COLOUR SORTING MACHINE

A Project Phase 1 Report
Submitted to the APJ Abdul Kalam Technological University
in partial fulfilment of the requirements for the Degree of
Bachelor of Technology
in
Electronics and Communication Engineering

by

Dinet Jose (TVE20EC067)
Nahad Abdul Latheef (TVE20EC036)
Arjun Raj M (TVE20EC008)

DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING
COLLEGE OF ENGINEERING, TRIVANDRUM

2023

DEPT. OF ELECTRONICS AND COMMUNICATION ENGINEERING

COLLEGE OF ENGINEERING TRIVANDRUM

2022-23

This is to certify that the report entitled COLOUR SORTING MACHINE submitted by Dinet Jose (TVE20EC067), Nahad Abdul Latheef (TVE20EC036), Arjun Raj M (TVE20EC008) to the APJ Abdul Kalam Technological University in partial fulfillment of the B. Tech. degree in Electronics and Communication Engineering is a bonafide record of the mini project work carried out by them under our guidance and supervision. This report in any form has not been submitted to any other University or Institute for any purpose.

Dr. Vinod	**Dr. Nikhil M**	**Dr. Joseph Zacharias**
(Project Guide)	(Mini Project Coordinator)	(Head of the Department)
Designation of the Guide	Assistant Professor	Professor
Dept. of ECE	Dept. of ECE	Dept. of ECE

Office Seal

DECLARATION

We hereby declare that the project report Colour Sorting Machine, submitted for partial fulfillment of the requirements for the award of degree of Bachelor of Technology of the APJ Abdul Kalam Technological University, Kerala is a bonafide work done by us under supervision of Dr. Vinod.

This submission represents our ideas in our own words and where ideas or words of others have been included, we have adequately and accurately cited and referenced the original sources.

We also declare that we have adhered to ethics of academic honesty and integrity and have not misrepresented or fabricated any data or idea or fact or source in our submission. We understand that any violation of the above will be a cause for disciplinary action by the institute and/or the University and can also evoke penal action from the sources which have thus not been properly cited or from whom proper permission has not been obtained. This report has not been previously formed the basis for the award of any degree, diploma or similar title of any other University.

Trivandrum
03/07/23

Dinet Jose
Nahad Abdul Latheef
Arjun Raj M

Acknowledgements

First and foremost, praises and thanks to the God, the Almighty, for his showers of blessings throughout our mini project work to complete the mini project successfully.

We would like to express our deep and sincere gratitude to our research guide Dr. Vinod, Professor, Department of Electronics and Communication Engineering for providing invaluable guidance throughout this mini project.We take this opportunity to express our profound gratitude to our Head of the Department, Dr. Joseph Zacharia whose encouragement was a great source of inspiration. We would like to thank all the teachers of the Department for their help on various areas of this project. We would also like to thank our friends and family for their continued support and inspiration.

Abstract

Small scale industries and farmers find it difficult to separate vegetables and fruits of different color, that is whether it is raw or ripe. The machine available today is not economically affordable for them. So we introduce a machine which has a colour sensor interfaced with an arduino. A colour sensor is a simple and easy to use device that can be used to identify the colour of an object and after detecting appropriate action can be triggered. This type of sensor provides easy solutions for sorting and packaging in an industrial environment. The sensor used is TCS3200. This sensor has two pins S2 and S3 which are used to select an array of photodiodes . If the colour detected by the colour sensor matches the selected array output frequency of the sensor increases and in other situations it remains the same. A colour sensor can detect the received light intensity for red, blue, green making it possible to determine the colour of the target. It works even in the dark as it has four bright led lights. The code to process data from TCS3200 is simple as it requires only to define the pins through which the sensor is connected with the arduino. Thereafter items can be sent through a conveyor belt and it can be discharged to specific boxes. By making certain changes in the code even impurities can be detected and separated from other ones.

List of Figures

2.a TCS Colour Sensor 3

2.b Pin Diagram 4

3.a Flow Diagram 5

3.b Table of Different RGB values 5

4.a Circuit Diagram 7

4.b Interfacing of Colour Sensor 8

4.c Initial Stage Diagram 9

4.d Connection with Servo Motors 10

5.a-e Screenshots of Working 16-17

Contents

Acknowledgements	i
Abstract	ii
List of Figures	iii
1 Introduction	1
2 Literature Review	3
3 Methodology	5
4 Work Plan	7
5 Results	15
6 Conclusion	19
7 References	21

Chapter 1

Introduction

As the name suggests, colour sorting is simply to sort the things according to their colour. It can be easily done by seeing it but when there are too many things to be sorted and it is a repetitive task, then automatic colour sorting machines are very useful. These machines have a colour sensor to sense the colour of any objects and after detecting the colour servo motor grab the thing and put it into the respective box. They can be used in different application areas where colour identification, colour distinction and colour sorting is important. Some of the application areas include Agriculture Industry (Grain Sorting on the basis of colour), Food Industry, Diamond and Mining Industry, Recycling etc. The applications are not limited to this and can be further applied to different industries.

