CO326: Industrial Networks
Lab 05 - Programmable Logic Controllers (PLCs)

Introduction

A **programmable logic controller** (**PLC**) or **programmable controller** is an industrial digital computer which has been adapted for the control of manufacturing processes, such as assembly lines, or robotic devices, or any activity that requires high reliability, ease of programming and process fault diagnosis.

PLCs can range from small modular devices with tens of inputs and outputs (I/O), in a housing integral with the processor, to large rack-mounted modular devices with a count of thousands of I/O, and which are often networked to other PLC and SCADA systems.

Lab Task

Required Devices and Tools

- Programmable Logic Controller (PLC)
- Unity Pro S software (download links will be provided)
  - EcoStruxureControlExpert (30 day trial, 2.2 GB)
        or
  - MachineExpertBasic (free version, 366 MB)

Video Demonstration

Refer to the video demonstration on programming the PLC available in the department with Unity Pro S via the FEeLS course page or by using the following Youtube link.

- https://www.youtube.com/watch?v=MvS3LRGdw90

Follow the instructions given in the video to set up a project in Unity Pro S software with the configurations required for the department's PLC, create an example ladder diagram, simulate the ladder diagram, and finally upload it to the PLC.

Lab Exercise

You are supposed to implement a "Pump Automation" system according to the following specifications.

The requirements for the design

- Tank level sensors TL and TH
- Well level sensors WL and WH
- All 4 sensors will be "Close Circuit" when water is equal to or above the sensor level.
- The water pump should be ON when the tank water level is lower than TL and the well water level is above WH.
- The water pump should turn off when the tank water level is high or the well water level is lower than WL.
- Draw ladder diagram to switch on and off the pump automatically
- Add push button to switch on the pump
- Add off button to switch off the pump
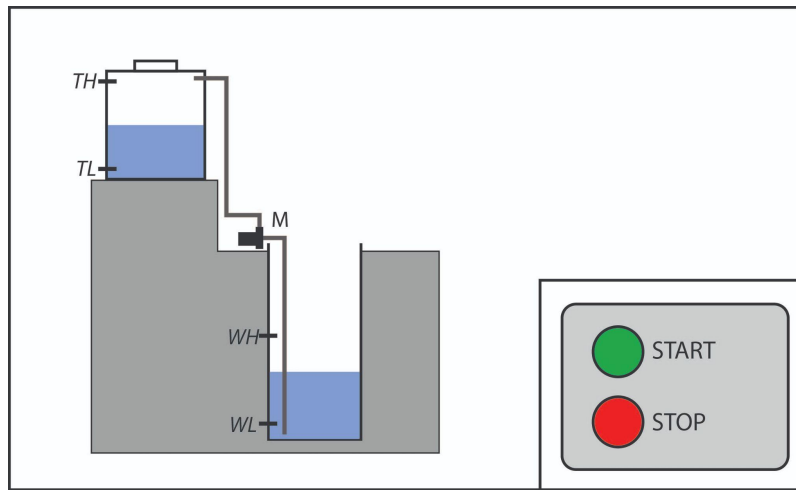- State any assumptions you made during the lab

Figure 01

Sensor Placement Details

The TH sensor is placed at the top of the water tank.

The TL sensor is placed at the bottom of the water tank.

The WH sensor is placed at the middle of the well (not at the top, please refer the figure 01)

The WL sensor is placed at the bottom of the well, but higher than Foot Valve.

All TH, TL, WH, WL sensors are floaters,

Lab Tasks

- Create the ladder diagram required using Unity Pro S and simulate it
- Suggest, design, and implement fail-safe mechanism(s)

Further References

- Setting up PLC with Unity Pro
    - https://www.youtube.com/watch?v=wE1owCFxO4I

- How to program the display using Video and Unity Pro
    - https://www.youtube.com/watch?v=mVKj75cykQU

- Modbus introduction
    - https://www.youtube.com/watch?v=k993tAFRLSE
    - https://www.youtube.com/watch?v=txi2p5_OjKU

- Ethernet
    - https://www.youtube.com/watch?v=pTPjI6lnRgY

Submission

Prepare a report including the ladder diagram and Screenshots from the simulation in Unity Pro S. Additionally, include a short description of the fail-safe mechanisms you considered while designing the ladder diagram. Submit a folder named Lab05_GroupXX.zip where XX is your Group number including,

- Report named Lab05_GroupXX.pdf
- Simulation files from Unity Pro