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# Automatic Liquid Filling System Using PLC With SCADA

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**Abstract –** *Automatic liquid filling is the process in which a machine packs liquid products like water, milk, cool drinks etc into bottles with reduced human intervention and more accuracy. The whole system is controlled using a PLC and monitored with the help of SCADA. A robotic arm is used to pick the bottle from the conveyor and place it in a box or a container which is programmed using Arduino Uno. PLC is the heart of the entire process. SCADA is used to monitor and control the process from control room which is away from the field.*

***Key Words***: Programmable Logic Controllers **(**PLC), Supervisory Control And Data Acquisition (SCADA), robotic arm, arduino uno, conveyor system, Totally Integrated Automation (TIA), arduino cc

## 1. INTRODUCTION

Automation is the utilization of different control techniques for operating equipment's such as operations in factories, aircraft and other applications with reduced human power and more accuracy. In the proposed system, filling process is controlled using PLC.

A conveyor system is used to move bottles from starting point to filling location and then to a robotic arm. Automatic filling of liquid is done using centrifugal pump.

Robotic arm is controlled with arduino uno using arduino cc software. PLC is programmed using TIA software and ladder logic is used. SCADA, a graphical user interface helps to control and monitor the entire process from a control room

## 2. Design Process

### Block Diagram

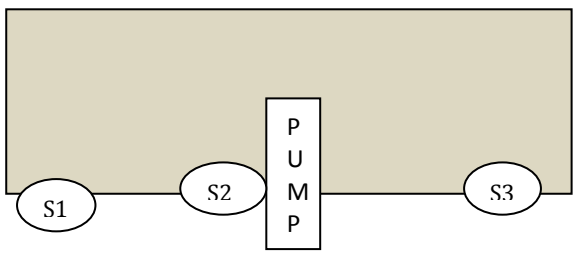
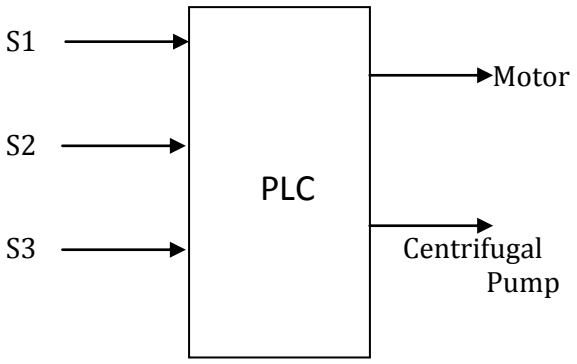



**Fig 2.1 Block Diagram of Proposed System**

1. When push start button is pressed, the system comes to ready position. When sensor1 (S1) detects the bottle, the conveyor system starts. Then the bottle starts moving forward.

2. When sensor2 (S2) detects the bottle, the filling of bottle takes place for 5seconds

3. When sensor3 (S3) detects the bottle, the robotic arm gets activated and picks the bottle and places it in a container.

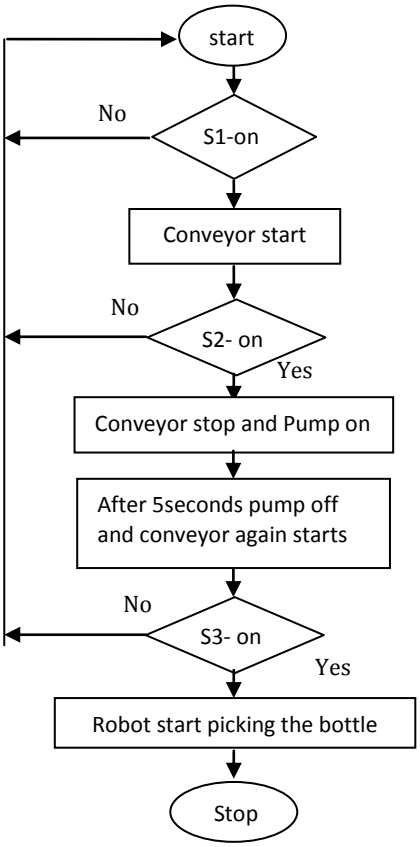



S1, S2, S3 are the photo electric sensors used for object detection which are the inputs to the Programmable Logic Controllers (PLC).

DC motor and submersible centrifugal pump are the outputs of the Programmable Logic Controller which is the main controller of the entire manufacturing process in the industries.

The whole system can be monitored and analyzed using a graphical interface Supervisory Control And Data Acquisition (SCADA).

This system can be seen in flow chart as follows:




## 3. Experimental Details

To run the conveyor system a DC motor is used with high torque and less speed. A photo electric sensor is used to detect the bottle. Filling process is done by using a submersible centrifugal pump. PLC programming is done in ladder logic using TIA portal.

