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Colour Based Sorting Machine Using Arduino

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Abstract

This paper presents development and design of automatic colour object sorting system. Our project has low cost and low power. In this paper object sorting using arduino based on colour sensor is designed and implemented. Furthermore, the motors are used to place the sorted object through conveyor belt. Existing sorting method uses manual work.The arduino sends signal to circuit which drives the various motors to place it at the specified location. Based upon the detection, the motor moves to the specified location, releases the object and comes back to the original position. So, the system will eliminate the reccurring work done by

human and provides greater accuracy and speed while performing the task. Presently a day's such a large number of helpful innovations are turning out to make our way of life more comfortable, and secure. In this ciruitwe are utilizing Arduino (controller) and colour sensor.

Keywords*– Arduino,Conveyer Belt, DC Motor,Colour Sensor.*

1) INTRODUCTION

Sorting machine using Arduino can sort object by colours. This type of machine forms automation so, no human interference is required. Prominentlycolour sorters are used in agricultural applicationss like rice sorter, beans sorter, peanut sorter and industrial applications also like quartz sand sorter, plastic granule sorting of coloured nuts and bolts and many more.

It reduces the human effort and helps it cutting out labour cost and production cost.Object Sorting Machine based on colour can be used for Industrial purposes, for sorting skittles, coloured balls and M&Ms. And also, in diamond and mining industry. The transparency of diamond is measured by colour sensor and used for measurement of its purity. In mining sorting industry, it is called sensor-based-sorting technology. Use optical colour (CCD colour camera) combine x ray sorting technology and NIR (near infrared spectrometry) to pick out the impurity of ore, minerals, stone and sand particles.

In food industries to identify the rotten or damaged fruits, separation of ripe or unripe fruits, packing of tablets having different colours where this system reduces the human effort, labor cost and also time of operation.

Machines can perform highly repetitive operations better than human beings. Worker fatigue while doing the same kind of work continuosly can result in reduced performance, and it may get challenging the maintain product quality. An employee who has been performing an quality checking task over and over again may eventually fail to recognize the colour of product. Automating many of the tasks in the industries may encourage to improve the efficiency of manufacturing system. The purpose of thiscolour sorter is to design and implement a system which automatically separates products based on their colour. This machine consists of three parts: conveyor belt, dc motor, and coloursensor ,ultrasonic sensor. The output and input of these components are interfaced using Arduino.

To reduce human efforts mechanically manufactured different types of sorting machines are being developed. These machines are too costly due to the complexity in the installation and manufacturing.

process. A common requirement in the field of colour sorting is that of colour sensing and identification.

The aim of this project is to build fully automatic material handling system. This leads to the elimination of the monotonous work done by human, and improve accuracy and speed in the production.

2). METHODOLOGY

STAGE 1**:**

Selection of topic: In this primary stage we have gone through many topics on this we can work. Finally, we have selected this topic for solving so many industrial problems. At the same time, we can increase the efficiency and accuracy of their system.

STAGE 2**:**

Block diagram selection: After finalizing of our project topic we started working on block diagram. After working on this we have made the proposed a block diagram.

STAGE 3**:**

Selection of components: After selection of block diagram we will select hardware components.

STAGE 4**:**

Interfacing: Did interfacing in proteus and prepare program on Arduino software.

STAGE 5**:**

Interfacing of LCD display with Arduino.

STAGE 6**:**

Interfacing colour sensor and ultrasonic sensor with Arduino.

Interfacing motor with Arduino.

STAGE 7**:**

Fabrication of conveyor belt.

STAGE 8**:**

TESTING OF SYSTEM: After the successful implementation of system, we have test of it and after we will give the demo.

3).Required Components

2 DC motors for converyer and tray,1185 sunromcolour sensor.

3.1 Arduino Uno–

In our project the role of arduinouno board is to read input light on a sensor. It is open source electronics platform is easy to use hardware and software.Arduino Uno is a microcontroller board based on the ATmega328. It has 14 digital input/output pins (of which 6 can be used as PWM outputs), 6 analogue inputs, a 16 MHz ceramic resonator, a USB connection, a power jack, an ICSP header, and a reset button. It consists ofeverything needed to support the microcontroller; simply connect it to a computer with a USB cable or power it with a AC-to-DC adapter or battery to start. The Uno differs from all other boards in that it does not use the FTDI USB-to-serial driver chip. Instead of it, features of the Atmega16U2 (Atmega8U2 up to version R2) programmed as a USB-to-serial converter. Revision 2 of the Uno board has a resistor pulling the 8U2 HWB line to ground, making it easier to put into DFU mode

