Department of Robotics and Mechatronics Engineering

University of Dhaka

Laboratory Report

Course: RME 3112 (Advanced Mechatronics Engineering Lab)

Experiment number: 06

Name of experiment: Programming a PLC trainer to sort metallic cylinders based on their height

Group no.: 01

Group members:

1) Abdul Monaf Chowdhury (Roll: FH-092-001)

2) MD. Sameer Iqbal Chowdhury (Roll: SH-092-002)

3) Mikdam-Al-Maad Ronoue (Roll: FH-092-003)

4) Tapos Biswas (Roll: JN-092-004)

5) Safaeid Hossain Arib (FH-092-020)

6) Rabeya Akter (SK-092-015)

Prepared by: Mikdam-Al-Maad Ronoue

Experiment performed on: 25th April 2022

Date of submission: 13th May 2022

Submitted to:

Dr. Shamim Ahmed Dewan

Assistant Professor

Department of Robotics and Mechatronics Engineering,
University of Dhaka

Objectives:

1) Understanding how PLC works.
2) Understanding ladder diagram and ladder logic programming.
3) Combining ladder logic programming with PLC to program an automation process.
4) Sorting metallic cylinders based on their heights.

Theory:

A **Programmable Logic Controller**, or **PLC**, is a ruggedized computer used for industrial automation. These controllers can automate a specific process, machine function, or even an entire production line.
PLC stands for Programmable Logic Controller. They are industrial computers used to control different electro-mechanical processes for use in manufacturing, plants, or other automation environments. PLCs vary in size and form factors. Some are small enough to fit in your pocket while others are large enough to require heavy-duty racks to mount. Some PLCs can be customized with backplanes and functional modules to fit different types of industrial applications.

PLCs are widely used in a variety of industries because they're fast, easy to operate and are considered easy to program. PLCs can be programmed in several ways, from ladder logic, which is based on electromechanical relays, to specially adapted programming languages of BASIC and C, to name a few.

Most PLCs today use one of the following 5 programming languages: Ladder Diagram, Structured Text, Function Block Diagram, Instruction List, or Sequential Function Charts.

Fig 1: PLC

Ladder logic is a programming language that creates and represents a program through ladder diagrams that are based on circuit diagrams. It is mainly used in developing programs or software for programmable logic controllers (PLCs), which are used in industrial applications. The language evolved from originally being a method for documenting the design and construction of relay racks used in manufacturing and process control, with each relay rack represented by a symbol on the ladder diagram that has connections to devices below them that look like vertical rails. The relay symbols themselves look like rungs in a ladder.

