Automatic Bottle Filling Using Plc

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Abstract: **The objective of our project is to design, develop and monitor "Automatic bottle filling system using PLC". This work provides 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**

Filling is the task that is carried out by a machine and this process is widely used in many industries. In this project, the filling of the bottle is controlled by using a controller known as PLC which is also the heart of the entire system. For the conveyor system, a dc motor has been selected for better performance and ease of operation. A sensor has been used to detect the position of the bottle. In our project we have used less number of systems hence the overall cost has been reduced to an extent. Ladder logic has been used for the programming of the PLC, which is the most widely used and accepted language for the programming of the PLC. The PLC used in this system is a MELSEC FX-1N which makes the system more flexible and easy to operate

I. INTRODUCTION

The project is based on industrial automation and PLC is the heart of automation. The hardware and the software are the two important areas in our project.

1) HARDWARE DESCRIPTION: In this project, MELSEC FX1N-24 is used for controlling the inputs and outputs. Input supply to the PLC is given through a SMPS. The rating of the SMPS is 24VDC 5 Amps. The PLC used here is a compact PLC which has a fixed number of inputs and outputs. In this kind of PLC model, the CPU contains 14 digital inputs and 10 digital outputs. One diffuse photoelectric sensor has been used for the positioning of the bottles. A geared DC motor has been used for running the conveyor system. The rating of the DC motor is 12V and 50 RPM speed with a high starting torque of 70 Kg-cm (at no load). Toggle switches are used to serve the purpose of some inputs to the PLC.

2) SOFTWARE DESCRIPTION: There are five important languages which are used for the programming of the PLC. The list of the methods are as follows: ● Functional block diagram (FBD) ● Structure text ● Instruction list ● Flow chart ● Ladder diagram Out of these five languages, ladder is the most widely used language and is simple as compared to other languages. Ladder diagram has been used for the programming of this PLC is the most widely used language and is simple as compared to other languages. Ladder diagram has been used for the programming of this PLC

II.LITERATURE SURVEY

1.An Automated Bottle Filling Project For Freshman Engineering Students –June 2005 In this paper the researchers Kala Meah, Timothy Garrison , York College of Pennsylvania at all.. The students work in small teams and have r toughly 12 weeks to design an automated electromechanical system that first transports three empty bottles, three tennis balls. The machine must fill each bottle of water, filled bottles to an area outside of the operational zone.

2. PLC Based Automatic Bottle Filling System With User Defined Volume Selection -8thAugust 2012.In This Research Paper the researchers T. Kalaiselvi, R.Praveena at have develop an automatic bottle, filling system with a mechanism using sensors. Automatic filling process for all the bottles simultaneously with a user defined selection for volume to be filled.

Different height Using Programmable Logical Controller –14th July 2013.In This Research Paper the researcher MALLARADHYA H M, K R PRAKASH have Design and Develop an automated liquid filling

to bottles of different height using PLC. A total control is made in a filling is achieved. The programming to this system developed is flexible, quickly and easily.

II.OBJECTIVE

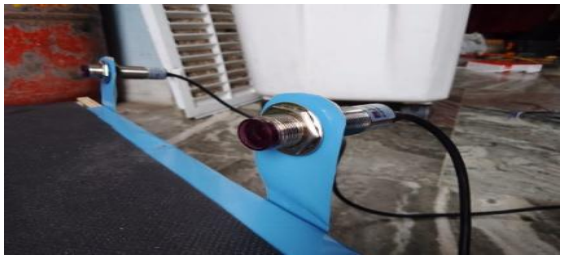
The Main objective to make this project is to introduce the interface between the human working in industry and with the industries. This project once implemented can save a lot of time of an individual so that this precious time can be saved to utilize on some other work.

III.METHODOLOGY

1. At first, the auto selection switch is selected so that the entire system operates automatically.
Then the "Auto start push button" (toggle switch is used here) is selected and the motor starts and the conveyor belt starts moving. The DC motor used is a 2.DC geared type motor whose shaft is coupled directly with the shaft of the roller. This motor has an input voltage of 12v with an input current of 600mA to 14A.The reason for selecting this motor is to achieve a high starting torque at a constant speed.
3.It has a torque of 70 kg cm. The motor comes with a metal gearbox and centered shaft. Shaft is loaded with bearings for wear resistance. The reason for choosing such a high torque is having such heavy rollers used on the either side of the hardware which is mounted with a conveyor belt.

