Color Detection Based Robotic Automation System

Lovely Professional University

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Project Report of ECE 366

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Abstract:

The Main aim of this Project, is demonstrating the methodology for identifying the shades of the colors with an exact prediction by their values. According to a study, [1] a normal human can able to identify nearly 1 million shades of the colors [1], so in this project we used LABVIEW software for identifying some shades of the colors. RGB are the three different colors which are helpful in recognizing the colors. In robotics these colors play very important role that are helpful to recognizing/ identifying the shades of the object easily.

Each parameter (red, green, and blue) defines the intensity of the color with a value between 0 and 255. By using these intensities, we can define value of the colors. For reduce human labor, robots are being manufactured and used in various fields. Robots are the intelligent machines that are designed to work according to the instructions given to them by their users. Some of these robots are also made automatic. In this project we designed a robotic automated system, that can detect the given specific color. According to that color, it performs some tasks which are defined previously, like moving the object from one place to another. Basically, these types of the systems mainly used at Warehouses.

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1. Introduction:

Color Detection Based Robotic Automation System is mainly used in warehouses. For implementing this Project, we used LabView software. In LabView software we designed a pattern that is used to detect the colors, according to the detected color it performs some assigned tasks. Coming to the hardware parts that we have used to implement in your project are, mainly servo motors, Arduinos, breadboard. Software part includes Arduino IDE & Maker Hub modules in LabView.

Project construction includes the physical connection of the project implementation by using those software's & hardware. Firstly, we done the code for color detection by using LabView vision modules, later on we done the code for 3 servo motors using Arduino ide. In this project we used two arduino's, 1st arduino is connected to laptop in which our LabView software part is simulated and the ports of the 1st arduino is connected to the ports of the 2nd arduino. The 2nd arduino is connected to 3 servo motors for implementing assigned task. All these connections are made with the help of breadboard and jumper wires.

The Project Construction is also implemented by using LED's. In 1st arduino output ports, we connect led's for checking whether the internal block diagram of LabView is logically right or wrong. The 2nd arduino ports are connected to the three (3) led's for implementing assigned task.

Project Working includes the working part of the project implementation by using those software's & hardware. Firstly, we run the design pattern which was implemented in LabView, then we start work on the RGB colors. According to the design in the LabView & the code written in the arduino.

1) First all the servos are set to 0 degrees.
2) If Red (R) color is Detected then the 1st servo will rotate up to 90 degrees, after the delay of 2sec its, back its previous position.
3) If Green (G) color is Detected then the 2nd servo will rotate up to 90 degrees, after the delay of 2sec its, back its previous position.
4) If Blue (B) color is Detected then the 3rd servo will rotate up to 90 degrees, after the delay of 2sec its, back its previous position.
5) If white color is Detected then the simulation of LabView comes to end and only arduino 2 will work.

2. Materials & Methodology:

This methodology is also implemented in the Tinkercad platform. By making the same connections which we were made, by using both hardware and software's. This methodology is identifying the shades of the colors for the given design on the tinkercad.

2.1 Circuit Diagram:

The below figure (fig2.1) shows the representation of the Color Detection Based Robotic Automation System circuit implementation on Tinkercad platform.

