives we set for ourselves at the start of the internship. The main body of the report is divided into four key sections, each dedicated to the specific domains we worked in:

1. **Electrical Domain:** Covers the activities related to control, power, and field wiring, along with an introduction to PLC programming and sensor technology.
2. **Assembly and Fabrication Domain:** Focuses on the practical tasks involving machining, fixture setups, and material discussions.
3. **Design Domain:** Describes our work with CAD software, specifically SolidWorks, and the reverse engineering processes we engaged in.
4. **Automation Domain:** Details our experience with automation programming, including the use of ISPsoft and HMI design.

The report concludes with reflections on our learning, recommendations for future interns, and acknowledgments to those who supported us throughout this journey.

2. COMPANY OVERVIEW

Center of Excellence for Factory Automation & Robotics

CDCE was established in 2010, delivers Innovation in Automation and Robotics. They aim to provide the best products and services to our customers by delivering timely and high-quality results by using advanced technologies and high-quality raw materials.

They Design and Develop the following products:

1. Assembly Stations
2. Special Purpose Machines
3. Leak Testing Machines
4. Vision Systems
5. Ultrasonic Welding SPMs
6. Poka Yoke Systems
7. Barcode Automation Systems
8. Automation Panels
9. Drive Panels
10. SPM Drilling Machines
11. Profile Cutting Using 6 Axis Robot
12. Ultrasonic Welding Using 6 Axis Robot

Their Services are

1. PLC Programming
2. Retrofits of Conventional Machines
3. Barcode Systems
4. Retrofit of relay logic panels to PLC Panels
5. HMI, PLC, and servo drive services

Fig. 2.1. CDCE Group

They procure raw materials from the most trustworthy and reliable industrial vendors, whom we have chosen after conducting thorough market research and based on their domain experience, prompt delivery schedule, financial stability, and material quality. Moreover, with the incorporation of advanced production techniques, the company successfully produces an innovative range in the market.

3. INTERNSHIP ACTIVITIES

3.1. ELECTRICAL DOMAIN

Architecture of Control panel

Day 1 was a more enthusiastic day for us. We received a warm welcome from all the workers, and Mr. Rajasekar sir introduced us to everyone as we are from Velammal Institute of Technology, Mechatronics department, joining as Intern for a small period. According to plan, Mr. Rajasekar told us to join the Electrical and Automation team for the week. Our mentor, Mr. Karthick, was a good tutor and listener. Along with other workers like Mr. Harish and Mr. Durgesh, and other interns, they started to help us understand control panel wiring. As we already had 70% theoretical knowledge, they filled in the rest, allowing us to visualize everything by just looking at a control panel for a few seconds. We did control panel wiring, mounted a tower lamp for the system, and soldered DB9 connectors (RS232) pins according to the datasheet given. Our learning curve was really good, as we expected on day one.

Fig. 3.1. Control panel wiring.

Component trace outline:

On the same day, we were asked to trace a PCB layout of a 4-channel relay module in the notebook we had assigned for homework. We then sketched it in EasyEDA software to create the PCB layout and schematic diagram professionally. The 4-channel relay we traced allows a common pin to be set to 24V or 0V by changing

the jumper pins. The next day, after showing the completed work to the team members, he appreciated us for our efforts.

