COLOR BASED OBJECT SORTING MACHINE

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Abstract - *-Sorting is a process in which two or more objects of similar, yet different characteristics are arranged in a systematic order. This is generally carried through manually or by using sensors in automation. Automatic color sorting is very much convenient in industry. Color and size are the most important features for accurate classification and sorting of product which can be done by using some optical sensors or analyzing their pictures. Color sorting machines are machines that are used on the production lines in bulk food processing and other industries. They separate items by their colors, detecting the colors if things that pass before them and using mechanical or pneumatic ejection devices to divert items whose colors do not fall within the acceptable range. The Color sorting machine using microcontroller is a fascinating and renowned project for techies, who would like to combine electronics, machine building and programming. The Color Sorting Machine is used for sorting mainly RGB colors. A simple robot arm is used to apply a color sorting to a physical system. The objects are placed to the conveyor belt using robot arm with servo motors. One conveyor belt is used, which is controlled by DC motors*

***Key Words*: Color Sensor, Ultrasonic sensor, ARM7 LPC2148, LCD Display, DC Motors, Conveyor Belt.**

1. INTRODUCTION

Now a day's industrial area requires demand for automation. Due to automation human efforts are goes on decreasing since last decade. The object sorting based on color is difficult task in recent days. In industry there is rapidly increasing demands for automation. The Sorting of objects based on color is very difficult task. This project gives us an idea about automatic color sorting. Here we are designing and implementing an efficient color sorting using color sensor TCS3200 based on ARM7. This project gives high accuracy and performance. Easy to operate and construct which reduces human errors. Existing sorting method uses a set of inductive, capacitive and optical sensors do differentiate object color.

The ability to differentiate colors is essential for human's life as it gives us the awareness about the changes in surrounding through our vision. Moreover, by exploiting the ability of color capture, intelligent machine gains the function to differentiate, sort and organize. The project consist of sensors that detect object color after that sends the information to ARM7 which in turn adjusts the DC motor which located just below the object slider to move it left and right also remaining carries as it is straight. Based upon the color detected and motor will movers clockwise or anticlockwise depend on color of object. The stations are in red, green and blue respectively. After every object placement, the slide will go back to its default angle position, awaiting the next color object. Throughout the years, many people tried to use various ways to programme and create intelligence robot in various ways to have respective function or achieving goals. Some of the claims made have contributed

directly or indirectly to the project. This project is developed with the purpose of minimizing the cost, optimizing the productivity and reducing human mistakes.

1.2. LITERATURE REVIEW

Rucha Kulkarni et al. [1] described PLC Based Object Sorting Automation. They have tried to create a setup that will decrease human effort and succeeded to an extent by using the low cost automation system (LAC) to avoid risk, improve precision, rise speed of manufacture and decrease the cycle time. Restrictions will be there due to the practical complications in programming of the project according the availability of the resources and apparatuses. This setup can be further improved to a sorting system that sorts the items based on the other various sensors. In production it can be used for sorting of several objects, tools, with high degree of precision and superiority with an automation.

A. P. Shinde et al. [2] 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.

Rohan Prakash Chumble et al. [3] described Automatic Sorting Machine Using Conveyor Belt. The programmed sorting machine using conveyor belt is mainly beneficial for sorting the yields in the industry definitely large scale industries where mass production is carried out. The machine also lessens the hard work of the workers by decreasing the time spent for material handling. The tender area of this machine is large in industries everywhere automation is made.

Rahul sonas et al.[4] Object Sorting using Image Processing described the proposed system has a conveyor belt which runs with the help of stepper motors and corresponding pulleys at the motor and its opposite ends which frequently run at a desirable speed. The stepper motors are initialized to run the conveyor belt.

Himanshu Patel et al. [5] IOT Color Based Object Sorting Machine described Objects which are to be separated are fed in tube. A color sensor senses the items coming in its sight and code for the same is coded in arduino in such a way that only the desired object colors are sensed and collected in the bins at the end using servo motors.

2. PROPOSED SYSTEM

For sorting mechanisms to work, an ARM7 programmed is written to carry out the color sensing and recognizing task correctly. The program has to be tested and simulation has to be carried out. After the design has been confirmed, the materials can be purchased.

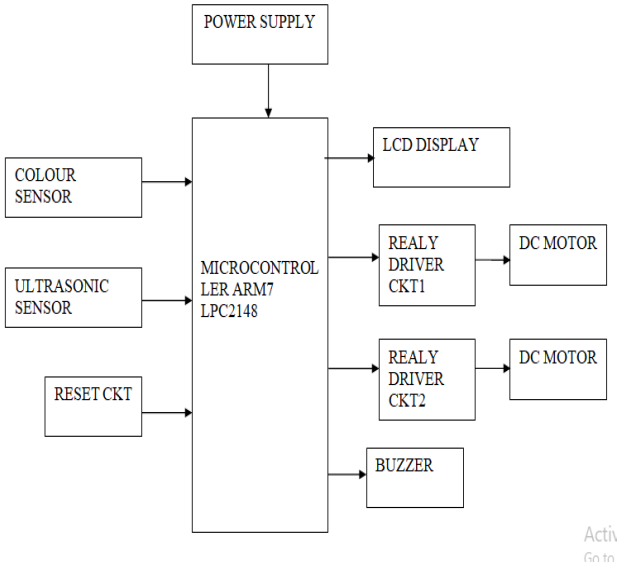

Fig 1: **Block Diagram of System**

There are various ways of doing simulation which by using software in computer and simulation on a breadboard. The breadboard simulation has to be done with real components. It is important to ensure there are no faulty on the components and the board after the circuit has been powered up with voltage and current.

