Complex Engineering Project

Subject:	Electric Measurement and Instrument. (EE383)
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Title:	PLC PROGRAMMING (AUTOMATIC DOOR CONTROL)
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INTRODUCTION:

This project is related to PLC(programmable logic controller) programming. For programming, we use LOGIX-pro software. We have to design the PLC logic that refers to the automatic door system this logic can be used in different applications. This project not only refers to the program but also the software simulation. We use feedback logic rather than latches to make it seem more efficient.

OBJECTIVE:

The objective of this project is as follows.

1. Design the PLC program logic for Automatic door control.
2. Implement the logic on software simulation.
3. Test the program.

AIM:

The aim of the project is as follows.

1. Initiate the system.
2. Emergency stop.
3. Open and Close logic.
4. Status Indicators (led bulbs).
5. No burning of motor(safety).

APPLICATIONS:

Applications of automatic door control system is as follows.

1. Industrial facilities.
2. Commercial buildings.
3. Garages and parking lot.
4. Hospital and laboratories.
5. Security systems.
6. Banks.

PROGRAMMABLE LOGIC CONTROL PROGRAMMING:

Definition:

The process of developing and composing a set of instructions that a Programmable Logic Controller (PLC) will adhere to to regulate and automate the operation of industrial equipment or processes is known as PLC programming. PLCs are specialized digital computers that monitor inputs, control outputs using established logic, and make choices in manufacturing and industrial automation.

Uses:

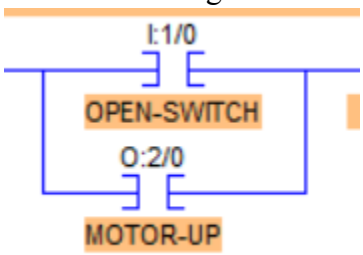
PLCs are frequently used to automate various operations, including managing a manufacturing process, operating machinery on a production line, and even supervising the operation of an entire industrial site.

Features:

1. Ladder logic programming.
2. Input-output configuration.
3. Control logic design.
4. Debugging and testing.

A. Ladder logic programming.

It is the basic logic that is used in PLC programming to perform different projects. It is named ladder logic because it seems like a ladder.



B. Input-output configuration.

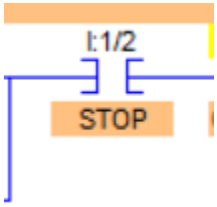
Instructions:

1) XIC.
2) XIO.
3) OTE.

A. XIC.

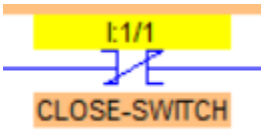
- It stands for EXAMIN IF CLOSED.

- It is used as an input.
- If the switch is closed then it is energized(1) and if open then it is not energized.



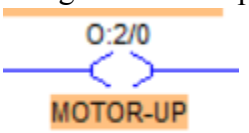
B. XIO.

- It stands for EXAMIN IF OPEN.
- It is also used as an input.
- It is energized when the switch is open and not energized on any other condition.



C. OIE.

- It stands for Output energized.
- It is used as an output.
- It depends upon the input.
- Energized when input is 1 and de-energized when input is 0.



C. <u>Control logic design.</u>

The designs are made depending upon the situation that refers to different outputs on different input conditions. The logic that is created should be clear and understandable.

D. <u>Debugging and testing.</u>

When a PLC program is made to check whether it is right or wrong we have to cheak it using a simulator we have different simulators available in LOGIX pro such as,

1. Input-output simulation.
2. Traffic light simulation.
3. Door simulation.

E. <u>LATCHES:</u>

LATCH

It is used to store the bit and will not change its state even when the input goes from on to off condition. And when input is on it stores 1 as a bit.

UNLATCH.
It is used to store the bit and will not change its state even when the input goes from on to off condition. And when input is on it stores 0 as a bit.

LOGIX PRO:

Logix Pro is often used in educational settings and training programs to simulate PLC programming without the need for actual hardware. . In this project, we use LOGIX Pro to design the software.