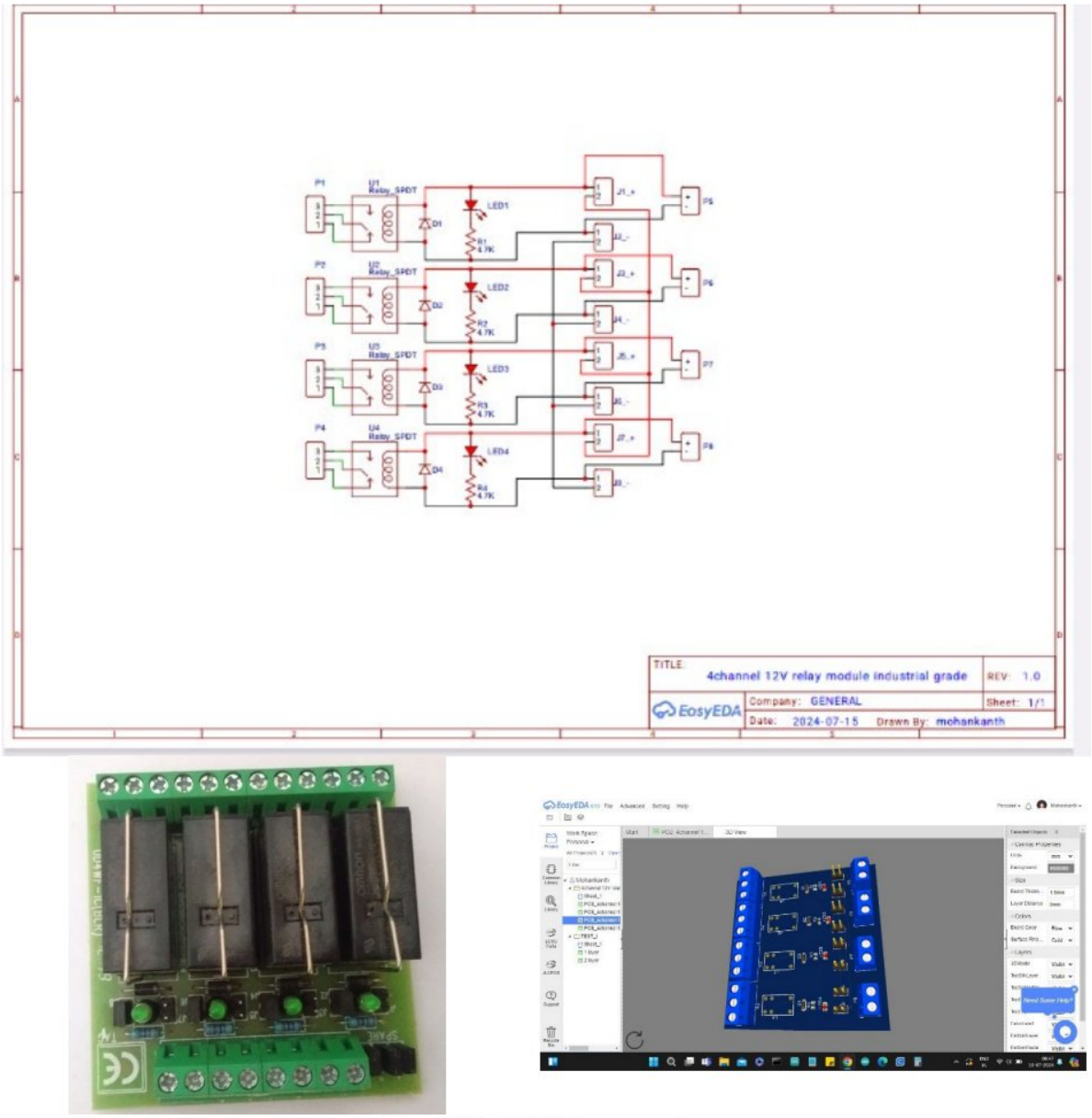

Fig. 3.2. PCB Trace out.

Since we were not familiar with contactors, they asked us to study them. We opened an old contactor and observed its working practically as well. A contactor is an electrically controlled switch used for switching an electrical power circuit. It operates by using an electromagnet (coil) that, when energized, creates a magnetic field, pulling in the contacts to close the circuit and allow current to flow. When the coil is de-energized, the contacts open, breaking the circuit. Contactors are commonly used to control electric motors, lighting, heating, and other electrical loads.

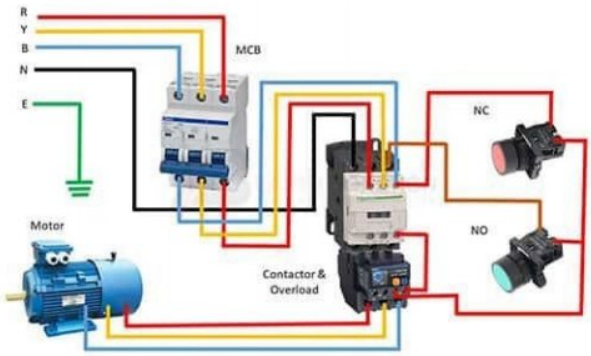

Fig. 3.3. Contactor circuit connection

Replace an ice cube relay with a slim relay when space-saving is crucial, as slim relays are more compact. Slim relays are also more energy-efficient and suitable for lower current applications, making them ideal for modern, compact electronic systems where reduced size and power consumption are important.

Fig. 3.4. Slim relay

When doing control panel wiring, it is crucial to choose the appropriate gauge wire according to the core and the square millimeter (sq. mm) of the wire. We also gained real-time experience in selecting and varying different square millimeter wires with different cores.

Fig. 3.5. Wire sizes

While doing wiring at both the field level and the power wiring level, we found it challenging because there was no visualization of the electrical wiring in the panel. We approached our team leader, Mr. Karthikeyan, and suggested providing a solution. He appreciated our initiative and assigned us the task.