Most popular sensor for detecting the colours is the TCS3200 colour sensor. We previously used a TCS3200 sensor with Arduino to get the RGB component (Red, Green, Blue) of any colour.

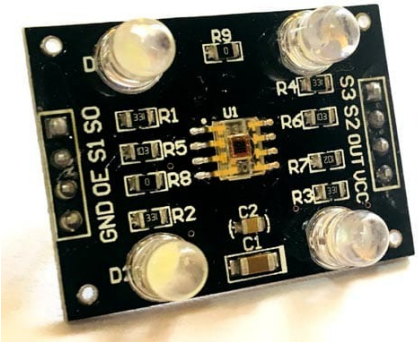
Components Required

- Arduino UNO
- TCS3200 Colour Sensor
- Servo motors
- Jumpers
- Breadboard

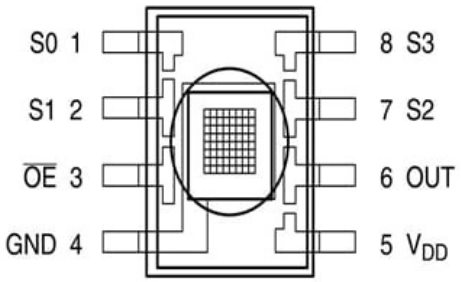
Chapter 2

Literature Review

TCS3200 Colour Sensor



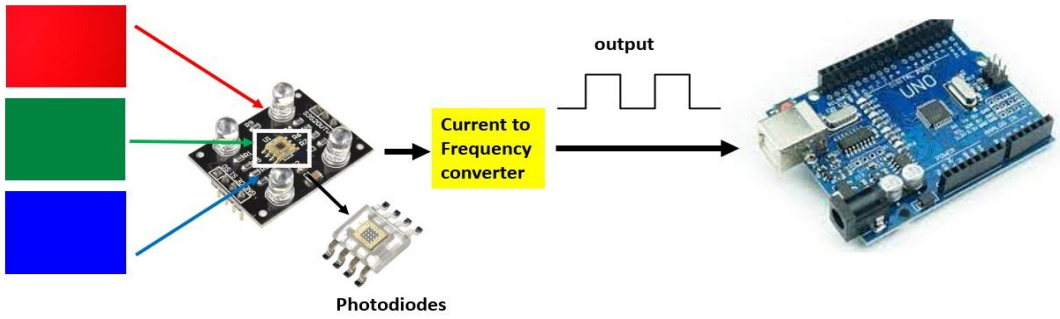
TCS3200 is a color sensor which can detect any number of colors with right programming. TCS3200 contains RGB (Red Green Blue) arrays. As shown in figure on microscopic level one can see the square boxes inside the eye on sensor. These square boxes are arrays of RGB matrices. Each of these boxes contain three sensors, One is for sensing RED light intensity, One is for sensing GREEN light intensity and the last is for sensing BLUE light intensity.



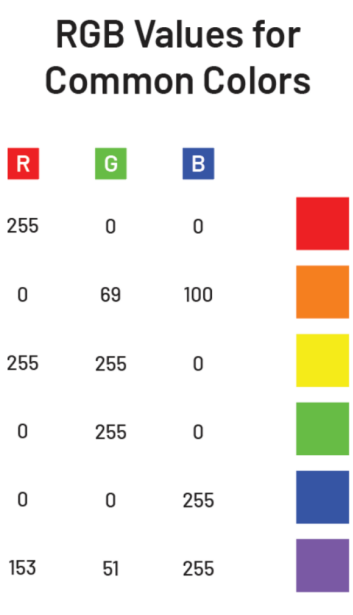
Each of the sensor arrays in these three arrays are selected separately depending on the requirement. Hence it is known as a programmable sensor. The module can be featured to sense the particular color and to leave the others. It contains filters for that selection purpose. There is a fourth mode called ‘no filter mode’ in which the sensor detects white light.

