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PLC(Programmable Logic Controller) BASED AUTOMATIC BOTTLE FILLING

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ABSTRACT- Filling 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 onto a conveyor and filling only one bottle at a time. This Method is time consuming and expensive.
This paper aims at filling bottles simultaneously. The filling and capping 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 operations are controlled using 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.

KEYWORDS

PLC,Automation,Sensors,Valve,Dc Motor,Programming Language,Addressing Of Delta Plc

INTRODUCTION

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.

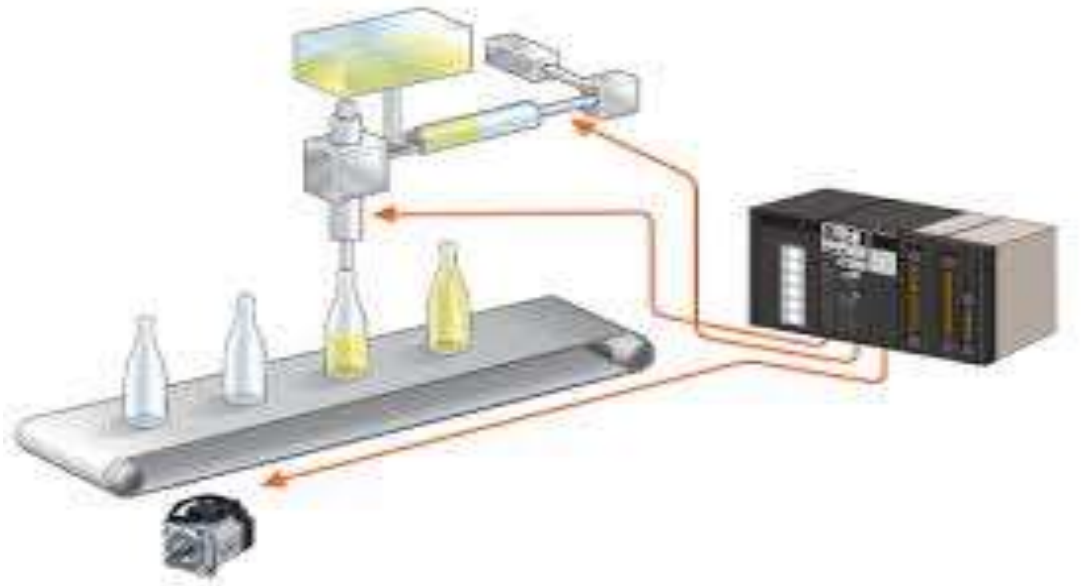
Automation plays an increasingly important role in the world economy. One of the important applications of automation is in the soft drink and other beverage industries, where a particular liquid has to be filled continuously.

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.

This project is an application of automation where in i have developed a bottle filling system .The various processes are controlled using a PLC (Programmable Logic Controller).

PROJECT DIAGRAM



WORKING

To develop an automatic bottle, filling and capping system with a deduction mechanism using sensors. Automatic filling process for all the bottles simultaneously with a user defined selection for volume to be filled.

Bottles are kept in position in a carton over a conveyor belt; they are sensed to detect their presence. Proximity 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 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.

This paragraph gives a detailed explanation of the various processes taking place in a complete bottling system.

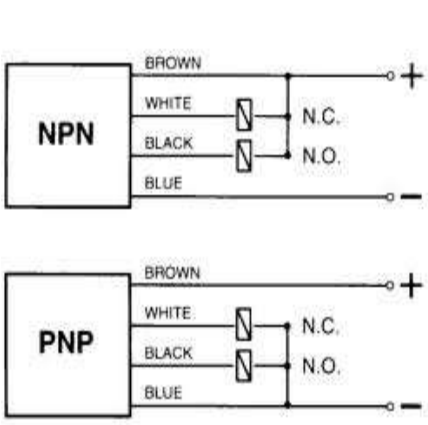
The filling operations take place in a sequential manner as shown in FIGURE . When no bottles are kept in the input the system is reset. Depending on the number of bottles fed into the input side, the corresponding bottles are filled.

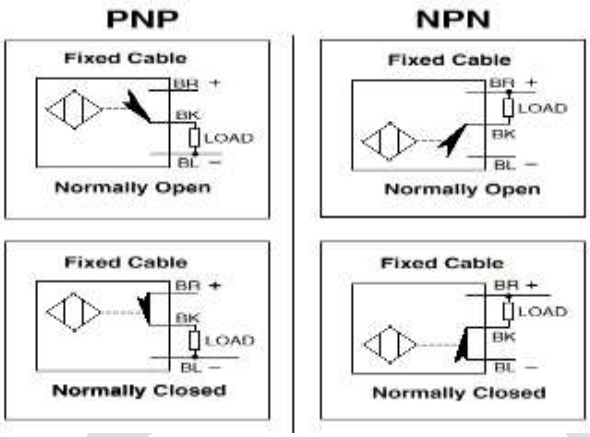
The process is also provided with a user defined volume selection menu.