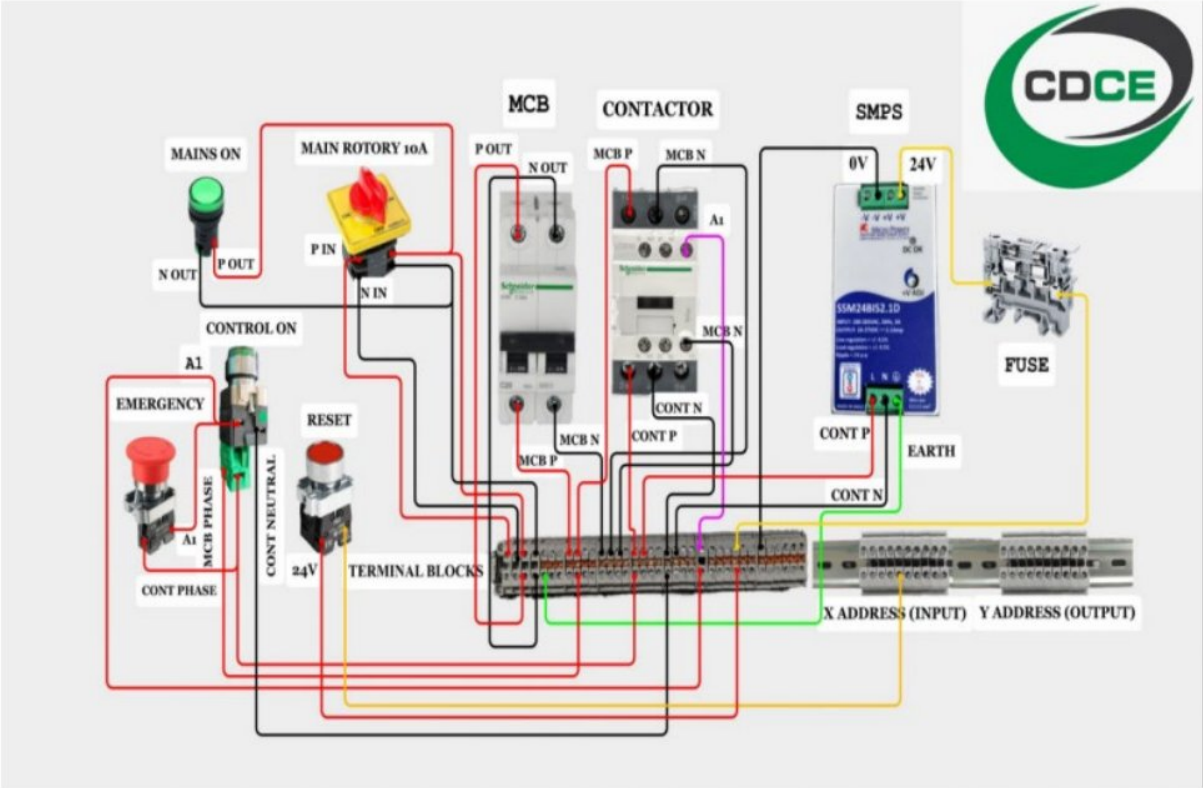

Fig. 3.6. Power circuit schematic diagram

Using Cirkit design software, we began creating the power wiring schematic diagram. After some detailing and discussions with our team, we created a board for it so that everyone could easily visualize the power wiring schematics.

Based on our work, we were also asked to create a sensor specification chart, which helped the team easily discuss the sensor specifications. We completed these tasks during that time as well.

Fig. 3.7. Sensor parameters visual display

Out of curiosity, we opened an old Delta DVP series PLC to explore its internal components. Our goal was to gain a deeper understanding of its architecture and how the various modules interact within the system.

