"Automatic Bottle Filling Using Microcontroller Volume Correction"

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Abstract –

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.

Filling is a task carried out by a machine that packages liquid products such as cold drinks or water. The bottle filling project serves as an interdisciplinary engineering design experience. It introduces aspects of computer, electronics and mechanical engineering, including the following five primary knowledge areas: 1) Machining & Fabrication 2) Electronics circuit prototyping and Programming 3) Sensor and Actuator application 4) Mechanical design 5) Project Planning 6) Presentation Skills.

Keyword: *Bottle Filling, Conveyor, Process Automation, , Conveyor Systems.*

I. INTRODUCTION[1]

An embedded control is done by a special-purpose computer system designed to perform one or a few dedicated functions, often with real-time computing constraints. It is usually embedded as part of a complete device including hardware and mechanical parts. In contrast, a general-purpose computer, such as a personal computer, can do many different tasks depending on programming. Embedded systems control many of the common devices in use today.

Embedded controllers are often the heart of an industrial control system or a process control application.The majority of computer systems in use today is embedded in other machinery, such as automobiles, telephones, appliances, and peripherals for computer systems. While some embedded systems are very sophisticated, many have minimal requirements for memory and program length, with no operating system, and low software complexity. Typical input and output devices include switches, relays, solenoids, LEDs, small or custom LCD displays, radio frequency devices, and sensors for data such as temperature, humidity, light level etc. Embedded systems usually have no keyboard, screen, disks, printers, or other recognizable I/O devices of a personal computer, and may lack human interaction devices of any kind.

1.1 Flow Chart

According to fig. No. 1 i.e. flow chart Firstly Switch is made On. The water level in the tank is checked and if the water level available is as per required then we can go to the second stage. Here in second stage, three sensors are used. First sensor will detect the presence of empty bottle. When empty bottle is detected, motor turns on conveyor and empty bottle starts moving forward. Second sensor is placed so as to detect bottle below filling station. Thus second sensor detect presence of bottle, conveyor stop working and Pump will remain on for 15sec. Filling process goes on. After bottle is completely filled, again the conveyor start when pump is made off. Now the bottle is again moved forward to its final position. At final position third sensor is placed which will detect the presence of filled bottle. After passing through this position, bottle count will be displayed on LCD.

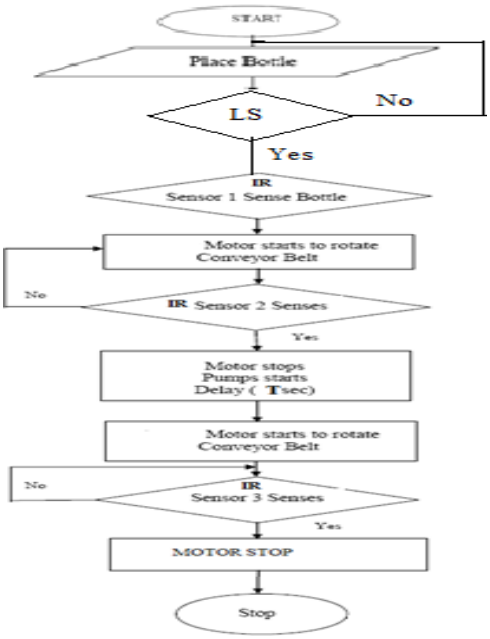

Fig. No. 01, Process flow chart

2. ELECTRONIC DESIGN[2]

2.1 MICROCONTROLLER

Microcontroller is a computer on a chip that is programmed to perform almost any control, sequencing, monitoring and display the function. Because of its relatively low cost, it becomes the natural choice to the designer. Microcontroller is designed to be all of that in one. Its great advantage is no other external components are needed for its application because all necessary peripherals are already built into it. Thus, we can save the time, space and cost which is needed to construct low cost devices

Fig. No.02 Microcontroller Chip

Specification of used microcontroller

AT89S52 MICROCONTROLLER
8KBytes of ISP Flash Memory
32 Programmable I/O Lines
Three 16 bit Timers/Counters
ull duplex UART Serial Channel
4.0 to 5.5V Operating Range
Operating temp 0 to 70 deg

2.2 SENSOR[3]

One type of feedback frequently needed by industrial-control systems is the position of one or more components of the operation being controlled. Sensors are devices used to provide information on the presence or absence of an object

IR SENSOR .TSOP17.. is the standard IR remote control receiver series, supporting all major transmission codes.
Photo detector and preamplifier in one package,
Internal filter for PCM frequency Improved shielding against electrical field disturbance ,TTL and CMOS compatibility, Output active low, Low power consumption , High immunity against ambient light, Continuous data transmission possible(2400 bps).

2.3 PUMP [4]

Series I and II Peristaltic Pumps are designed for single and multi-stage pressure or vacuum pumping of liquids. They operate by mechanical peristalsis, so the sample only comes in contact with the tubing. This allows for consistent sample integrity as well as easy cleaning and replacement. The Geo pump is ideally suited for field sample removal from shallow wells and all surface water sources or for laboratory use.

