# PLC Based Bottle Filling Capping Labelling & Counting

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***Abstract*— Automation plays an increasingly important role in the world economy. One of the important applications of automation is in the soft drink and other beverage industries, where a particular the field of automation has had a notable impact in a wide range of industries beyond manufacturing. Automation is the use of control systems and information technologies to reduce the need for human work in the production of goods and services. In the scope of industrialization, automation is a step beyond mechanization. Whereas mechanization provides human operators with machinery to assist them with the muscular requirements of work, automation greatly decreases the need for human sensory and mental requirements as well. Liquid has to be filled continuously. For these kinds of applications. The trend is moving away from the individual device or machine toward continuous automation solutions. Totally Integrated Automation puts this continuity into consistent practice. Totally Integrated Automation covers the complete production line, from receipt of goods, the production process, filling and packaging, to shipment of goods**

***Keywords*— PLC delta,16 relay board , solenoid valves , motor , IR Sensor , compressor , SMPS , PLC software(WPL soft) , SCADA software (SCR EDIT V2.00).**

## I. INTRODUCTION

In Production Industries Filling, Capping & Labeling is a task carried out by a machine that packages liquid products such as cold drinks or water .Traditional methods of bottle filling involved placing bottles below a filling machine, only one bottle at a time. After filling bottles were collected and placed in capping machine and after capping again bottles were collected and forwarded to labeling division. This method is time consuming and expensive. Our project aims at filling, Capping & labeling bottles simultaneously. The filling, capping, labeling &counting operation takes place in a synchronized manner. It also includes a user-defined volume selection menu through which the user can input the desired volume to be filled in the bottles. The entire system is more flexible and time saving. The filling and capping operations are controlled using a Programmable Logic Controllers (PLC'S). This is because PLC's are very flexible, cost effective, space efficient and reduces complexity. By programming the PLC we control the entire system. SCADA (Supervisory Control and Data Acquisition) is used to monitor the process.

## II. BLOCK DIAGRAM

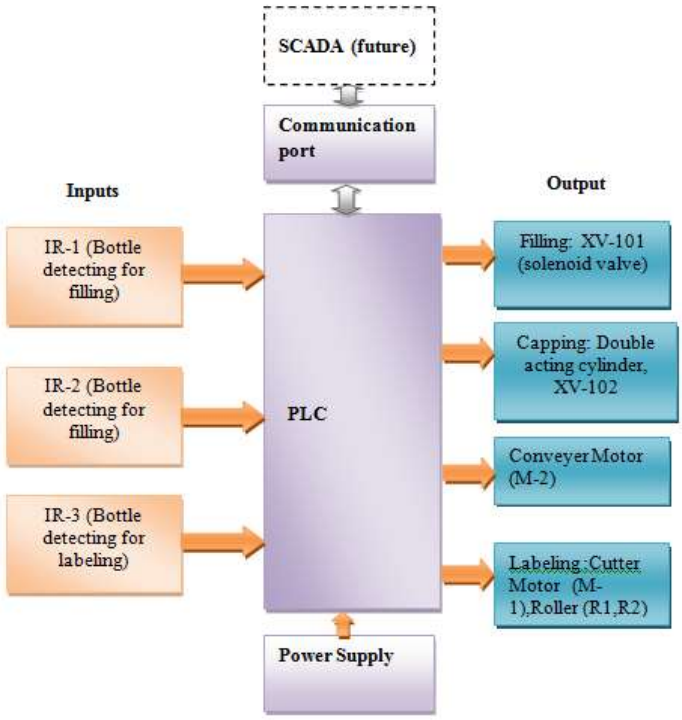


**Fig – Block diagram of overview system**

**Objectives:**

To develop an atomization using bottle

- Filling System
- Capping System
- Labeling System
- Counting System

with an intelligent control mechanism using sensors, transducers, PLC controller and SCADA system.

