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Automatic Bottle Filling System Using PLC

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ABSTRACT: In this project Automatic Bottle Filling System is introduced using Programmable Logic Controller (PLC) based controller in automation industry. The main aim of this project is to program a filling system using Delta PLC Software. Filling is controlled by PLC using ladder logic method. By programming the PLC, the entire system is being controlled. The position of the bottle is detected by proximity sensor so that the pump can be functioned at right time and it starts filling the bottle. This work provides with a lot of benefits like low power consumption, low operational cost, less maintenance and accuracy. This automatic bottle filling system is a vast application used in many industries like chemical, milk, food, water and many industrial manufacturers. The PLC used in this system is Delta PLC which makes the system more flexible and easy to operate.

KEYWORDS: Automation , PLC ,Sensor, Conveyor system

I. INTRODUCTION

Nowadays in industries the human manual work is replaced by automation. Automation involves remotely controlling processes and creating control loops, so that the operation can be carried out electronically with minimum human intervention. This project aims on designing an automatic filling of bottle along with conveyor system using Delta (PLC) programmable logic controller. Programmable Logic controller is extensive used in industrial automation and it act as a brain in industrial application. This PLCs in industrial field are utilized to control a certain process in order to get better performance and high accuracy to give more production in an efficient manner. Other than PLC, some more hardware parts are also used in this project such as sensors, control valve, motor and some connectors. Filling is the process in which a machine packs the liquid products such as water, cool drinks, etc. This method includes placing bottles upon a conveyor belt and filling one bottle within a given time.

II. MATERIALS AND METHODS

The materials used in this project are listed as follows,

- PLC
- DC motor
- Conveyor
- Solenoid Valve
- Proximity Sensors

PLC :A Programmable Logic Controller, PLC is a digital computer used for automation. It is an interface between program and the inputs.. PLC can execute a program by executing at a time single instruction. For instance, when the first input is set ON, then it will turn the first output ON. Further, it knows which input already on/off, so with respect to the previous process, PLC modifies the value of the outputs accordingly. PLC has many programming languages but the most famous and important language is Ladder diagram language which are used to programming the PLC in this paper. The PLC used in this paper is Delta WPL PLC software.

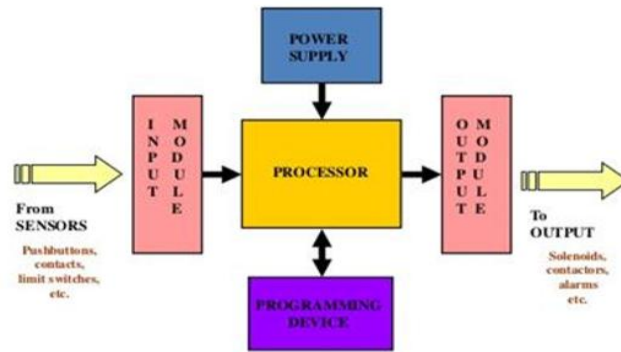


FIGURE 1.PLC

DC motor :DC motor is type of rotary electrical machines that convert electrical current into mechanical motion. In this paper a DC motor is used to rotate the conveyor belt to move the bottle first under the valve and after it filled move it away from valve

Solenoid Valve :Solenoid valve is an electromechanical device in which the solenoid uses an electric current to produce a magnetic field and thereby drives a mechanism which controls the opening of fluid flow in a valve. It is operated to control pouring of liquids in a specific time by automatic opening and closing. Several types of applications are accomplished by using this solenoid valve



FIGURE 2.SOLENOID VALVE

Conveyor Belt:It must be strong, long-term and unaffected to an extensive range of temperatures, moisture, chemical, etc. There are some materials that are used to make conveyor belts such as: thermoplastics, leather, rubber, metal and fabric. The material used in this paper is a rubber composite, as it is stretchy, resistant, unbroken and smooth. Plastics consist of polyester, polyethylene, polyvinyl chloride and silicone. In case of bulk material manufacturing and production, steel made conveyor belts are preferred because of their high strength



FIGURE 3.CONVEYOR SYSTEM



Proximity Sensor: A proximity sensor is a sensor able to detect the presence of nearby objects without any physical contact. A proximity sensor often emits an electromagnetic field or a beam of electromagnetic radiation (infrared, for instance), and looks for changes in the field or return signal. In this the presence of bottle is sensed by this sensor and then the motor and conveyor switched on.



FIGURE 4. PROXIMITY SENSOR

III. LITERATURE REVIEW

[1] IEEE International Conference on Power Electronics, Intelligent Control and Energy Systems (CPEICES) PLC based automatic liquid mixing and bottle filling. This paper gives a detailed view in the automatic bottle filling using PLC.