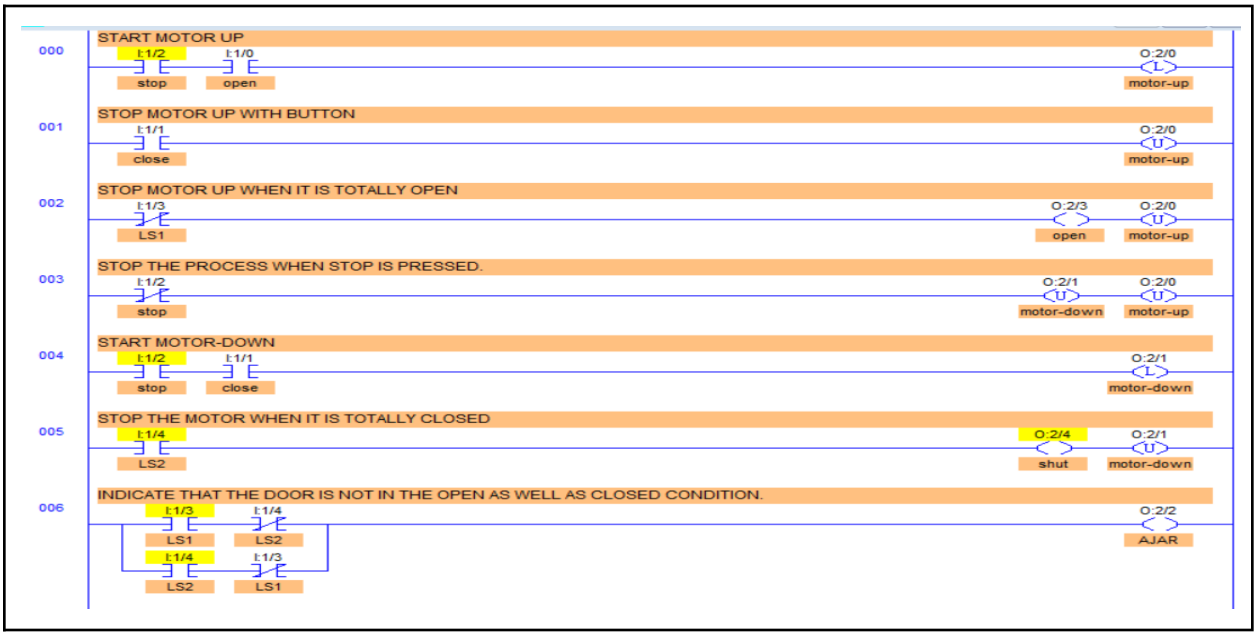
Question Statement:

- **In this exercise we want you to apply your knowledge of Relay Logic Instructions to design a ladder logic program for PLC which will maintain the appropriate door movement once the operator initiates. The Opening or Closing operation of the door will continue to completion even if the operator releases the pushbutton that initiated the movement. The program will adhere to the following criteria:**