## III METHODOLOGY

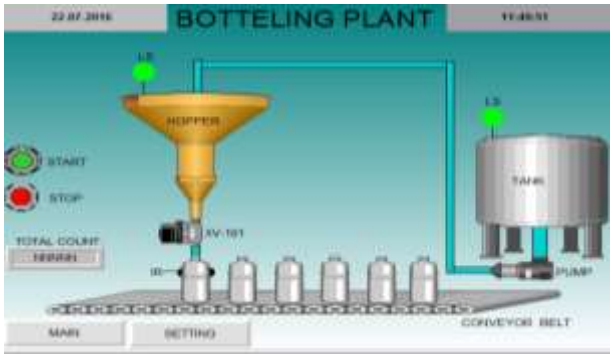


**Fig – Bottle filing**

Bottles are kept in position in a carton over a conveyor belt; they are sensed to detect their presence. IR sensors are used for sensing the bottles. Depending on the output of the sensor the corresponding pumps switch on and filling operation takes place. If the particular bottle is not present then the pump in that position is switched off, thereby avoiding wastage of the liquid. The filling operation is accompanied with a user-defined volume selection menu which enables the user to choose the volume of liquid to be filled. The filling process is done based on timing. Depending on the preset value of the timer the pump is switched on for that particular period of time and the filling is done.

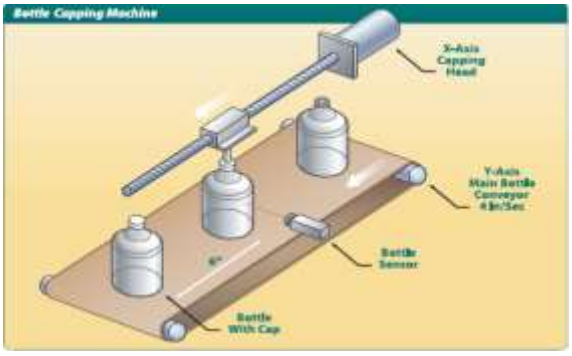


**Fig – Bottle Capping**

Bottle capping machines are one of the last pieces of equipment a liquid-filled container will pass through prior to shipping. The bottles of liquid, in this particular application shampoo bottles, are passed via conveyor from the filling station to the capping station. At the capping station, a capping head is accelerated to match speed with the bottles on the conveyor. Once at matched speed with the bottle, an output fires which crimps the cap onto the bottle. The capping head then decelerates, and rapidly returns to the beginning of the cycle for the next bottle. To maintain high throughput, the conveyor is never stopped during the cycle.

**Fig – Bottle Labelling**

In a labelling system, incoming Capping bottle is till rotated in horizontal direction and put into a labelling system. In this system brand name label roll is attached on roller motor. Bottle is come on a conveyer, roller put a label on a bottle and bottle rotated 360dgr. Label putting is completed; cutter is used to cut a label roll to a bottle.

## III.FLOW CHART OF SYSTEM

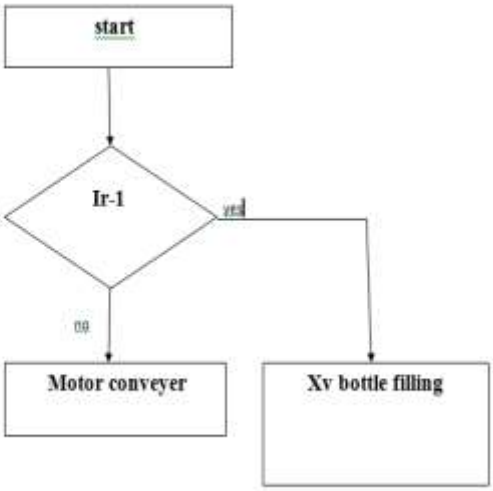


**Fig- Flow Chart of Bottle filling**

 