Chapter 3

Methodology



RGB values for different colours:



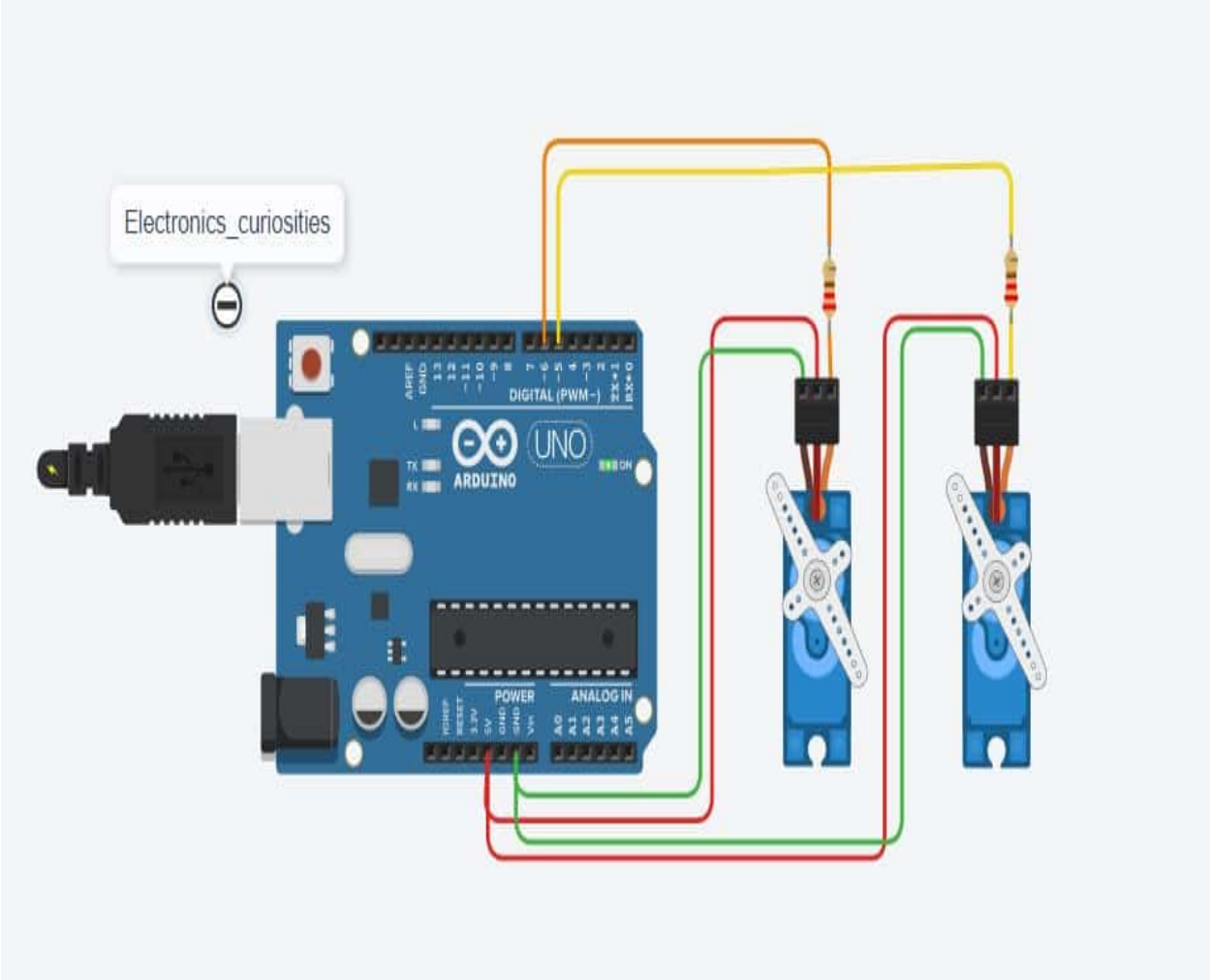
Cluster	R_{min}	G_{min}	B_{min}	R_{max}	G_{max}	B_{max}	Difference
1	128	64	32	159	95	63	16.57
2	32	0	0	63	31	31	7.48
3	32	32	32	63	63	63	6.62
4	160	96	64	191	127	95	6.07
5	96	64	64	127	95	95	5.65
6	128	96	64	159	127	95	5.04
7	160	96	32	191	127	63	4.61
8	64	32	0	95	63	31	4.26
9	64	32	32	95	63	63	3.58
10	160	128	96	191	159	127	3.42
11	96	32	0	127	63	31	3.05
12	32	32	0	63	63	31	2.98
13	128	96	96	159	127	127	2.68
14	160	64	32	191	95	63	2.61
15	160	96	96	191	127	127	2.27
16	128	64	64	159	95	95	2.24
17	96	32	32	127	63	63	2.02
18	192	96	96	223	127	127	1.50

All colours are composed of RGB values. The TCS3200 senses the colour intensity of different objects and these values are then fed to the arduino and objects are sorted accordingly. Different colours have different RGB values. The RGB values of some colours are shown in the above table.