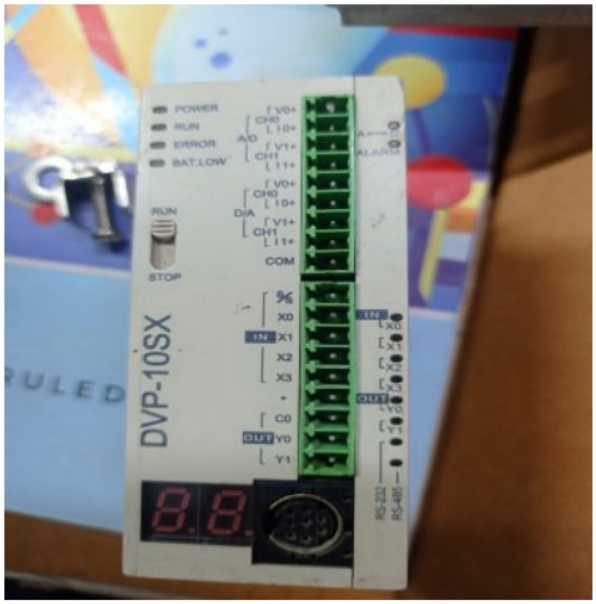

Fig. 3.8. DELTA PLC teardown and study

We explored distinct types of photoelectric sensors, including through-beam, retro-reflective (which uses reflectors), and diffuse reflective sensors (similar to the concept of IR sensors). We noted the differences in their operation and application. Additionally, we learned about the sourcing and sinking configurations of sensors. For PNP sensors, the output voltage is positive at 24V, while for NPN sensors, the output voltage is negative at 0V. During this process, we collected and organized all relevant information, which provided us with a comprehensive understanding of these sensors and their functions.

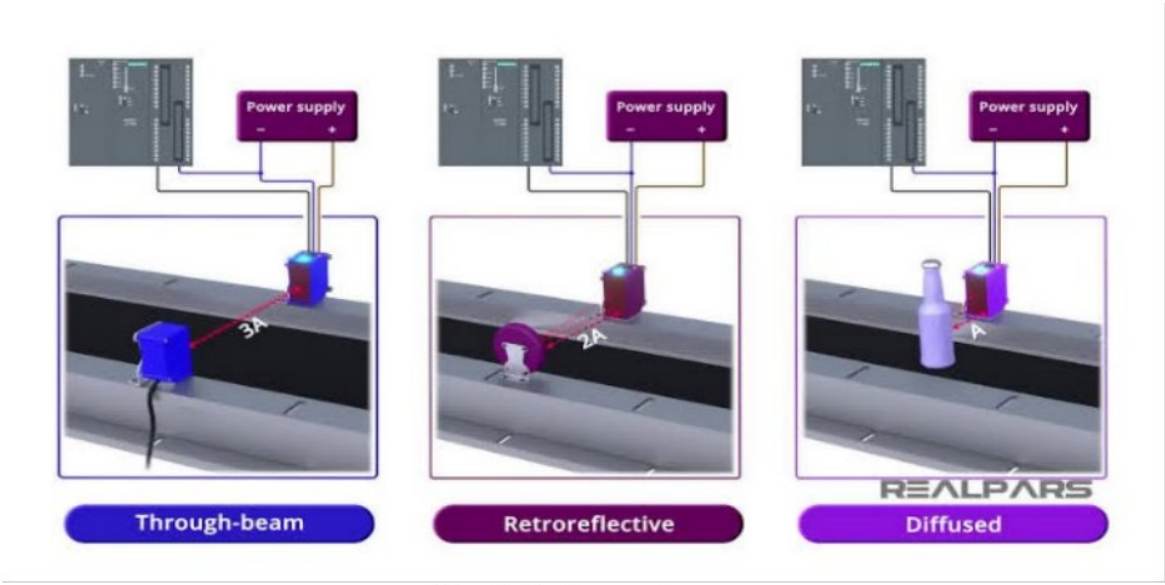

Fig. 3.9. Sensor types

We wired the 10A rotary switch in the control panel using reference from our previous work on power wiring circuit diagrams. During this process, we ensured proper insulation, verified load capacity, and adhered to safety standards to maintain circuit integrity and prevent potential overcurrent issues.

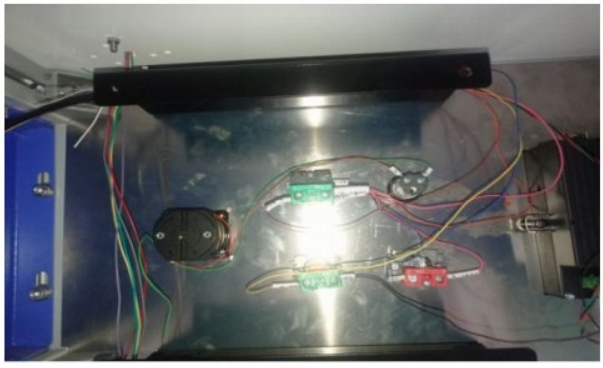

Fig. 3.10. Power wiring

3.2. ASSEMBLY AND FABRICATION DOMAIN

Nesting Process:

When I first joined the fabrication team, our initial task was to cut aluminum extrusion profiles according to a provided 2D sketch. We employed the concept of nesting to optimize the cutting process. Nesting involves strategically arranging the profile cuts on the material to minimize waste. We used an Excel sheet to calculate and document the required lengths for each piece based on the 2D sketch, ensuring efficient material usage. This approach significantly reduces material wastage and optimizes the overall cost-effectiveness of the project.