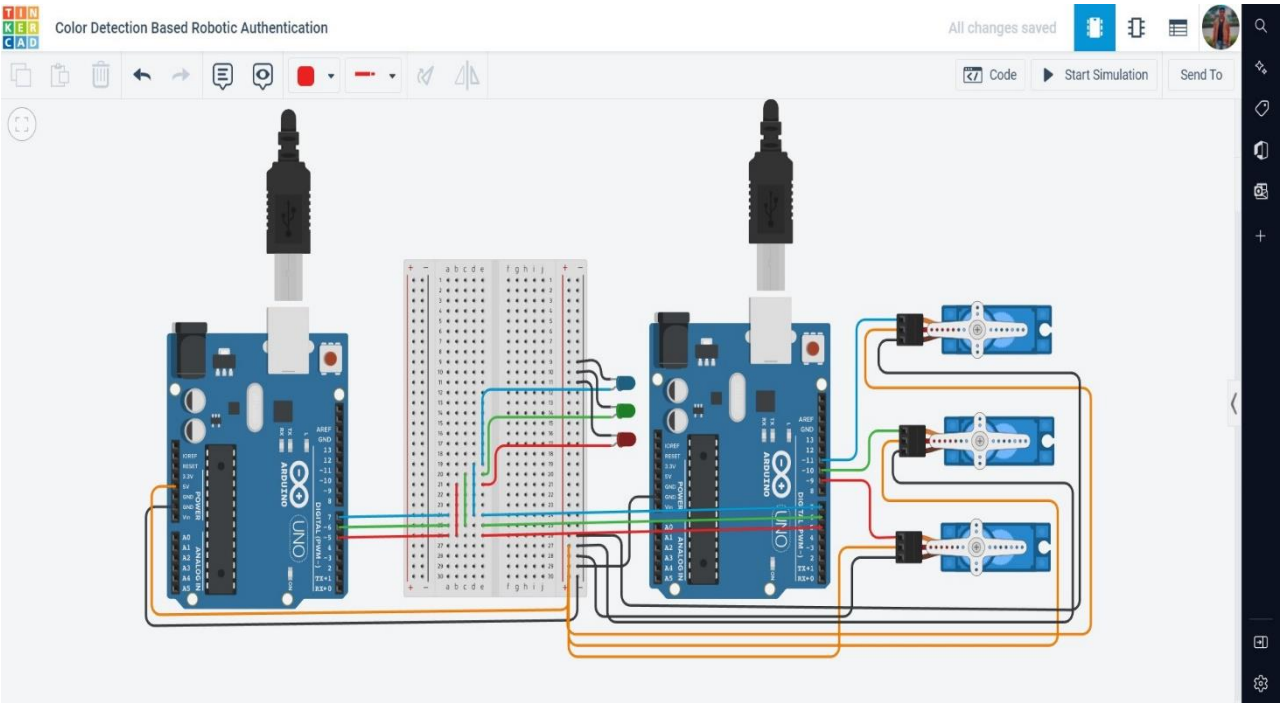

fig 2.1

2.2 Components:

Arduino:

Arduino UNO board is the open-source software and hardware microcontroller board, [2] that can be integrated into a variety of electronic Projects. This board can be interfaced with other Arduino boards, Arduino shields, Raspberry Pi boards and can control relays, LEDs, servos, and motors as an output [2].

In this project we used two arduino uno boards for implementing our project. The 1st Arduino is used for simulation in the LabView, whereas other is used for servo motors. The below figure (fig 2.21) shows the arduino uno board.

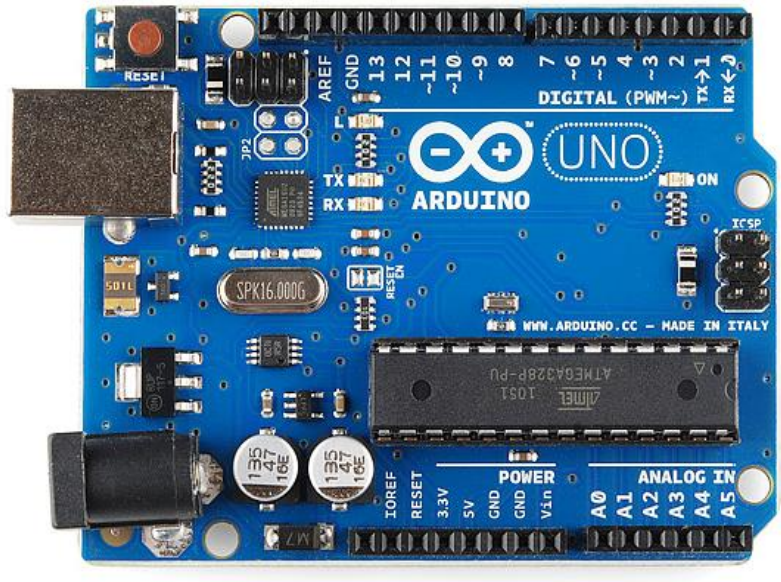

fig 2.21

Servo Motors:

A **servo motor** is a type of motor that can rotate with great precision. [3] Normally this type of motor consists of a control circuit that provides feedback on the current position, this feedback allows the servo motors to rotate with great precision [3]. If the servo motor is rotating with DC power supply, then it is called DC servo motor, and if it is AC-powered motor then it is called AC servo motor.

In this project we used 3 DC servo motors. All the 3 servos are connected to the 2nd arduino uno board. As we discussed in working, if red color is detected then the 1st servo rotates to 90 degrees, similarly the motors perform same action for all three RGB colors. Figure (fig 2.22) shows servo motor, it has three pins, the three pins represent 1) PWM Signal 2) VCC 3) ground.

fig 2.22

Bread Board:

A breadboard (sometimes called as protoboard) is used for building temporary circuits. [4] It is very useful to users/designers because it allows components to be removed and replaced easily. It is useful to the person who wants to build a circuit to demonstrate its action, then to reuse the components in another circuit.

A breadboard can be divided into two segments, which are called the bus strip and the terminal strip [4]. A bus strip has 2 long lines which are used to provide Supply Voltage (VCC) & Ground (GND) to the circuit. The terminal strip is used for connections. In this project we used breadboard for making our circuit physical connections, the below figure (fig 2.23) shows the breadboard.