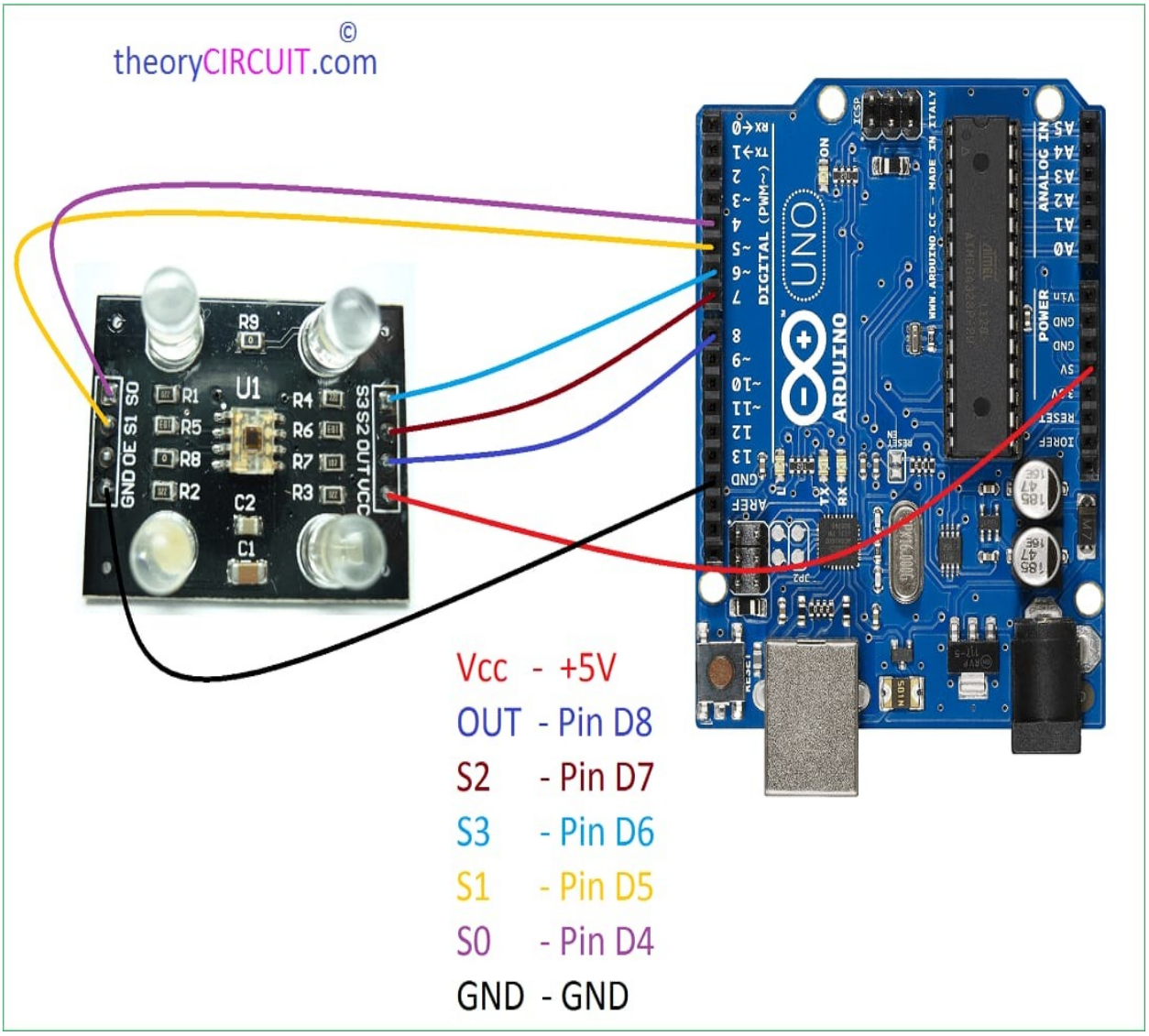
Chapter 4

Work Plan

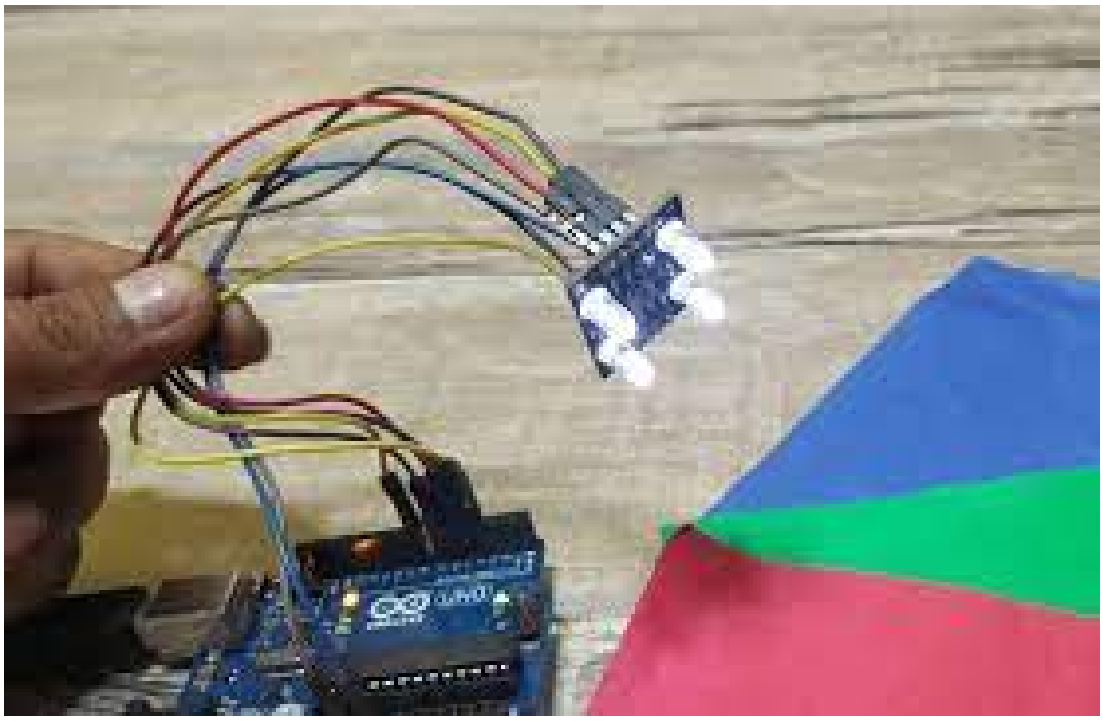
Circuit Diagram



Interfacing of Colour Sensor with Arduino



Initial Stage:

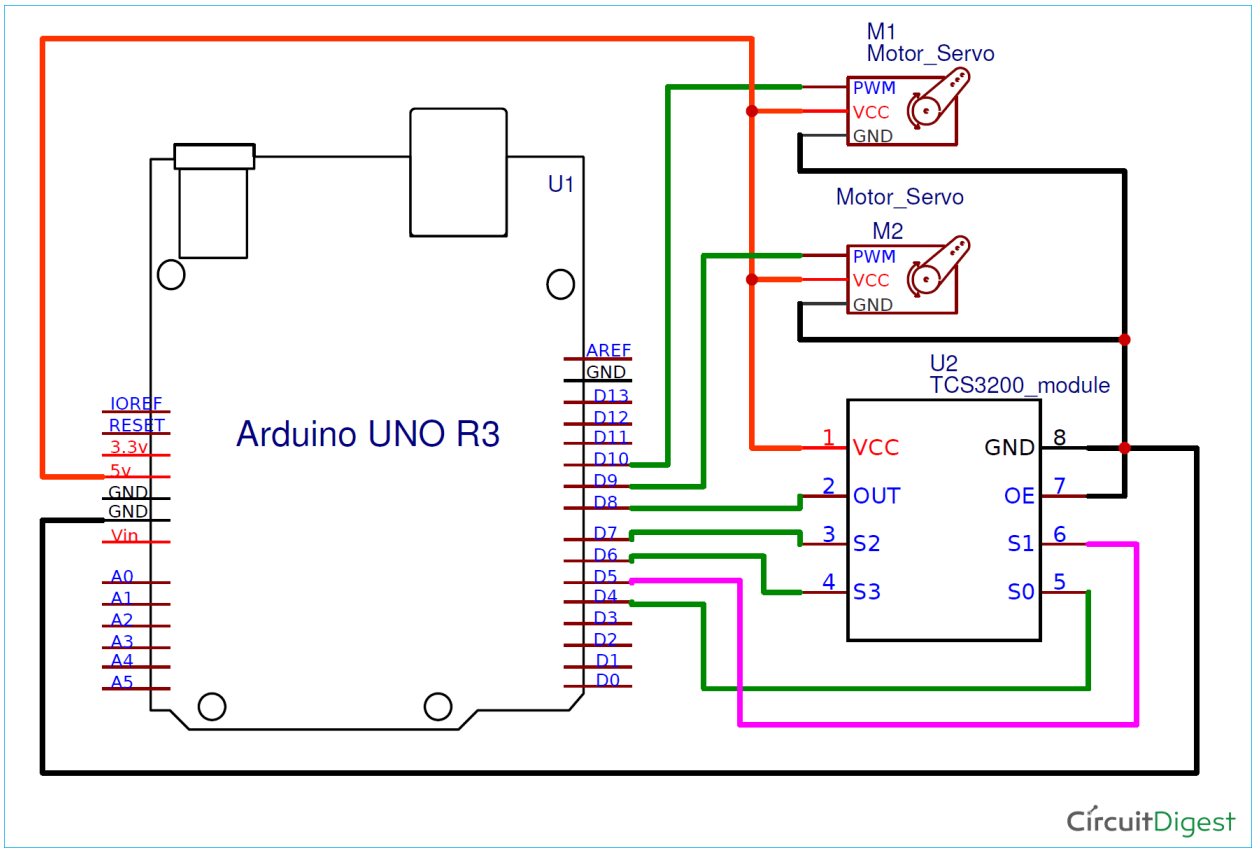


Once an object is placed in front of the colour sensor it detects the red green blue intensity of the object.Then as per code it gives the output. In the code we have given a loop and once these loops are satisfied it gives the detected color.

Second Stage:

Connection with servo motors:

One of the servo motors rotates at a certain angle when red color is detected and the other servo motor rotates at another specified angle when blue is detected. When green color is detected none of the servo motors run.



With the help of a conveyor belt, sorting becomes easier. Objects placed on the conveyor belt can then be brought to the color sensor for which the servo motors help in sorting the objects based on their colours to the respective boxes allotted to each colour.

Code:

```
#include <Servo.h>

Servo myservo7;
int pos=0;
const int s0=8;
const int s1 = 9;
const int s2=12;
Servo myservo6;
const int s3 = 11;
const int out = 10;\

// LED pins connected to Arduino
int redLed= 2;
int greenLed=3;
int blueLed=4;

// Variables
int red=0;
int green =0;
int blue = 0;

void setup()
{
        Serial.begin(9600);

        pinMode (s0, OUTPUT);
        pinMode (s1, OUTPUT);
        pinMode (s2, OUTPUT);
        pinMode (s3, OUTPUT);
        pinMode (out, INPUT);
        pinMode (redLed, OUTPUT);
        pinMode (greenLed, OUTPUT);
```

```
        pinMode (blueLed, OUTPUT);

        digitalWrite(s0, HIGH);
        digitalWrite(s1, HIGH);
        myservo7.attach(7);
        myservo6.attach(6);

}

void loop()
{
        color();

        Serial.print ("R Intensity: ");
        Serial.print (red, DEC);
        Serial.print("G Intensity: ");
        Serial.print(green, DEC);
        Serial.print(" B Intensity: ");
        Serial.print (blue, DEC); //Serial.println();
        if (red<blue && red < green && red <20)
        {

                Serial.println(" (Red Color)");
                 delay(3000);
                 for (pos = 0; pos <= 180; pos += 1)        // goes from 0 degrees to 180