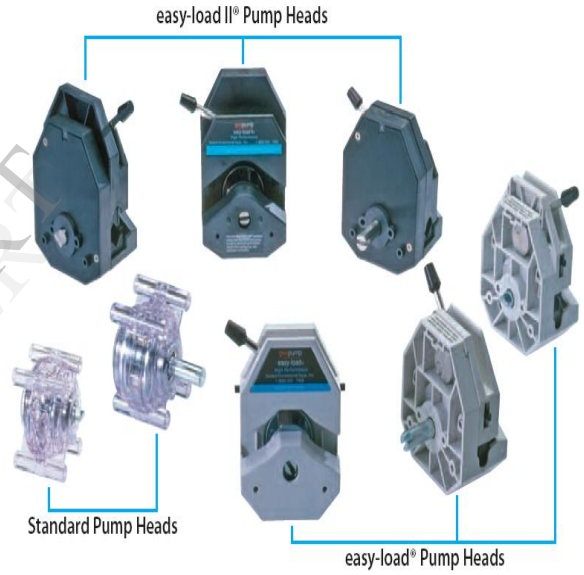

Fig. No. 03 Pump

Specification of pump

12V DC
2. Current 1-1.5A
3. Discharge capacity is 1 lit per min.
4. Operate from 60 to 600 RPM
5. Up to 1 liter/min. delivery rate
6. Operate to a depth of 27 feet (8 meters)
7. Variable speed control
8. AC only, DC only, or AC/DC combination

2.3.1 Water Pump Controlling System

We can control the water pump by connecting it with an output pin of microcontroller via a motor driver circuit. When microcontroller sends a positive signal (+5v) or a ground signal (0v) to the motor driver circuit, then the water pump become on or off respectively. We also would like to use a manual switch on the motor driver circuit

which is supposed to use for controlling it manually. It makes this system more users friendly.

2.3.2 Water Level Sensor

To make special water level sensor we would like to introduce some convenient materials such as Iron rod, nozzles, resistance, rubber etc. A connecting rod made by iron and steel which should be connected with ground and we need at least four nozzles which should be connected with +5v via a 1kΩ resistance. We need to bind them together and put a rubber at their joint point which will act as an insulator for every nozzle. When the sensor touches water, nozzles and connecting rod get electric connection using water conductivity [3].

2.4 DC Geared Motor

Motor with metal gearbox

1. 12 V DC
2. No load current 800mA(Max), Load current 9.5 A
3. Rated Torque- 10Kg-cm
4. Rated speed -30 rpm

Fig. No.04 DC Motor

3. MECHANICAL DESIGNING[4]

3.1 Conveyor Design

1) Conveyor Belt Length : 0.6m
2) Roller Diameter : 0.0350m
3) Speed of Conveyor Belt: 0.06m/ s (Considering Inertia of Bottle)
4) According to Formula :

$$V=Pi*D*N/60 \text{ m/s}$$
$$N= (60*V)/ (Pi*D)$$
$$N= (60*0.06)/ (3.14*0.035)$$
$$N=32.74 \text{ RPM}$$

From this Data standard Motor is selected having specification:
N=30 RPM, Torque: 10Kg-cm
5) Pump run time : 5sec. (Capacity: 1 lit /min)
6) Time required for one operation: 19 s (Start—fill—stop)

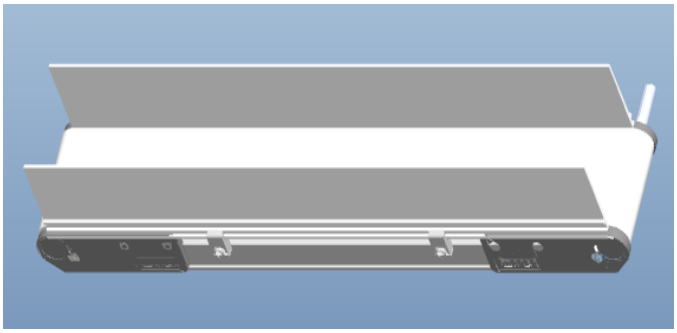

Fig. No. 05 Conveyor belt CAD Model

Advantages:

1. Inexpensive
2. Rigid
3. Small voltage usually 3V to 5V
4. These are the cores that will do anything you program

3.1 Production Rate

3.2 Production Rate [2]

The objective of this experiment is to verify that the machine can fill ten bottles in one minute. A time lapse test will begin at the start of the filling of the first bottle. End time will be recorded at the start of filling of the seventh bottle. The total time elapsed is then recorded. The experiment is done on both prototypes 1 and 2. it can be seen that on average, prototype 1 can fill 10 bottles in 50seconds.

3.3 Volume Correction

The objective of this experiment is to verify that the amount of insecticide solution dispensed by the machine into the bottle is within the specified tolerance — 200 ml to 240ml. The experiment starts by loading empty 250ml bottles on the conveyor. The machine is then turned on. Wait until all bottles are filled and . Measure the actual volume dispensed into the bottles using a beaker and record. By this method correction in volume is achieved and cost of manufacturer and customer is reduced by reducing loss of filled liquid.

CONCLUSION:

1.The system can perform the task of autonomous quality control system used in industrial production and it is most suitable for small

2.Scale industries as definite process is set by programming.

3. 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. Our project is giving us complete build up of embedded work done.

4.Designing Embedded system giving us intersecting experience in working with Microcontroller chip. Also our project is a combination of electronics and mechanical work.

5. This provides us knowledge and make us aware of what all factors we need to consider while designing a project based on automation.

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