[2] International Journal of Power Electronics Controllers and Converters Design and Implementation of Bottle Filling Automation System for Food Processing Industries using PLC. In this project the designing and implementation of filling system is clearly explained and the programming of PLC is done using the ladder logic Instruction .

IV. METHODOLOGY

Water filling in the bottles is the key job of this project via automatic system. This operation starts with keeping bottles on the top of a conveyor belt, also pouring liquid at the same time in one bottle. Filling is controlled and managed by PLC by means of ladder logic programming method. Initially, the whole conveyor system will be in off state, it turns on when the proximity sensor detects the bottle in conveyor system. And when the sensor under the solenoid valve senses the bottle, the solenoid opens and starts to fill the bottle for given time.

i. Supply Tank Level Control: The Supply tank is connected to continuous water supply line and controlled by solenoid valve. It is fitted with high and low level float switches which directly controls the inflow to the tank using a solenoid valve.

ii. Overhead Tank Filling: This is a timer-based operation. The pump on the Supply tank will be running for every 10secs in an interval of 20 secs. These timings can be user defined.

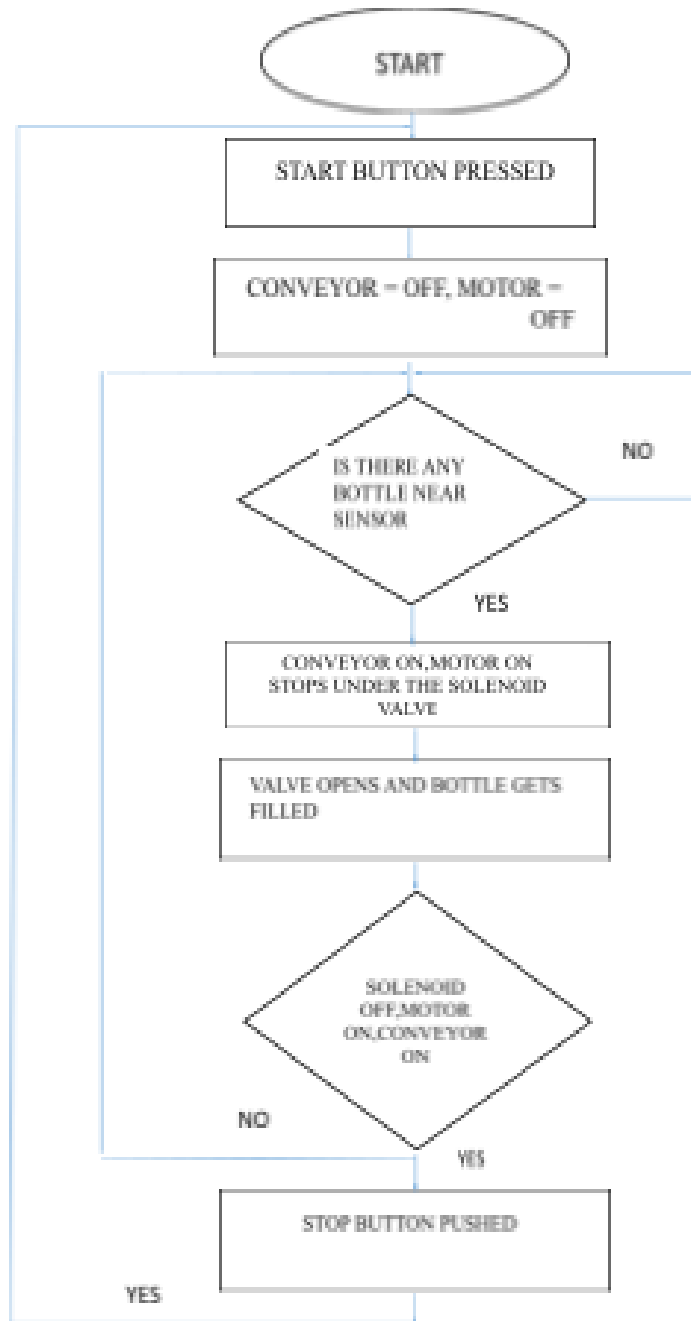
iii. Conveyor Control: Bottle sensor 1 senses the presence of the bottle and moves the conveyor. There will be an internal counter that counts the number of bottles. This value will be compared with bottle sensor 2 value and the conveyor will be in working until the difference is zero.

iv. Filling Unit operation: Conveyor will be stopped once bottle sensor 2 (BS2) is high. After a delay of 2 secs the filling solenoid valve will operate for 5 secs. After one second of delay, the conveyor will move further.



