DESIGN OF PROCESS REACTOR IN PHARMA INDUSTRY AND CONTROL USING PLC

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ABSTRACT

Process reactor which is used for drug manufacturers in the pharma industry which carry out chemical reactions. A reactor is a process vessel designed to add chemicals and conduct chemical reactions. The process reactor consists of different parts. Process reactors are designed to give maximum yield in a chemical reaction. Different types of reactions are being carried out in process reactors. To operate the process reactor manually, it takes more time. To avoid this disadvantage, it is automated with PLC. A Programmable Logic Controller, or PLC used for industrial automation. These controllers can automate a specific process, machine function, or even an entire production line. The PLC receives information from connected sensors or input devices, processes the data, and triggers outputs based on pre-programmed parameters. Programmable Logic Controllers are a flexible and robust control solution, adaptable to almost any application. Placing weight sensor, low level sensor in process reactor, plc takes information from this sensor and acts accordingly to process it. We implement this with Selecpro ladder diagram software.

Keywords:Process reactor, Automation, PLC, Sensors, Ladder diagram

I.   INTRODUCTION

Control systems is an area of engineering which crosses disciplines, when researching this topic, one will find many articles published by mechanical, control and chemical engineers. Many pharmaceutical companies such as Pfizer employ engineers specializing in the aforementioned areas in the design construction, commissioning, operation and maintenance of batch processes, meaning that engineers from different backgrounds must work together to successfully complete projects therefore making this industry a particularly challenging on work with.
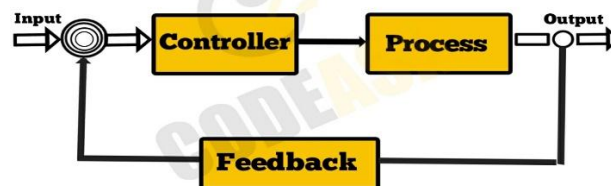

Figure1: Control System

II.   METHODOLOGY

- There are two major components:
  - Programmable Logic Controller (PLC)
  - Batch Reactor
  - A PLC takes in inputs, whether from automated data capture points or from human input points such as switches or buttons. Based on its programming, the PLC then decides whether or not to change the output. A PLCs outputs can control a huge variety of equipment, including motors, solenoid valves, lights, switchgear, safety shut-offs and many others.
- A reactor is a process vessel in which raw materials are added and a reaction can be conducted. There are different types of reactors used in different types of industries like pharmaceutical industries, colours and dyes industries, petrochemical industries, fine chemical industries, and many more.

III. MODELING AND ANALYSIS

Control of Process reactor using PLC:

1. Open SelecPro Software.
2. Click on New Option.
3. Select Product, Name and Click on Finish.
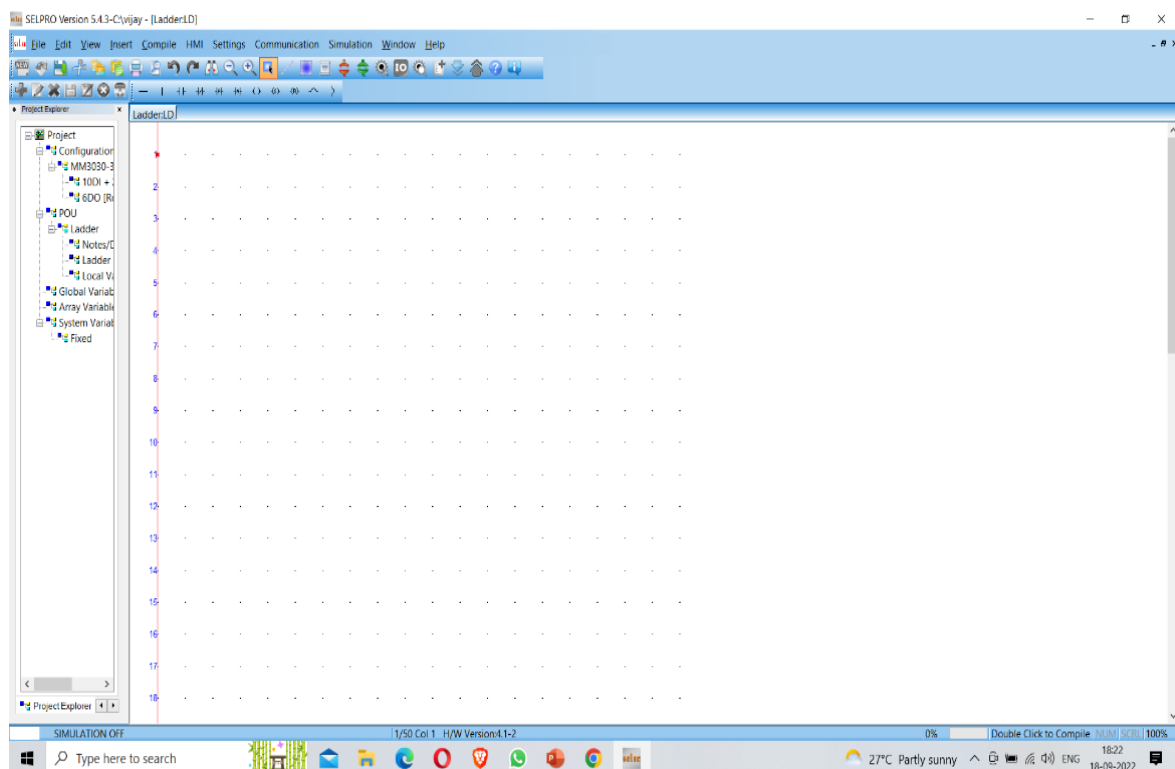4. Now draw the Ladder Diagram in the Graphic Editor Page.
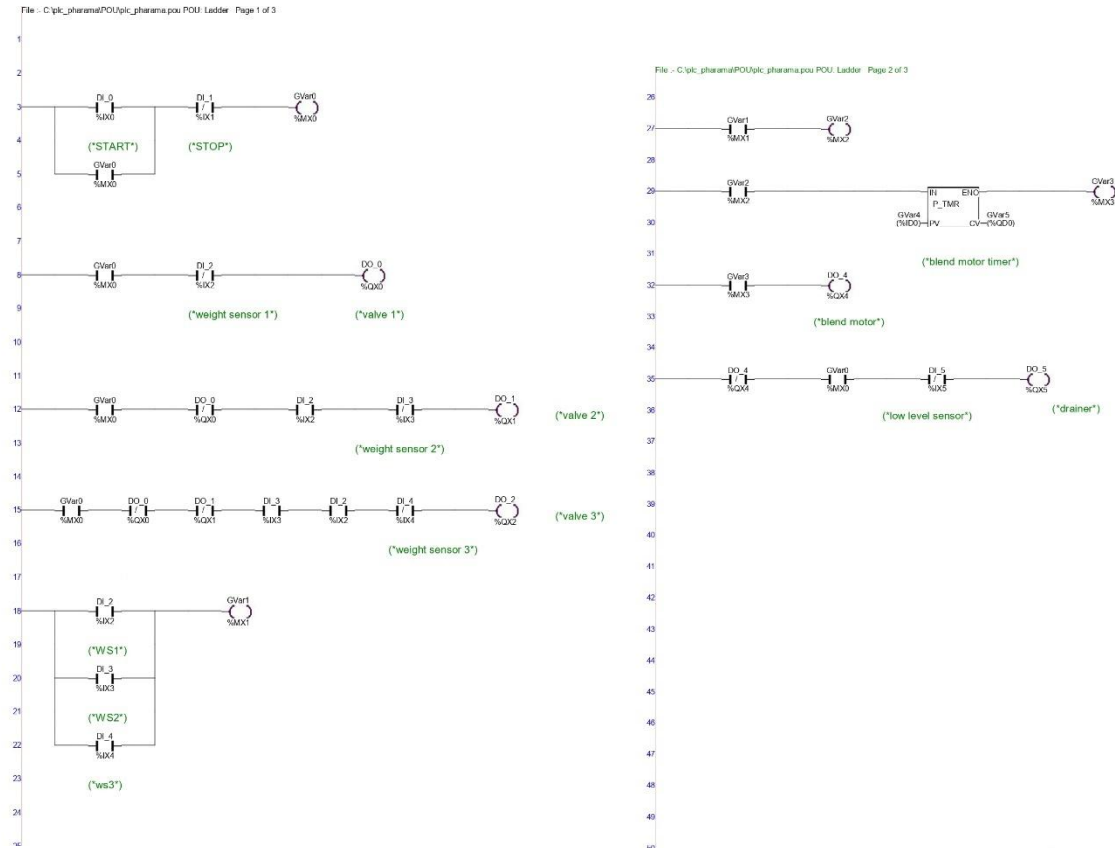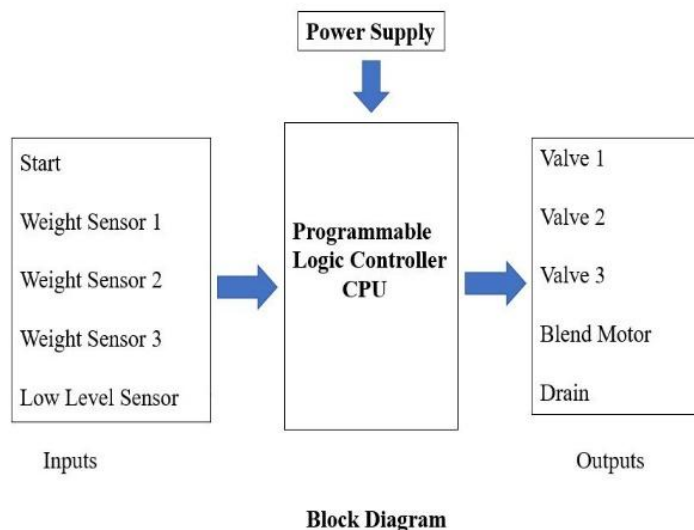

Figure2: Graphic Editor Page

Simulation Model:

Figure3: Ladder diagram

IV.   RESULTS AND DISCUSSION

The below figure is the block diagram of our Programmable Logic Controller (PLC) model.

