AUTOMATED SORTING SYSTEM BASED ON COLOR AND THICKNESS OF WASTE MANAGEMENT

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Abstract - *Nowadays, color and color application science and technology have widely used throughout the world for a long time ever since such a need arose in the manufacturing industry. A color sorting system provides sorting out objects by different properties compromising shape, color and etc. Color sorting machines have been found working on the purpose to separate materials in every type of industrial wastes. In this paper, it has been developed and built a multiple sorting electromechanical system on plastic materials on different colors and size as a prototype. The goals of the future work is to assemble a prototype with a sensing mechanism that is capable of type recycle waste (including metal, paper and plastic) and automatically sort the waste correctly to specific partition according to their color and thickness. The prototype in this study consists of hardware and software systems. Hardware system is designed by using conveyor belt, microcontroller and LCD display as the user interface unit, and also feeding the system.*

***Key Words*: Waste Sorting, Color Sensor, Metal Proximity Sensor, Ultrasonic Sensor, Conveyor Belt.**

1. INTRODUCTION

Waste, depending on the type of material, consists on unwanted materials left over from manufacturing processes (industrial, commercial, mining or agricultural operations,) or from community and household activities. Every day, tons of waste are generated; causing a major problem to various cities and their municipal authorities due to the shortage of landfill to dump such waste. Therefore, recycling is becoming an important issue with the shortage of the landfill and environmental pollutions as well as its economic impact [1].

The main task performed here is to sorting of this waste. The purpose of this project is to save the time for inspection and to reduce the efforts of the workers in material handling. An automatic sorting machine has main task of sorting components according to the size, color. A sorting machine is more practical and economical method of automation, which transfers material from one point to another. This also consists of conveyor belt, which reduces the efforts of material handling. Also both processes take place simultaneously i.e. material handling and inspection. Plastic bottles, for example, are the main municipal waste and they are non-biodegradable materials (are chemically stable). In fact, plastic waste can be visible for months or years and is a serious environmental problem. Hence, the treatment of

plastic wastes becomes a serious problem and it is necessary to develop an effective recycling process.

The main benefits of the device are less time required to sort the product, because the whole device is achieved via machine there is less possibility of mistake, much less man energy require.

1.1. LITERATURE REVIEW

Design of the automated sorting machine using conveyor belt used for manufacturing industry in many fields is a very complex process. The system needs to satisfy industry requisitions. This is an industrial automation based application. It shows the concept of normal conveyor belt, but with some intelligence. We can also call it as intelligent conveyor belt, as it has also ability to sort the object of different color and size. By developing such sorting system the production rate of the manufacturing industry has been increased since these sorting systems replaced the human resources.

The compilation of system and interfacing of various elements, sensors, servo motors, hardware and software package interfacing of the system is prescribed by the "software interfacing of TCS3200 color device with arduino"

"LIMJIESHEN[1] during this paper color sorting automation is research designed and created with Arduino UNO microcontroller, TCS3200 color device, SG90 tower professional servo motor and alternative physical science element. They found that color device provides totally different results once it tested outside and indoor.

Dhanoj M.[4] was researched on automatic arm primarily based color sorting robot mistreatment this TCS3200 color device. They were additionally used liquid crystal display to display the color detected. In image process image is captured mistreatment real time system like digital camera so objects are often sorted as per our demand like on the idea of shapes and colors.

A. P. Shinde et al. [5] described Sorting of Objects Based on Color, Weight and Type on A Conveyor Line Using PLC. They have proposed a system which would increase the production rate and accuracy of material handling systems. The system would separate out objects based on their form i.e. metal or non-metal, weight and color as required by the consumer. Usage of PLC with the frame of logic gates will

make program alteration easy and thus, we can modify the system according to the requirement.