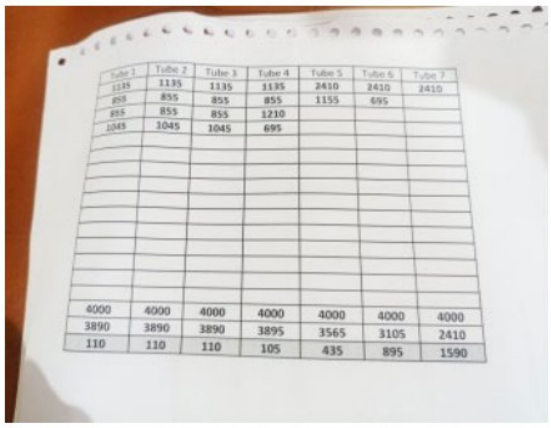

Fig. 3.11. Nesting

Profile planning:

For this assembly, we utilized 45mm aluminum extrusion profiles, which are known for their strength and modularity. The profiles featured 10mm T-slots, which accommodate 10mm T-nuts, allowing for secure attachment of various components. Additional parts used in the assembly included end caps to cover exposed ends of the profiles, L brackets for creating strong right-angle joints, and hidden brackets for a clean, streamlined appearance. These components combined provide a robust and versatile framework ideal for the project's structural requirements.

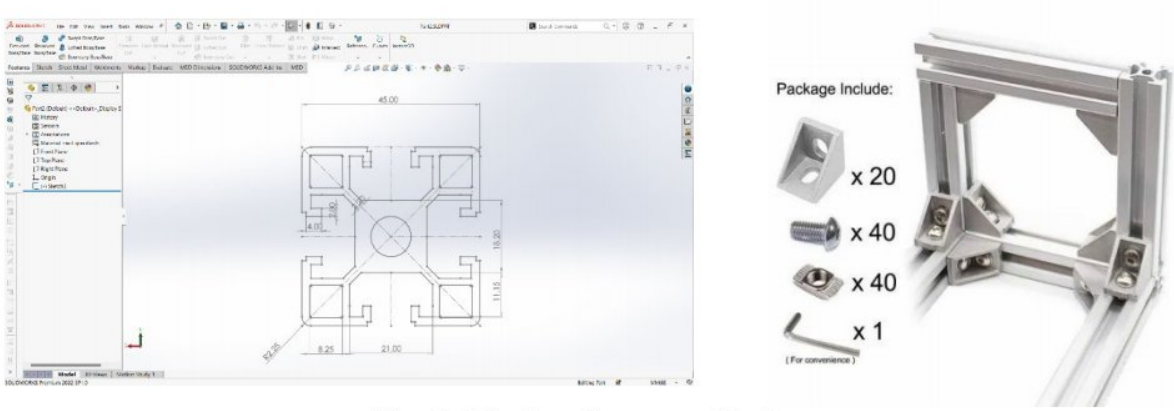

Fig. 3.12. Aluminum profile fixture

Panel layout:

We used a drilling machine with self-tapping screws to fix the Din rail and cable duct onto the electric metal panel, as required for the electrical panel sketch in different company projects.

