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Automatic Sorting, Counting and Bottle Filling Robotic Station

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Abstract
This project is aimed at automating the sorting and bottle filling. This project will automatically sort bottle according to their size by using IR sensors. Then it sorts the bottle on the designated portion of conveyor belt and passes it to the Solenoid Operated Valves to fill the bottles. The overall system is liberated from human intervention. The system is comprehensive and efficient, thus can help in automating the sorting, counting and bottle filling.

Keywords: *Filling Station, Robotic Arm, Solenoid Operated Valves, Automation, Robotics*

1. Introduction

Industrial Automation plays an increasingly important part in the global economy and in daily experience. At present, for companies, the purpose of automation has shifted from growing productivity and reducing costs to broader issues. This work takes the idea of automatic sorting and bottle filling. The control system uses microcontroller. Sorting of bottles is done on the conveyer belt via IR sensors and then these bottles are filled by actuating the solenoid valves. The conveyors are used in many automated industries for moving parts from one place to another. The second concern is the bottle filling. Once the bottle is sorted, conveyer belt transfers it under the water tank for filling. The main objectives of our project are:

- Sorting of bottles based on their respective sizes.
- Filling of bottles using SOV.

2. Operation

The IR sensors are clamped at specific height to detect the bottles according to their heights. When the sensor detects the bottle, it gives signal to the controller. Controller drives the dc motor for push mechanism, in this way sorting of bottle is done. In second stage, after sorting, when the bottle reaches near to the water reservoir. IR sensor detects bottle again it generates the logic 1. The controller receives that signal, and at the same time it performs two functions by switching two relays. The first relay stops the motor which is driving the conveyor belt. Secondly, solenoid valve is actuated via second relay.

3. Mechanical Structure of Project

Dimension of conveyor belt

- Length == 12 feet
- Width == 21 inch

Dimension of wooden roller

- Length == 28 inch
- Diameter of roller == 4 inch

Diameter of pulleys

- Pulley 1 == 24 inch
- Pulley 2 == 12 inch
- Pulley 3 == 2 inch
- Pulley 4 == 2 inch

Diameter of bearings

- There are four bearings used in our project, each having diameter 1.5 inch.

Diameter of shaft

- There are four shafts at the end of rollers. Each shaft has diameter equal to 1.5 inch.

Dimension of A Size V belt:

- 85 inch
- 45 inch

Dimension of structure

- Length = 6 feet
- Width = 3 feet
- Upper border = 26 inch
- Lower border = 29 inch

- Height = 18 inch

Types of wood
- Shesham
- Cheerh

4. Electronic Components

4.1 Microcontroller:
We used microcontroller AT89C51 in our project as a control unit. We select it because it is cheap and easily available. It has 4 Kbytes of ROM and 128 bytes of RAM.

4.2 ULN 2003:
The ULN2003A is a high voltage and high current Darlington transistor arrays. It consists of seven NPN darling-ton pairs that feature high-voltage outputs. Applications include relay drivers, motor drivers, lamp drivers, line drivers, and logic buffers. The ULN2003A has a 4.7kilo ohm series base resistor for each darling-ton pair.

4.3 Alphanumeric LCD:
Liquid crystal display (LCD) is a flat panel display, electronic visual display or video display It is used to display. Alphanumeric characters It has 16 pins. Display size is 20x4.

4.4 Optocoupler:
Used to isolate 2 parts of a system e.g. driving a motor. It reduces the effect of back E.M.F. Uses in systems having coil winding like motors. Has an LED transmitter and a photo sensor receiver separated by each other by gap The IC we used in our project as an optocoupler is MCT2E.

4.5 Sensors:
We used IR sensors in our project to sort, fill and count bottles. We chose it because it has high sensitivity and long range. Emitter LED emits infra-red rays which are invisible. It requires 5v to operate and 330ohm resistor to limit the current.

5. Electrical Components

5.1 Single phase induction motor:
Type of AC motor where power is supplied to the rotor by means of electromagnetic induction. The stator is powered with alternating current and rotor is attached to shaft. The induction motor in our project is used to drive the conveyor belt. Identical to 3-phase induction motor except it has single phase winding on the stator. It has no starting torque but some special arrangements have to be made for making itself starting. During starting period, it must be converted into type that is not single phase induction motor but it becomes true single phase induction motor when it is running. Induction principle, depends on Faraday's law of induction.

- Power = 0.5 HP
- Current = 3 - 3.5 A
- I/p Voltage = 220 - 240 volts
- O/p RPM = 1450 rpm

5.2 Solenoid Operated Valve:
A solenoid valve is an electromechanically operated valve.

Controlled by an electric current through a solenoid. The solenoid converts electrical energy into mechanical energy.