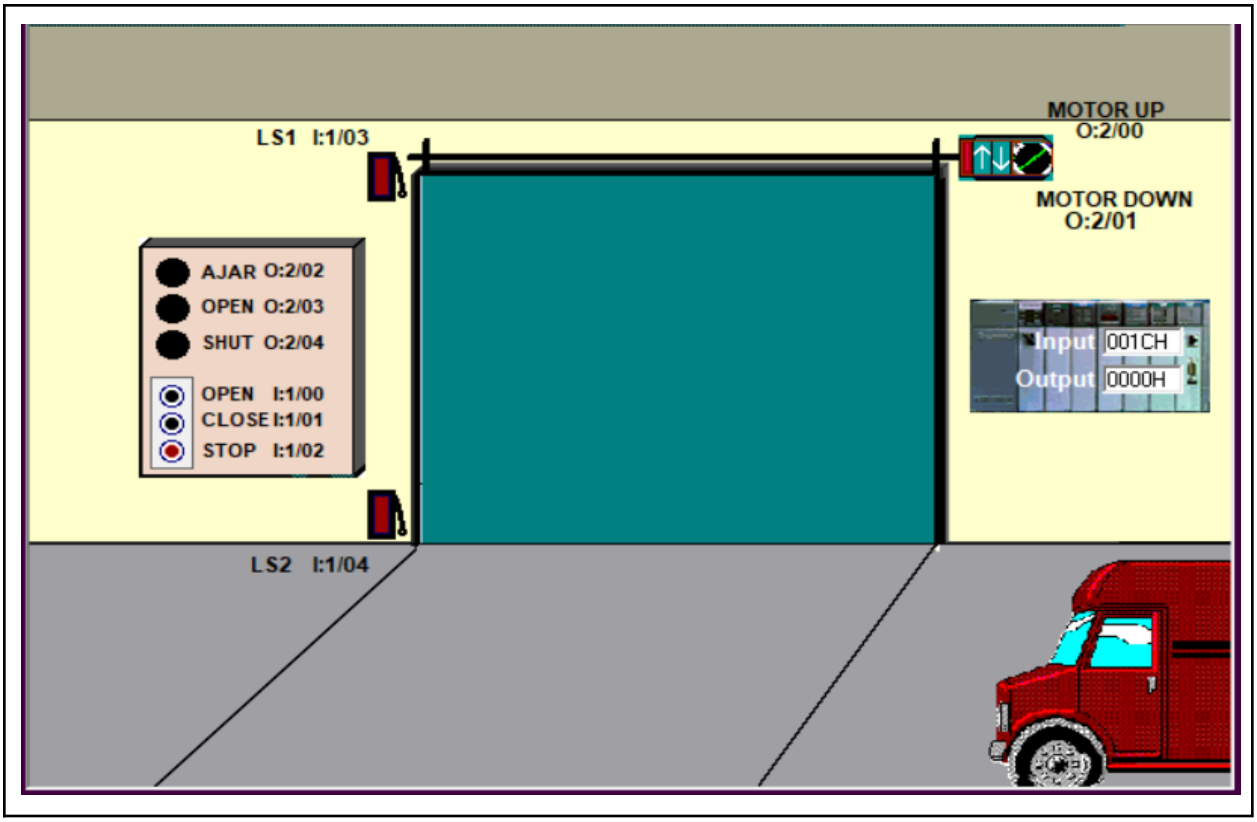
  - **The door system will be turned on when we press the start button**
  - **Door movement will halt immediately when the Stop Switch is initially pressed, and will remain halted if the switch is released.**
  - **Pressing the Open Switch will cause the door to Open if not already fully open. The opening operation will continue to completion even if the switch is released.**
  - **Pressing the Close Switch will cause the door to Close if not already fully shut. The closing operation will continue to completion even if the Switch is released.**
  - **If the Door is already fully opened, pressing the Open Switch will not energize the motor.**
  - **If the Door is already fully closed, pressing the Close Switch will not energize the motor.**
  - **The Ajar Lamp will be illuminated if the door is NOT in either the fully closed or fully opened position.**
  - **The Open Lamp will be illuminated if the door is in the Fully Open position.**
  - **The Shut Lamp will be illuminated if the door is in the Fully Closed position.**

PLC-PROGRAM:
WITHOUT LATCHES:

PLC-PROGRAM using latches:



