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# Automatic Liquid Filling Unit Using PLC

Prof. P.V. Suramwar<sup>1</sup>, Ashish Meshram<sup>2</sup>, Pallavi Bhadke<sup>3</sup>, Pranali Pathode<sup>4</sup>, Tejeshwini Thakre<sup>5</sup>

<sup>1</sup>Project Guide, Department Of Electrical Engineering, Govindrao Wanjari Collage Of Engineering & Technology. Nagpur

<sup>2, 3, 4, 5</sup>Projecties, Department Of Electrical Engineering, Govindrao Wanjari Collage Of Engineering & Technology. Nagpur

**Abstract:** An 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. The filling process is a mission performed by a machine that fills liquid products such as water or cold drinks. Traditional bottling method include placing bottles on a conveyor belt and filling only one bottle at a time. In this paper, it has been designed and implement water filling machine system for different types of bottles by using PLC.

Where the water filling machine system includes design and implement prototype of a flat belt conveyor with dimensions (300\*40) mm and automatic process for water filling machine using the water pump and sensors which gives the appropriate information to control unit then design the controller using PLC. The PLC plays important role to implement automatic filling process by using PLC programing software and ladder diagram language. It was found that the water filling machine using PLC is less operational cost and less power consumption than the traditional control systems, in addition more flexible and time saving

**Keyword:** PLC, conveyor, DC motor, inductive sensor, water pump, Relay, etc.,

## I. INTRODUCTION

Industry automation becomes a spacious field in manufacturing which had important role in an extensive range of industries beyond manufacturing .Nowadays the rapid development of manufacturing and technology has led to an increase in production level.. Where the production managers are faced challenged to reduce the cost of the product with maintaining product quality within a time framework and due to the increased demand for on consumer products so competition among manufacturing companies has become dependent on cost, accuracy, time, and quality for that the key to such a problem is the use of integrated processes in the industry . Programmable logic controller (PLC) is extensively used in industrial automation and it act as a brain in industry application. PLC in the industrial field are utilized to control a certain process in order to get better performance and higher accuracy to give more production in an efficient manner. This paper present, design and implementation water filling machine

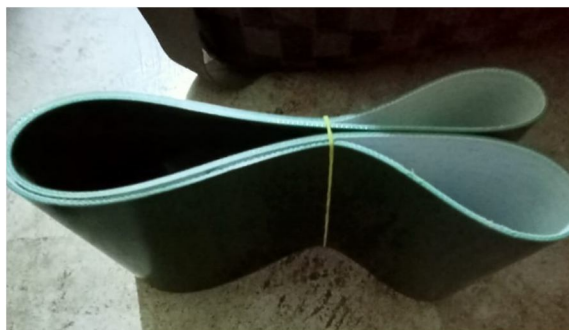
## II. DESCRIPTION OF CONVEYOR SYSTEM

System for different sized bottles by using PLC. The water filling machine system consist of prototype conveyor section, filling section with sensors and control section using PLC. The PLC control unit is utilized to reduce the human work and increasing the production with less time[4].

A water filling machine with PLC controller allows the user to choose the size of bottles with helping the sensors. The filling process is based on the selection of the size of the bottles by the user, through which the user can select the size of the liquid to be filled. A inductive sensor is placed on the conveyor to sense the location of bottle under the valve and the corresponding valve is switched on to fill the bottle by using control unit. In this paper, first present a short introduction about conveyor system and the filling system and the second part talk about the hardware system and the programming of PLC

Nowadays with many industrial applications, a conveyor system is used to move object from one location to another in effective way to reduce losing time and effort and it is very useful in packaging process. A conveyor system has several forms but in this paper, a Flat belt type is used to move the bottles as shown in Fig.(1).

Conveyors are especially useful in applications which including the transportation of heavy or large materials. A Flat belt conveyer has a dimensions of (300\*40) mm the belt is made from elastic material. Six pulleys a distributed along the belt, the first one rotates with the rotation of motor shaft and it usually called drive pulley and the other five pulley called idler pulley[4]. The Flat belt is fitted with aluminum plate between the pulleys to support the be



### III. OBJECTIVE

The objective of our project is to design, develop and monitor “Automatic filling system using PLC”. This work provides with a lot of benefits like low power consumption, low operational cost, less maintenance, accuracy and many more. This project is based on Industrial automation and is a vast application used in many industries like milk industries, chemical, food, mineral water and many industrial manufacturers. A prototype has been developed to illustrate the project

### IV. SOFTWARE PART

In software part we are going to discuss about the programs and the logics used. There are some programming languages for control systems: Block diagram (BD) Ladder diagram (LD) In our proposed device the Ladder Diagram (LD) is used. This is to interface the ONOFF button, programming logic. There are several programming softwares available but in our device ladder logic is used. It is easy to understand and the programming is made more flexible to users.

