
**REPORT 5: PLC INTERFACING**

**GROUP 4**

**MCTA 3203**

**SEMESTER 2 2023/2024**

**MECHATRONICS SYSTEM INTEGRATION**

**DATE OF SUBMISSION:**

**17 APRIL 2024**


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**TABLE OF CONTENT**

**ABSTRACT**

The experiment looks at a Start-Stop Control Circuit built with OpenPLC ladder diagrams and Arduino hardware. We designed and tested the circuit using OpenPLC Editor software, Arduino boards, and basic electronic components such as switches and LEDs. Our findings indicate the successful integration of industrial control ideas with Arduino. We talk about hardware, electrical concerns, and software elements. Recommendations include thorough component testing and programming. This project provides useful insights on PLC programming and microcontroller interface.

Keywords: Start-Stop Control Circuit, OpenPLC, Arduino, ladder diagram, industrial control, microcontroller.

**MATERIALS AND EQUIPMENT**

- OpenPLC Editor software
- Arduino Board
- 2 Push Button Switches
- Jumper Wires
- LED
- Resistors
- Breadboard

## EXPERIMENTAL SETUP

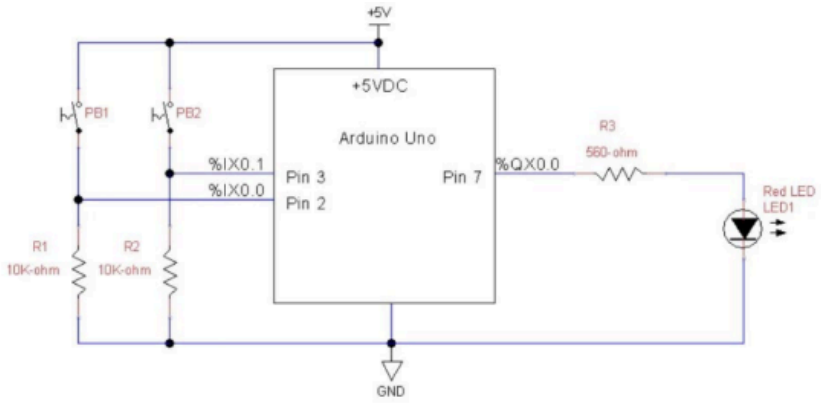
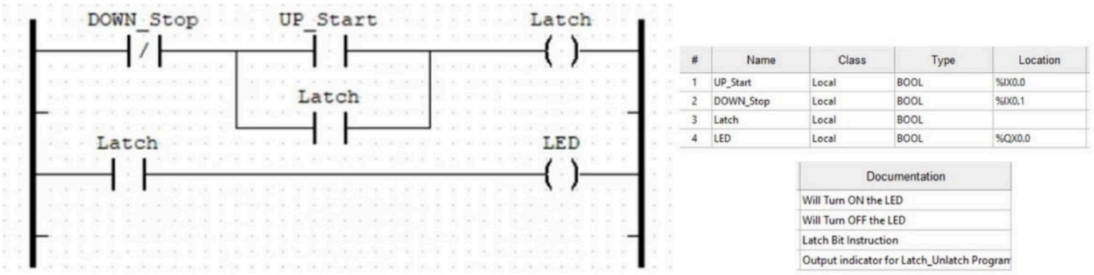



Fig. 4: Start-Stop Control Circuit




| # | Name | Class | Type | Location |
|---|---|---|---|---|
| 1 | UP_Start | Local | BOOL | %IX0.0 |
| 2 | DOWN_Stop | Local | BOOL | %IX0.1 |
| 3 | Latch | Local | BOOL | |
| 4 | LED | Local | BOOL | %QX0.0 |

| Documentation |
|---|
| Will Turn ON the LED |
| Will Turn OFF the LED |
| Latch Bit Instruction |
| Output indicator for Latch_Unlatch Program |