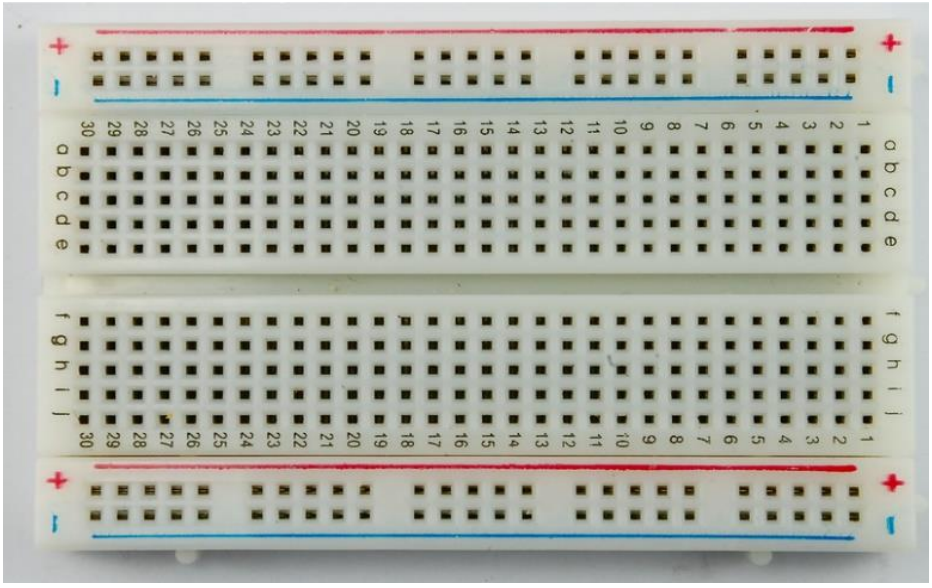

fig 2.23

Jumper Wires:

In this project we used M-M jumper wires for making connections from 1st arduino to breadboard and then breadboard to 2nd arduino. The below figure (fig 2.24) shows the M-M jumper wires.

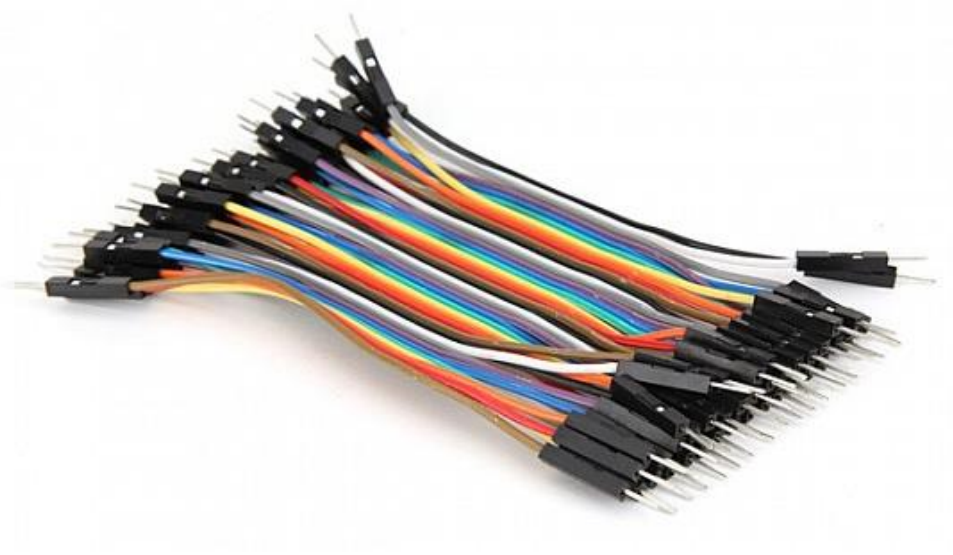

fig 2.24

LED:

Light Emitting Diode is a semiconductor diode, that emits light when electric current flows through it. In this project we used 3 different colored leds (RGB). The below figure (fig 2.25) shows the RGB leds.

fig 2.25

3. Project Code:

Project code of the Servo motors can be implemented by using arduino ide software, as per the color detection design pattern on the LabView, the action of the servo motors is implemented using the arduino ide software.

servo_11

```
#include<Servo.h>
Servo Red,Green,Blue;
const int redPin = 5,greenPin = 6,bluePin = 7;
int redState = 0,greenState = 0,blueState = 0;
void setup() {
  pinMode(redPin,INPUT);
  pinMode(greenPin,INPUT);
  pinMode(bluePin,INPUT);
  Red.attach(9);
  Red.write(0);
  Green.attach(10);
  Green.write(0);
  Blue.attach(11);
  Blue.write(0);
}

void loop() {
  redState = digitalRead(5);
  greenState = digitalRead(6);
  blueState = digitalRead(7);
```

fig 3.1

```
  if(redState == HIGH)
  {
    Red.write(180);
    delay(2000);
    Red.write(0);
    delay(1000);
  }
  else if(greenState == HIGH)
  {
    Green.write(180);
    delay(2000);
    Green.write(0);
    delay(1000);
  }
  else (blueState == HIGH);
  {
    Blue.write(180);
    delay(2000);
    Blue.write(0);
    delay(1000);
  }
}
```

fig 3.2

4. Project Plan Picture:

The below figure (fig 4.1) shows the process of color detection simulation of LabView.