### V. LADDER LOGIC

Ladder logic is the main programming method used in PLC. Ladder logic is based on mimic relay logic. The relay logic diagrams are difficult, hence we have selected ladder logic as main programming method. In modern control systems they used relay but these are not used for logic. A relay is a device that controls a switch using magnetic field. Relays are used as one power source close a switch for another power source, while keeping isolated

### VI. HARDWARE SPECIFICATION

#### A. PLC

A programmable logic controller (PLC) is an industrial digital computer which is used in various and they act as the brain of the devices where they are used. With PLC the revolution in industries is changing very rapidly and with its effort they are helping industries to move towards automation. They are used in industries where the filling bottle, also used in traffic controlling system. The PLC is used because they are the controller of the devices in which they are used. PLCs are used to produce the output in a specific time and so they are the examples of “Real time system”. After using PLCs in various applications, it helped to replaced hard wired relays.





### B. Relay

These are electromagnetic switches which are coiled. When a voltage is applied to a coil the magnetic field is generated and this field sucks the contact of the relay in causing them to make a connection. From here only, the concepts of NO (normally open) and NC (normally closed) has appeared in PLCs.



### C. Geared Dc Motor

12Volts 100RPM geared motors used for the robotics applications and has approximately weight of 125grams.



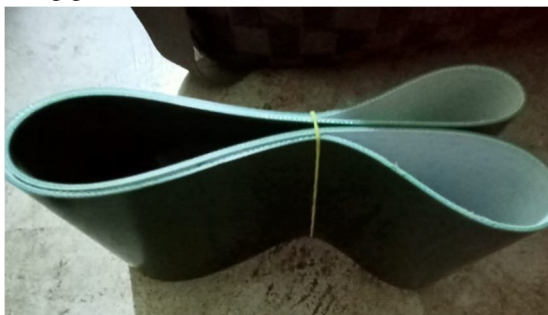
### D. Inductive Sensor

It is a type of photoelectric sensor which detects objects, and checks either any changes on the surface conditions. Mainly it consists of an emitter and receiver which emits and receives the light respectively



### E. Conveyor Belt

It is a type of flexible belt which slides the object placed on it from one point to another point to perform the task. The belt is in a loop form and it works with the help of using geared motors.



#### F. Water Pump

This is a mini size water pump that works on 12V DC. It is extremely simple and easy to use. Just connect the inlet to a water source, connect a suitable pipe and power the motor to start pumping water. Great for building science projects, fire-extinguishers, fire fighting robots, fountains, waterfalls, plant watering systems etc.



#### G. SMPS

[ 1) i/p 230 V AC o/p 24V , 5A DC , 2) i/p 230V AC o/p 12 V 5A DC ] is an **electronic power supply system** that makes use of a switching regulator to transfer electrical power effectively. ... An SMPS adjusts output voltage and current between different electrical configurations by switching the basics of typically lossless storage such as capacitors and inductors.



#### H. Ball Bearing

A ball bearing is a type of rolling-element bearing that uses balls to maintain the separation between the bearing races. The purpose of a ball bearing is to reduce rotational friction and support radial and axial loads.

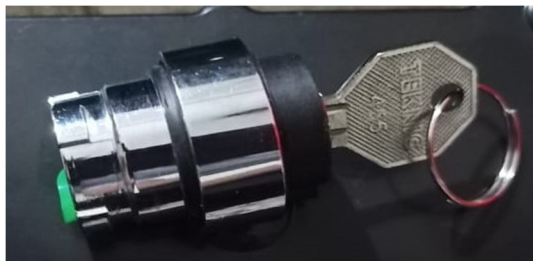
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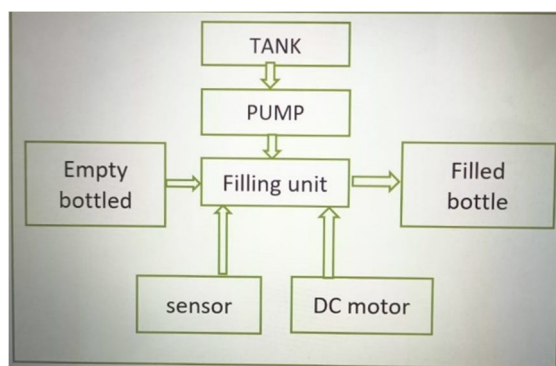
### I. Selector Switch

The key-operated selector switch is used for safety-related issues. The key can be removed in various positions and when it is removed no other action can be done.

