A Sensor Based System for Sorting Objects

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Abstract— This paper describes size segregation of materials using automated system. It is difficult to segregate objects by their size manually at industrial level. An experiment has been carried out in order to sort objects by height by using two IR sensors along with the conveyor belt. The IR sensor senses the object kept in the conveyor belt. After sensing the object the motor will be started automatically. The conveyor belt carries the object along the wooden setup. The wooden pieces attached with the setup sorts the object by their height. Pieces of plastic, wood, metallic materials are separated by height out from proposed work.

Key words: PIC Microcontroller, Infra-Red Sensor, DC Motor

I. INTRODUCTION

As we all know that the production of plastic, glass, metals and other materials are increasing day by day. During production, the objects may have same size. There may be situation that objects of different size may mix up together. During such situation it is difficult to segregate these objects. For easy segregation a mechanical setup that sometimes resembles a human is used for separating the object. This may reduce the manual work. The usage of conveyor belt helps for easy motion of objects along the setup. A mechanical setup. It is capable of performing a variety of often complex human tasks which is programmed in advance in PIC. Single chip microcontroller is used for controlling the mechanical setup. For sensing the objects the IR sensor is connected to both the end of the conveyor belt. The flexibility of the system is increased because systems sensing capability permits the object to be anywhere on the conveyor belt. Signal from IR sensor is used to control the motors of the conveyor belt and arms of the mechanical setup. Conventional system uses robotic arm instead of IR sensor for sensing and segregating the objects which makes the setup quite complex.

II. EXISTING SYSTEM

The existing system deals with the sorting of objects by using two robotic arm connected with the conveyor belt. The sensors connected to the robotic arm senses the objects and then the arms sort the objects according to their height. The conveyor belt helps for the motion of objects along the setup. The objects are placed on the conveyor belt and then made to move along the conveyor belt. Then the objects are sorted by using the robotic arm [2], [7], [9]. Due to difference in weight it is difficult for the arm to sense the difference in weight between the light, heavy and no object. If the position of the object varies, robotic arm is not capable of detecting the position of objects. For detecting position some more sensors are used which makes the setup large and it may requires more space.

III. PROPOSED SYSTEM

In this paper, we demonstrate about size segregation of objects by automatic method. This model has some advantages over conventional model such as complexity is reduced and the objects can be placed anywhere in the conveyor belt. The system consists of two major components. The first major component is mechanical setup and hardware. Sensing is the second major component. Sensing is classified into two major categories. One is sensing the object and switch on the motors. Another one is sensing the position of objects. The sensing is done with the help of IR sensor.

A. Hardware Design

1) Microcontroller

The microcontroller forms the heart of the device. The microcontroller is used to control the motors. The PIC micro controller is based on RISC CPU. The PIC microcontroller has small instruction set which is easy to learn, [3], [6]. The controller consists of 40 pin IC and there are 33 pins are input and output. The pins receive inputs and run the motor automatically. The operating voltage of PIC is 2.2 V to 5.0 V. The operating speed is 20 MHz. It uses low power, high speed CMOS FLASH/EEPROM technology. The current model of PIC use flash memory for program storage, and new model allow the PIC to reprogram itself. The EEPROM provides a memory space for long term storage of program.

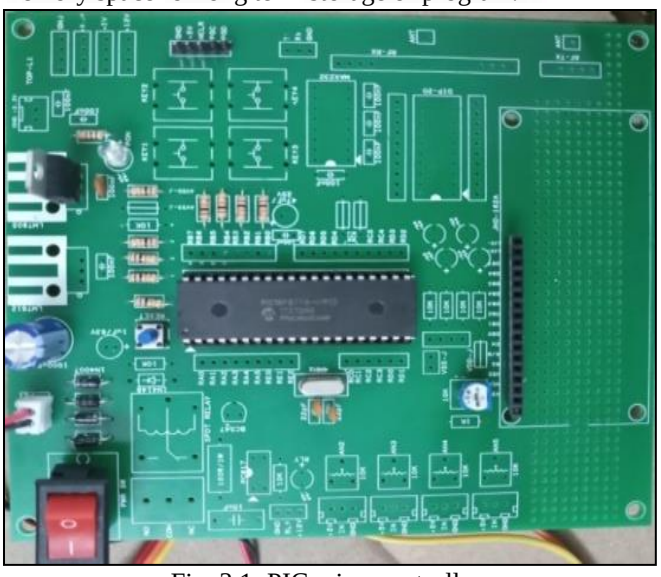

Fig. 3.1: PIC microcontroller

B. IR Sensor

The two basic parts for working with IR are the emitter and detector the emitter is typically an LED that emits near Infra red light. A typical wavelength is 880nm, which is just beyond the human eyes ability to see [2], [4], [8]. Many suppliers, new and surplus, can provide you with the source

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of LED emitters. A typical IR detection system will use two emitters. By controlling when the emitters are active, the detection system can determine simple directional information: left, right or front.

The other important detector for working with IR is a detector module, such as the sharp GP1U5 module. This module contains the IR detector and the small circuit that detects the 40Khz modulation. The nice part about using a modulated light is the ability to reject noisy light signals

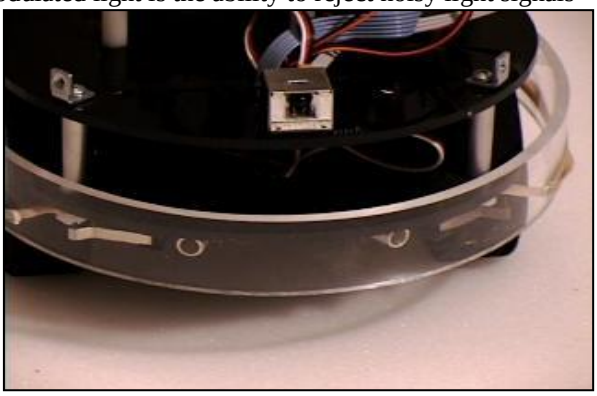

Fig. 3.2: IR Sensor

The above photo shows these parts installed on the front of a mechanical setup.