5.3 Transformer:
Device that transfers electrical energy from one circuit to another through inductively coupled conductors. Varying current in the first or primary winding creates a varying magnetic flux in the transformer's core and thus a varying magnetic field through the Secondary winding.

- We have used step down transformer in our project.
- Decreases 220v ac to 12v ac.
- Converted into 12v dc using bridge rectifier.

This document is set in 10-point Times New Roman. If necessary, we suggest the use of condensed line spacing rather than smaller point sizes. Some technical formatting software print mathematical formulas in italic type, with subscripts and superscripts in a slightly smaller font size. This is acceptable.

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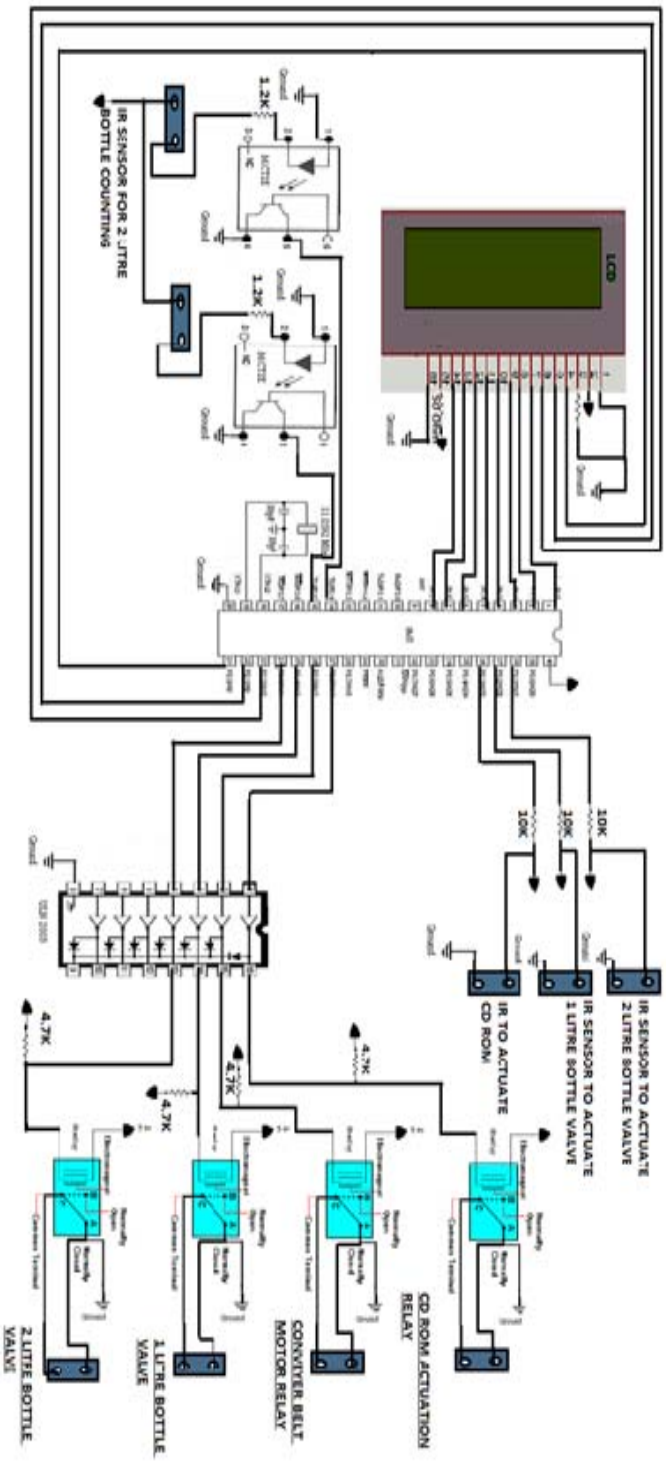