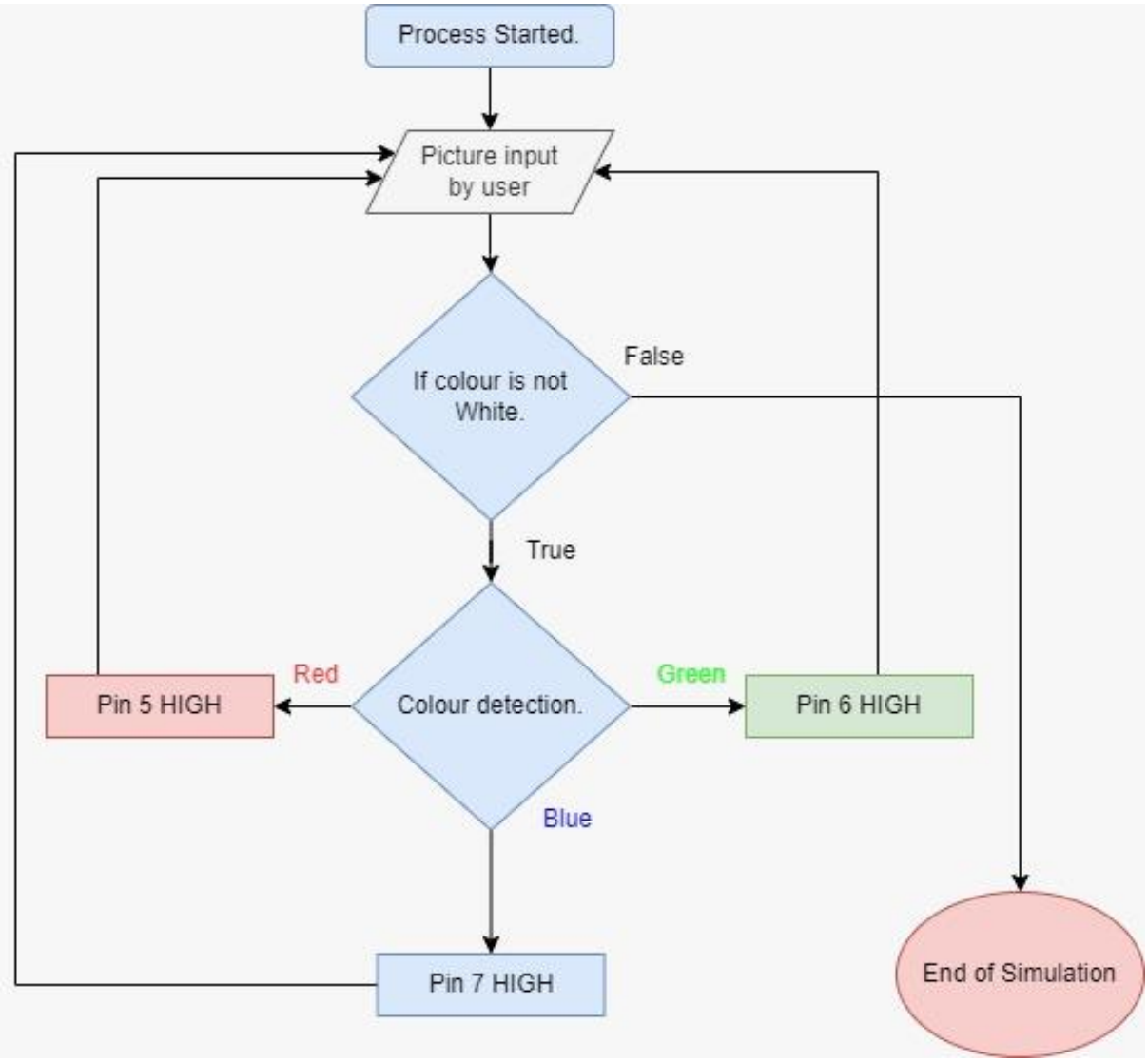

fig 4.1

The below figure (fig 4.2) shows the process of servo action on the second arduino.

1) If Red (R) color is Detected then the 1st servo will rotate up to 90 degrees, after the delay of 2sec its, back its previous position.
2) If Red (R) color is Detected then the 1st servo will rotate up to 90 degrees, after the delay of 2sec its, back its previous position.
3) If Red (R) color is Detected then the 1st servo will rotate up to 90 degrees, after the delay of 2sec its, back its previous position.

