Automatic Bottle Filling System

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Abstract- *Liquid filling machine is capable of incorporating a tank, bottle or container to fill the liquid. Liquid filling machines are important equipment in various industries like cosmetics, food, etc. where liquids are to be packed in various types of containers. This machine helps in reducing wastage and can be easily and efficiently packed into containers that to very fast. In our proposed technology we have designed an automatic liquid filling machine which will work on flow meters. We have use microcontroller, flow meter, solenoid valve, stepper motor, and proximity sensor and conveyor belt. The paper includes working of the machine, simulation result and also the scope. Our project is a combination of electronics and mechanical work and it is used in industrial production and it is also suitable for small scale industries.*

Keywords- microelectronic design, micro machines, customer survey, bottle filling, conveyor system, automation

1. Introduction

The current scenario in industries is to embrace new technologies to proceed towards automation .The same vision is exercised in bottle plants .In small industries bottle filling operation is done manually. It aims to eliminate problems faced by small scale bottle filling systems. With this system that operates automatically on microcontroller, every process of filling can reduce workers cost and operation time.

The automation of bottle filling involves use of PLC for control but it is costly. Instead of all such advanced technologies small industries are still involved in manual filling of bottles. They might be discouraged from adapting to new technology due to the high cost involved in automation. The study emphasizes on reduction in cost using pic18f microcontroller. The pic microcontroller is relatively cheap and widely available. The manual filling process has many shortcomings like spilling water while filling it in a bottle, equal quantity of water may not be filled, delay due to natural activities of humans etc. So using the Flow meter eliminates the problem of filling bottles in equal quantity. The research paper emphasized on reducing complexity and cost involved in the present liquid dispenser machine. The research paper aimed to improve the metering quality of dispenser machines. The system is controlled by microcontroller programming. Also, the research paper gives information about working of system and measurement of process variables.

2. System Requirements

2.1 Pic 18f Microcontroller

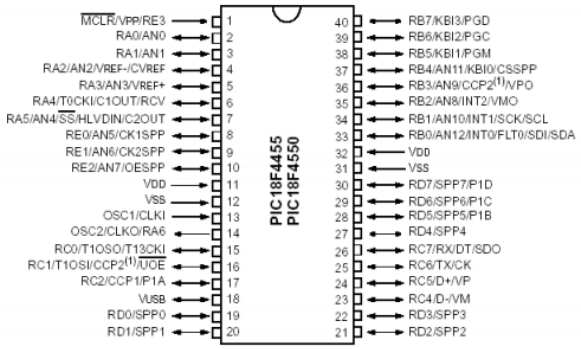

Fig-1 Pic 18f Microcontroller

The PIC18 microcontroller provides PIC micro devices that are compatible with the PIC16 family in 18-to 80-pin packages. The PIC18 family contains all the common peripherals for the most versatile solution, such as MSSP, ESCI, CCP, adjustable 8- and 16-bit timers, PSP, 10-bit ADC, WDT, POR and CAN 2.0B Active. Some PIC18 machines can have FLASH system memory in sizes from 8 to 128 Kbytes and

storage RAM from 256 to 4 Kbytes; running at frequencies from DC to 40 MHz from 2.0 to 5.5 volts;

2.2 Proximity Sensor

Fig-2 Proximity Sensor

A proximity sensor usually produces an electric force or an electromagnetic radiation pulse (e.g. infrarot), and watches for force or return signal adjustments. Often the point being felt is referred to as the target of the proximity sensor. Throughout electrical engineering, capacitive sensing (sometimes capacity sensing) is a capacitive coupling system that can sense and quantify something that is conductive that has a separate dielectric from air. Most sensor styles utilize capacitive sensing, including sensors that sense and quantify proximity, heat, location and displacement, energy, temperature, fluid level and acceleration.

2.3 Stepper Motor

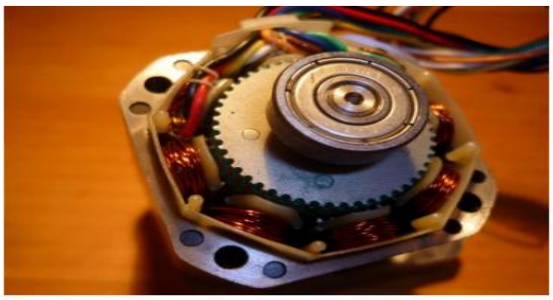

Fig-3 Stepper Motor

Stepper motors are DC motors, which move discreetly. They have several coils, grouped into "phases" sections. The motor must spin by energizing each step in a series, one stage at a time. You may obtain very accurate positioning and/or velocity regulation with a machine operated stepping. Stepper motors are, therefore, the motor of choice to several accuracy motion control applications. Stepper motors also have several "toothed" electromagnets grouped across a piece of central gear-shaped iron.