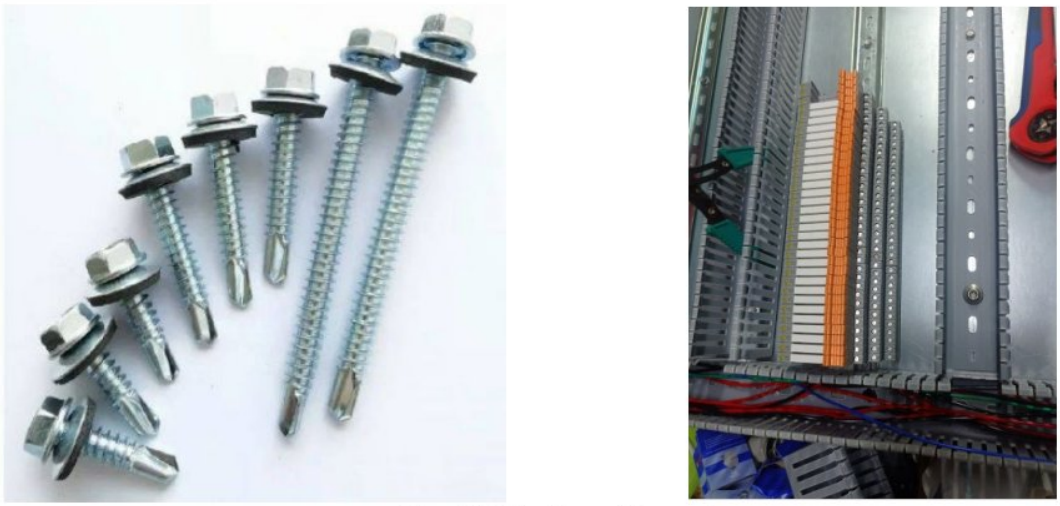

Fig. 3.13. Panel layout

We had a discussion with the fabrication team. Mr. Suresh sir explained about the several types of powder coating finishes available, including glossy, matte, and texture (such as sandtex). They provided detailed explanations of each finish and demonstrated their characteristics. We engaged in a hands-on learning experience by examining and feeling the different finishes, which significantly enhanced our understanding of their technical properties and applications.

Fig. 3.14. Powder coating

3.3. DESIGN DOMAIN

Introduction to SolidWorks:

As soon as we joined the design team, we were instructed about SOLIDWORKS software usage and its features. There we gained knowledge about how to utilize the software for design perspectives to attain calculative and understandable graphical representations.

Part and Assembly design:

We were tasked with drafting 2D and 3D sketches for several standard diagrams to familiarize ourselves with the ribbon interface and other design tools in SolidWorks software. After completing a few designs, we were assigned the task of reverse engineering various aluminum profile tables by measuring their dimensions and drafting detailed 3D models.