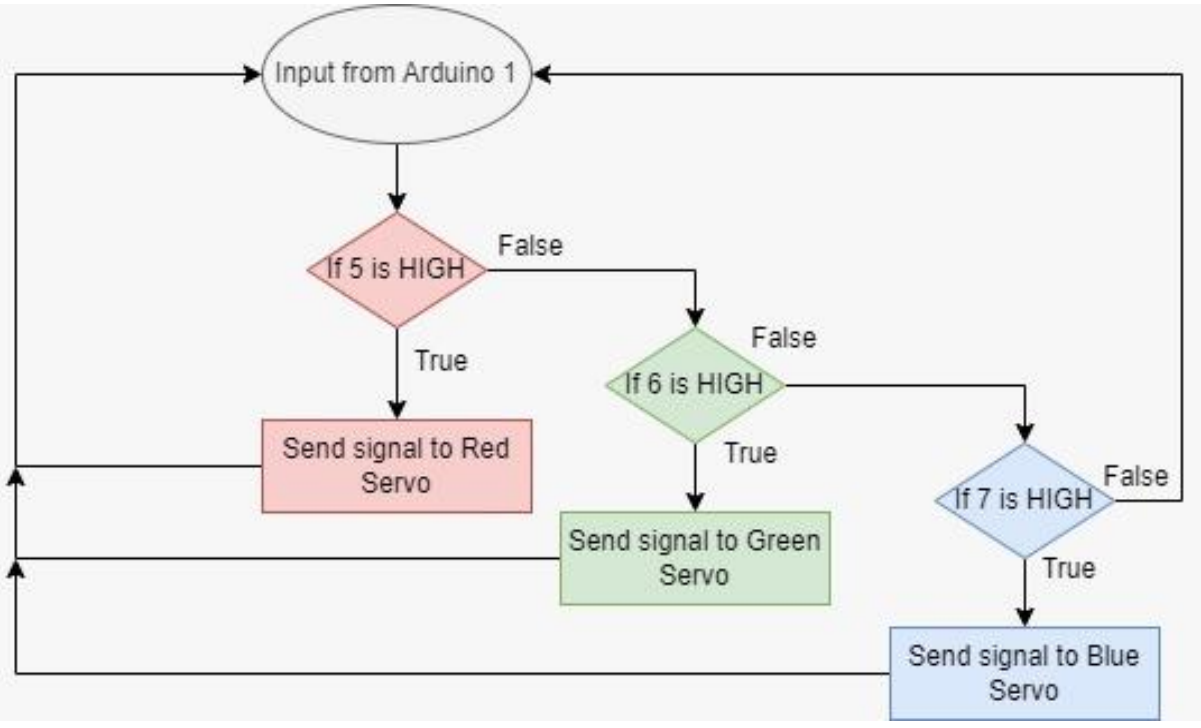

fig 4.2

The below figure (fig 4.3) shows the block diagram of the circuit implementation of color detection on LabView. We used three Digital write channels for output pins, serial port for LINX & one-color spectrum.