Fig. 5: Ladder Diagram for the Start-Stop Control Circuit

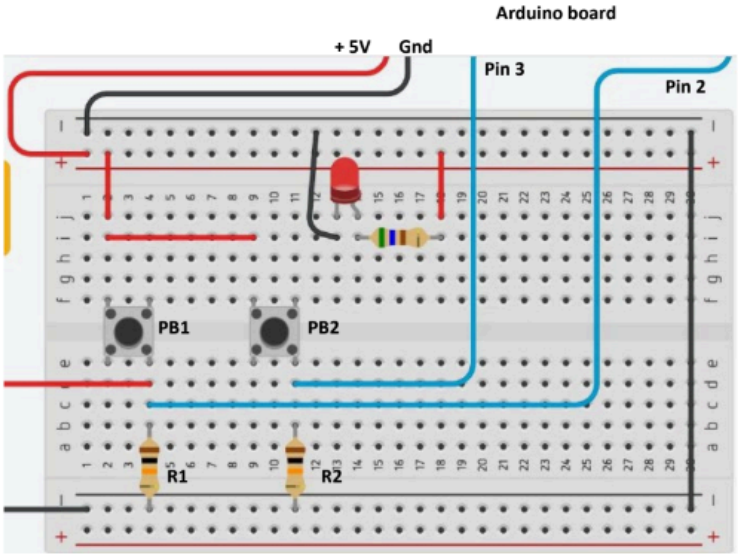
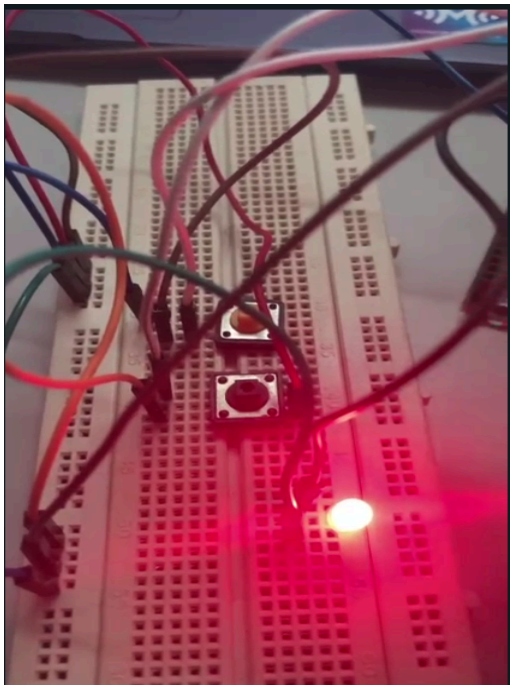


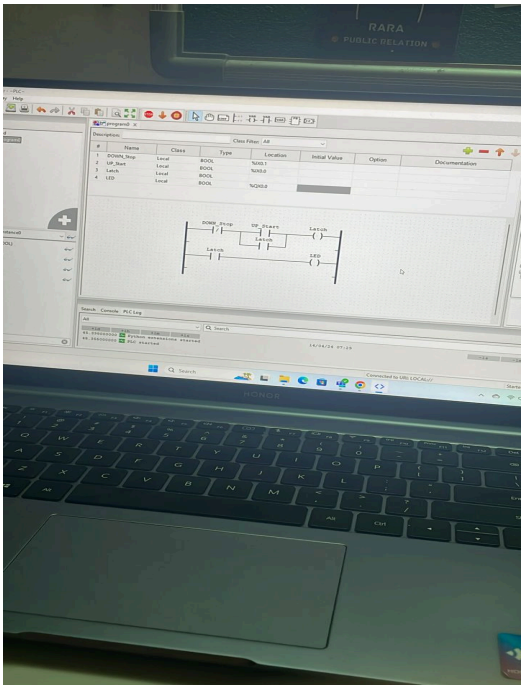

Fig. 6

**PROCEDURE**

1. Create the ladder diagram seen in Figure 5.
2. List all variables utilised in the ladder diagram.
3. Use OpenPLC Editor to compile and simulate the ladder diagrams.
4. Upload the ladder diagram to the Arduino board.
5. Select the right COM port number and pin relationship for OpenPLC variables and Arduino board.
6. Build the circuit as seen in Figure 6.
7. Test the functioning.