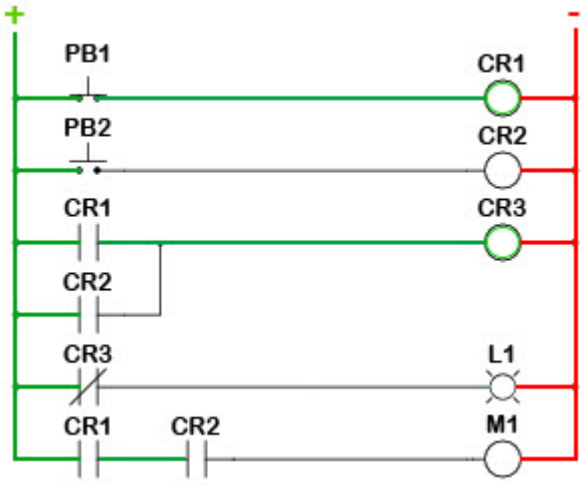
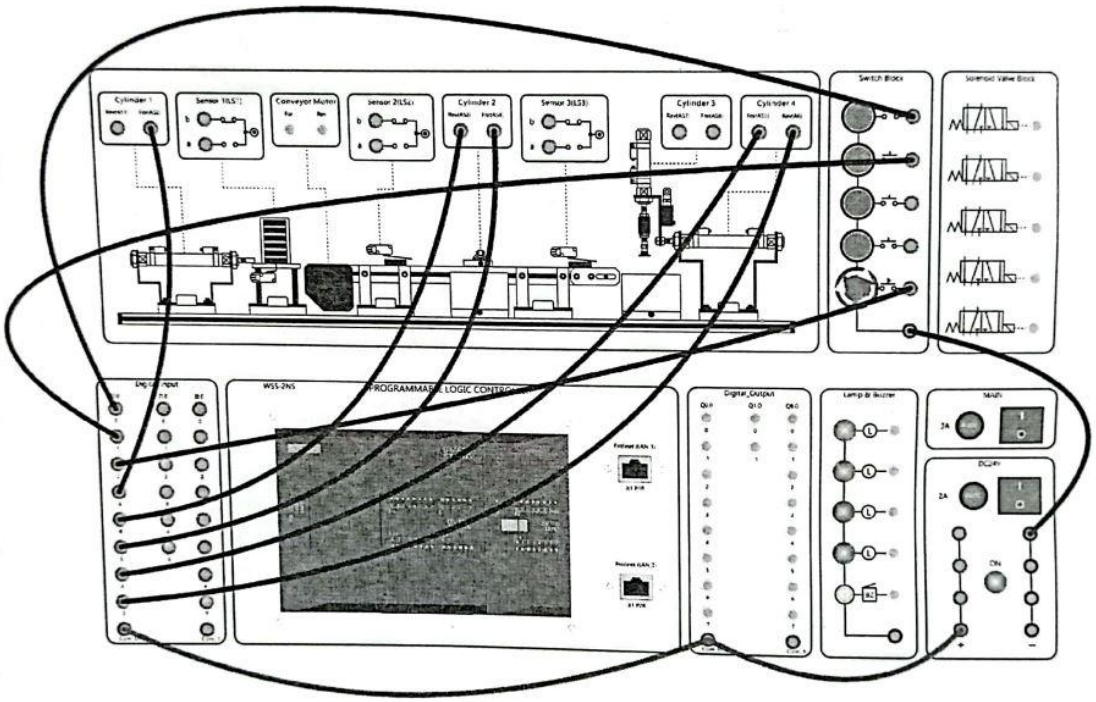


Fig 2: An example of Ladder Logic.

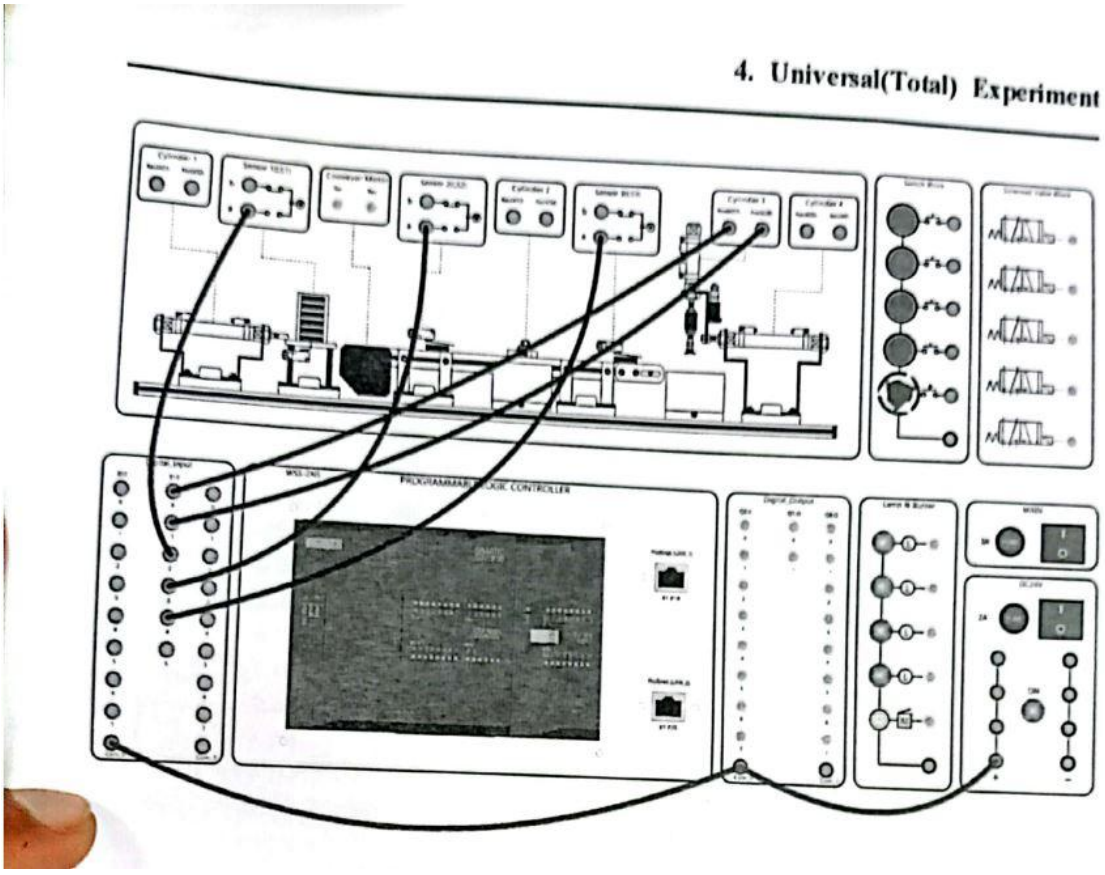
Procedure:

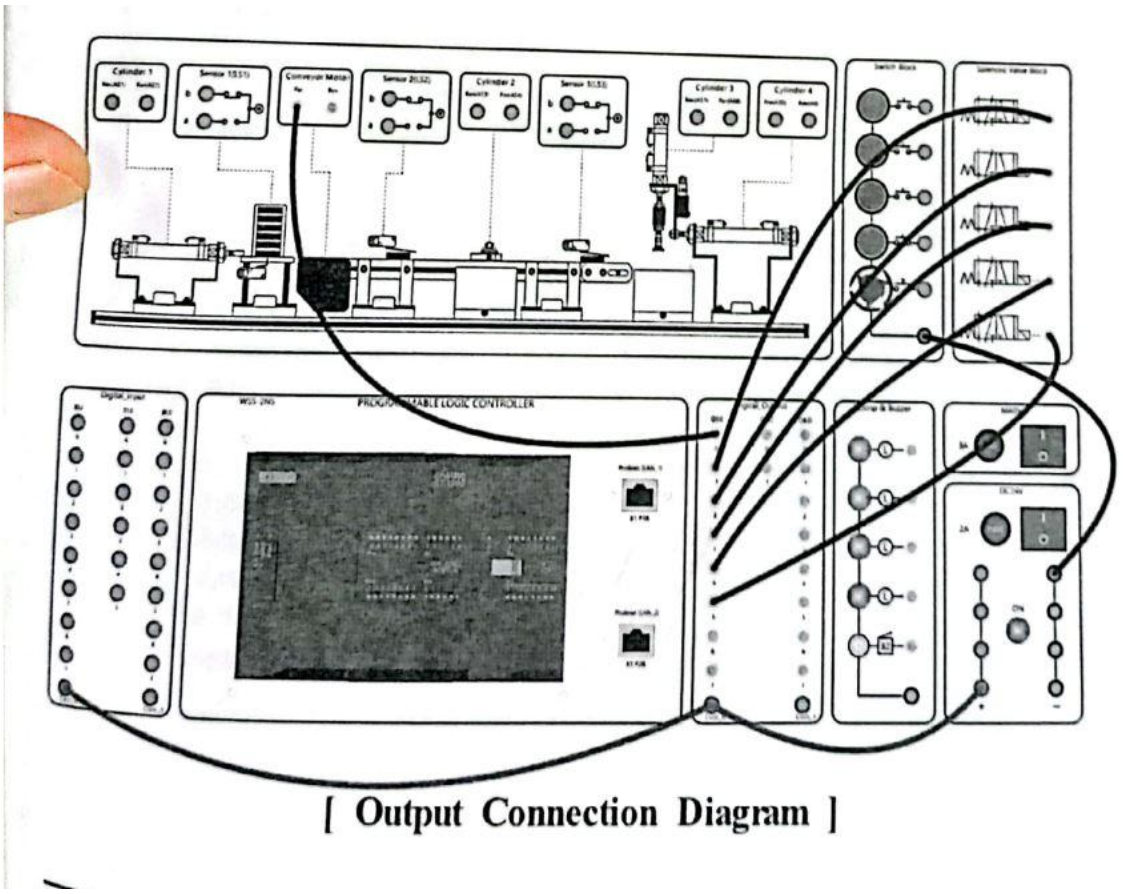
1) Firstly we connected all the inputs and outputs of the plc with the sensors, conveyor motor, cylinder, and pressure valves according to the diagram.