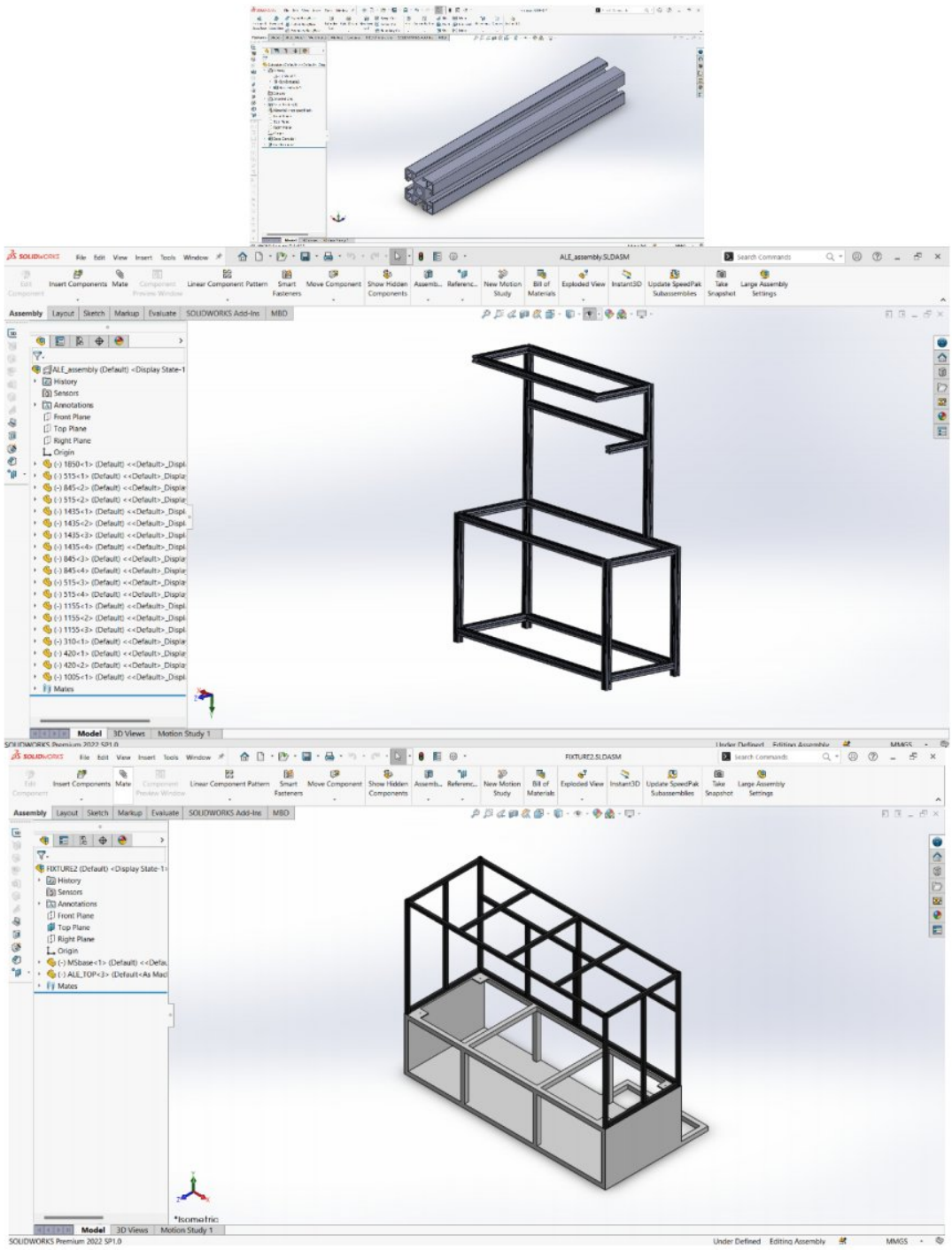

Fig. 3.15. Part and Assembly design

This process helped us understand the principles of Design Thinking with a focus on manufacturability. The key takeaway is that the design phase must be carried out with a strong emphasis on how the product will be manufactured.

3.4. AUTOMATION DOMAIN

The automation domain was a crucial part of our internship, where we were trained in automation programming and HMI (Human-Machine Interface) design. This experience provided us with a deep understanding of how software interacts with hardware to control industrial processes, an essential skill in the field of industrial automation.

Training in Automation Programming with ISPsoft:

Mr. Sadha sir from the automation team provided us with Delta PLC and HMI software to practice and familiarize ourselves with PLC programming and HMI design. We began with basic operations using ISPsoft, such as programming bottle filling processes, conveyor belt movements, and induction motor control. These operations were programmed using ladder logic, incorporating timers, counters, and interlocks to simulate real-world automation scenarios.

HMI Design and Integration with PLC Logic:

Designing an HMI may seem straightforward at first, but there are many technical aspects to consider, such as configuring button addresses, overseeing page navigation, and managing user access levels (UAE). Everything must be designed with the end-user's perspective in mind, ensuring that the interface is intuitive and functional for the operators.