IV.REQUIREMENT SPECIFICATIONS

Photoelectric Sensor:



[FIG: Photoelectric Sensor]

A photoelectric sensor is a device used to determine the distance, absence, or presence of an object by using a light transmitter, often infrared, and a photoelectric receiver. They are largely used in industrial manufacturing. There are three different useful types: opposed (through-beam), retro-reflective, and proximity-sensing (diffused). The operating voltage of a photoelectric sensor is 6 – 36 V DC and its output current is 300 m A. Its response frequency is 0.5 kHz. Its output type is n – p – n 3 wire (Black, Blue and Brown). It is made of brass or plastic. In this project, It is used to sense the position of the bottles. A round shaped sensor is used which can detect opaque, transparent or any other kinds of objects. In this case it is detecting different plastic bottles. The sensor used here is a diffuse reflective type sensor. The range of sensing the objects are 100 mm.

DC Geared Motor:

[FIG: dc geared motor]

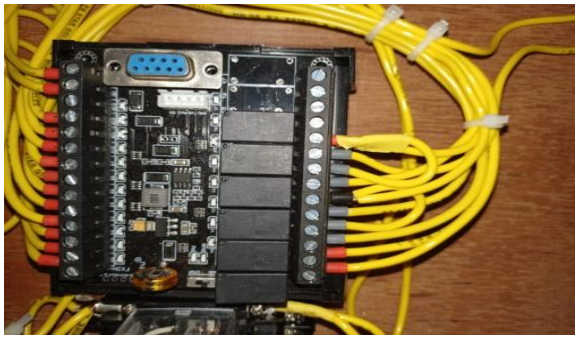
The DC motor used is a DC geared type motor whose shaft is interconnected with the shaft of the roller. This motor has an input voltage of 12v with an input current of 600mA to 14A. It's no load speed is 50 RPM. The reason for selecting this motor is to achieve high torque at a constant speed. It has a torque of 70 kg cm which provides sufficient torque for our load. The motor comes with a metal gearbox and centered shaft. Shaft is loaded with bearings for wear resistance. The reason for choosing such a high torque is having such heavy rollers used on either side of the hardware which is mounted with a conveyor belt

Water pump:

[FIG: WATER PUMP]

The net weight of the pump is 150 gm. Its dimensions of inlet and outlet are 15 mm O. D. and 5 mm O. D. Its working voltage is 12 V DC and working current is 0.1 – 0.5 A. Its lift is 130 cm at 12 V DC and flow rate is 300L/H. In this project, the water pump is submerged in the reservoir from where the water will be pumped up to the main tank if it gets empty

PLC MODULE :



[FIG: PLC MODULE]

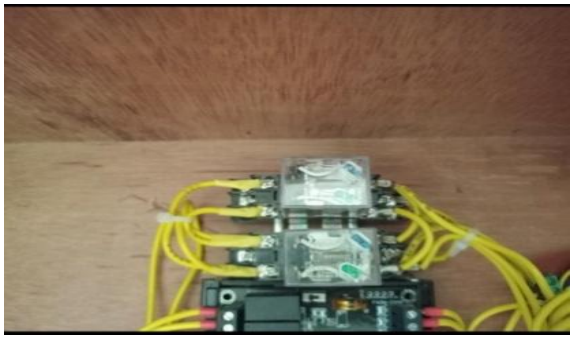
The compact micro-controllers of the MELSEC FX series provide the foundation for building economical solutions for small to medium-sized control and positioning tasks requiring 10 to 256 integrated inputs and outputs in applications in industry and building services. With the exception of the FX1S all the controllers of the FX series can be expanded to keep pace with the changes in the application and the user's growing requirements. Network connections are also supported. This makes it possible for the controllers of the FX family to communicate with other PLCs and controller systems and HMIs (Human-Machine Interfaces and control panels). The PLC systems can be integrated both in MITSUBISHI networks as local stations and as master or slave stations in open networks like PROFIBUS DP.