D. Connection Diagram



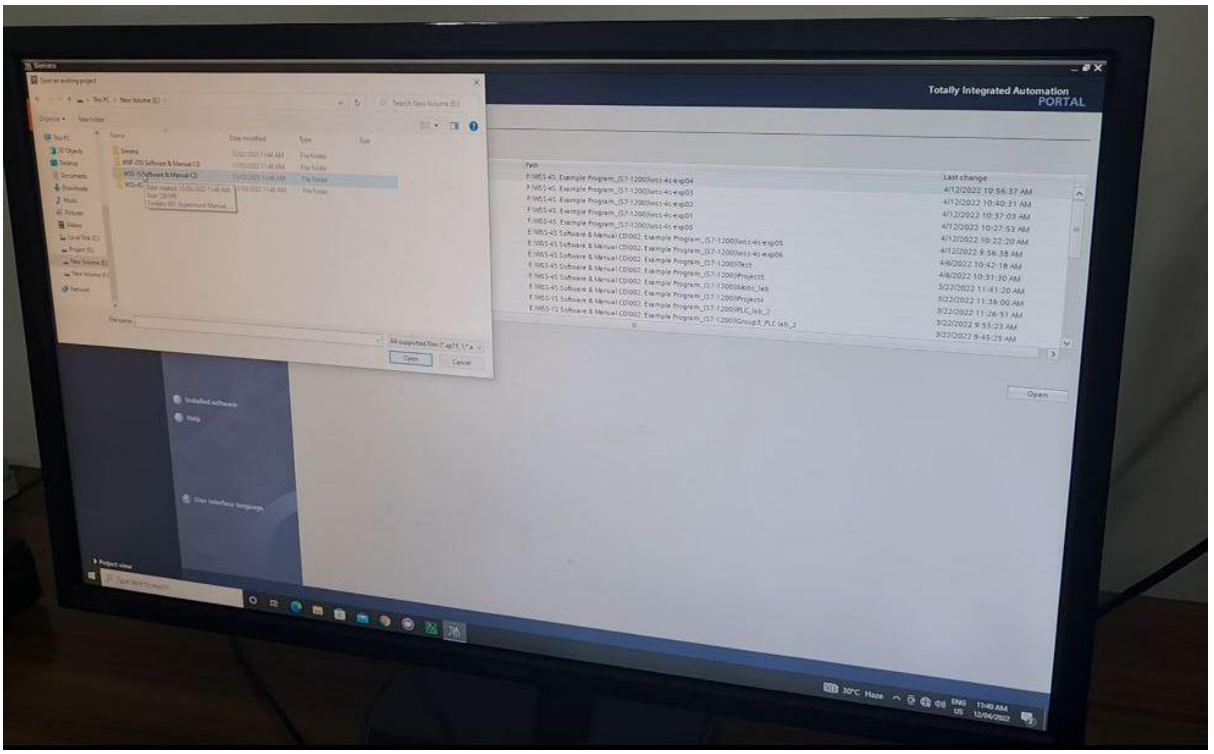
[Input Connection Diagram 1]