                                                                                degrees
                                                                        // in steps of 1 degree

                {

                                 myservo7.write(pos);          // tell servo to go to position in
                                                                                variable 'pos'

                                delay(15);                                      // waits 15ms for
                                                                the servo to reach the position
```

```
        }

}

else if (blue < red && blue < green)
{

        Serial.println(" - (Blue Color)");
        delay(3000);
         for (pos = 180; pos >= 0; pos -= 1)        // goes from 0 degrees to 180
                                                                    degrees

                                                          // in steps of 1 degree

        {

                myservo6.write(pos);                        // tell servo to go to
                                                          position in variable 'pos'

                 delay(15);                                 // waits 15ms for the
                                                        servo to reach the position
        }
}
else if (green < red && green < blue)
{
        Serial.println(" - (Green Color)");
}

else
{
        Serial.println();
}

delay(3000);
```

```
        digitalWrite (redLed, LOW);
        digitalWrite (greenLed, LOW);
        digitalWrite (blueLed, LOW);
}

void color()
{
        digitalWrite(s2, LOW);
        digitalWrite(s3, LOW);

        //count OUT, PRed, RED
        red = pulseIn(out, digitalRead(out)==HIGH ? LOW: HIGH);
        digitalWrite(s3, HIGH);

        blue = pulseIn(out, digitalRead(out)==HIGH?LOW:HIGH);
        digitalWrite(s2, HIGH);

        //count OUT, pGreen, GREEN
        green = pulseIn (out, digitalRead(out) == HIGH ? LOW : HIGH);
}
```