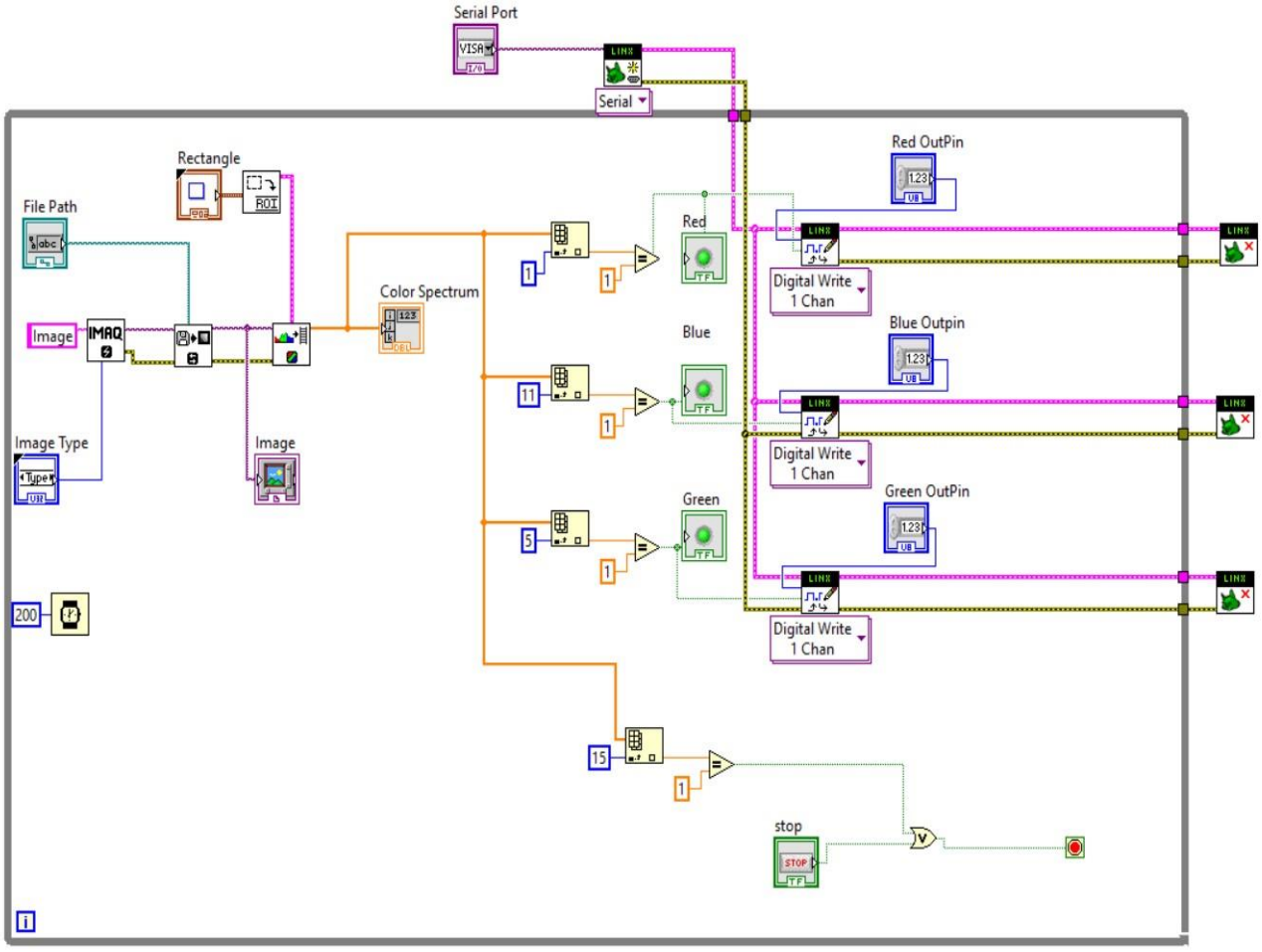

fig 4.3

The below figure (fig 4.4) shows the block diagram of the circuit implementation on front panel in LabView, in this we used three Boolean switches to represent the detected color, File path is used to locate the require file in the system.