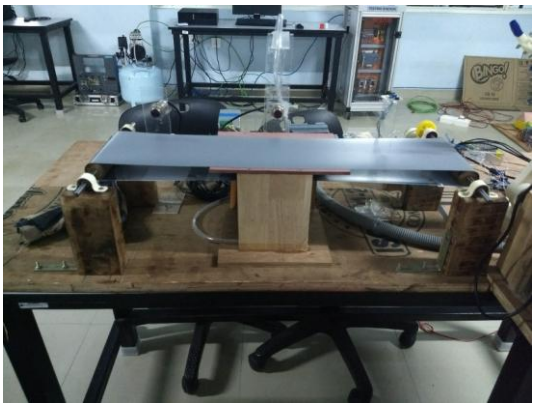


**Fig3.1 Conveyor system**

Supervisory Control And Data Acquisition (SCADA) is a graphical interface which is helpful to analyze and monitor the whole process by sitting at one place and can also helps in maintaining security by keeping data confidentially.

### 3.1 Robotic Arm Description

Servo motors are used to control various parts like waist, shoulder, elbow, wrist roll, wrist pitch and gripper of robotic arm. Arduino uno is used to control the robotic arm.

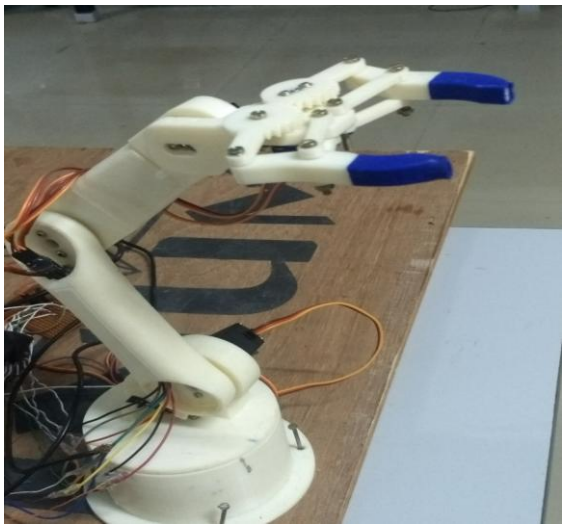


**Fig 3.2 Robotic arm**

## 4. Results

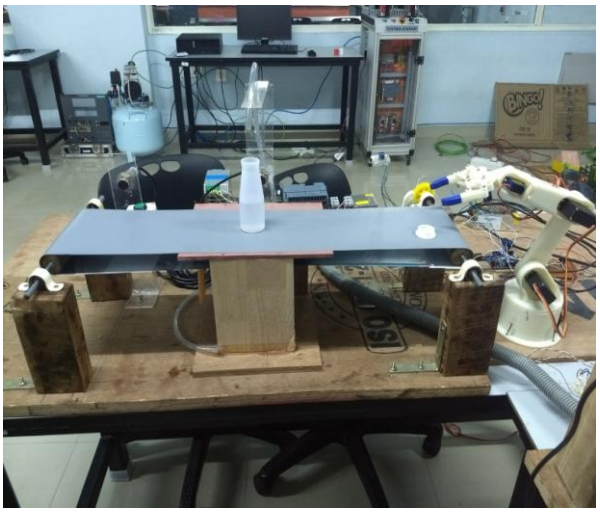


**Fig 3.3 Filling Prototype**

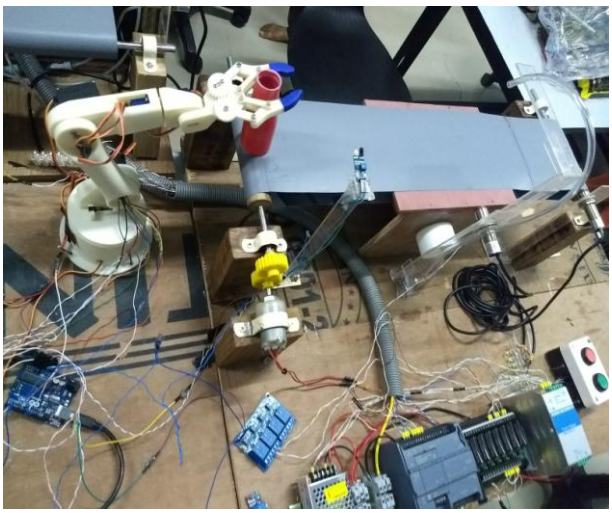


**Fig 3.4 Robotic Arm Picking Bottle**

**Fig 3.5** Overall Arrangement

## 5. Conclusions And Future Scope

Automatic filling is done using PLC with less human intervention and more accuracy. Bottle picking and placing is done using robotic arm. Monitoring of whole process is done using SCADA.

This system can be extended to automatically fill different liquids in different bottles based on size, color, material etc can be done with reduced human intervention and more accuracy.

In the place of robotic arm we can also implement a rotatory motion to move the bottles from one station to other station.

## 6. References

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