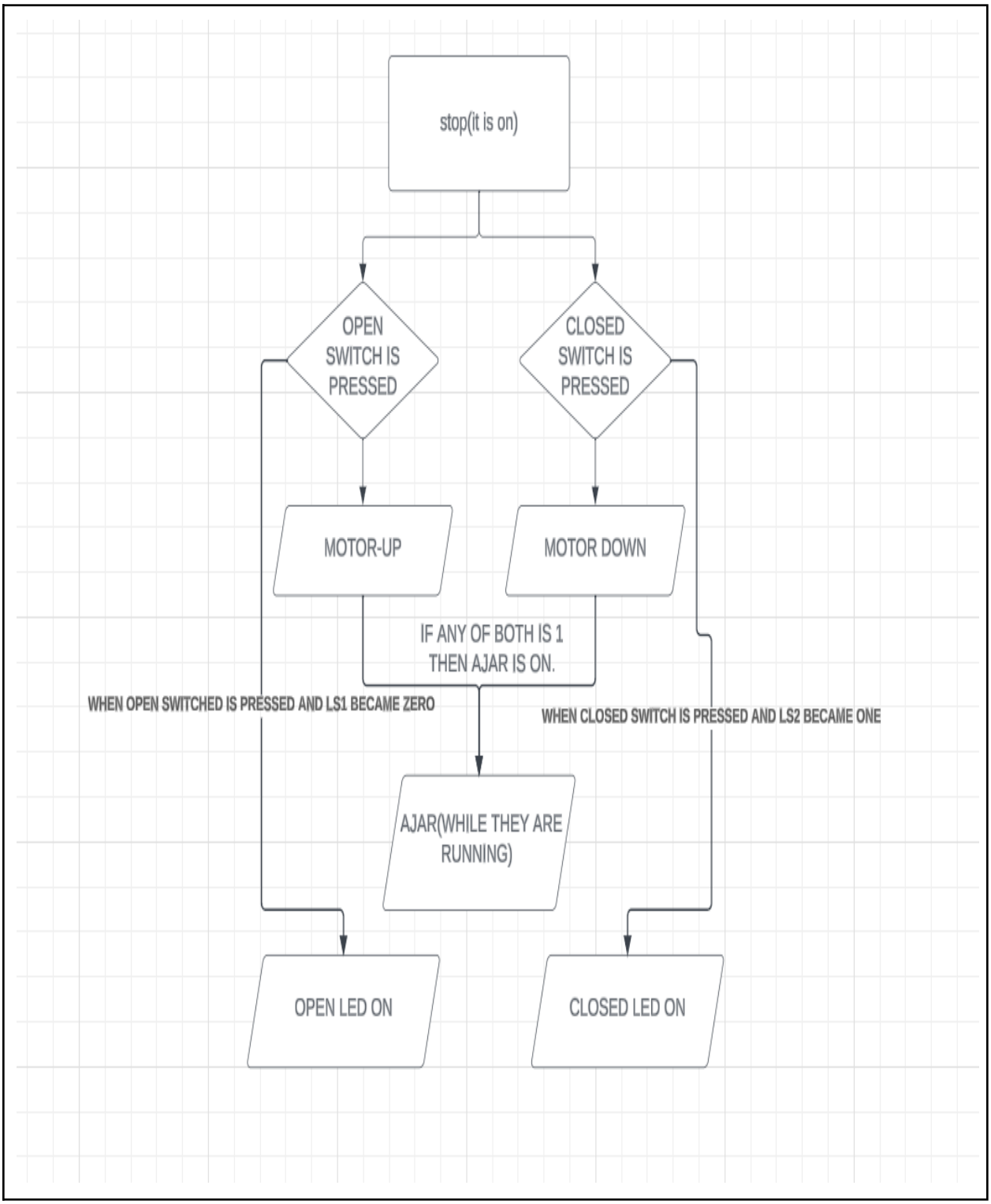
SIMULATOR WINDOW:



INPUT-OUTPUT:

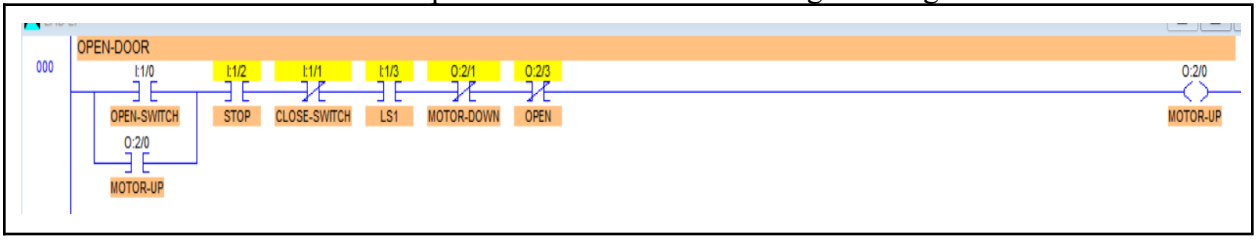
Input	Output	Led
open	Motor-up	Open
Closed	Motor -down	Shut
Stop		AJAR

FLOW DIAGRAM:

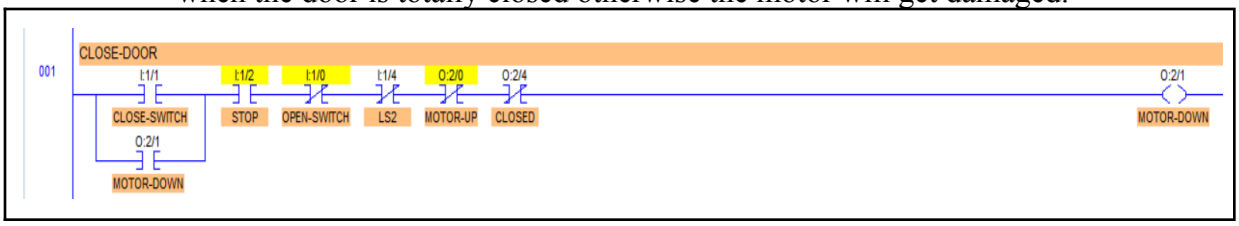


STEPS WITH EXPLANATION:
WITHOUT LATCHES:

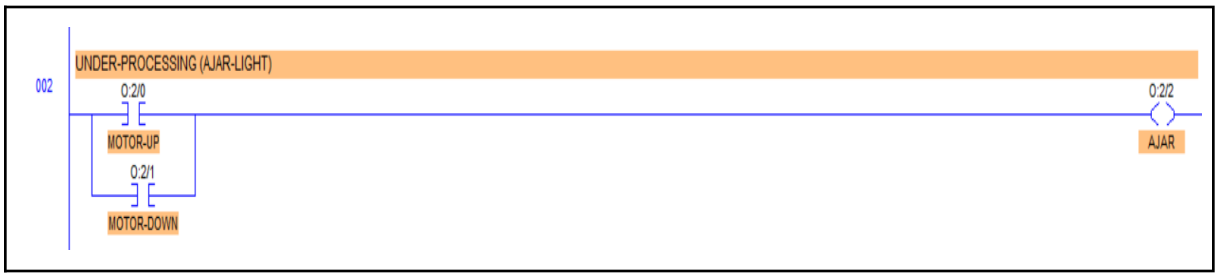
1. **1st RUNG:**
   - A. In this rung, we are turning on the motor that moves the door upwards.
   - B. This process depends upon the 3 inputs and 3 feedback inputs 1 is the input that is not controlled by the user in depends upon the door.
   - C. Open-switch, Closed-switch, and Stop are used as input.
   - D. Motor-up, Motor-down, and open are used as feedback input.
   - E. LS1 depends upon the door.
   - F. We use the open switch and motor up in OR condition because we have to run the motor even if the open switch goes into an off state after turning on.
   - G. A stop switch is used to stop the process when it is pressed.
   - H. Closing and opening processes can not be performed at the same time so we use the closed switch and motor down feedback input as XIO.
   - I. LS1 and open (as XIO and feedback input) is used because the motor has to stop when the door is open otherwise the motor will get damaged.



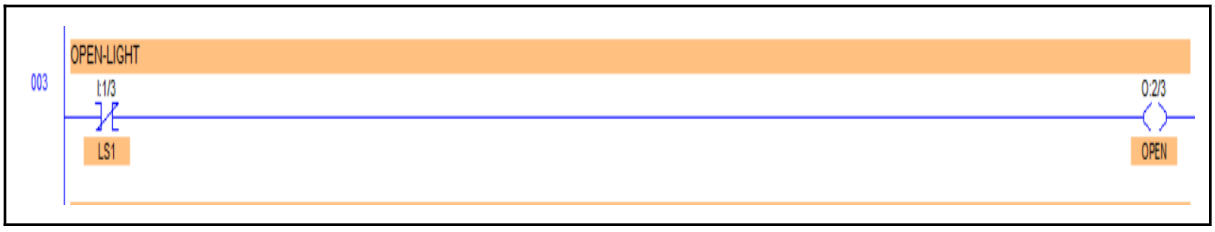
2. **2nd RUNG:**
   - **A.** In this rung, we are turning on the motor that moves the door downwards.
   - B. This process depends upon the 3 inputs and 3 feedback inputs 1 is the input that is not controlled by the user in depends upon the door.
   - C. Open-switch, Closed-switch, and Stop are used as input.
   - D. Motor-up, Motor-down, and open are used as feedback input.
   - E. LS2 depends upon the door.
   - F. In this, we use the closed switch and motor down in OR condition because we have to run the motor even if the closed switch goes into an off state after turning on.
   - G. A stop switch is used to stop the process when it is pressed.
   - H. Closing and opening processes can not be performed at the same time so we use the open switch and motor up feedback input as XIO.
   - I. LS2 and closed(feedback input) are used as XIO because the motor has to stop when the door is totally closed otherwise the motor will get damaged.