## RESULTS





## DISCUSSION

- **Hardware**

  The hardware components are vital for assuring the performance and reliability of control circuits like the Start-Stop Control Circuit described in the task.An Arduino board, push-button switches, an LED, resistors, wires for jumpers, and a piece of breadboard are among the hardware components used in this scenario. The push-button switches serve as the input devices and the Arduino board functions as the microcontroller, interpreting the

ladder diagram logic created using OpenPLC. As the output display, the LED shows the result depending on the logic that has been written. In order to guarantee that the control circuit works properly, it is important that the hardware components be functional.

- **Electrical**

  Start-Stop Control Circuit connects a number of electrical components. Considerations including of voltage and current ratings, power distribution, and signal conditioning are crucial to this conversation.It is essential to know the electrical properties of components, like push-button switches and Arduino pins, in order to make safe connections and avoid electrical errors. Furthermore, during circuit assembly and testing, it is important to follow safety procedures and standards to reduce the possibility of electric shock, short circuits, or component damage.

- **Software**

  Ladder diagram logic may be converted into executable instructions easily thanks to OpenPLC Editor's connection with the Arduino board. Ladder diagrams can be created, simulated, and uploaded to the microcontroller using the software, allowing electromechanical operations to be automated and controlled. Real-time responsiveness and synchronisation require uninterrupted interaction between the hardware and software components.

## CONCLUSION

In conclusion, the development of a Start-Stop Control Circuit utilising OpenPLC ladder diagram design, compilation, simulation, and transfer to an Arduino UNO board illustrates the

practical integration of industrial control ideas with microcontroller-based hardware. By employing items such as push button switches, LEDs, resistors, and jumper wires, the experiment gives hands-on experience in building and executing control systems. The procedure requires learning ladder diagram programming, setting pin connections, and verifying the functionality through simulation before deployment into the Arduino board. This experiment serves as a useful instructional exercise for learning about PLC programming, circuit design, and microcontroller interface, showing the multidisciplinary aspect of control engineering and embedded systems.

## REFERENCES

[1]"PLC Ladder Logic on an Arduino: Building a Start-Stop Circuit [Article],"
https://control.com/technical-articles/plc-ladder-logic-on-an-arduino-building-a-start-stop-circuit/
[2]"Simulating a PLC ladder diagram on arduino"
https://forum.arduino.cc/t/simulating-a-plc-ladder-diagram-on-arduino/130132

## RECOMMENDATION

When conducting the experiment to build a Start-Stop Control Circuit, numerous measures may be taken to reduce mistakes and assure reliable results. Firstly, confirm that all components are properly connected according to the circuit schematic, with correct polarity and pin configurations. Double-check the wiring to eliminate any loose connections or short circuits that might lead to unexpected behavior. Additionally, validate the operation of individual components such as push button switches, LEDs, and resistors before integration into the circuit. When programming the ladder diagram in OpenPLC Editor, evaluate the reasoning carefully to avoid

logical mistakes or undesired actions. During simulation, watch the circuit attentively for any abnormalities or differences between predicted and observed outcomes. Finally, while transferring the ladder diagram program to the Arduino board, confirm compatibility with the board's hardware and firmware versions, and follow the instructions supplied by the OpenPLC software. By following these measures, you may reduce potential mistakes and ensure a smooth implementation of the experiment.

**ACKNOWLEDGEMENT**

A special thanks goes out to Dr. Wahju Sediono, Dr. Ali Sophian, Dr. Zulkifli Bin Zainal Abidin, my teaching assistant, and my peers for their invaluable help and support in finishing this report. Their advice, feedback, and experience have greatly influenced the level of quality and understanding of this work. Their time, patience, and commitment to supporting my academic success are greatly appreciated.

**STUDENT'S DECLARATION**

**Certificate of Originality and Authenticity**

This is to certify that we are responsible for the work submitted in this report, that **the original work** is our own except as specified in the references and acknowledgement, and that the original work contained herein have not been untaken or done by unspecified sources or persons.

We hereby certify that this report has **not been done by only one individual** and **all of us have contributed to the report**. The length of contribution to the reports by each individual is noted within this certificate.

We also hereby certify that we have **read** and **understand** the content of the total report and that no further improvement on the reports is needed from any of the individual contributors to the report.

We, therefore, agreed unanimously that this report shall be submitted for **marking** and this **final printed report** has been **verified by us.**

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