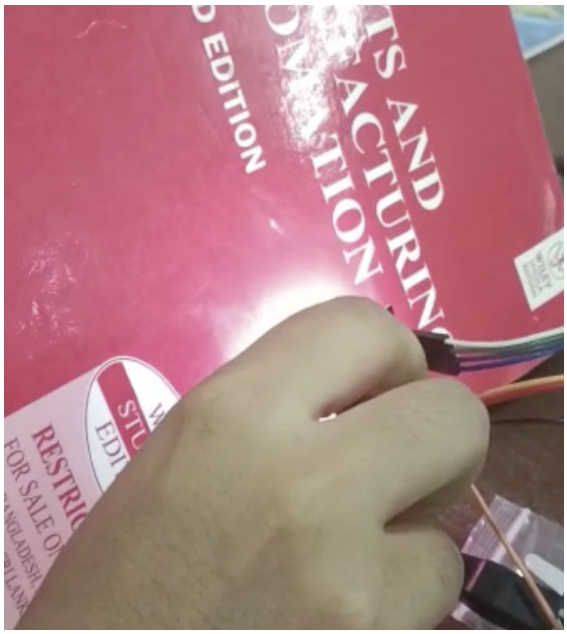
Chapter 5

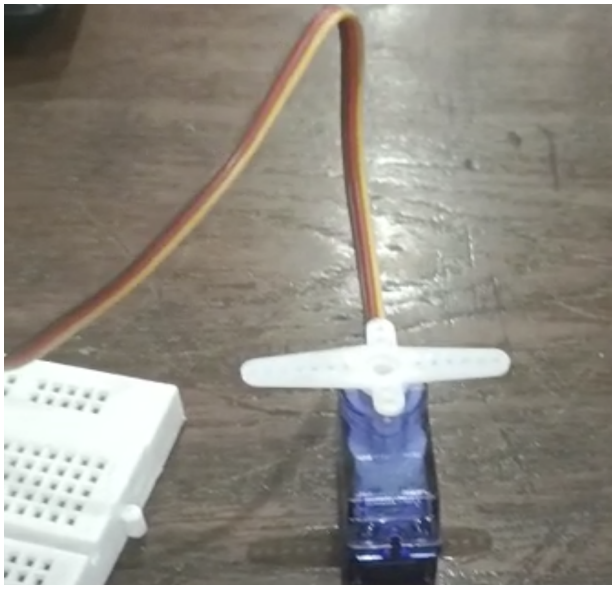
Results

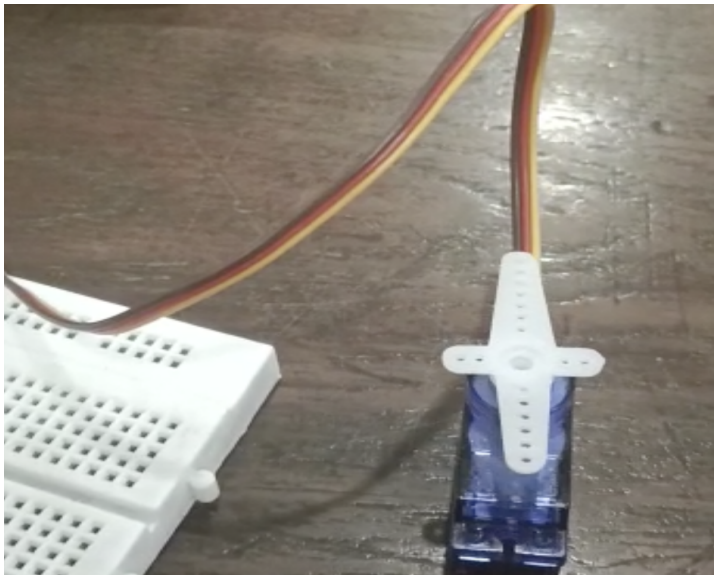
```
Red = 304; Green = 336; Blue = 271
Red = 298; Green = 342; Blue = 271
Red = 305; Green = 343; Blue = 272
Red = 304; Green = 336; Blue = 271
Red = 304; Green = 336; Blue = 277
Red = 303; Green = 342; Blue = 277
Red = 298; Green = 342; Blue = 271
Red = 303; Green = 336; Blue = 277
Red = 292; Green = 338; Blue = 275
Red = 297; Green = 331; Blue = 273
Red = 293; Green = 328; Blue = 263
Red = 271; Green = 317; Blue = 252
Red = 148; Green = 210; Blue = 163
Red = 89; Green = 205; Blue = 160
Red = 87; Green = 205; Blue = 160
```