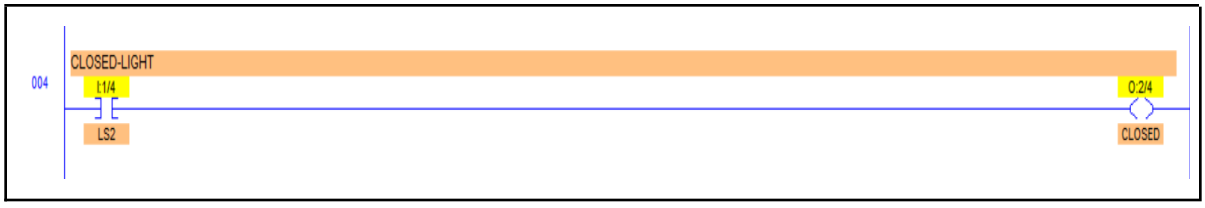
3. **3rd RUNG:**
   A. This rung has 2 feedback inputs.
   B. When one of them is on then it is on.
   C. At the output we have AJAR (slightly open) led.



4. **4th RUNG:**
   A. We have XIO input for the door to be totally open.
   B. LS1 is the switch that is attached at the top of the door it becomes zero when the door is open so it is used as XIO that can cause the open LED to be on when the door is fully open.



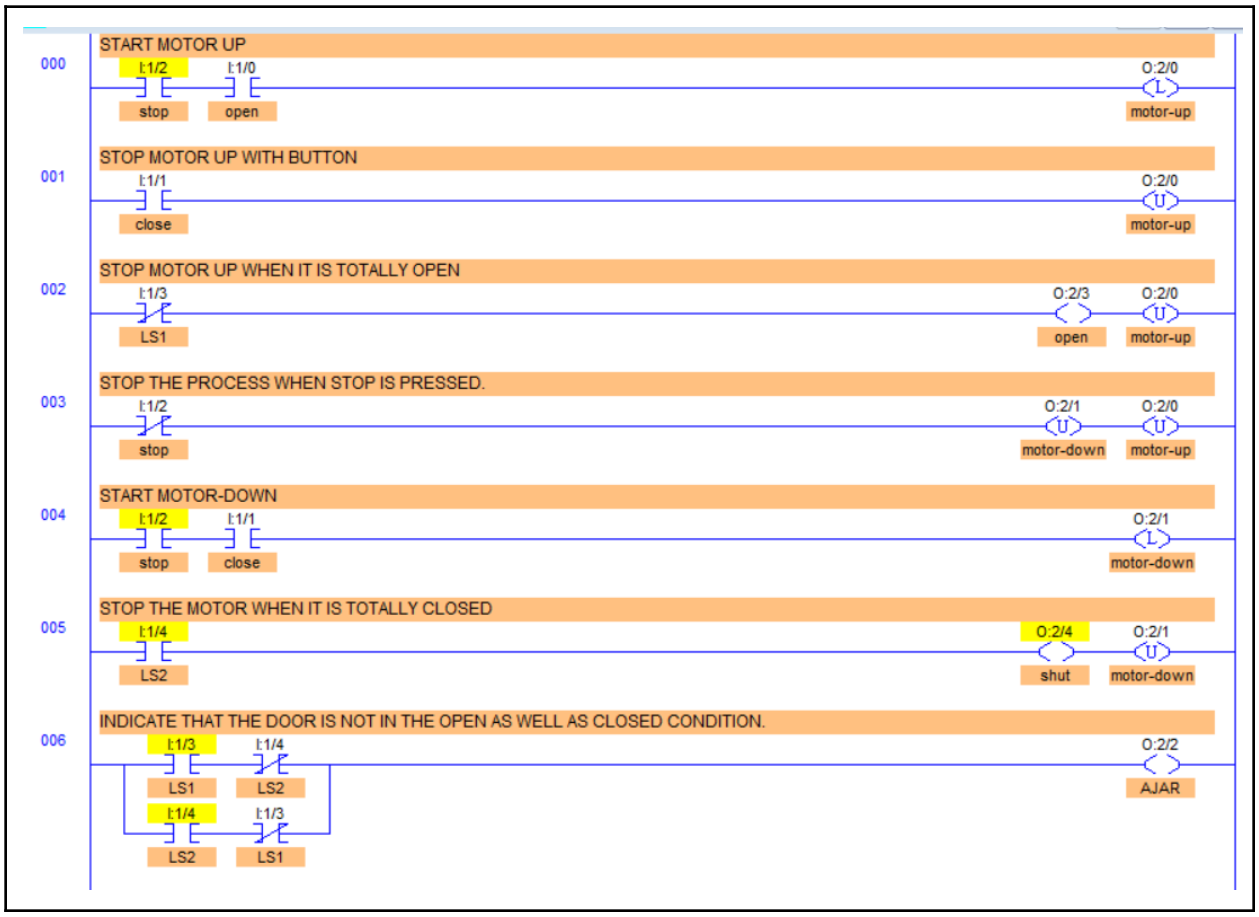
5. **5th RUNG:**
   A. We have XIC input for the door to be closed.
   B. LS2 is the switch that is attached at the bottom of the door when it is one means that the door is closed so when the switch is on or closed led will be on.