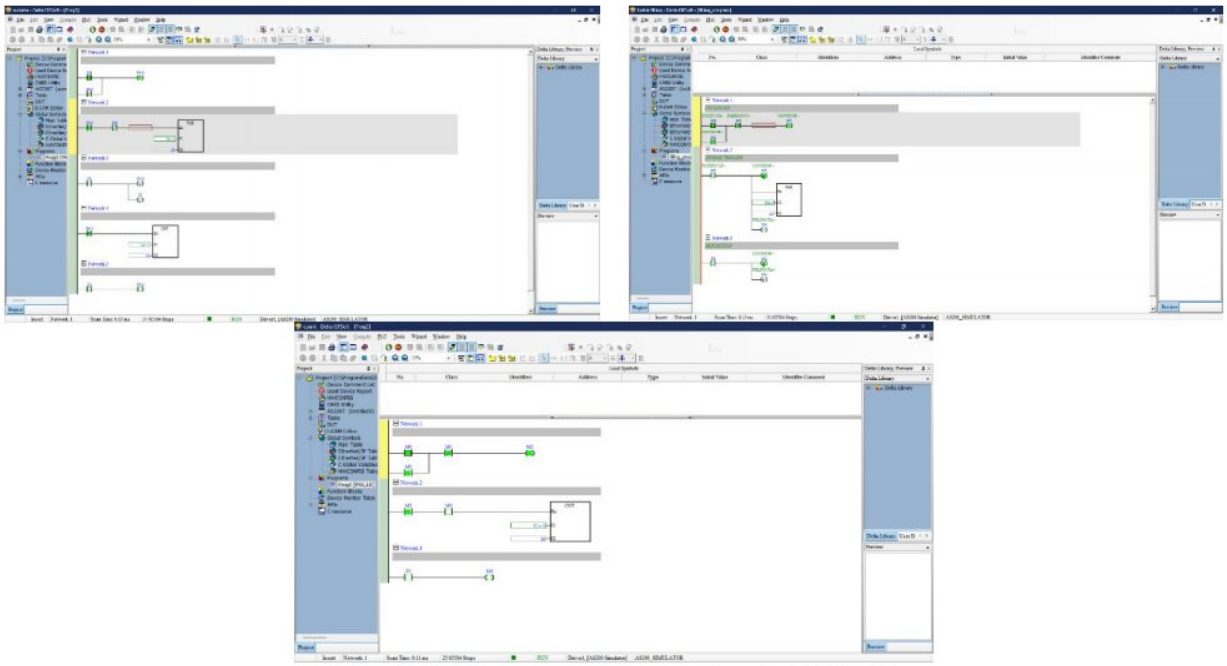

Fig. 3.16. Logic programming in ISPsoft

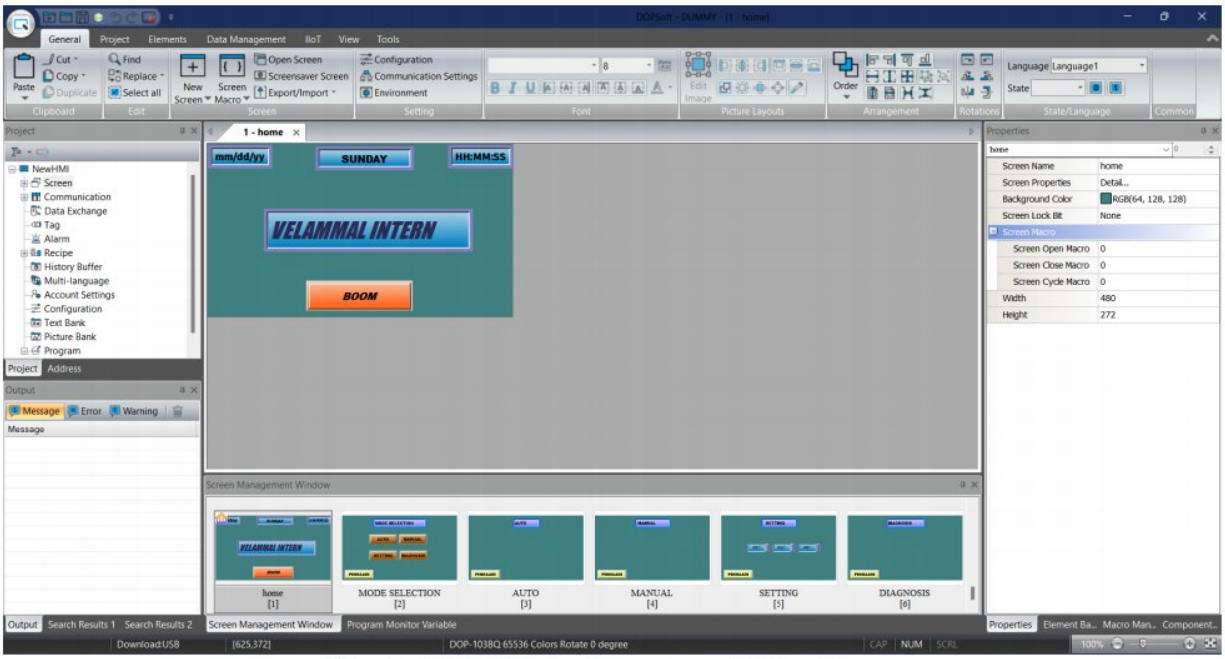

Fig. 3.17. HMI design using DOPsoft.

For trial-and-error purposes, we connected an SMPS to various sensors, such as capacitive, inductive, and part-present sensors, along with a light load, to verify their functionality. Similarly, we also interfaced a DB9 connector with an HMI and a printer for communication. These small interfacing experiments helped us ensure that the system was functioning correctly.

Fig. 3.18. Reference for Interfacing devices

4. VISIT TO INDUSTRY

We had the opportunity to visit a client company, Sekisui DLJM Molding Pvt. Ltd, where we supported the automation team working in a Delta robot to precisely cut specific PP material from car door components. It was an invaluable experience to observe other SPMs developed by CDCE in operation for various processes. The exposure to industrial applications was truly remarkable and difficult to fully capture in words.

Fig. 4.1 Visit to SEKISUI DJLM industry

APPENDICES

CDCE	-	Centre for Development, Center for Excellence
CAD	-	Computer-aided design
PLC	-	Programmable logic controller
HMI	-	Human-machine interface
SPM	-	Special purpose machine
RS	-	Recommended standards
PCB	-	Printed circuit board
PP	-	Poly Propylene
IR	-	Infra-red
SMPS	-	Switched-mode power supply

CERTIFICATIONS

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Date: 13.08.2024

TO WHOMSOEVER IT MAY CONCERN

This is to certify that **Mr. MOHANKANTH B – 113321115011 (B. E. MECHATRONICS ENGINEERING)** student at **VELAMMAL INSTITUTE OF TECHNOLOGY** has successfully completed 1 month internship in **Design, Electrical and Automation & Mechanical Department** at **CDCE AUTOMATION AND ROBOTICS, CHENNAI** from **15th July 2024 to 15th August 2024.**

He has successfully completed his Internship Training and during the above Period his conduct and approach to learning was **Good and Satisfactory**.

We wish him great success in his future endeavors.

For CDCE Automation And Robotics

Authorized Signatory
Mr. Rajasekar
Managing Partner

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