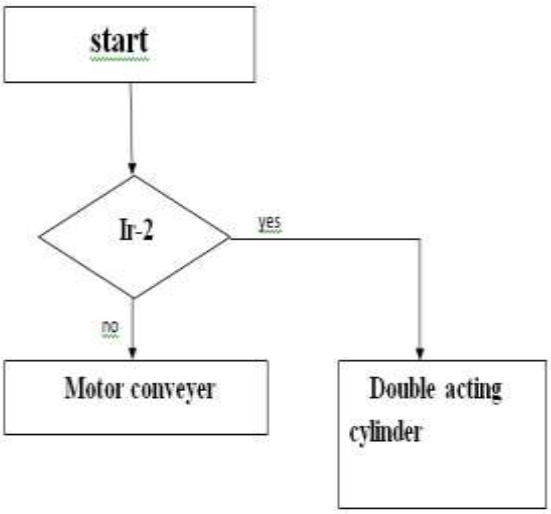


**Fig – Flow Chart of Bottle Capping**

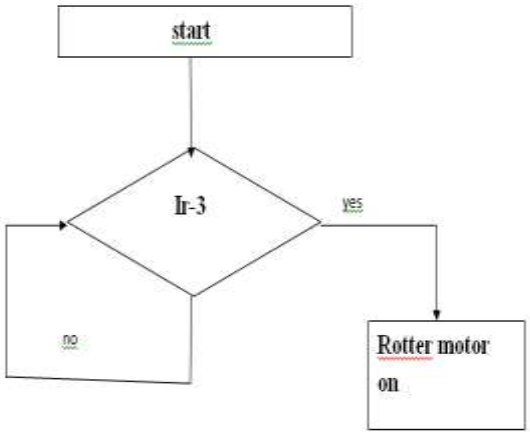


**Fig – Flow Chart of Bottle Labelling**

## IV. REQUIRED HARDWARE

### 1. PLC

**Hardware Features**

Feature Description

1 Output Terminal Block 7 LCD Keypad (ESC, OK, Up, Down, Left, Right)

2 Battery Connector 8 Status LED indicators

3 Bus Connector Interface to Expansion I/O 9 Memory Module Port Cover(1) -or-Memory Module(2)

4 Battery 10 DIN Rail Latches

5 Input Terminal Block 11 RS-232/485 Communication Port (Channel 0, isolated)

6 LCD 12 Ethernet Port

### 2. Power Supply


Power supply is an electronic circuit that is used for providing the electrical power to appliances or loads such as computers, machines and so on. These electrical and electronic loads require various forms of power at different ranges and with different characteristics. So, for this reason the power is converted into the required forms (with desired qualities) by using some power electronic converters or power converters.

Electrical and electronic loads work with various forms of power supplies, such as AC power supply, AC- to-DC power supply, High-voltage power supply, Programmable power supply, Uninterruptable power supply and Switch-mode power supply.

**DC to DC Converter SMPS Working Principle**

In a DC-to-DC converter, primarily a high-voltage DC power is directly obtained from a DC power source. Then, this high-voltage DC power is switched at a very high switching speed usually in the range of 15 KHz to 50 KHz.

And then it is fed to a step-down transformer which is comparable to the weight and size characteristics of a transformer unit of 50Hz. The output of the step-down transformer is further fed into the rectifier. This filtered and rectified output DC power is used as a source for loads, and a sample of this output power is used as a feedback for controlling the output voltage. With this feedback voltage, the

 

ON time of the oscillator is controlled, and a closed-loop regulator is formed.

### 3. Valve

It is an electromagnetic valve used to control various types of liquids by opening and closing automatically. Various types of applications are performed by using this solenoid valve. When the start button is pushed, the motor starts hence the conveyer belt starts moving. When the bottle is under the solenoid valve, the bottle is sensed and the motor stops hence the conveyer belt stops. Then the solenoid valve operates and the bottle starts filling the water. When the bottle completes filling process, the solenoid valve is closed and the motor starts, the conveyer belt starts moving and carries the bottle away from the solenoid valve. If another bottle is sensed then the above process will be repeated. When stop button is pressed or activated then the entire process will be stopped.