3.2 Ultrasonic sensor -

It is used for object detection.it convert electrical energy into acostic wavesand vice versa.The Arduino Uno can get powere supply via the USB connection or with an external power supply and the power source is selected automatically. External (non-USB) power can come either from an AC-to-DC adapter or battery. The adapter could be connected by plugging a 2.1mm center-positive plug into the board's power jack. Leads from a battery can be inserted in the Ground and Vin pin headers of the POWER connector. The board can work on an

external supply of 6 to 20 volts. If supplied with less than 7V, however, the 5V pin may supply less than five volts and the board might be unstable. If using more than 12V, the voltage regulator may get overheated and damage the board. Recommended range is 7 to 12 volts.You only need to give a short 10uS pulse to the trigger input to start the ranging, and then the module will send out an 8-cycle burst of ultrasound at 40 kHz and eco will rise. The Echo is a distance object that is pulse width and the range in proportion.

To calculate the range through the time interval between sending trigger signal and receiving echo signal. Formula:

uS / 58 = centimeters

or

uS / 148 =inch;

or:

range = high level time * velocity (340M/S) / 2;

we suggest to use over 60ms measurement cycle, to prevent trigger signal to the echo signal

3.3 Power Supply

The Arduino Uno can be powered via the USB connection or with theexternal power supply. The power source is thusselected automatically. External (non-USB) power can come be provided either from an AC-to-DC adapter (wall-wart) or battery. The adapter can be connected by plugging a 2.1mm center-positive plug intoboard's power jack. Leads from a battery can be inserted in the ground and Vin pin headers of the POWER connector. The board can operate on external supply of 6 to 20 volts. If supplied with less than 7V, however, the 5V pin may supply less than 5 volts and the board might get unstable. If using more than 12V, the voltage regulator may get overheated and damage the board. Recommended range is 7 to 12 volts

3.4 Motor Driver

The L293 and L293D devices are the quadruple highcurrent half-H drivers. The L293 is designed toprovide bidirectional drive currents of up to 1 A at voltages from 4.5 V to 36 V. The L293D is designed to provide bidirectional drive currents of up to 600-mA at voltages from 4.5 V to 36 V. Both devices are solenoids, DC and bipolar stepping motors, as well as supply applications.The working of motor driver is an interface between the motors and the control circuits.it requires high amount of current where as the controlled circuit is worked on low current signal.

3.5 LCD

It used to display the output of program or which colour is detected

- 5*8 dots with cursor.
- 16 characters * 2 line display.
- 4-bit or 8-bit MPU interface.
- Built- in controller (ST7066 or equivalent).
- Display mode and backlight variation.

This term LCD stands for liquid crystal display. It is one kind of electronic display module used in an extensive range of applications like various circuits & devices like mobile phones, calculators, computers, TV sets, etc. These displays are mainly preferred for multi-segment light-emitting diodes and seven segments. The main benefits of using this module are inexpensive; simply programmable,and there are no limitations for displaying custom characters, special and even animations.

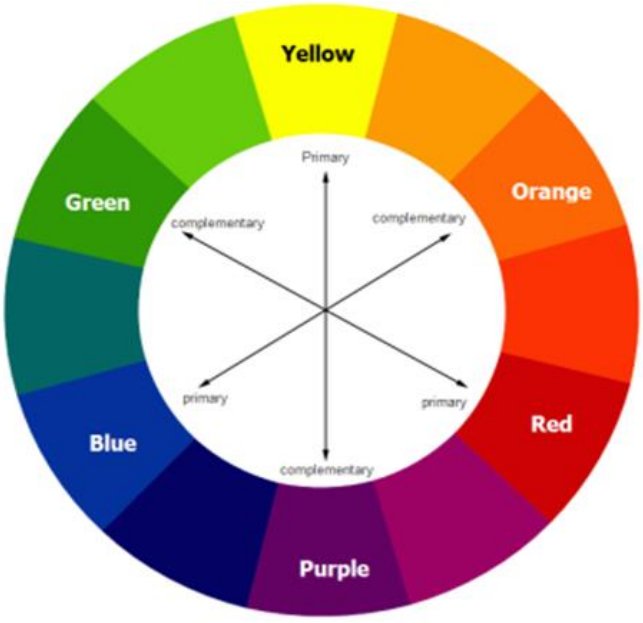
3.6 Converyer Belt –

Conveyer belt is stretched across two wheels and the use of this belt is to carry the object to the sensors for identification and then further for segregation .It acts a mediun to carry the object without any human interference.It is controlled by Aurdino Uno to coordinate with the sensors.