Block Diagram

The above figure is the block diagram of our Programmable Logic Controller (PLC) model. The above block diagram consists of Power Supply, PLC CPU, Inputs and Outputs.

The Inputs consists of Start, Weight Sensor 1, Weight Sensor 2, Weight Sensor 3, Low Level Sensor and Stop. The Outputs consists of Valve 1, Valve 2, Valve 3, Blend Motor, Drain or Outlet.

At first Power Supply is sent to Programmable Logic Controller CPU from then the inputs are applied and the output is shown in the PLC Graphic Editor. The output is shown in the below images from the SelecPro Software.
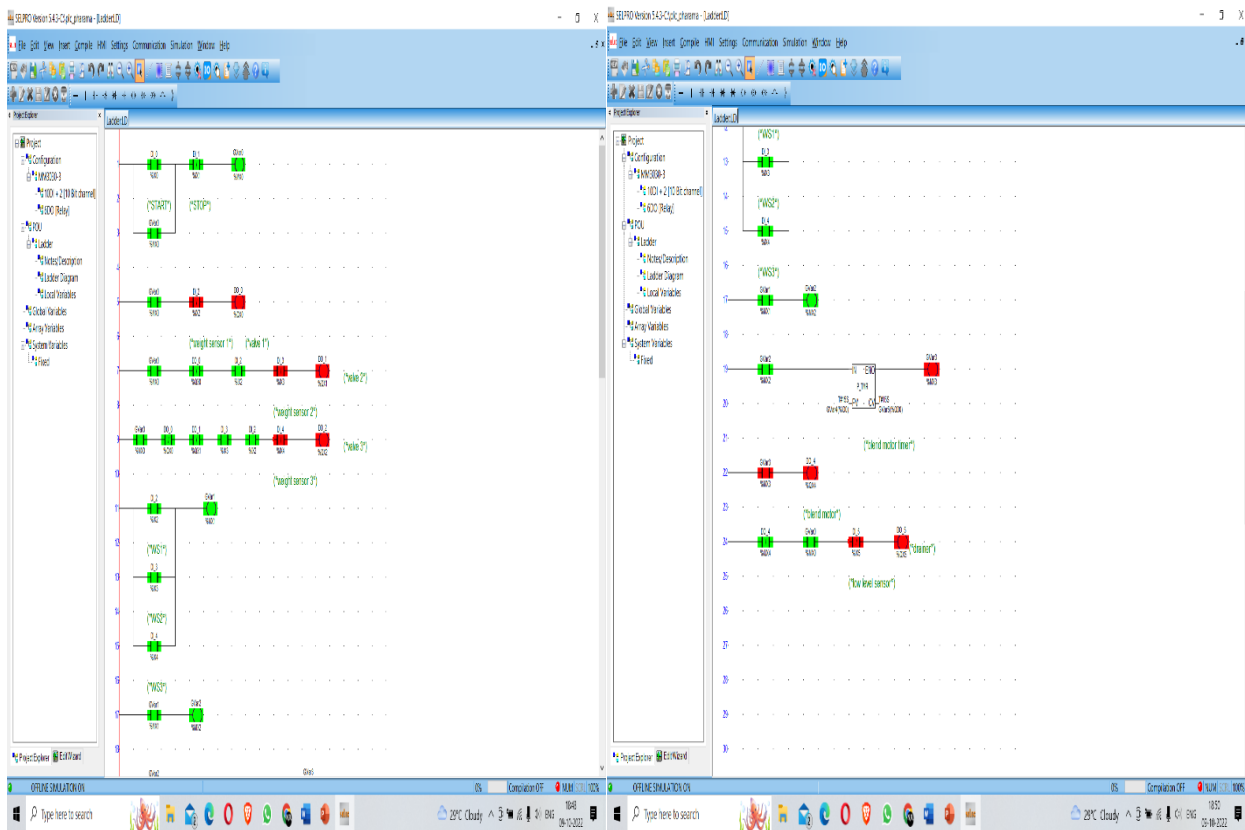
OUTPUT:

Figure3: Outputs

V.   CONCLUSION

We designed and automated the process reactor in the Pharmaceutical Industries using Programmable Logic Controller (PLC). Here at first, we switch ON the Start. After that the raw material gets flowed to the reactor by Valve - 1. After the required amount is supplied which is determined by the Weight Sensor - 1 the Valve - 1 will get closed. The same is done to Valve - 2 and Valve - 3 and get closed when the required amount of raw material is supplied to the reactor by the Weight Sensor - 2 and Weight Sensor - 3.

Now the Blend Motor in the reactor will start for the required set time (about 15 seconds) after the Blend Motor stops rotating the final composition will get out of the reactor through the outlet. After the whole composition gets drained through the outlet, the outlet gets closed with the help of Low-Level Sensor. Placing weight sensor, low level sensor in process reactor, plc takes information from this sensor and acts accordingly to process it. We implemented this with SelecPro Software.

VI.   REFERENCES

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