# Review Paper on PLC & Its Applications in Automation Plants

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ABSRACT: The basic task performed is filling up of water bottles. The filling operation is done using PROGRAMABLE LOGIC CONTROLLERS (PLC). We are using plc because they are flexible, easy to program and space efficient. Such filling task is performed in beverage industry, mineral water bottling plant etc. In our project bottles are placed on the conveyor belt one at a time and then they get filled. The user can input the volume that is needed to be filled in the bottles. The opening and closing of the inlet to the bottle is controlled by solenoid valve. Filling process takes place in a synchronized manner. Thus it is time saving and flexible process. Inductive type proximity sensors are used for the detection of the water bottles at the end and starting point of the conveyor and also below the water inlet. The entire system can be controlled using PLC. SCADA (Supervisory Control And Data Acquisition) will be used for visual representation of the bottling plant.

#### **INTRODUCTION**

Our project is an example of industrial automation. Automation is the use of various automatic control equipments, machinery, devices in a process or in a manufacturing firm. Automation has changed the face of industries all over the world. In a layman's language automation means 'doing things automatically in a systematic way' .Introduction of automation in industries have increased the efficiency of the plants and also helped in reducing human errors. Thus helped to improve the quality of the products. Another benefit of automation is that it also saves labor therefore increasing the precision, accuracy and efficiency. Industrial Automation mainly deals with automation of manufacturing, material handling and quality control. It uses various programmed robots to perform activities in an industry. Various sensors, controllers, indicators, valves are used in the process. Programmable logic controllers are used to control various instruments used. Computers are used to display the whole process and any fault anywhere in the system is displayed on the screen. The fault can be cleared using the computer itself.

PLC has evolved as a main controller in industries nowadays. This is because of the simplicity and robustness of the PLC.A programmable logic controller is a digital, industrial computer which is made up of integrated circuits. PLCs can store instructions like counting, timing, arithmetic manipulations and communication to machines and different control instruments. PLCs have many input and output ports therefore many instructions can be followed at a time with great accuracy. PLC's have replaced automated systems consisting of hundreds of sensors, timers, counters, etc. Its ability to redesign and reform the programming allowed flexibility in performing different processes also in different ways.

Various domains like motion control, networking, sequential relay control, distributed control systems have been adjoined in PLC functioning since its inception. The abilities of storage, processing speeds and communication possibilities have made the modern PLC's complement to the desktop computers.

Basic parts of a PLC are :

- (a) CPU(processor)
- (b) Memory
- (c) Input Devices
- (d) Output Devices
- (e) Programming Unit
- (f) Power Supply

PLC's find their applications in many industries like manufacturing, travel, aerospace, food, textile, printing, hospitals, agriculture, film, foundry, etc. Continuous bottle filling system is one of the important application of PLC in bottle filling industry where the empty bottles move on a conveyor belt and are automatically detected at an appropriate position. Then the desired quantity of liquid gets filled in the bottle and the same procedure is carried out for all other queued up empty bottles. If this process is carried out manually it will take a long time and also errors will be more and the quantity of liquid in each bottle may also differ. So PLC becomes an important tool for all these industries.

The various processes in the system will be controlled using a PLC and monitored using SCADA.



## **BLOCK DIAGRAM**

Details of the block diagram have been explained in the Methodology and Working sections. Here SMPS represents the signal conditioning system in the circuit.

#### **METHODOLOGY**

This project is a framework demonstrating the bottling plant which is automated by using PLC. While the entire process is being supervised on SCADA. The different sensors used in the system takes care of unnecessary operation like overfilling or lower filling of the bottles. The system is completely monitored using SCADA and plant may be stopped or controlled through SCADA in case of emergency.

The plant is controlled by programmable logic controller. The PLC is the core of the whole automated system. The instructions to the PLC are fed using Ladder Logic programming language. The software used in this programming is RS LOGIX ENGLISH and the communication software used is RS LINX Classic for windows operating systems. After the program is written and successfully driven in the OFFLINE mode then it is downloaded on PLC using the communication software as per the program written. When the bottles are detected in the input side the conveyor motors switches ON and thus the conveyor belt starts moving in the forward direction. Motor automatically stops when the bottle reaches the exact location under the valve. Then the solenoid valve in tank switches ON and filling operation takes place. Once the level of liquid reaches high level valve shuts OFF and correspondingly signal is sent to plc to move the conveyor drive. 24V solenoid valve is used for this purpose and proximity sensor in used for sensing the bottle. In our project dc motor drive system is being used while in industries ac motor drive systems are used. When the bottle is sensed by the sensor, a signal is sent to the PLC which stops the drive motors and after the filling process is over, the PLC again starts the drive motors to move the conveyor. On the end of conveyor another mechanism is in place to move away the filled bottle from the

conveyor belt. The conveyor moves till the presence of other bottle is sensed by the proximity sensor. At the end of conveyor another sensor is placed to count the number of bottles filled so as to know the production rate of the plant.

The different stages in bottle filling process can be supervised on the SCADA in the computer. The entire process can be altered from SCADA screen itself, like start/stop of the conveyor motors, working of the different proximity sensors or even an emergency stop. This is made possible by the communication cable used which is RS 232. This cable is made link between Wonderware In Touch software and PLC used. Thus SCADA provides complete control over the project without even touching the hardware components, thus working as a remote control. This is a very important feature of automation where in case of any error or disruption the process can be rectified or stopped using SCADA only.

### **OPERATION**

- When metallic can is placed on start point of conveyor the proximity sensor 1 (inductive) senses the can and signal PLC to start the motor thus conveyor start moving.
- Now metallic can is detected by proximity sensor 2 and it signal PLC to stop the motor thus conveyor stop and bottle filling start after a short delay.
- If sensor 1 detects another metallic bottle still it don't send any signal to the PLC so there will be no interference.
- When the filling process is done by the help of electric valve then PLC send the signal to start the motor again thus conveyor start moving further.

Now when filled bottle is moved and come to the end of conveyor a push button to stop the conveyor is pressed so that filled bottle can be easily removed from the process. **SCADA** 



The combination of PLC and SCADA gives better monitoring of the system. It continuously gathers information from the system on real time basis and evaluates and displays it on the computer screen through various trnds, graphs and alarms. In this model we have given a Start/Stop button which makes it easier for the supervisor to control the system.

#### CONCLUSION

The intent of this project is to create a plc based automatic bottle filling system plant based on given description. During this project we gained knowledge about various processes directly utilized in industries such as automation system in which we specifically learnt about programmable logic controller (PLC) and SCADA. Different concepts in PLC were understood including its working, construction, selection of PLC, programming of PLC (Ladder programming) etc. Also programming in SCADA was learnt and even other programs were made in SCADA to understand the concept properly. Generally the aim of our project was to fill the bottles and then pass them to the production line which was successfully accomplished. Different features like capping, counting, packaging can also be affixed in this project. Laser sensors can be installed to detect a defective bottle being put on the conveyor belt. Different techniques like alarms, buzzer system, trends, bar graphs, etc. can be set up in SCADA system. This technique of bottle filling is very accurate, cost saving and time saving. Further improvement is requested.

# REFERENCES

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