2.4 Flow meter

Fig-4 Flow meter

A flow meter (or flow sensor) is a device used to calculate the flow rate of a liquid or gas, linear, nonlinear, mass or volumetric. While selecting flow meters, one will weigh these qualitative considerations as the competence of the plant staff, their installation and repair expertise, the supply of replacement parts, and the mean period between the background of failure, etc. While calculating the velocity volumetric flow of the incompressible liquids, the existence of floating bubbles may result in error; thus, air and gas must be separated before the meter enters the substance

2.5 Solenoid Valve

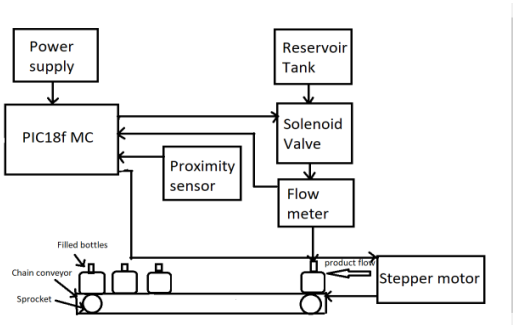

Fig-5 Solenoid valve

Solenoid valves regulate the fluid and gas flow rate in systems, equipment, and motors. These control valves, which are unique in character and have multiple kinds, have clearly performed tasks that are simple to complicate without difficulties involved. It can be designed particularly to suit specific needs and used to regulate fluids, fuels, oils, electricity from higher to lower temperatures, and other forms of media.

3. Methodology and Working

We are designing and implementing the Automatic Bottle Filling System using pic18f microcontroller. In this project all the components and devices are controlled by the microcontroller. The components we are using are conveyer belt, solenoid valve, proximity sensor, flow meter, stepper motor. The conveyor belt is driven by the motor at a constant speed and the motor is controlled by the microcontroller. Here the proximity sensor senses the bottle then it sends a trigger to the microcontroller to stop the stepper motor and thereby the conveyor belt. Flow meter is used to control the flow of the liquid that is to be filled in the bottle. Solenoid valves are acting as a switch that will start or stop the flow of liquid.

In this project we have used components that are conveyer belt, stepper motor, proximity sensor, solenoid valve, flow meter and microcontroller. This project is completed by programming.

Fig-6 Automatic bottle filling system using PIC18f

The input is given through the keyboard into the microcontroller. Accordingly, the microcontroller then activates the motor to rotate and as the motor rotates it cause the conveyor belt to move. On the conveyor belt the bottles are placed. And when the bottles will be sensed by the proximity sensor then the conveyor belt will stop moving. The proximity sensor triggers the microcontroller to actuate the solenoid valve. The moment at which the motor has stopped rotating indicating that the conveyor belt has also stopped, the solenoid valve starts or opens to flow the liquid. Next the flow meter will control the rate of flow of the liquid. As the proximity sensor is capacitive in nature it can also sense the volume of the liquid to be filled in the bottles. As soon as the required liquid is filled, the microcontroller will cut off the excitation current, thereby stopping or closing the valve and simultaneously it will rotate the motor to rotate. And thus for the remaining bottles it repeats the same process for the liquid to be filled in the rest of the bottles.

4. Result

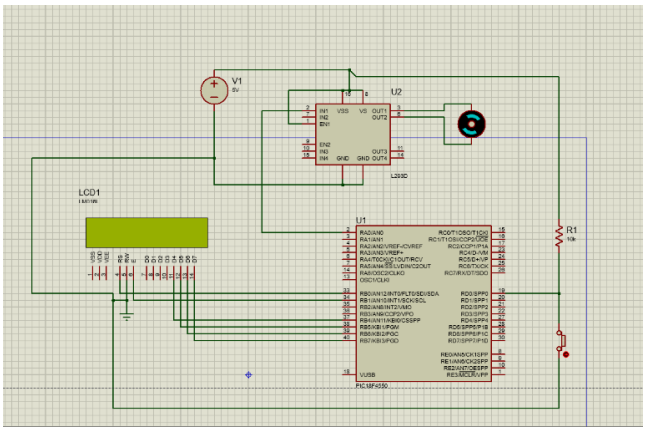

Fig-7 Simulation Result

In the simulation we have taken the components which are LCD(LM016M), pic18f, motor, motor driver(L293d).

Here instead of taking proximity sensors which will sense the bottles we have taken the switch button. When the switch is pressed then it indicates that the sensor senses the bottle and when the switch is open that is when it is not pressed that indicates that it doesn't sense the bottle. And so accordingly it sends the information to the microcontroller pic18f. When the microcontroller gets this information then it controls the motor. Here when the switch is pressed then the motor will stop and when the switch is not pressed then the motor continues to rotate. And when the switch is pressed then the LCD will display that the bottle is being filled at that time. Like this one by one bottle will get filled.

5. Scope

For now it can only fill up in bottles itself but in future it can upgrade in such a way that bottles can also feed in the conveyor itself. Here in by installation of nozzles we can fill bottles at a time which reduces the time to fill bottles and can

efficiently increase productivity but still some manual interference is required for loading and uploading of pallets from the conveyor belt .This manual interference can reduce by programming for loading and uploading operations.

The use of different types of Sensor can add to the Accuracy and precision of the product. The Calculation design can be generated to speed up the process while reducing the wastage at Zero level. The system could be redesigned for increase bottle size, speed and productivity.

6. Conclusion

The automated bottle filling system using pump filling concept was successfully implemented and studied. The system can perform the task of autonomous quality control system used in industrial production and it is most suitable for small Scale industries as definite process is set by programming. Our aim of this work is to establish a flexible, economical, easily configurable, reliable system which makes our project eco friendly because all small components that are required will be taken from scraps. This will make our project cheaper.

The fabricated model of Automated bottle filling system can be used where high precision is not necessary and time limits are not bound. Hence it must be used application specific and must not be used in places where faster and more accurate methods of filling are available.

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