2. PROPOSED SYSTEM
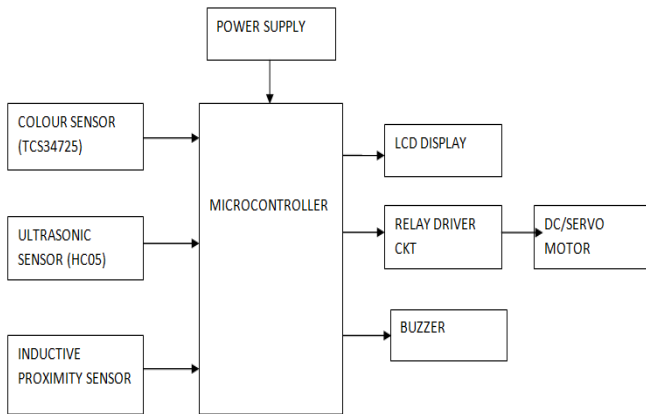
Fig 1: **Block Diagram of System**

In this, we present the theory on automatic color and thickness based sorting of waste. In this proposed block diagram consist of several sensors (color sensor, ultrasonic sensor, inductive proximity sensor) is connected to our controller. The controller is accessing the sensor values, processing them and gives command to DC/survo motor for sorting. Here color sensor sense object color, inductive proximity sensor sense it is metal or not, ultrasonic sensor sense thickness of object. On LCD display counting of object will display according to their type.

A. PIC 18f4520 microcontroller:

Data Memory up to 4k bytesn Data register map - with 12-bit address bus 000-FFF

- Divided into 256-byte banks

- There are total of F banks

- Half of bank 0 and half ofbank 15 form a virtual (oraccess) bank that is accessibleno matter which bank isselected – this selection isdone via 8-bits

- Program memory is 16-bits wide accessed through a separate program data bus and address bus inside the PIC18.

- Program memory stores the program and also static data in the system.

- On-chip program memory is either PROM or EEPROM.

- The PROM version is called OTP (one-time programmable) (PIC18C) The EEPROM version is called Flash memory (PIC18F).

- Maximum size for program memory is 2M n Program memory addresses are 21-bit address starting at location 0x000000

Fig -2: **PIC18f4520**

B. Color sensor (TCS3200):

TCS3200 Color Sensor is a complete color detector, including a TAOS TCS3200 RGB sensor chip and 4 white LEDs. The TCS3200 can detect and measure a nearly limitless range of visible colors. Applications include test strip reading, sorting by color, ambient light sensing and calibration, and color matching, to name just a few.

The TCS3200 has an array of photo detectors, each with either a red, green, or blue filter, or no filter (clear). The filters of each color are distributed evenly throughout the array to eliminate location bias among the colors. Internal to the device is an oscillator which produces a square-wave output whose frequency is proportional to the intensity of the chosen color.

Fig -3: **Color Sensor**

C. Ultrasonic Sensor:

Ultrasonic sensors work by sending out a sound wave at a frequency above the range of human hearing. The transducer of the sensor acts as a microphone to receive and send the ultrasonic sound. Our ultrasonic sensors, like many others, use a single transducer to send a pulse and to receive the echo.

Typically, a microcontroller is used for communication with an ultrasonic sensor. To begin measuring the distance, the microcontroller sends a trigger signal to the ultrasonic sensor. The duty cycle of this trigger signal is 10µS for the HC-SR04 ultrasonic sensor.
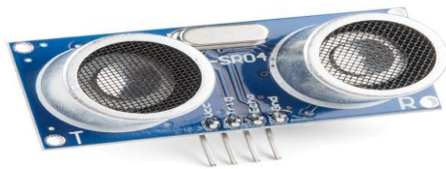

Fig -4: **Ultrasonic Sensor**

D. LM35 Temperature Sensor:

The inductive proximity sensor detects the metallic object which is present next to their active side. This sensor operates under the electrical principal of inductance where a fluctuating current induces an electromotive force (EMF) in a target object. These non-contact proximity sensors detect ferrous targets, ideally mild steel thicker than one millimeter

Advantages:

- Contactless detection

- Environment adaptability- resistant to common conditions seen in industrial areas such as dust and dirt