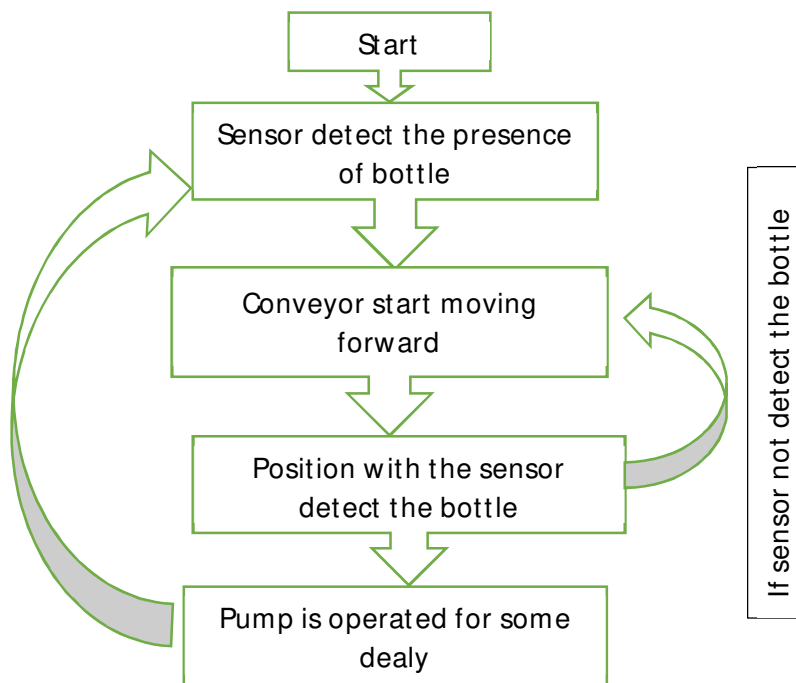
It is used to select the mode auto/manual



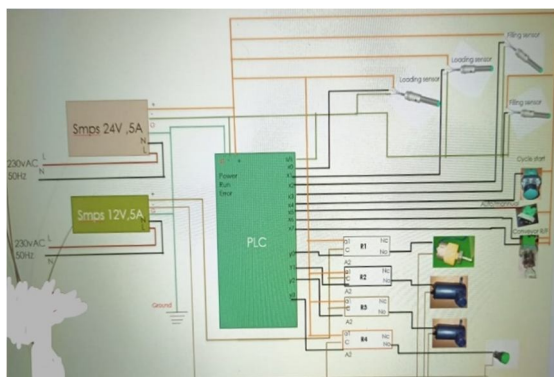
## VII. BLOCK DIAGRAM



## VIII. FLOW CHART



## IX. CIRCUIT DIAGRAM



## X. WORKING PRINCIPLE

If the button of the power supply is pressed, the conveyor motor will start to move. When the Inductive sensor detects the bottle, the conveyor motor stops to move and the dc pump will start to flow the water to fill the bottle. After completing the filling operation, the dc pump stops. Hence the conveyor motor starts to move and the bottle goes away from the dc pump. This process will be repeated if another bottle is sensed

## XI. ADVANTAGES

- 1) Multi purpose – Due to this is two 2 types of liquid filling machine
- 2) Time saving – due to automatic operation of machine we save the time
- 3) reduce man power
- 4) Increase the machine efficiency.
- 5) Flexibility & convertibility in manufacturing process

## XII. FUTURE SCOPE

Now a day automation is used in Such company for increase the production and reduce the manpower in future all the company get automation using PLC and get low maintenance losses on production . we are trying to make multi purpose machine for production purpose this is very needful to small scale industry .

## XIII. CONCLUSION

Automation systems are used to increase productivity, which in turn brings economic progress. The main purpose of PLC in automation is used to control the whole system. The cost of installation is not cheap but it can efficiently run for a long period of time. The performance, flexibility and reliability is based on the investment. A PLC based control system was applied to the automatic liquid filling station previously specified and the performance was measured. The entire system is more reliable, time saving and user friendly.

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