values for red decrease when red material is placed in front of the color sensor

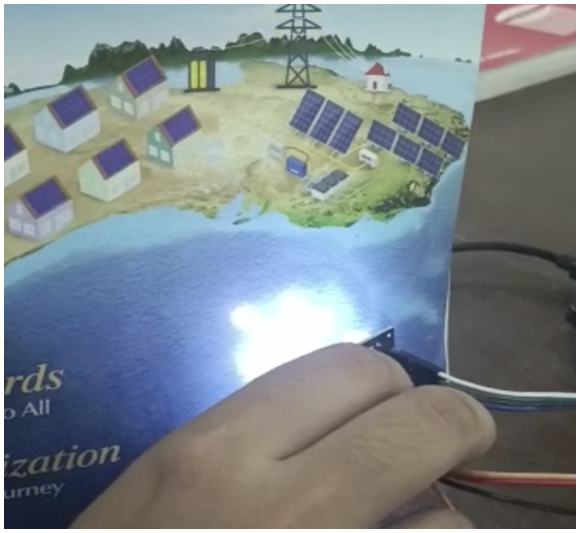
Here are some of the screenshots from the video that we took of the working of the colour sorter.

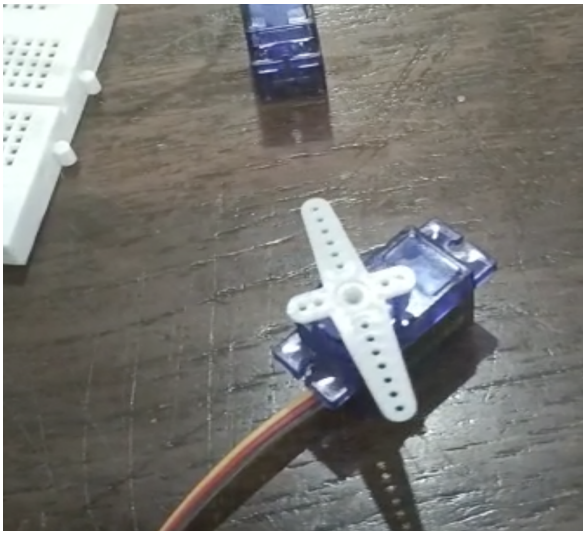






The servo motor rotates when red colour is detected by the colour sensor.





When blue is detected the servo motor rotates. When green is detected the servo motor doesn't rotate. The output of the rgb values is shown above.

Applications

- Colour sensors have a wide range of applications in the fields of image processing, digital signal processing, object detection, color identification, etc.
- In industries, colour sensors are often used in sorting objects based on color.
- TCS3200 is applied for industrial process control.
- In laser edge banding machines, to detect colour, TCS3200 is used.
- To detect chronic kidney diseases, it is used for urine analysis.
- TCS3200 is used in fruit sorting systems.

Chapter 6

Conclusion

These methods can be implemented to any minds of industrial sorting irrespective of the size and shape of the objects. These are the most cost-effective and user-friendly ways to separate objects based on colour. This system is relatively cheap, and thus could be employed in small scale industries in need of object separation based on colour, as well. Object separation is an unavoidable part in most of the industries. Separating them based on colour is an important task.

Future Scope

- By using a counter we can count the number of objects.
- Speed of the system can be increased according to the speed of production.
- The system can be used as a quality controller by adding more sensors.
- We can use a robotic arm to pick and place the object.

Chapter 7

References

- https://sites.google.com/a/umn.edu/me2011/
- https://www.arduino.cc/en/Main/ArduinoBoard
- https://www.arduino.cc/en/Guide
- https://www.programmingelectronics.com