Automatic Rotten and Fresh Apple Sorting Machine using Arduino and TCS3200

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Abstract— It is very difficult to sort the fresh apple from a huge batch. This paper describes about the sorting of fresh apple depending upon the colour change occurs in its skin. TCS3200 sensor was used to detect the colour of the product and the ARDUINO MEGA 2560 was used to control the overall process. The identification of the colour is based on the frequency analysis of the output of TCS3200 sensor. Depending on this we can develop fruit sorting machine. Two conveyor belts were used, each controlled by separate DC motors. The first belt is for placing the product to be analysed by the colour sensor. Sensing the result there will be two separate compartment for fresh and rotten apple.

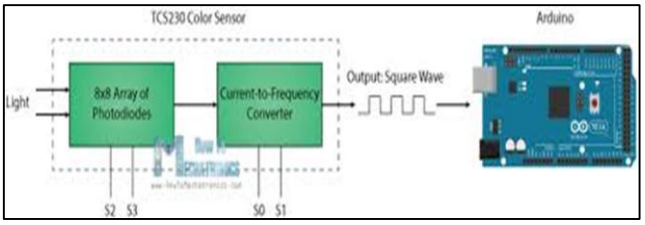
Keywords: TCS3200 sensor, Fresh Apple Sorting Machine, ARDUINO MEGA

I. INTRODUCTION

Machines can perform highly repetitive tasks better than humans. Worker fatigue on assembly lines can result in reduced performance, and cause challenges in maintaining product quality. An employee who has been performing an inspection task over and over again may eventually fail to recognize the colour of product. Automating many of the tasks in the industries may help to improve the efficiency of manufacturing system. The purpose of this model is to design and implement a system which automatically separates products based on their colour. This machine consists of three parts: conveyor belt, colour sensor, and dc motor. The output and input of these parts was interfaced using Arduino Mega 2560. To reduce human efforts on mechanical man are introducing different types of sorting machines and they are being developed. These machines are too costly due to the complexity in the fabrication process. A common requirement in the field of apple sorting is that sensing of colour of skin and identification.

A. How TCS3200 Color Sensor Works

The TCS3200 senses colour light with the help of an 8 x 8 array of photodiodes. Then using a Current-to-Frequency Converter the readings from the photodiodes are converted into a square wave with a frequency directly proportional to the light intensity. Finally, using the Arduino Board we can read the square wave output and get the results for the colour. If we take a closer look at the sensor we can see how it detects various colours. The photodiodes have three different colour filters. Sixteen of them have red filters, another 16 have green filters, another 16 have blue filters and the other 16 photodiodes are clear with no filters. Each 16 photodiodes are connected in parallel, so using the two control pins S2 and S3 we can select which of them will be read. So for example, if we want to detect red colour, we can just use the 16 red filtered photodiodes by setting the two pins to low logic level. The sensor has two more control pins, S0 and S1 which are used for scaling the output frequency. The frequency can be scaled to three different reset values of 100 %, 20 % or 2%. This frequency-scaling function allows the output of the sensor to be optimized for various frequency counters or microcontrollers.



B. Principle of the Machine

Its main principle is the change of colour of apple skin. The fresh fruit will have a certain colour and if it is rotten the skin colour will vary. Studying this colour change the optimum result has been found and depending this result the Arduino will sort the apple.

II. METHODOLOGY

A. Prototype Design Parameters:

The proposed system is designed for automatic sorting of fresh and rotten apples. The prototype consists of two DC motors, two conveyor belt, an ARDUINO MEGA and a colour sensing circuit using TCS320. DC motors are used to control the conveyor belts. After integrating the programmed Arduino and the TCS3200 circuitry with the structure of the model, we measure the frequency of signals corresponding to each colour by observing them on a CRO. Based on 34 International Journal of Research and Innovations in Science and Technology Volume 2: Issue 2 : 2015 this study the timer delay value is adjusted by reprogramming the Arduino. The time required for the product to reach the corresponding container in the separator placed on second conveyor belt is also considered. L293D Hybrid IC is used to drive the second motor both in clock wise and anti-clock wise direction, which provides the forwards and backwards movement of the container of dimensions 9cm x 30cm x 7cm (Width x Length x Height). Separators were used to create compartments of equal sizes meant for collecting objects of same type product. The end section consist of a DC motor (12V, 30rpm), which is used to control the movement of the second conveyor belt in order to position the separator according to the sensor output. The whole framework, excluding the DC power supply, weighed 1.5kg approximately and was 27cm tall, 35cm wide and 77cm long.

B. Programme to Identify Fresh Apple:

```
#define S0 4
#define S1 5
#define S2 6
#define S3 7
#define sensorOut 8
int frequency = 0;
```



```
void setup() {
pinMode(S0, OUTPUT);
pinMode(S1, OUTPUT);
pinMode(S2, OUTPUT);
pinMode(S3, OUTPUT);
pinMode(sensorOut, INPUT);
digitalWrite(S0,HIGH);
digitalWrite(S1,LOW);
Serial.begin(9600);
}
void loop() {
digitalWrite(S2,LOW);
digitalWrite(S3,LOW);
frequency = pulseIn(sensorOut, LOW);
Serial.print("R= ");
Serial.print(frequency);
Serial.print("  ");
delay(100);
digitalWrite(S2,HIGH);
digitalWrite(S3,HIGH);
frequency = pulseIn(sensorOut, LOW);
Serial.print("G= ");
Serial.print(frequency);
Serial.print("  ");
delay(100);
digitalWrite(S2,LOW);
digitalWrite(S3,HIGH);
frequency = pulseIn(sensorOut, LOW);
Serial.print("B= ");
Serial.print(frequency);
Serial.println("  ");
delay(100);
}
```

C. Condition for Fresh Apple:

When R value is >150 G must be <600 and B must be >75. If R value is between 100 and 150 the value of G must be <450 B>110. If the R value is <100 the value of B must be >150 and G<350. The values are according to the programme.

III. CONCLUSION

Depending upon this sensor reading if sensor value lies between above the apple is fresh and it will be placed to fresh apple compartment otherwise it will be transferred to rotten platform.

IV. FUTURE SCOPE

It will be very useful for others fruit also. Depending upon this programme if all fruits colour change is studied then the machine will work for all fruits.

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