V. FLOWCHART OF THE PROPOSED SYSTEM

The following flowchart represents the working process of automatic bottle filling system in an orderly manner,





VI. BLOCK DIAGRAM

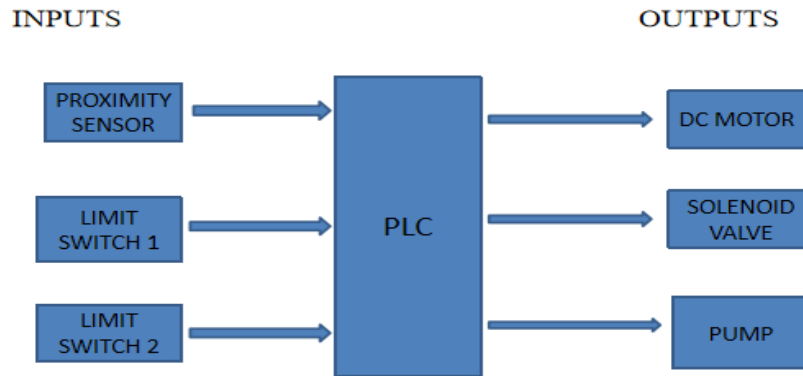
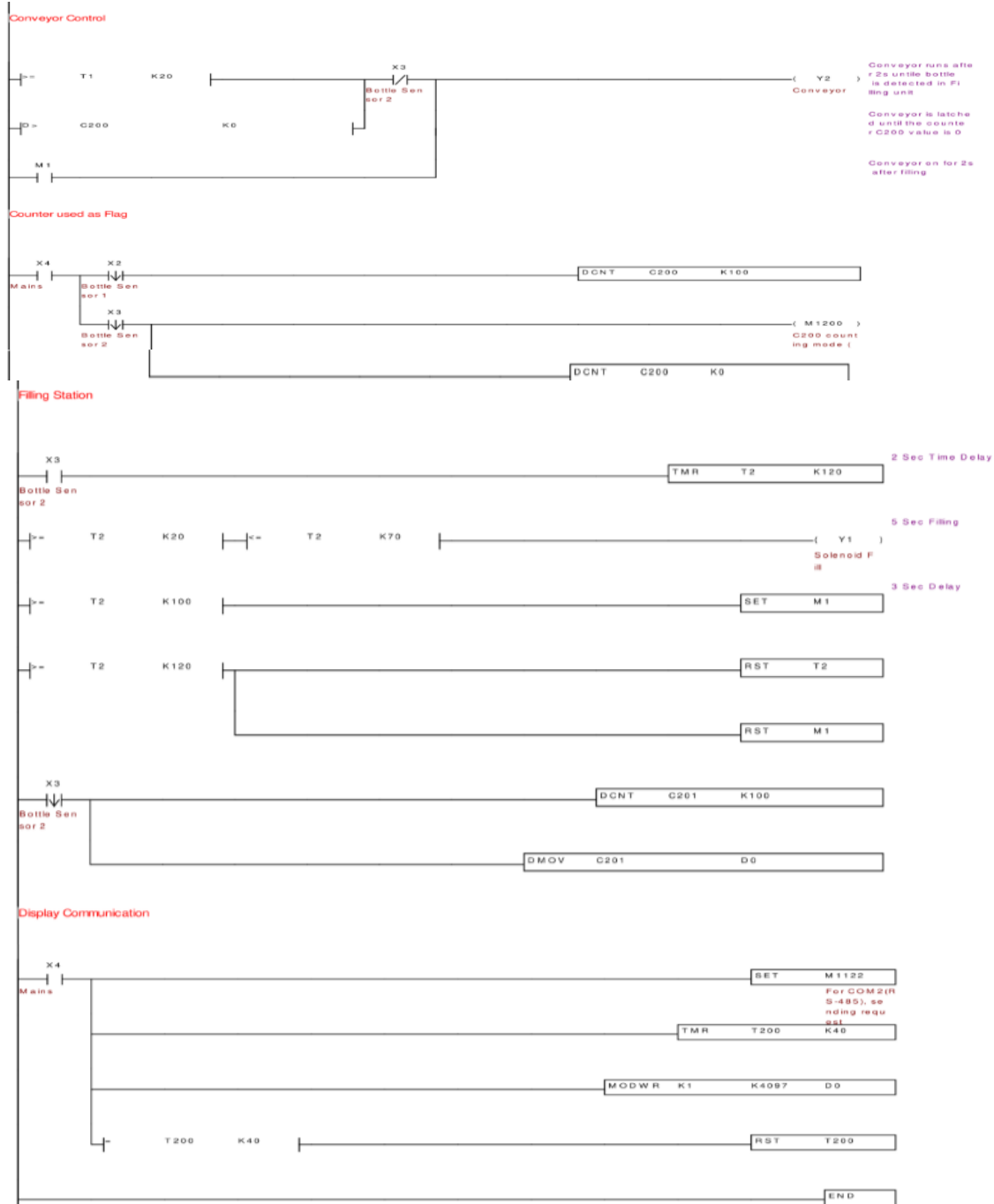


FIGURE 5: BLOCK DIAGRAM OF AUTOMATIC BOTTLE FILLING SYSTEM USING PLC

VII. IMPLEMENTATION OF SOFTWARE





VIII.APPLICATIONS OF PROPOSED SYSTEM

- Ink filling Industry.
- Soft-drink and water filling Industries.
- Oil Industries.
- Milk and Food processing Industries.