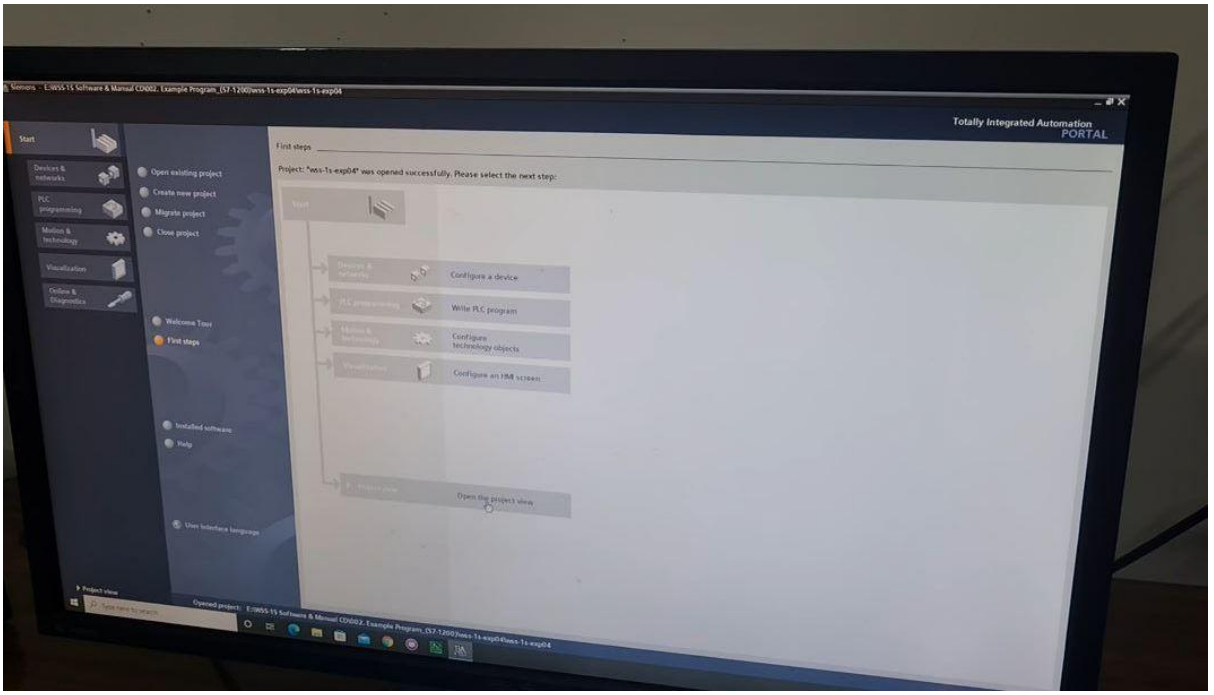


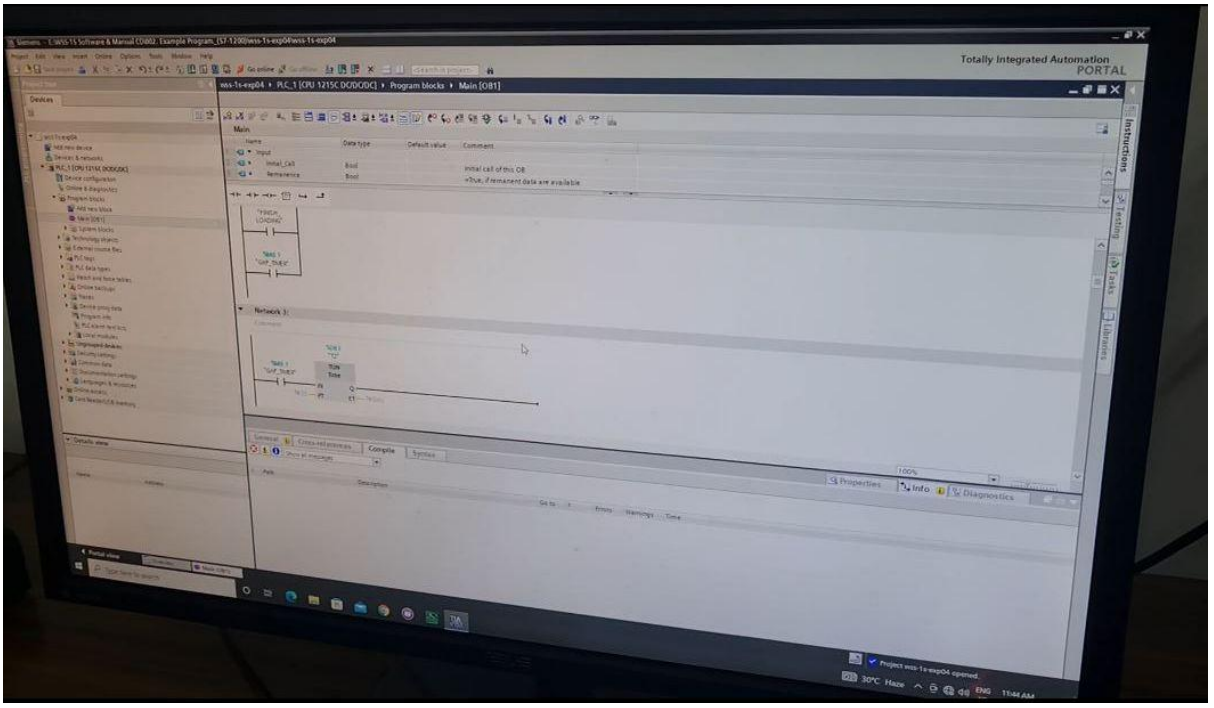
[Output Connection Diagram]