Fig. 1 Block diagram of process

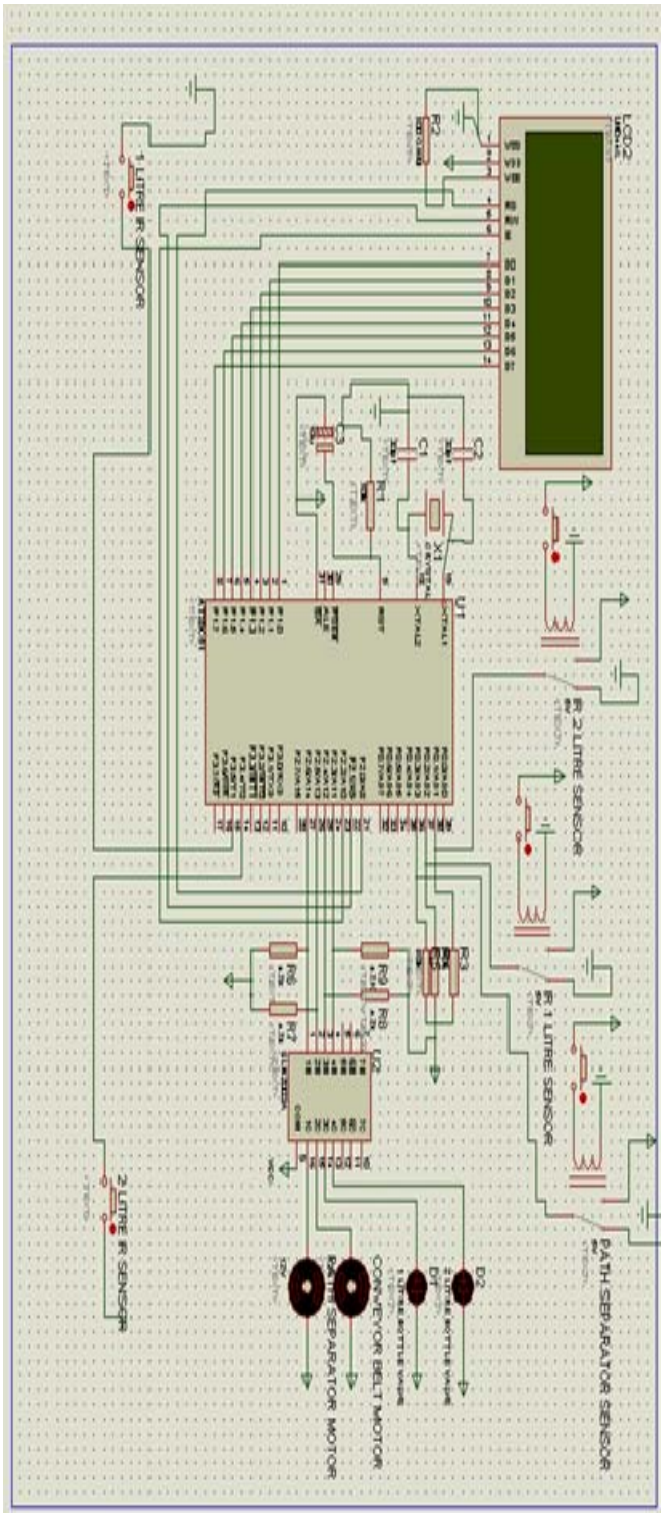

Fig. 2 Simulated Circuit Diagram

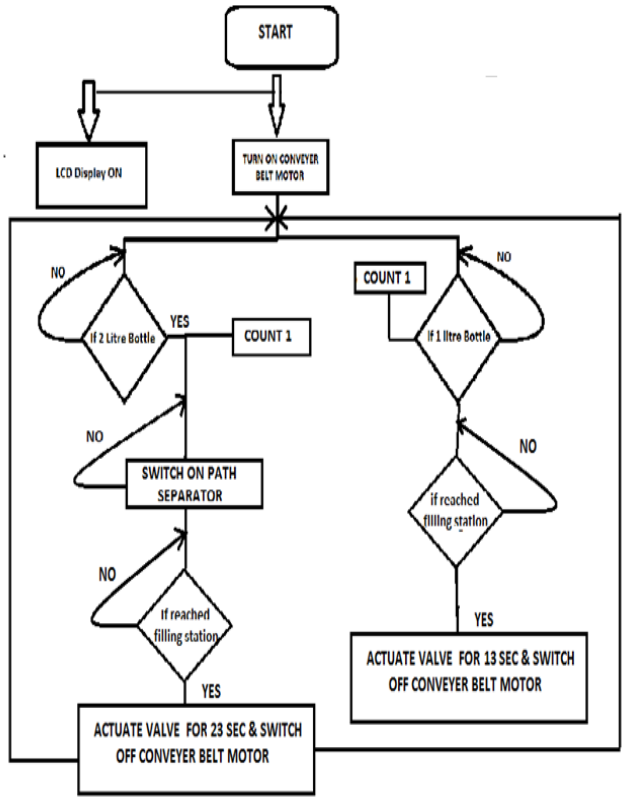

Fig. 3 Flow chart of the process

6. Conclusion

In this project sorting is based on height of the bottles. However, sorting is improved through image processing. In image processing bottle can be sorted based on colors and shapes.

The second part of the project was bottle filling, for which solenoid operated valves were used. Programming is done in such a way that it actuated the valve for a few seconds. The operation of filling of bottles can be improved by using level sensor.

For further improvement of material handling operations Scara Robot can be used. The robot is very helpful in picking and placing of bottles.

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