- Capable and versatile in metal sensing

- High switching rate

- No moving parts, ensuring a longer service life

Fig -5: **Inductive Proximity Sensor**

E. LCD display:

A **16x2 LCD** means it can display 16 characters per line and there are 2 such lines. In this LCD each character is displayed in 5x7 pixel matrix. This LCD has two registers, namely, Command and Data. The command register stores the command instructions given to the LCD. A command is an instruction given to LCD to do a predefined task like initializing it, clearing its screen, setting the cursor position, controlling display etc. The data register stores the data to be displayed on the LCD.
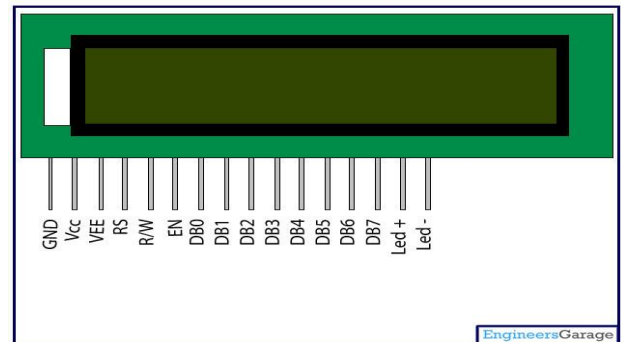

Fig -6 LCD display

F. DC Motor:

A DC motor is an electrical machine which converts electrical energy into mechanical energy. The basic working principle of the DC motor is that whenever a current carrying conductor places in the magnetic field, it experiences a mechanical force. DC motor used for various applications like robotics, momentary projects etc. The output shaft has a hold for best mounting for wheels and pulleys.
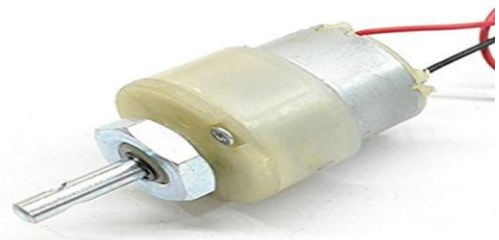

Fig -7 DC Motor

G. Relay Driver Circuit:

A relay driver circuit is a circuit which can drive, or operate, a relay so that it can function appropriately in a circuit. The driven relay can then operate as a switch in the circuit which can open or close, according to the needs of the circuit and its operation. Since DC and AC voltages operate differently, to build relay drivers for them requires slightly different setup Now that we're using a transistor to drive the relay, we can use considerably less power to get the relay driven. Because a transistor is an amplifier, we just have to make sure that the base lead gets enough current to cause a larger current to flow from the emitter of the transistor to the collector. Once the base receives sufficient power, the transistor will conduct from emitter to collector and power the relay.
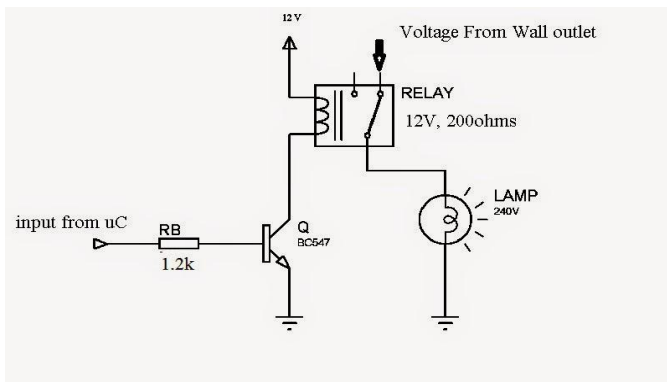
Fig -8: Relay Driver Circuit

3. CONCLUSIONS:

The fully automatic system outlined above provides cost effective, low time consuming and technically simple approach for sorting of objects. This system uses C programming which makes the model easy to use and more efficient. Generally, sensing the color of the object is a big challenge as there is a chance of high uncertainty due to the external lighting conditions. Similarly while collecting the objects from conveyor by using a linear actuator system. This project of automatic color and thickness sorting is excellent one because of its working principle and wide implementation. By using this idea we can sort large amount of waste according to their color, thickness or type (metal/plastic).

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