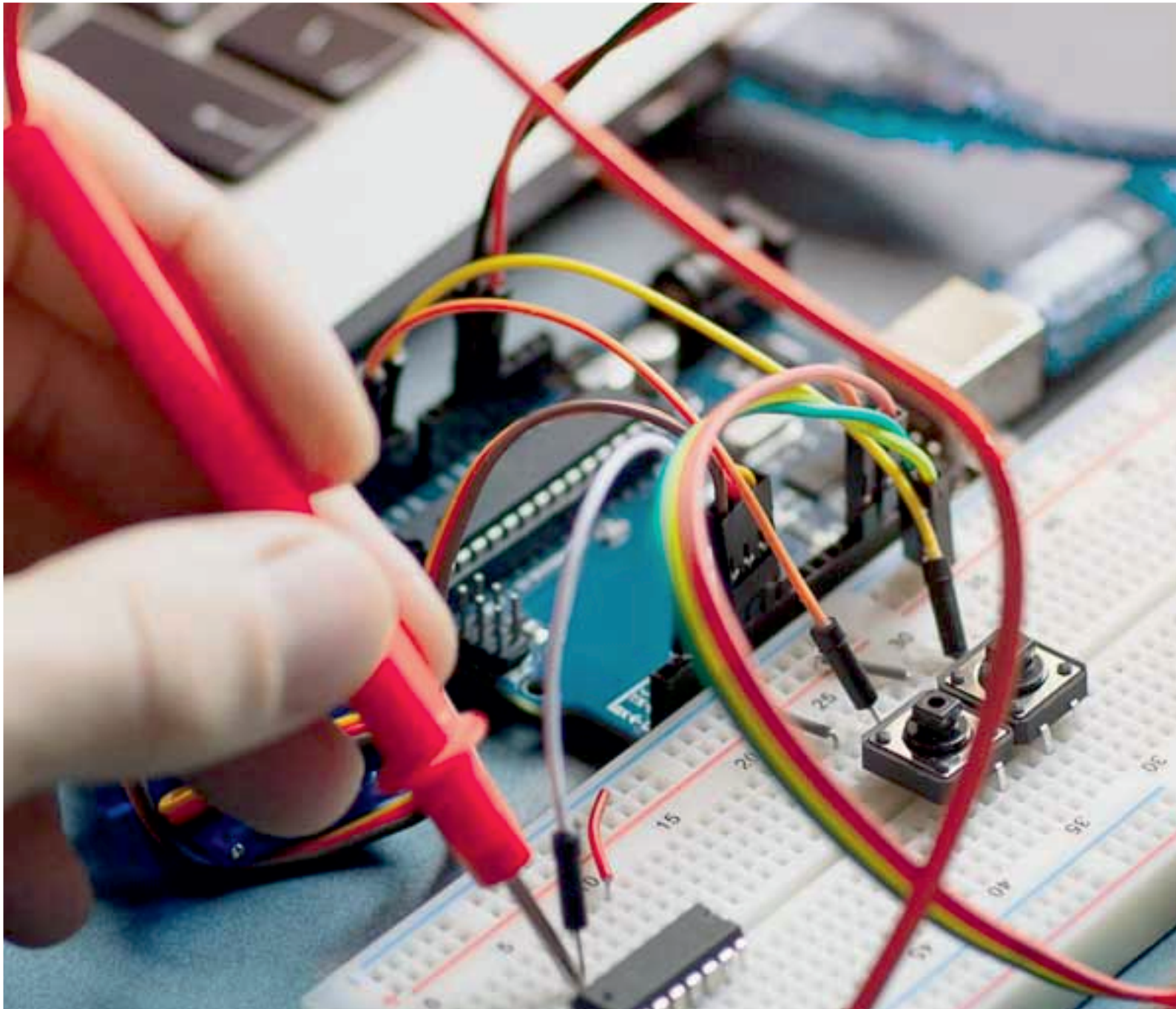
- Chemical Industries.
- Beverage Industries.
- Pharmaceutical Industries.

IX. RESULT AND CONCLUSION

This bottle filling automation system is used to increase productivity, better quality and quantity in a given time. The main purpose of this system is to control the industries with lesser manual work and also cost is minimized . Thus, requirement of full automation is to be attained by using Delta PLC . The aim of this is also to make this system more flexible than other, more reliable, time saving so that productivity will be improved.
Solenoid

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