3.7Colour Sensor –

This colour sensor identifies colourand thengives serial output of RBG value. It can identify 16.7 millioncolour shades giving RGB value for the detected colour. The detected colour is identified as amount of three primary colour values namely Red, Green & Blue with 8 bit accuracy for each primary colour. Any colour can be separated or combined into three primary colours Red, Green and Blue using the RBG values.We use these sensor to detect the intensity of light reflected from an object and differentiate it into separate colour.

Colours which are next to each other make poor colour match as they both have values .Thus it becomes difficult to identify.Bestcolour combinations occur with the colours which are opposite in the colour wheel such as Green and red.Yellow and Purple are good match as they have different values and *intensities*



Serial Data Output format: -

The serial data at 9600 baud rates consist of 25 bytes for each 500ms interval.

When RED shade of colour is detected you would get following type of data in terminal

R=130 G=030 B=030 L=010

Here value of RED is 130 while Green and Blue are 30 both L=10 means the amount of Light reflected by surface, White surface will reflect most and black will be reflected the least.This L value you can use to detect the darkness of surface. We recently added this L parameter as it was difficult to detect white and black surface

from only RGB values. The sample code of microcontroller and VB software does not implement L value processing but it works with only RGB values. L value can be used to detect white/black surface.

4).APPROACH

In these article we shows that how we can separate different coloured object by using ArduinoUno.Servo motors are used to the carry the object, to the colour sensor which detects its colour.

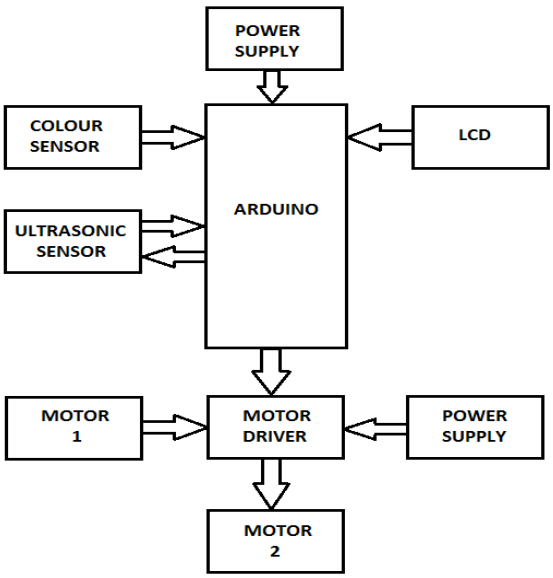


Figure 1: Block DigramOf The System

Figure shows the block diagram of colour-based sorting machine using Arduino. This systemconsists of a colour sensor, Arduino UNO board, motor driver IC LN293D, Ultrasonic sensor, DC motors. Colour sensor is used for colour identification. It identifies colour and gives serial output of RGB value.
The five different values for five differentcolours that are red, green,blue, purple and yellow are then compared. The sorting machine takes 40 consecutive readings and the most stable reading is taken into consideration before giving output of colour sensor. The five standard values for five colours are displayed in serial monitor. Arduino gives the values of these colours as serial output. In colour sensor, the detection is done by comparing amount of three colours in the colour to be detected.

At the end of the detection, whether red, blue,green,yellowor purple colour is maximum calculated and the max colour will get displayed on LCD. This output gets displayed on LCD. LCD also displays the current status of the system like 'Welcome','Readingcolour', 'Colour not found' etc. The Arduino is connected to colour sensor through pin Tx for serial communication.

Ultrasonic sensor is used for object detection. The trigger and echo pins are used to transmit and receive the ultrasonic waves. Trigger is used to transmit the ultrasonic waves. If the obstacle occurs within the range of the

ultrasonic sensor, the pulses are returned to the echo pin of the sensor. When such pulse is returned to the echo pin of ultrasonic sensor, the conveyor belt stops and the colour sensor starts to detect the colour.

So, the operation of the conveyor belt is dependent on the object detection of the ultrasonic sensor. The

two motors that are used in this project are for conveyor belt and storage tray adjustment.The rotating tray is attached with dc motor for separation of different colour. These trays are rotated by using DC motor.Specified rotation timings are coded in programming for all colours. Conveyer belt carries sorted objects to the trays and the trays get adjusted according to the colour of the object.