SMPS:

[FIG: SMPS]

A switched-mode power supply is an electronic power supply that incorporates a switching regulator to convert electrical power efficiently. Like other power supplies, an SMPS transfers power from a DC or AC source (often mains power) to DC loads, such as a personal computer, while converting voltage and current characteristics. Unlike a linear power supply, the pass transistor of a switching-mode supply continually switches between low-dissipation, full-on and full-off states, and spends very little time in the high dissipation transitions, which minimizes wasted energy. Ideally, a switched-mode power supply dissipates no power. Voltage regulation is achieved by varying the ratio of on-to-off time. In contrast, a linear power supply regulates the output voltage by continually dissipating power in the pass transistor. This higher power conversion efficiency is an important advantage of a switched-mode power supply. Switched-mode power supplies may also be substantially smaller and lighter than a linear supply due to the smaller transformer size and weight. In this project, 24 V DC and 12 V DC SMPS had been used for the power supply of the different components used. For example, 12 V DC is used to supply power to the water pump, DC geared motor and 24 V DC is used to supply power to the solenoid valve, water float switch and photoelectric sensor.

RELAY:



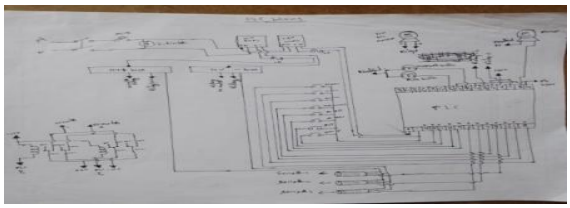
[FIG:RELAY]

In our simple relay above, we have two sets of electrically conductive contacts. Relays may be "Normally Open", or "Normally Closed". One pair of contacts are classed as Normally Open, (NO) or make contacts and another set which are classed as Normally Closed, (NC) or break contacts. In the normally open position, the contacts are closed only when the field current is "ON" and the switch contacts are pulled towards the inductive coil.

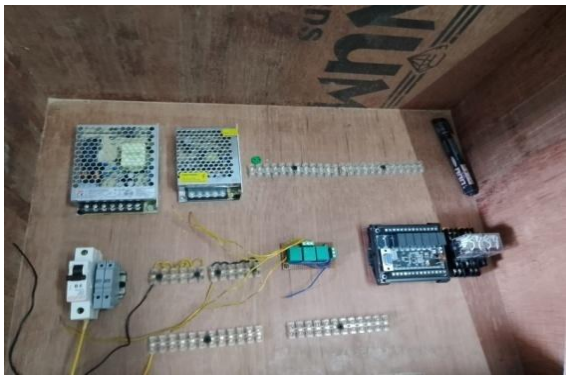
In the normally closed position, the contacts are permanently closed when the field current is "OFF" as the switch contacts return to their normal position.

These terms Normally Open, Normally Closed or Make and Break Contacts refer to the state of the electrical contacts when the relay coil is "de-energized", i.e, no supply voltage connected to the relay coil. Contact elements may be of single or double make or break designs.

V.CIRCUIT CONNECTION



[FIG : CIRCUIT DIAGRAM]



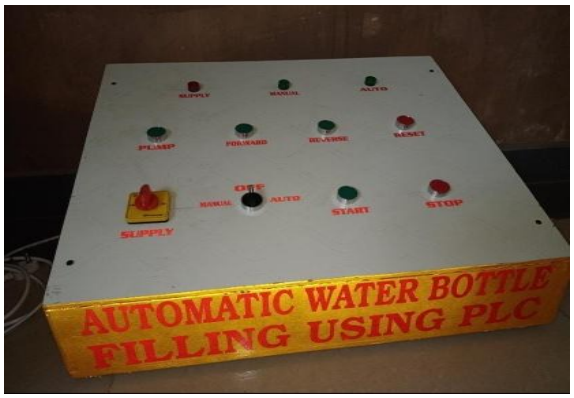
[FIG:ASSEMBLING PARTS]

[FIG: TOTAL DESIGN OF CIRCUIT]

VI.CONCLUSION

The main objective of this project was to develop a bottle filling system based on certain specifications. The project presents an automatic filling system controlled by PLC as per the filing requirement which has simple operation. The system has the advantages of simple structure and reliable operation. The system is controlled by PLC. This was successfully implemented. We consider this project as a journey where we acquired knowledge and also gained some insights into the subject which we have shared in this report.

VII.RESULT



[FIG: FINAL PROJECT]

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