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يُونِيسَيْتِي إِسْلَامُ أَنْتَارَايُغْسِيَا مَلَيْسِيَا  
*Garden of Knowledge and Virtue*

KULLIYAH OF ENGINEERING  
DEPARTMENT OF MECHATRONICS ENGINEERING

Mechatronics System Integration (MCTA3203)

**WEEK 5: Programmable Logic Controller (PLC)**

Section 1  
(Group E)

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Date of submission: 15/11/2023

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## **Abstract**

A Programmable Logic Controller (PLC), is a ruggedized computer used in industrial automation. These controllers are used to automate a specific process, machine function, or even an entire production line. In this experiment , the OpenPLC editor, a free software PLC is used to interface a ladder diagram to a microcontroller and control the blinking of an LED.

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## **1.1 Introduction**

Programmable Logic Controller (PLC) is a specialized industrial computer used for controlling and automating electromechanical processes in manufacturing plants, machinery, and various other applications. In this session, OpenPLC Editor is used and interfaced with a microcontroller.

Objectives:

1. Understanding both software and hardware aspects of PLC interfacing with Microcontrollers.
2. To link an interface of a PLC with a microcontroller via OpenPLC.

## **1.2 Materials & Equipments**

1. OpenPLC Editor Software
2. Arduino Board
3. 2 push buttons switches
4. Jumper wires
5. LED
6. Resistors
7. Breadboard

## **1.3 Experiment setup**

Software setup:

1. Create the ladder diagram shown in Fig. 5.1
2. Specify all variables used in the ladder diagram.
3. Compile and simulate the ladder diagram in OpenPLC Editor.

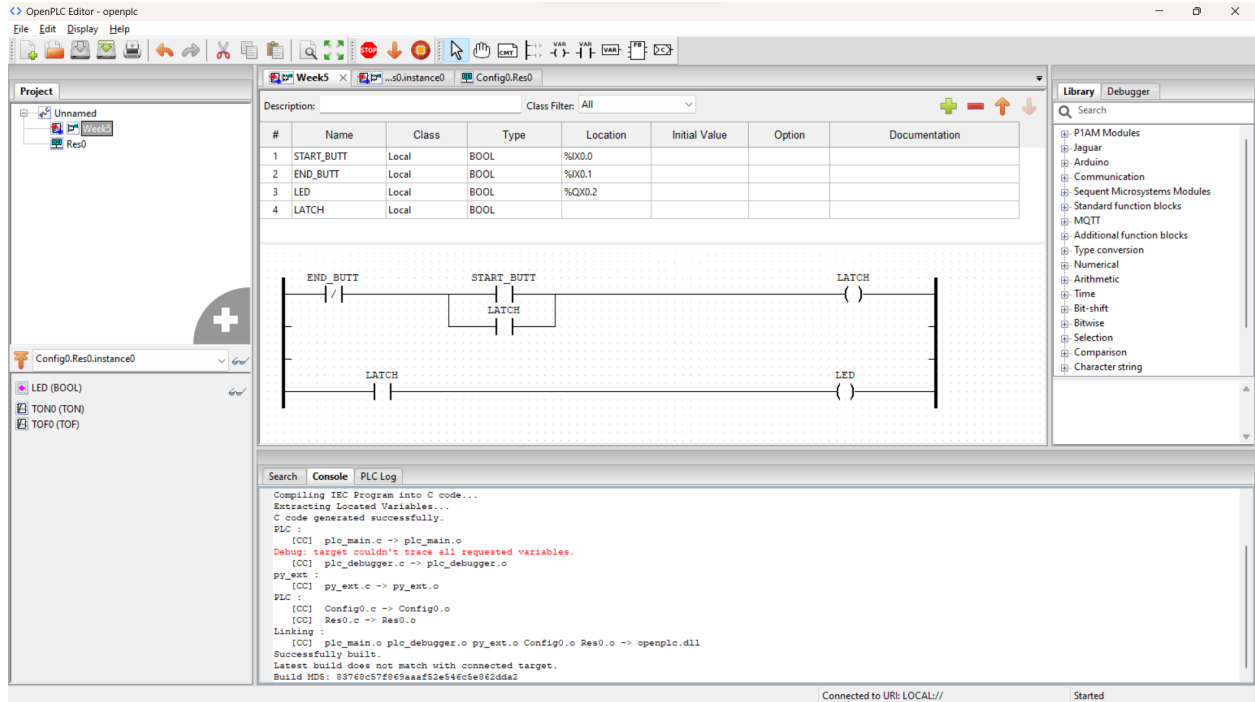


Figure 5.1: Ladder diagram to latch an LED output

Circuit setup:

1. Connect the cathode of the LED to the ground while the anode of the LED to the Arduino pin and 5V.
2. Connect both push buttons to the Arduino digital pin, Vcc, and ground according to Figure 5.2

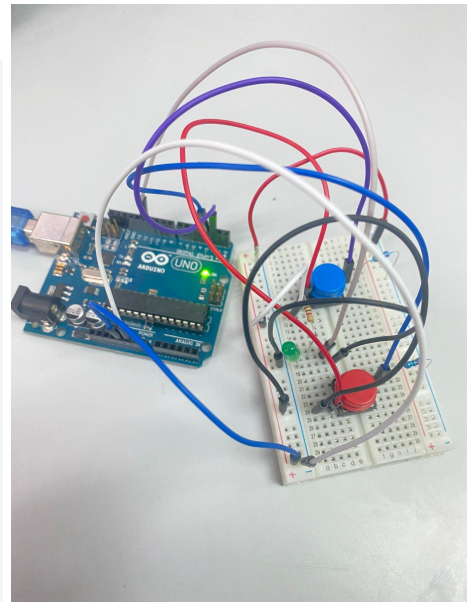
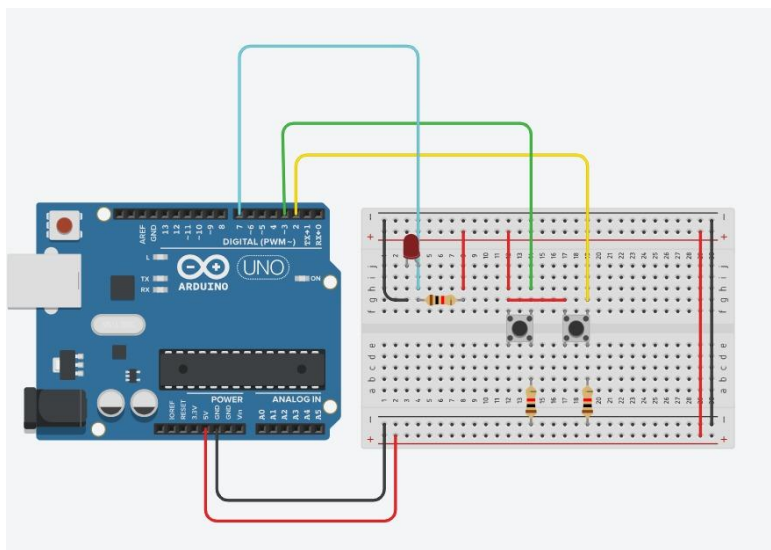


Figure 5.2: Circuit setup of experiment

## 1.4 Methodology

1. Connected Arduino board with computer via USB cable
2. Uploaded the ladder diagram to the Arduino board
3. Ensured to select the correct COM port number and all pin associations between the OpenPLC variables and Arduino board.
4. Tested the functionality.
5. Pushed the blue button to turn on the led light and red button to turn off the led light.

## 1.5 Data Collection

- No data collection

## 1.6 Data Analysis

- No data analysis

## 1.7 Results

- As the blue push button is pressed, the LED lights up while as the red push button is pressed, the LED turns off.

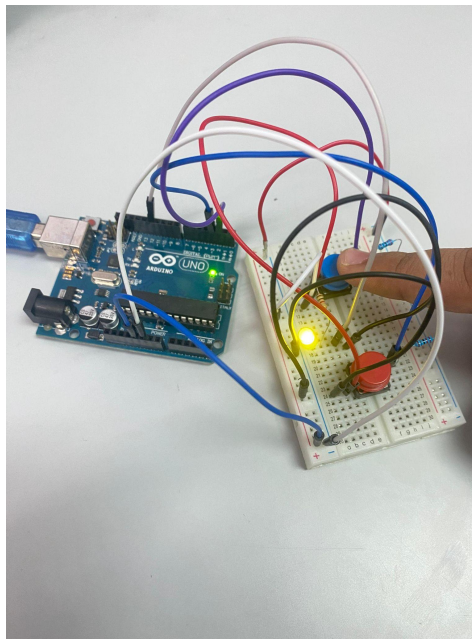


Figure 5.3: LED turned on after pressing the button

**Link Video (refer to GitHub “LEDButton-Demo”):**

<https://github.com/EimanAzzam/Group-E-Mecha-Integration/blob/main/Week5/LEDButton-Demo.mp4>

## 1.8 Discussion

We modified the ladder diagram and utilized timer blocks to control the blinking time interval of the LED. We then simulated the modified ladder diagram program to our Arduino board and recorded the results. The results show that the LED blinking interval was successfully controlled, with two different blinking intervals successfully outputted.