The angles of rotation of motor for colours are: -

1. Blue = 0.1 sec
2. Red =1.6 sec
3. Green =2.9 sec.
4.Purple=4 sec

So the mechanism behind these timings is ,the delays have been provided in the programming after the detectation of colour by coloursensor.The conveyer will start working to carry he objects ,to the sensors.As it reaches closer to the ultrasonic sensor ,the conveyer belt will stop rotating.Thecolour will be observed by colour sensor placed nearer to the head of object.The rotating tray will adjust according to the colour observed and will travel to its specified position for the particular colour.The object will be dropped in the tray within the time allotted for it.And again the conveyer will start working.Furtherwe will wait ,till it displays on LCD as “Colour Not Found”. And then we can repeat the process for all the five colours.The motors are driven by using motor driver circuit. As the output from the Arduino is only 5V and the motors need 12V supply.

5).Result-

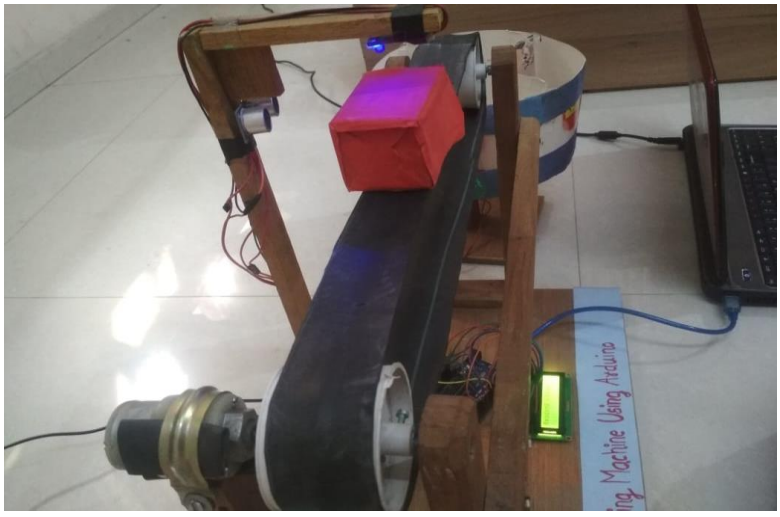


Figure 5.1:Diagram Showing Colour Detection:

Fig 5.2 Colour Displayed on LCD

Fig 5.3 Arrangement of the colour sorter

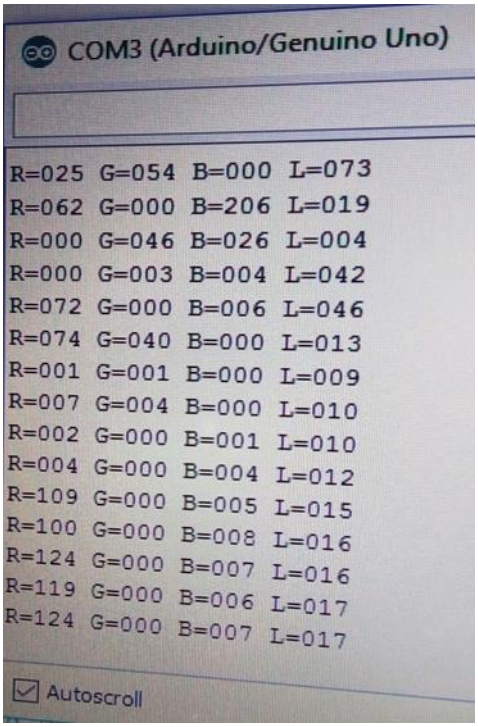


Figure 5.4 Serial Monitor Output

6). CONCLUSION

The colour-based sorting machine gives differentiation between objects according to their colours. The fully automated system reduces human efforts as well as increases accuracy in minimum time**.**It uses Arduino Uno board and colour and ultrasonic sensors in hardware. Ultrasonic sensor is used to detect the object and colour

sensor to identify shades.Motors are used to carry the objects on conveyor belt and to store them afterwards. So, this sorting machine is cost effective and human friendly.Colour sorter can be used for sorting ripened and unripened fruits, vegetables.In future it can be used for quality check purpose and sorting according to its quality. The issue regarding this circuit is ,it has to placed in almost same light source so that sensors won't mix up with colours provided while programming.

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