1) Relay

A relay is usually an electromechanical device that is actuated by an electrical current. The current flowing in one circuit causes the opening or closing of another circuit [1], [5], [10]. Relays are like remote control switches and are used in many application because of the relative simplicity, long life, and proven high reliability

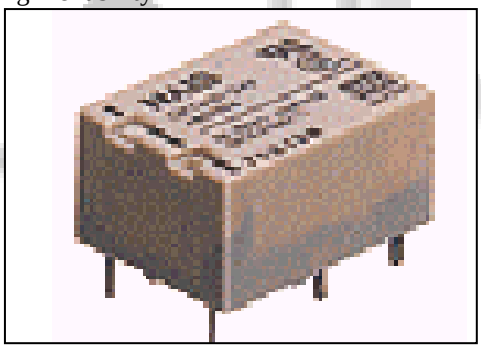

Fig. 3.3: Relay

IV. Internal Operation Of Mechanical Relays

Standard: Single side stable with any of the following three different for closing contacts:

1) Flexure Type: The armature actuates the contact spring directly, and the contact is driven into a stationary contact, closing the circuit.
2) Lift –off Type: The movable piece is energised by the armature, and the contact closes.
3) Plunger Type: The lever action caused by the energization of the armature produces a long stroke action.
4) Polarised: A permanent magnet is used either attract or repel the armature that controls the contact.

A. DC Motor

Fig. 3.4: DC Motor

A brushless DC motor is a synchronous electric motor which is powered by direct current electricity and which has an electronically cotrolled commutation system, instead of mechanical commutation system based of brushes [3], [8]. In such motors, currentand torque, voltage and rpm are linearly related.

1) Features:

- 300RPM 12V DC motors with Gearbox
- 3000RPM base motor
- 6mm shaft diameter with internal hole
- 125gm weight
- Same size motor available in various rpm
- 0.35kgcm torque
- No-load current=60mA, Load current=300mA

B. POWER SUPPLY UNIT:

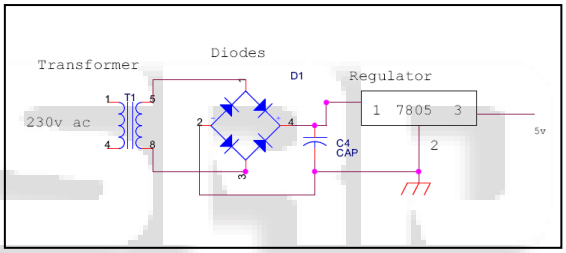

Fig. 3.4: Power supply unit

1) Power supply unit consists of following units

- Step down transformer
- Rectifier unit
- Input filter
- Regulator unit
- Output filter

V. Block Diagram

The objects are placed in the conveyor belt. The objects are sensed by sensors and the motors are automatically switched on. The power is supplied using power supply unit. The voltage fluctuations can be reduced using relay circuit. Then the objects are separated. The separated objects are then collected. The power supplied by power supply unit is about 9 volts.

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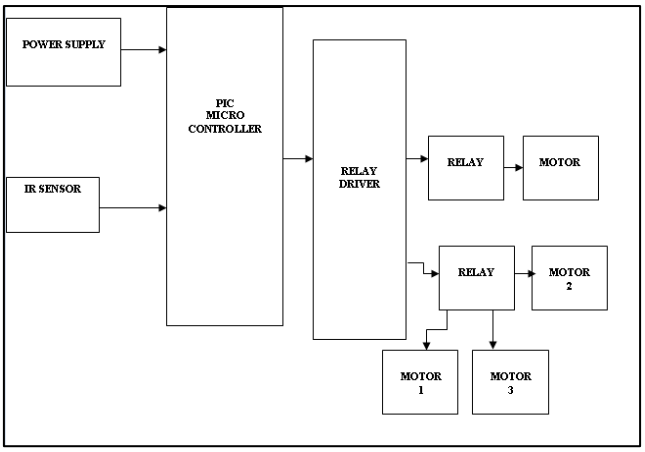

Fig. 4.1: Block diagram

VI. RESULTS & DISCUSSION

In this paper, a mechanical setup is proposed which separates the glass, wood, plastic and other materials. This may help to reduce the manual work.

A. *Phase I:*

Fig. 5.1: Mechanical setup

The above diagram shows the mechanical setup. It consists of three arms to separate the objects.

B. *Phase II:*

In the above diagram, the objects are placed in the conveyor belt. The motors are automatically switched on and the objects start to move.

Fig. 5.2: Primary arrangements

C. *Phase III:*

Fig. 5.3: Automatic sorting

In the above diagram, the objects are sorted and then collected.

VII. CONCLUSION & FUTURE SCOPE

The proposed system sorts the materials according to their height. This process is done automatically after sensing the placed on the conveyor belt. Designed system is very helpful for reducing the system cost and manpower. The designed system is less complex as compared to conventional system. However there is need to make this system more advanced more accurate and cost effective so that industries can use this system in large scale which is challenge that must be addressed in future, and hence system become fully automatic by using IOT (Internet Of Things).

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