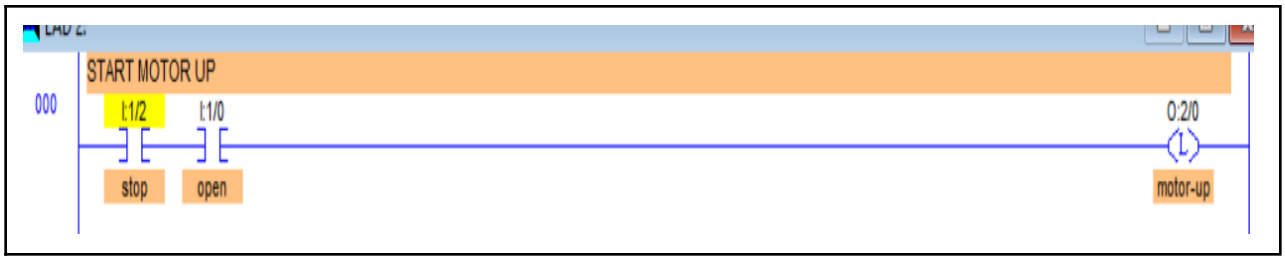
Using latches:

STEPS WITH EXPLANATION:

1ST RUNG:

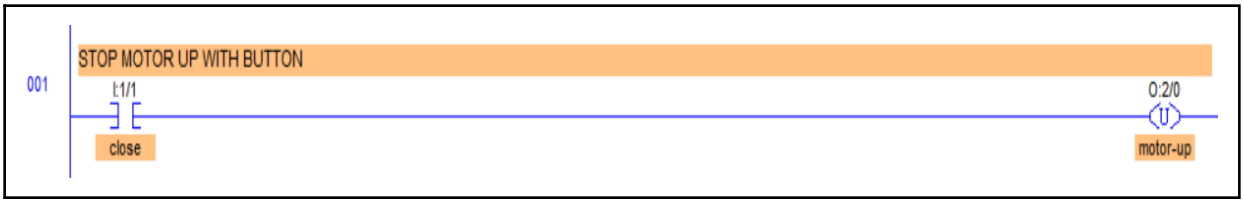


1. This will start the UP motor and store the output in the latch.



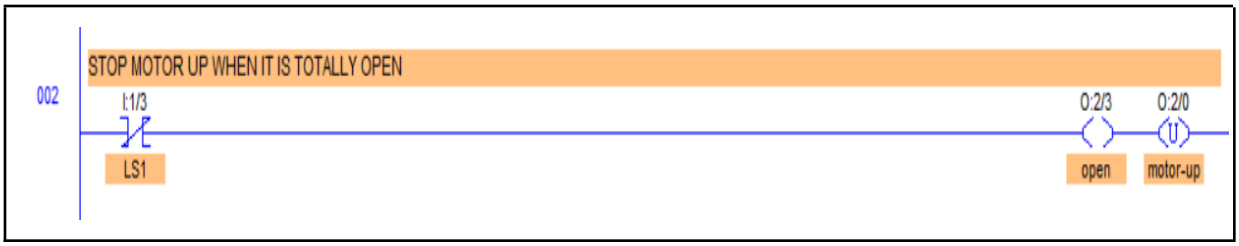
2ND RUNG:

1. When the closed switch is pressed the up motor will stop.



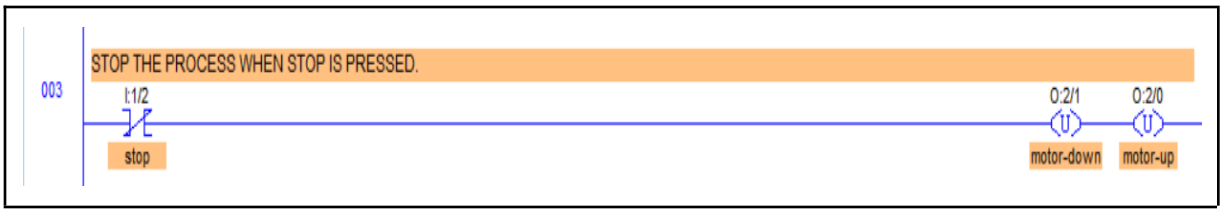
3RD RUNG:

1. This will turn off the motor when the door is opened.
2. It also turns on the open light.



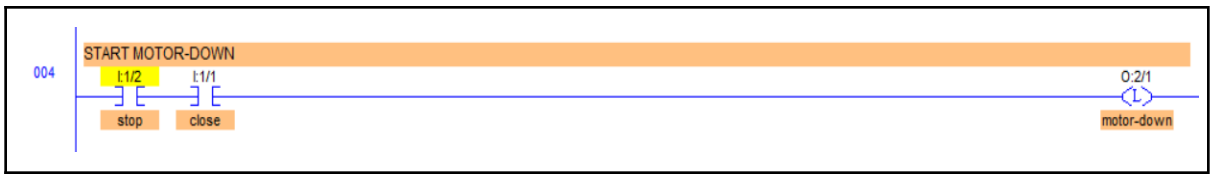
4TH RUNG:

1. When the stop switch is pressed the process will stop even if the door is opening or closing.



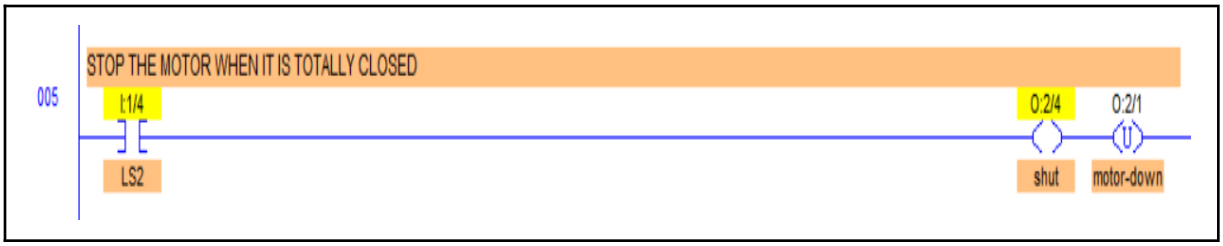
5TH RUNG:

1. when the closed switch is pressed the door will start closing.



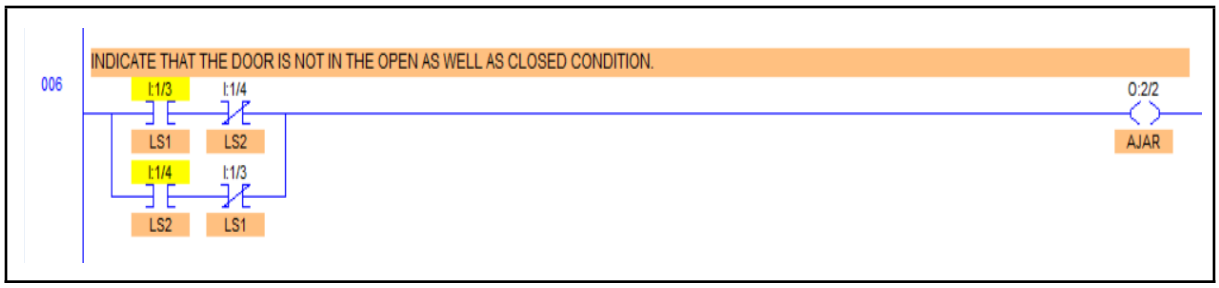
6TH RUNG:

1. When the door is fully closed the down motor should turn off.
2. It also turns the closed light indicating that the door is totally closed.



7TH RUNG:

1. This will show that the door is not in on condition as well as off condition.



Conclusion:

In conclusion, our PLC programming project successfully implemented an automatic door controller. The concept of ladder logic is used to design this project further we use latches and feedback effects. We tried to use as many rungs as we could because this made the program easy to understand. We used Logix Pro software for this. This software is only for software simulation hardware simulation software is not available. Moving forward automatic door control is very useful in many areas and it is efficient and gives us an indication of every task that is performed.