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Automatic Bottle Filling System using PLC Based Controller

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ABSTRACT - In this paper a bottle filling machine is introduced using Programmable Logic Controller (PLC) based controller in automation industry. The main aim of the paper is to design and fabricate a small and a simple filling system using PLC. The belt conveyor is used for moving the bottle. The position of bottle is detected by infrared sensor so that pump can be functioned at right time. When bottle is under the tank, the pump is started and bottle is filled by water. All the components perform well. This filling machine is cost effective and it can be used in small scale bottle filling systems such as coffee shops, juice shops and other beverage industries.

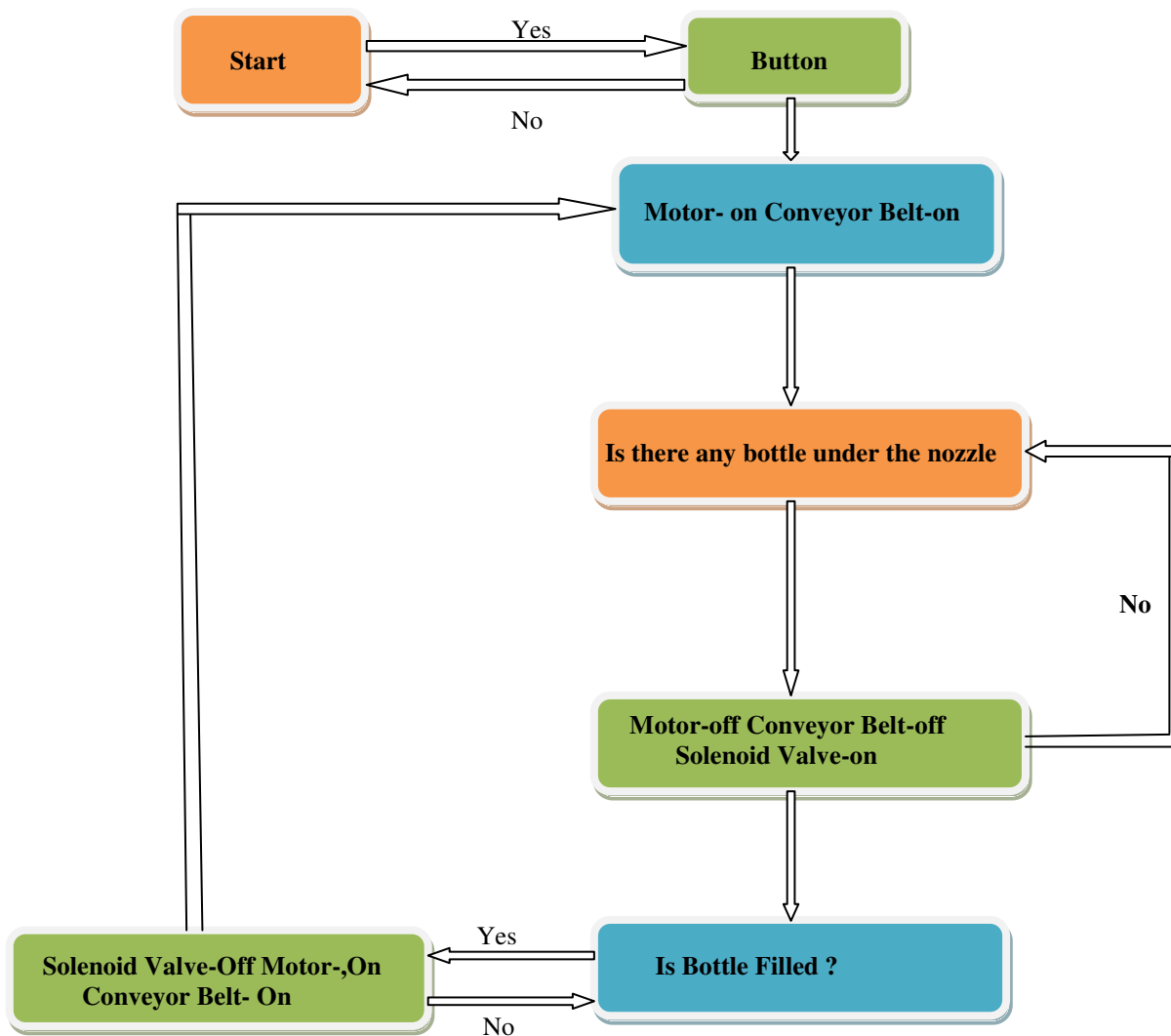
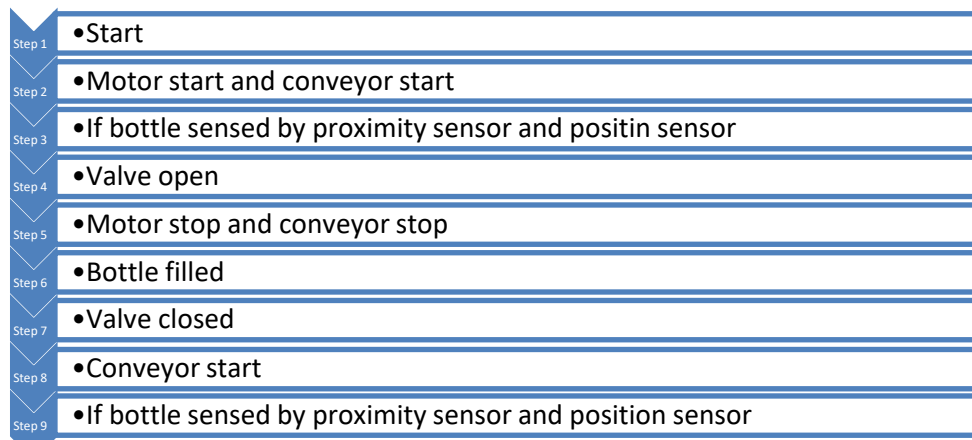
KEYWORDS: PLC, Automation, flow sensor, conveyor belt, solenoid valve, Easy technology, Low cost and smooth performance.