Once the bottles are detected in the input side the conveyor motor switches ON and it starts moving in the forward direction. The bottles then reach the desired position for filling and the conveyor stops. The corresponding pumps in process tank switch ON and filling operation takes place. For e.g. if only bottle is present then inlet valve switches ON.

OTHER HARDWARE USED

SENSORS (PROXIMITY SENSORS)





PNP Normally Open: provides voltage to BR & BL, the resistor such as 1K can be used as a load. BK will provide a positive voltage if the metal object presence. Therefore, you can use BK & BL to power a motor or a light when the metal part is presence.

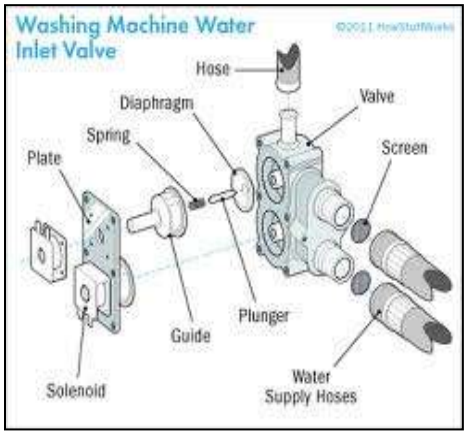
PNP Normally Closed: provides voltage to BR & BL, the resistor such as 1K can be used as a load. BK will not provide a positive voltage if the metal object presence. Therefore, you can use BK & BL to turn off a motor or a light when the metal part is presence.

NPN Normally Open: provides voltage to BR & BL, the resistor such as 1K can be used as a load. BK will provide a negative voltage if the metal object presence. Therefore, you can use BK & BR to power a motor or a light when the metal part is presence.

NPN Normally Closed: provides voltage to BR & BL, the resistor such as 1K can be used as a load. BK will not provide a negative voltage if the metal object presence. Therefore, you can use BK & BR to turn off a motor or a light when the metal part is presence.

Sometimes the proximity sensor has built in "LOAD" mechanism; therefore, there is no need for resistor.

INLET VALVE



DC MOTOR

- Basically consists of

1. An electromagnetic or permanent magnetic structure called field which is static.
2. An Armature which rotates-

- The Field produces a magnetic medium.

The Armature produces voltage and torque under the action of the magnetic field.

ABOUT SYSTEM MODEL

The details specification and system details are as follows

SYSTEM SPECIFICATION

- Input: 220 V AC
- Maximum bottle height: 5.7''
- Maximum bottle diameter: 2.7''
- Maximum pressure: 1 bar

- 2 filling Nozzle
- Automatic shut off when bottle is full
- Best liquid: Water

SYSTEM DETAILS

- Conveyor system with motor for movement of bottle.
- Proximity sensor for sensing bottle positions.
- Liquid filling Operation.
- Bottle count operation
- Inlet valve for control of liquid filling.
- Digital Input- 4 no.
- Digital Output- 3 no.
- PLC with DI/DO Configurations.

LANGUAGE USED FOR PROGRAMMING PLC

Ladder logic is a programming language that represents a program by a graphical diagram based on the circuit diagrams of relay logic hardware. It is primarily used to develop software for programmable logic controllers (PLCs) used in industrial control applications. The name is based on the observation that programs in this language resemble ladders, with two vertical rails and a series of horizontal rungs between them.

Ladder logic has contacts that make or break circuits to control coils. Each coil or contact corresponds to the status of a single bit in the programmable controller's memory. Unlike electromechanical relays, a ladder program can refer any number of times to the status of a single bit, equivalent to a relay with an indefinitely large number of contacts.

