DESIGNING OF AUTOMATIC BOTTLE FILLING SYSTEM USING PLC

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ABSTRACT

In this new generation, technological revolution is fast reducing the need of humans to operate machines. To promise the delivery of the product on time high tech automated production is essential. The objective of this paper is to design, develop and testing the "PLC based Bottle filling". The notable thing about this project is the high level of flexibility and its remote control option. PLC are used in many real world applications and to achieve automation in any industry PLC is the first choice. A programmable logic controller (PLC) is a digital computer which is used for automation of various electrochemical processes. Traditional methods for filling the bottle is very time consuming and as well as it is expensive. Also the outcome of such methods is not as per desired. This paper mainly focuses of the use of PLC for bottle filling and capping. It is dependent on the programming how much to fill the liquid in the bottle. We have controlled the entire system by the help of PLC and the ladder diagram. The process is monitored with the help of SCADA.

Keywords: PLC, Ladder diagram , controller , SCADA , Proximity Sensor , Hand-Held Programming etc.

I. INTRODUCTION

Market offers various opportunities that can be easily transformed into success, only by those companies that make the use of high end technology. Various challenges are faced by the industries other than competition. Due to the increase in the production level, stress has been created on the existing systems which has increased the maintenance requirements. After all, if all the process undertaken in the company are perfectly co-ordinated with each other and a reliable and strong communication have been established between them it becomes much easier to tackle the bigger challenges. Automation is used for all the control systems and hence to achieve automation in industries PLC is used widely. PLC plays an important role is the automation industry. In this project we have used a PLC to control the filling of the liquid and capping of the container. A bottle filling system allows to fill the container with user defined volume in percentage and this is achieved with the help of ladder diagram. Ladder logic is the widely used technique for the locations, programming of the PLC. Various types of sensors are used for the positioning of the bottle.

II. SYSTEM DESCRIPTION

This project is an application of industrial automation. Various processes in this project are controlled with the help of PLC and are monitored with the help of SCADA. Both PLC and SCADA are the heart of the system. The program used in the PLC is the one which controls all the processes sequentially. In our project we have used inputs like toggle switch and proximity sensors. The proximity sensors are used to sense the presence of the bottle which will be placed on the conveyor belt. When a bottle is placed on the face of the sensor then the sensor sends a signal to the PLC. Then the PLC operates the DC motor and the solenoid solenoid valve which are used for the conveyor belt and filling of the bottle respectively.

![Block diagram of bottle filling](image-url)
III. HARDWARE DESCRIPTION

1) Programmable Logic Controller
A PLC is a digital computer used for the automation of various processes in the industry and is executed with the help of an arithmetic logic program, timers, counters etc. PLC consists of five important blocks:
- Power Supply
- Input module
- Output module
- Central processing unit (CPU)

All logical and control operations are done by the CPU which is the heart of the PLC. The PLC we have used in our project is an Allen Bradley made PLC which belongs to the family of Pico-Controllers. In this type of PLC, usually the inputs and outputs are fixed.

![Typical PLCs](image1.jpg)

Figure-2: PLC

2) Solenoid Valve
It is an electromagnetic valve which is used to control the flow of various types of liquids by opening and closing the valve on the application of current. The overhead tank will provide the necessary liquid to the solenoid. As the liquid is filled, then the valve will switch OFF automatically. In our project, we have connected our solenoid valve to the water tank.

![Solenoid Valve](image2.jpg)

Figure-3: Solenoid Valve

3) DC Motor
The main use of the DC motor is for the Conveyor system. With the help of the conveyor belt, we can transfer or move products from one place to another. The motor used in our project works on 12V DC supply. We are using a Gear box which is used to increase the torque. The speed of the motor is 8-10 RPM. We have chosen less speed as we require more torque for our application.
4). Proximity Sensor
Proximity sensors are used to detect any object which moves in the operating zone.

5). Conveyor Belt
Conveyor belt is long loop rubber or plastic, which is used for moving the strip of bottle.

SOFTWARE PART:
In Software Part we are going to discuss about the programs and logics used. In this part we have used ladder logic. Basically plc works on ladder programming which is easy to implement and less complexity.

Programming Language
LAD (ladder logic) is a graphical programming language. The representation is based on circuit diagrams.

METHODOLOGY
1. Sensing the Bottles.
2. Dispensing the desired amount of liquid.
3. Moving the bottle over conveyor belt.

Start
Motor start and conveyor start
If bottle sensed by proximity sensor and position sensor
Valve open
Motor stop and conveyor stop
Bottle filled
Valve closed
Conveyor start and motor start
Stop

Flow Chart For Automatic Bottle Filling Using Plc
ADVANTAGES
1. Reduce the human efforts and physical work
2. Replacing human work by technologies.
3. Economy improvement.
4. Perform the tasks which are beyond the human capabilities of size, weight, speed.

DISADVANTAGES
1. Unemployment increases due to machine replacing human.
2. Development cost cannot predict.
3. Huge initial investment.
4. Positioning of solenoid valve is critical issue

APPLICATIONS
1. It is used in process robotics
2. It is used to enhance the process
3. By using PLCs numerous applications are possible in the industry.
4. It is used to integrate the different handling level.

IV. CONCLUSION AND FUTURE SCOPE
This paper is based on the application of industrial automation. This system meets the demands of today's market which require high productivity with sustained quality. The system provides with accuracy and efficiently using the materials with low wastage. Another advantage is the language used for the programming of the PLC is very useful to run all types of industrial application since ladder logic is the most widely used language method. The power consumed by the PLC is also less. The PLC works on 12V DC supply. Also the wiring of the inputs and outputs is easy. The programming of the system is quick and easy. The program can be edited and deleted as per our needs. This system is very useful in future since India is moving forward towards automated industrialization. With the help of this technology we can yield significant financial benefits which will prove beneficial for the industries as well as the country.

More features can be added to this existing system which can be implemented in the future. Features like fast filling of the liquid with the help of jet nozzle, using more number of valve to fill more bottles at a time to improve productivity, use of sensors for the alarms which will indicate any mishandling in between the process, implementation of HMI (human-machine interface) and many more.

This concept can be used in various industries like food, milk, medicine, chemical, mineral water and manufacturing industries.

V. REFERENCES