I. INTRODUCTION

Automation is basically something that reduces human activity and increases productivity. As technology increases productivity also increases. Automation is a one-time investment that will benefit the economy and production. The most important use of automation is in the filling of a soft drink bottle. Our paper provides water bottle filling using PLC. Our three-phase project incorporates the sensing bottle into the transmission belt and discharges the required amount of liquid into the bottle with a solenoid valve at the bottom of the liquid tank. It will then move the bottle over the conveyor belt. Ladder logic is used to control the whole process. Also the sensors are used to feel the bottles and the liquid dispense in the bottle. Filling is done by opening and closing the solenoid valve.

II. WORKING METHODOLOGY

Flow chart of working principle is shown in Fig.1. Initially, if the start push-button is pressed and the first infrared sensor detects the bottle the motor starts and the conveyor belt starts moving. When the second infrared sensor detects the bottle, the conveyor motor stops to move and the solenoid valve will start to flow the water to fill the bottle. After completing the filling operation conveyor belt starts moving. When the third infrared sensor detects the bottle, the conveyor motor stops to move. This process will be repeated if another bottle is sensed.



Flow chart of assembly of the proposed filling machine is shown in Fig.1.

PLC Basic



The Programmable Logic Controller (PLC), also referred to as an orderly controller, is the name given to the type of computer commonly used in commercial and industrial control systems. PLCs are different from office computers within the types of tasks they perform and as a result the hardware and software they need to perform these tasks. Although accurate applications vary widely, all PLCs monitor inputs and other variable values, make decisions based on a stored system, and control output to perform a process or machine automatically. The basic features of PLC include input modules or points, Central Concentration Unit (CPU), output modules or points, and editing device. The type of input modules or points used by PLC depends on the type of input devices used. Some input modules or points respond to digital inputs, also called separate inputs, open or closed. Some modules or inputs respond to analog signals.

The main function of the PLC input circuit is to convert the signals provided by these various switches and sensors into sensible signals to be used by the CPU. The CPU checks the input status, output, and other parameters because it uses a stored system. The CPU then sends signals to update the output state. The editing device is used to insert or change the PLC system or to view or modify stored values.

Ladder Logic Programming Language

III. HARDWARE PART

Float Sensor:



Fig: Float Sensor

The float switch gets the liquid level in the tank or container. It floats on a liquid surface and acts as a machine switch as the liquid level rises or falls. They control devices such as pumps (indoor or outlet water pumps), valves (open or closed inlet / outlets), or alarms to notify users. They are expensive, reliable, and can be used with a wide variety of liquids.

Photoelectric Sensor:



One of the most common types of proximity sensor is a photoelectric sensor. These sensors detect objects in front of them directly by detecting sensors that are not their own transmitted light from a specific location. A common arrangement is that both the emitter and the receiver are installed in the same unit, but not all photoelectric sensors are built this way.

Switch Mode Power Supply (SMPS):



Power supply switching power converter that uses switching devices such as MOSFETs that are always on and off at high frequencies; and energy storage devices such as capacitors and inductors to provide power during the operation of the switching device.

The goods are 90% efficient, are small in size and are widely used in computers and other sensitive electronic devices.

Solenoid Valve:



The solenoid valve is an electrically controlled valve. The valve has a solenoid, which is an electric coil with a ferromagnetic spine (plunger) that moves in the center. In the resting area, the plunger closes the small orifice. The electric current using the coil creates a magnetic field. The magnetic field uses a vertical force on the plunger that opens the orifice. This is the basic principle used to open and close solenoid valves. It helps to fill the bottle by

opening and closing the tank valve when the bottles are found.

Conveyor belt:



The conveyor belt system consists of two or more pulleys (sometimes called drums), with a closed loop carrying-belt-loop-loop. One or both pulley is powered, moving the belt and objects in the belt forward. A strong pulley is called a driving pulley while a weak pulley is called an idler pulley. The conveyor belt is a long rubber band or plastic, used to move a bottle line.

IV. CONCLUSION

In this project, an automatic bottle filling machine is designed and constructed. All the components are performing well. It is a time based control system. It has some advantages over traditional filling process. This filling machine is cost effective. It saves human effort and time. It can be used in small scale bottle filling systems such as coffee shops, juice shops and other beverage industries.

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