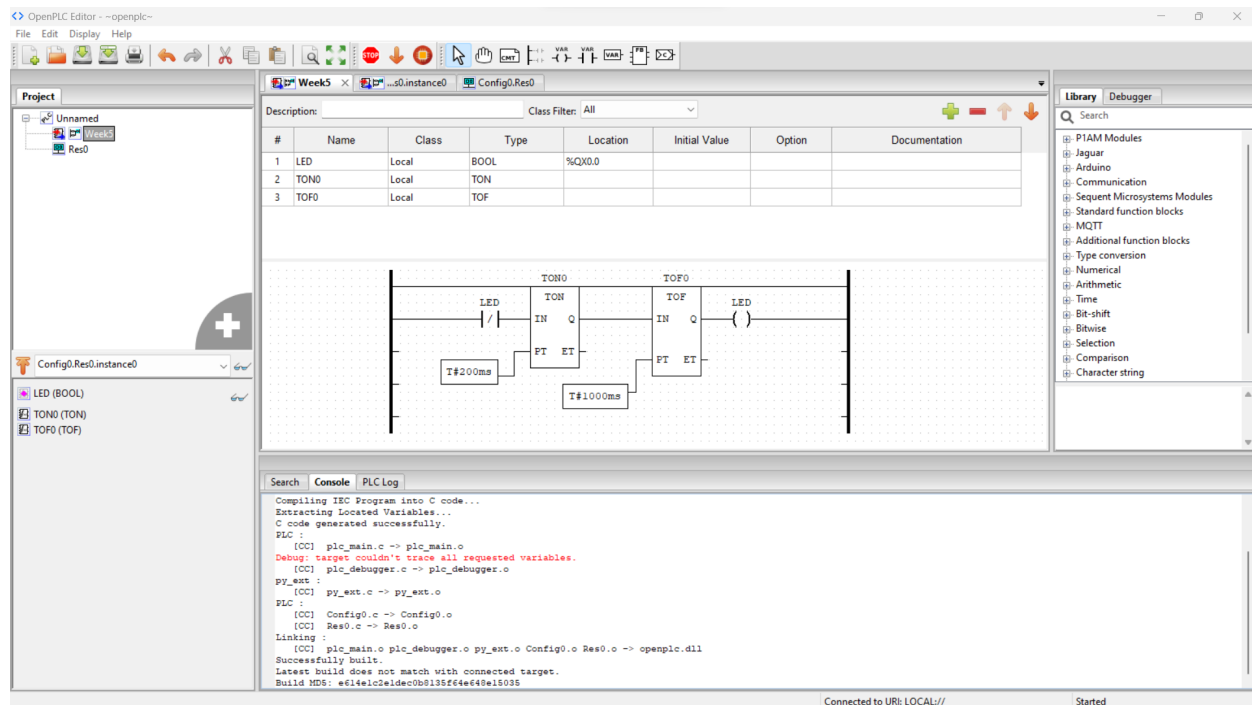


Figure 5.4: Ladder diagram with timer blocks to control LED blinking interval

**Link video (refer to GitHub “Blink1-Demo” and Blink2-Demo):**

**Blink1-Demo:**

<https://github.com/EimanAzzam/Group-E-Mecha-Integration/blob/main/Week5/Blink1-Demo.mp4>

**Blink2-Demo:**

<https://github.com/EimanAzzam/Group-E-Mecha-Integration/blob/main/Week5/Blink2-Demo.mp4>

## 1.9 Conclusion

Based on the experiment, all the objectives were achieved. We learned how to interface the Arduino board using a ladder diagram by using OpenPLC software to control the LED by switching on and off by pressing the push button.

### **1.10 Recommendations**

Use a larger breadboard so the wire connections will become more tidy and neat.

Explore other alternatives to ladder diagram software and understand their advantages and disadvantages. This will help us find the best choice of simulator for future simulations.

Use correct color coding for wires, such as red for VCC and black for GND to avoid wiring mistakes and makes it easy for others to analyze the circuit.

### **1.11 References**

1. Autonomy - Physical Addressing (2022)

<https://autonomylogic.com/docs/2-4-physical-addressing/>

### **1.12 Appendices**

Refer to GitHub for coding and videos.

### **1.13 Acknowledgements**

We would like to acknowledge our instructor, Dr. Nadzril Bin Sulaiman for teaching us how to interface the Arduino board by using OpenPLC editor software and answering all our tedious questions due to the difficulties we faced during the experiment. We hope to learn more in the future from such a talented instructor if the opportunity arises.

We would also like to give thanks to Allah S.W.T for giving us guidance in demonstrating this experiment successfully.

### 1.14 Student's Declaration

Declaration:

We certify that this project/assignment is entirely our own work, except where we have given fully documented references to the work of others, and that the material in this assignment has not previously been submitted for assessment in any formal course of study.

adam

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