2) Then we opened the TIA Portal software on our PC. Then from the browsed option we opened the Universal Program file and selected the 4th experiment example from there.

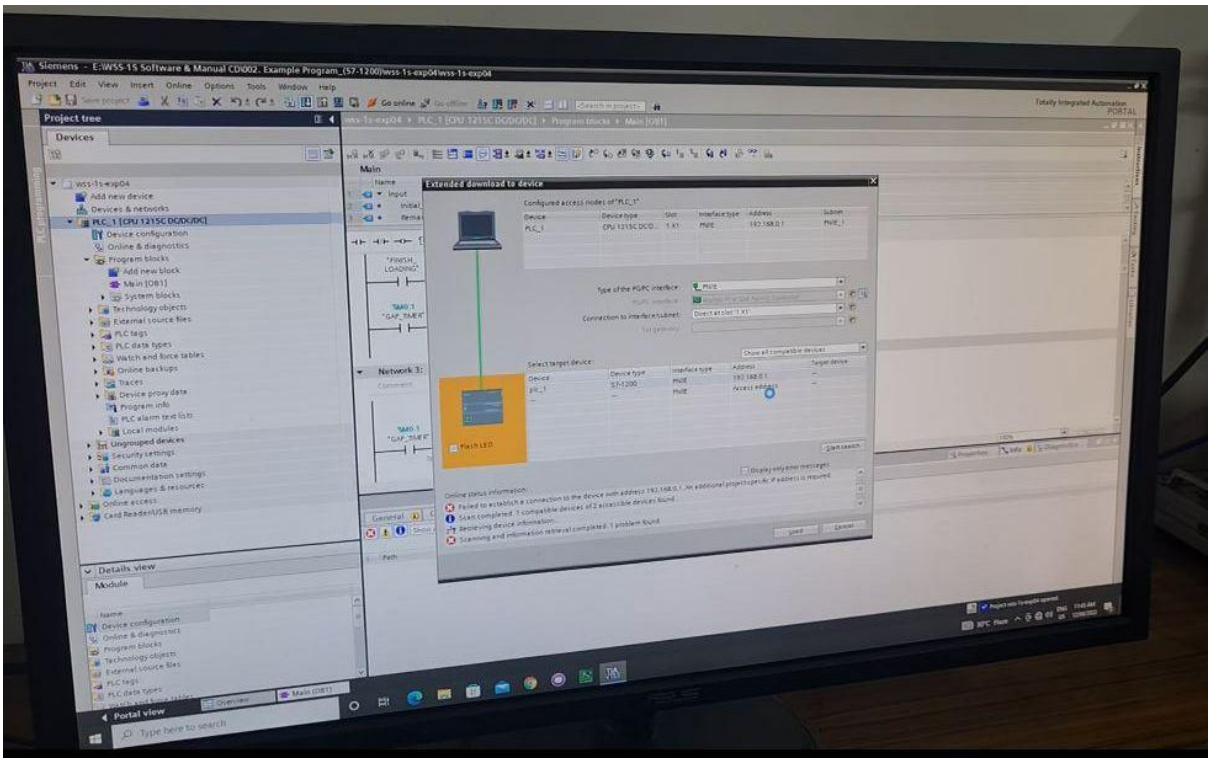


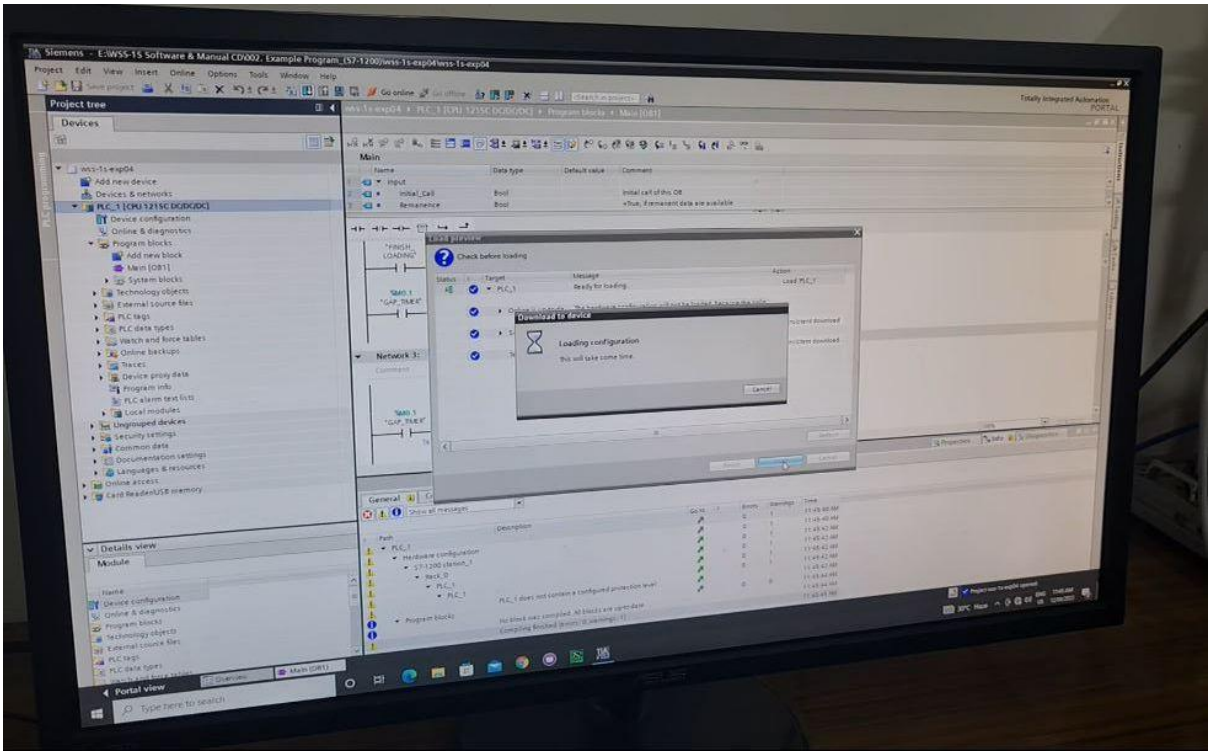
3) Then we will select the “Open the project drill” option.





4) Then to upload the program we will click on the “PLC” option and then select the “Download” option. This will upload the ladder program into the PLC.





Result:

1. As we turned on the PLC and pressed the start button, the process started. Firstly a piston gently pushed a cylinder(silver) on the conveyor belt which then passed through a sensor that measured the height of the cylinder.

2. As the height was less than the threshold value, the cylinder was picked up by the manipulator and put in the box below it.

3. Then the process ran until a red cylinder came into the conveyor belt. The height of the red cylinder was more than the threshold, so after detection, a piston pushed it to a different box in front of it.

Hence the process of sorting cylinders based on their height worked perfectly.

Conclusion:

The process ran perfectly, except for one case. One time the piston that pushed the red cylinders was a little bit slow to perfectly push it to the basket. Before pushing it, the cylinder got away. This happened because there was some kind o leakage on the joint of this cylinder which we then fixed by tightening a screw. Besides this, the whole process ran smoothly.

References:

1) Image of the PLC was taken from
https://www.toshiba.com/tic/other-products/plcs/type1-light

2) Example of Ladder Logic taken from
https://library.automationdirect.com/understanding-ladder-logic/