### 4. Pneumatic valve

Pneumatic valves help to provide safe and precise control of actuators in a compressed air system. Pressure relief valves control pressure at their inlet port by exhausting pressure to atmosphere. They are used only in receivers or air storage devices, such as accumulators, to prevent excessive pressurization.

### 5. IR sensor (+5v)


This sensor provides the system with ability to detect the presence of object position. The theory is the IR emitter emits infrared light. If an object presence the signal will be reflected back to the receiver. Then, the IR detector implemented will detect the reflected light. Then, the correspondence signal sends to the PLC for being analyze.

### 6. Relay

A relay is an electromagnetic switch operated by a relatively small electric current that can turn on or off a much larger electric current. The heart of relay is an electromagnet. Relay are switches that open and close circuits electromechanically or electronically. Relays control one electrical circuit by opening and closing contacts in another circuit. When relay contact is Normally Closed (NC), there is closed contact when the relay is not energized.

### 7. Motor

Motor is a small electronic device that can move if the power supply connect. It is a main part to make the conveyor belt moves perfectly. There are many type of DC Motor at market such as gear DC motor, motor servo and stepper motor but in this project DC motor will be used because it can spin 360°ss continuously. Moreover, it is strong enough to move the trek Figure above shows the sample of the DC motor. DC motor or

 

direct current motor is the most common motor. There are many types of DC motor likes 5-pole motor, servomotor, brushless motor, coreless motor, fix magnet motor and many more. DC motor takes direct current voltages as input and converts it into a rotational movement. DC motor basically have two wires, and can directly powered from a battery or other DC power supply. DC motor also can be power from the driver circuit that can regulate the speed and direction of the motor. The usual voltages of the DC motor use are 6V and 12V. The current rating depends on the make of the conveyor build for and it is usually between IA and 3A. Varying the voltage input to the motor will varies the speed of motor accordingly. DC motor has ability to turn at high revolution per minutes (RPM) but has low torque.

## V. CONCLUSION & FUTURE ENHANCEMENT

The purpose of this project is to develop a PLC based automatic bottle filling system plant. We gained more knowledge about various processes directly used in industries such as filling, capping, labelling. Which are used in automation system in which we specifically learnt about Programmable Logical Controller (PLC). Automation system is used to increase productivity, better quality in less time. The main purpose of this whole system is control the plant without human this provide full automation to any industry by using PLC . This system is more flexible than other, more reliable time saving and user friendly

Actually, a lot of weakness from the project can be taken as future works so that the improved system will be better in terms of performance. So that, there are several recommendations or suggestions that we can take to increase performance in this project. The performance of Automatic Filling Water System can be increased based on two recommendations which are;

The system that is proposed now is using only one sensor that is IR sensor to detect position of bottle. It will be better if we add more sensors in this system like a flow sensor to detect water flow or use level sensor to detect water level. Thus, the system will be more sensitive as there will be more sensing point Besides using PLC as controller, the other controller can be used in this future work is like Microcontroller. However, many factors must be considered like cost, practically and others. More features can be added to this system as follows: depending on the size, shape and weight of the bottles, filling and capping operations can be implemented. Capping operation can be improvised using a piston arrangement.

## REFERENCES

[1 ] Shaukat.N, ,PLC based automatic liquid filling process, Multi Topic Conference 2002, IEEE publications.
[2 ] Dunning Gray (1998) - 'Introduction to Programmable Logic Controllers' - Delmar publishers, pp.421-428.
[3 ] Petruzella, Frank D. (2010) - 'Programmable logic Controllers' - Tata McGraw Hill Education, pp.6-12.
[4 ] Rashid, M.H. (2010) – 'Power Electronics'- British Library of Congress.
[5 ] Rehg,James A. Glenn J Sartori (2009) – 'Programmable Logic Controllers'- Pearson prentice Hall ,pp. 230-239.

 