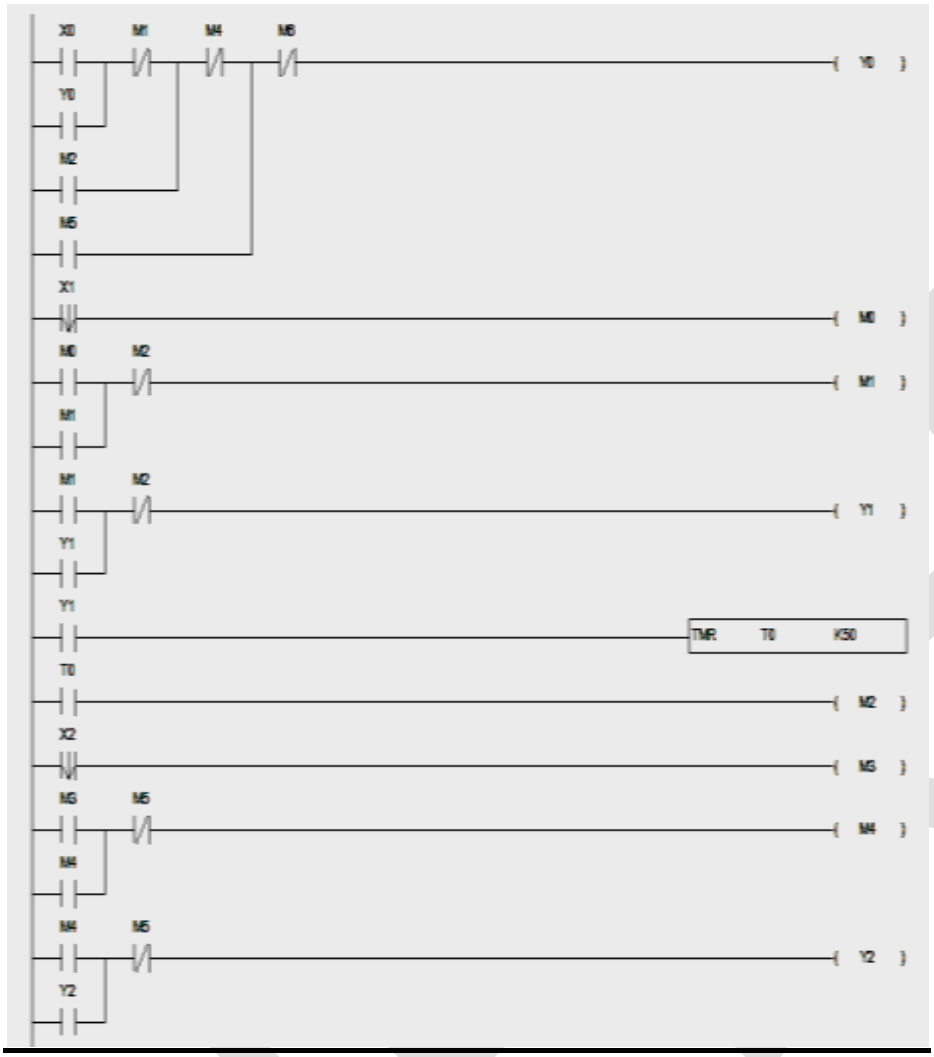
So-called "contacts" may refer to physical ("hard") inputs to the programmable controller from physical devices such as pushbuttons and limit switches via an integrated or external input module, or may represent the status of internal storage bits which may be generated elsewhere in the program.

Each rung of ladder language typically has one coil at the far right. Some manufacturers may allow more than one output coil on a rung.

- —( )— A regular coil, energized whenever its rung is closed.
- —(\)— A "not" coil, energized whenever its rung is open.
- —[ ]— A regular contact, closed whenever its corresponding coil or an input which controls it is energized.
- —[\]— A "not" contact, open whenever its corresponding coil or an input which controls it is energized.

The "coil" (output of a rung) may represent a physical output which operates some device connected to the programmable controller, or may represent an internal storage bit for use elsewhere in the program.

PROGRAM FOR THIS RESEARCH



PLC Used In This research

- **DELTA**

- **DVP – 14ES/EX/EH/SS2**

Other models of delta plc are ..

- DVP – 16ES/EX/EH/SS
- DVP – 32ES/EX/EH/SS
- DVP – 64ES/EX/EH/SS
- DVP – 128ES/EX/EH/SS

Software:

- WPL Soft 2-12

+

Communication Cable: RS-232

Addressing:

For addressing in Delta,

Data Register, D0 to D119 : General
D200 to D512 : Latched
D8000 to D8255 : Special

Timer, T0 to T119 : 100ms
T200 to T245 : 10ms

T246 to T249 : 1ms
T250 to T255 : 100ms^{R} (R- retentive)

Counter, C0 to C99 : 16-Bit Up-Counter
C100 to C199 : 16-Bit Latched Up Counter
C200 to C219 : 16-Bit General Counter
C220 to C254 : 32-Bit Latched Up-Down Counter

Input	Output	Auxiliary Relay	Data Register	Timer	Counter
X0	Y0	M0	D0	T0	C0
X1	Y1	M1	.	.	.
.	.	.	.	.	.
.	.	.	.	T119	C99
.	.	.	D119	T200	C100
.	.	.	D200	.	.
.	.	.	.	.	.
.	.	.	.	T245	C199
X15	Y15	M15	.	T246	C200
.	.	.	D512	.	.
.	.	.	D8000	.	.
.	.	.	.	T249	C219
.	.	.	.	T250	C220
.	.	.	.	.	.
.	.	.	.	.	.
X128	Y128	M1023	D8255	T255	C254

CONCLUSION

The main objective of this paper is to develop a bottle filling system based on certain specifications.

More features can be added to this system as follows: Depending on the size, shape and weight of the bottles, Filling operations can be implemented. Capping operation can be done using a piston arrangement.

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