If the program is not functioning during the test or simulation, then troubleshooting process is essential. The next step is to analyze the program and understand the code function. This is an important process until the best code has been simulated. The balls are tested on the circuits which are connected on a breadboard to make sure the code is right before all the parts are assembled to become a robot. For the hardware, a suitable plastic material is used as the body of the robot and compartment to place all the materials. After placing together both software and hardware, the robot is basically formed. The RGB (Red, Green, and Blue) values taken from the sensor will then send signal to ARM7 to process. The connection is done by connecting all wires to connect up ARM7 which act as ARM7, batteries, servo motor as well as the color sensor. The sorting system is monitored and checked if there is any error during the testing. Once the combination between the hardware and software has some error of fault, either one or both of the parts will need to be modified.

A. ARM7 LPC2148 microcontroller:

The LPC2141/42/44/46/48 microcontrollers are based on a 16-bit/32-bit ARM7TDMI-S CPU with real-time emulation and embedded trace support, that combine the microcontroller with embedded high-speed flash memory ranging from 32 kB to 512 kB. A 128-bit wide memory interface and unique accelerator architecture enable 32-bit code execution at the maximum clock rate. For critical code size applications, the alternative 16-bit Thumb mode reduces code by more than 30 % with minimal performance penalty. Due to their tiny size and low power consumption, LPC2141/42/44/46/48 are ideal for applications where miniaturization is a key requirement, such as access control and point-of-sale.

Fig -2: **ARM7 LPC2148**

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. When triggered, the ultrasonic sensor generates eight acoustic (ultrasonic) wave bursts and initiates a time counter. As soon as the reflected (echo) signal is received, the timer stops. The output of the ultrasonic sensor is a high pulse with the same duration as the time difference between transmitted ultrasonic bursts and the received echo signal.

Fig -4: Ultrasonic Sensor

D. 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. We will also go over a generic relay driver which can operate from either AC or DC voltage and operate both AC and DC relays. 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.

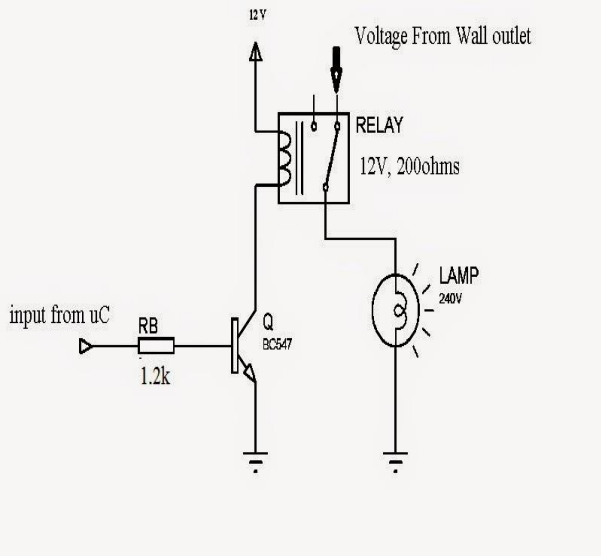

Fig -5: **Relay Driver Circuit**

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.

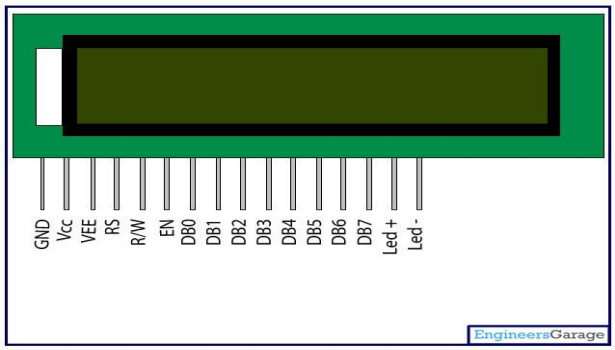

Fig -6 LCD display

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.

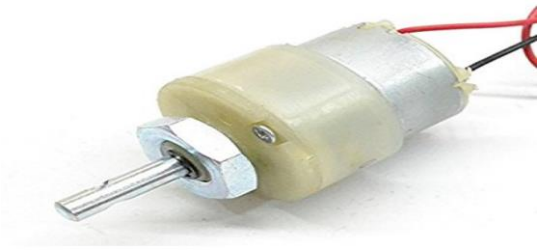

Fig -7 DC Motor

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 sorting is excellent one because of its working principle and wide implementation. By applying the idea of this project an industry can easily sort the required product according to its color. Through it has some limitation, but by having done some modification this concept can be implemented in wide range of application. The authors can conclude that time and human effort can be reduced by implementing such project in industries like chemical, food, chip manufacturing and so on.

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