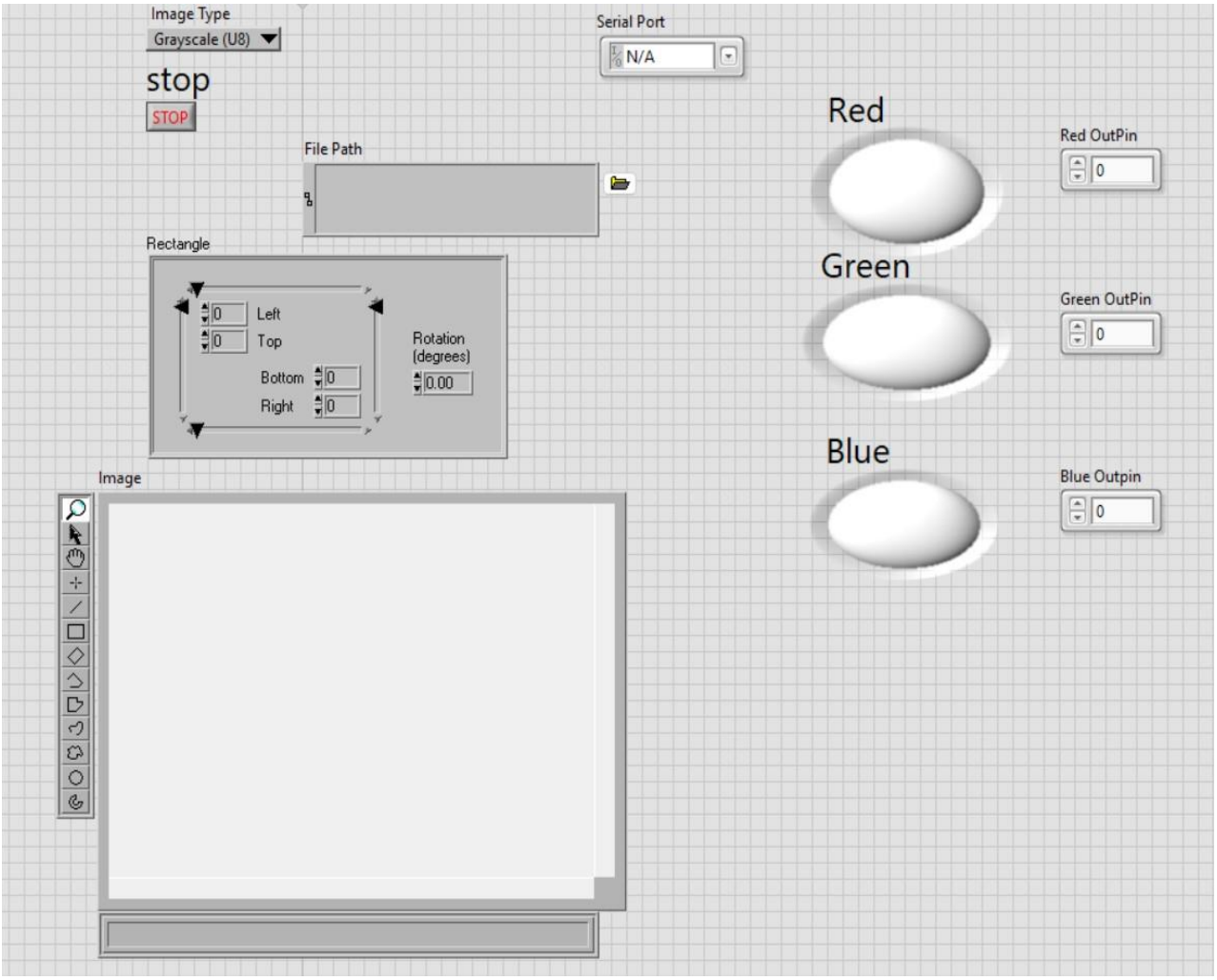

fig 4.4

5. Result & Discussion:

We implemented the, color detection based robotic automation system practically as per the circuit diagram shown (fig 4.1 & fig 4.2) in the LabView previously. We get the exact and accurate output as we discussed it in the introduction part.

First of we set the all servos to 0 degrees, then we start simulation of our project

1 When we give the file location of the Red Color (R) to the file path tab in the front panel of LabView shown in figure (fig 5.1) the 1st servo will rotate up to 90 degrees, after the delay of 2sec its, back its previous position.

2 When we give the file location of the Green Color (G) to the file path tab in the front panel of LabView shown in figure (fig 5.2) the 2nd servo will rotate up to 90 degrees, after the delay of 2sec its, back its previous position.

3 When we give the file location of the Blue Color (B) to the file path tab in the front panel of LabView shown in figure (fig 5.3) the 3rd servo will rotate up to 90 degrees, after the delay of 2sec its, back its previous position.

4 When we give the file location of the White Color (W) to the file path tab in the front panel of LabView shown in figure (fig 5.4) the simulation of the LabView is ended.

File Path → RGB & White Locations:

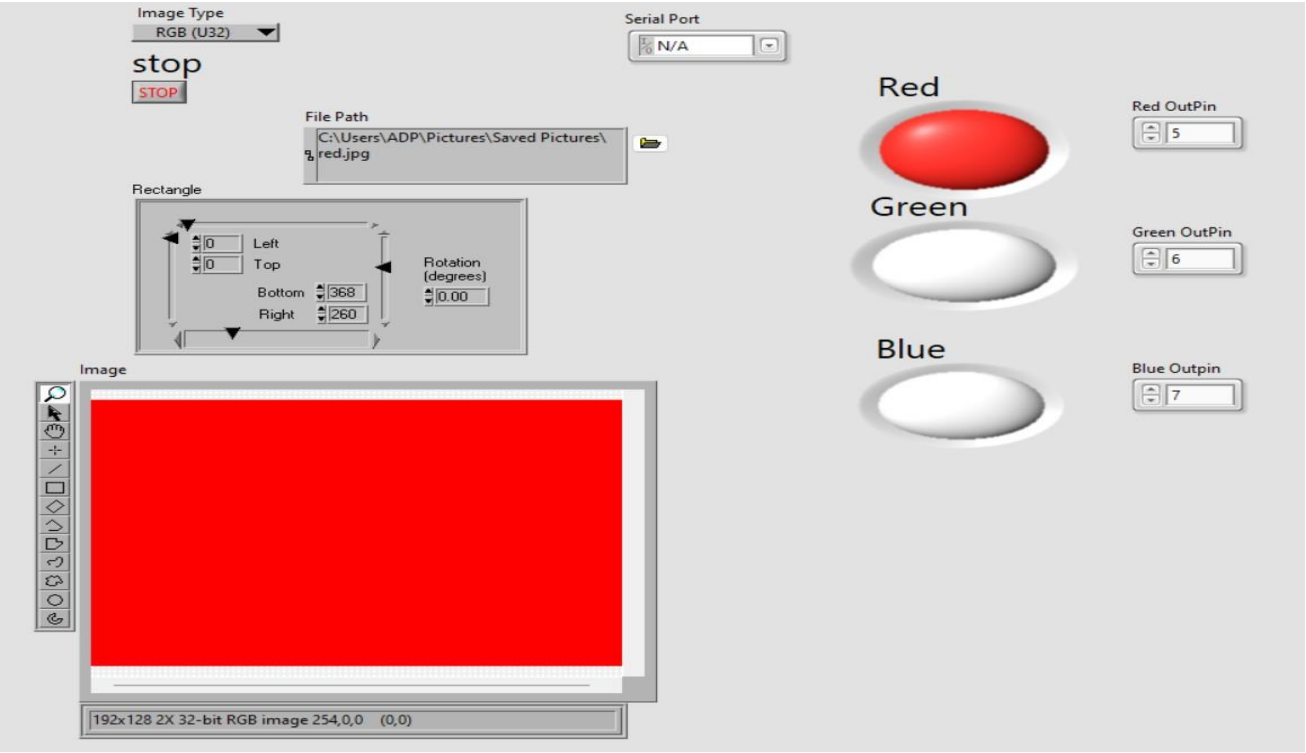

fig 5.1

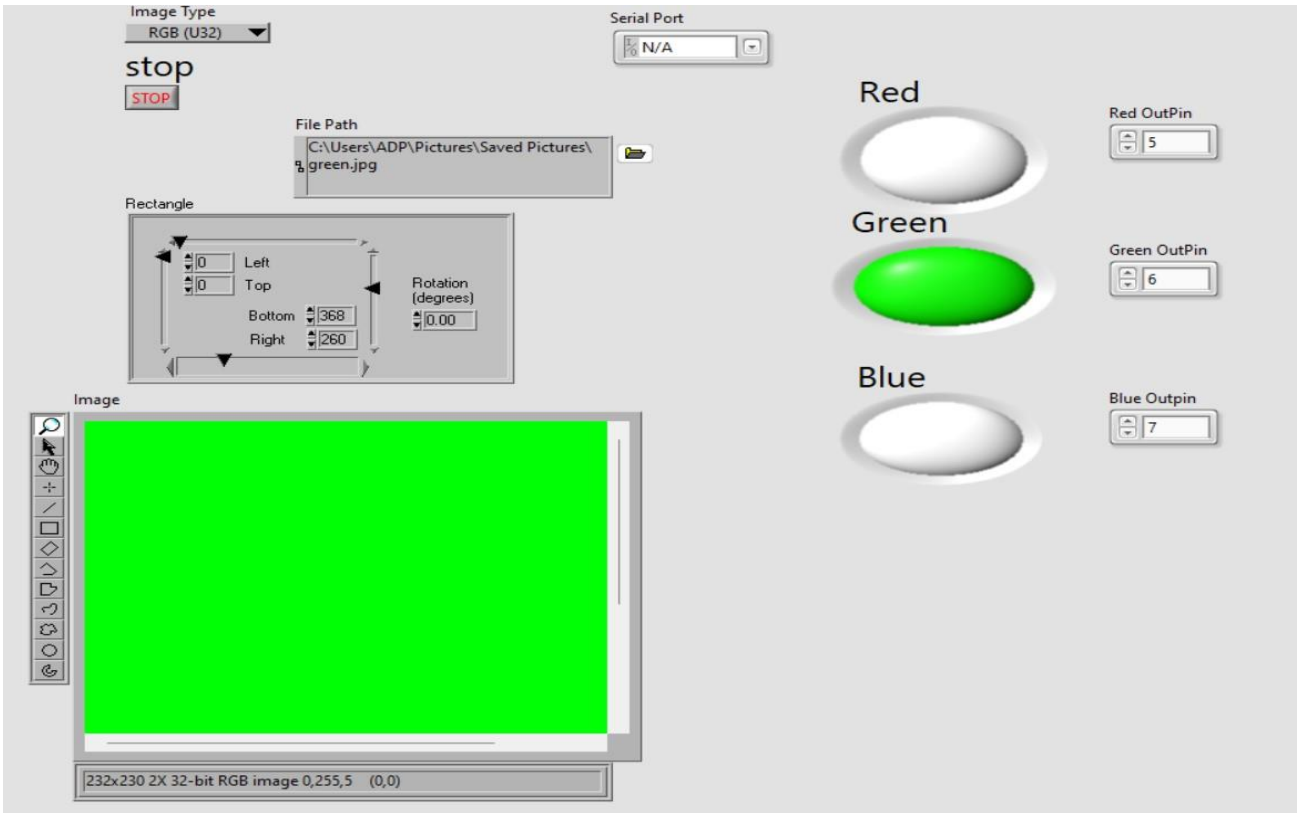

fig 5.2

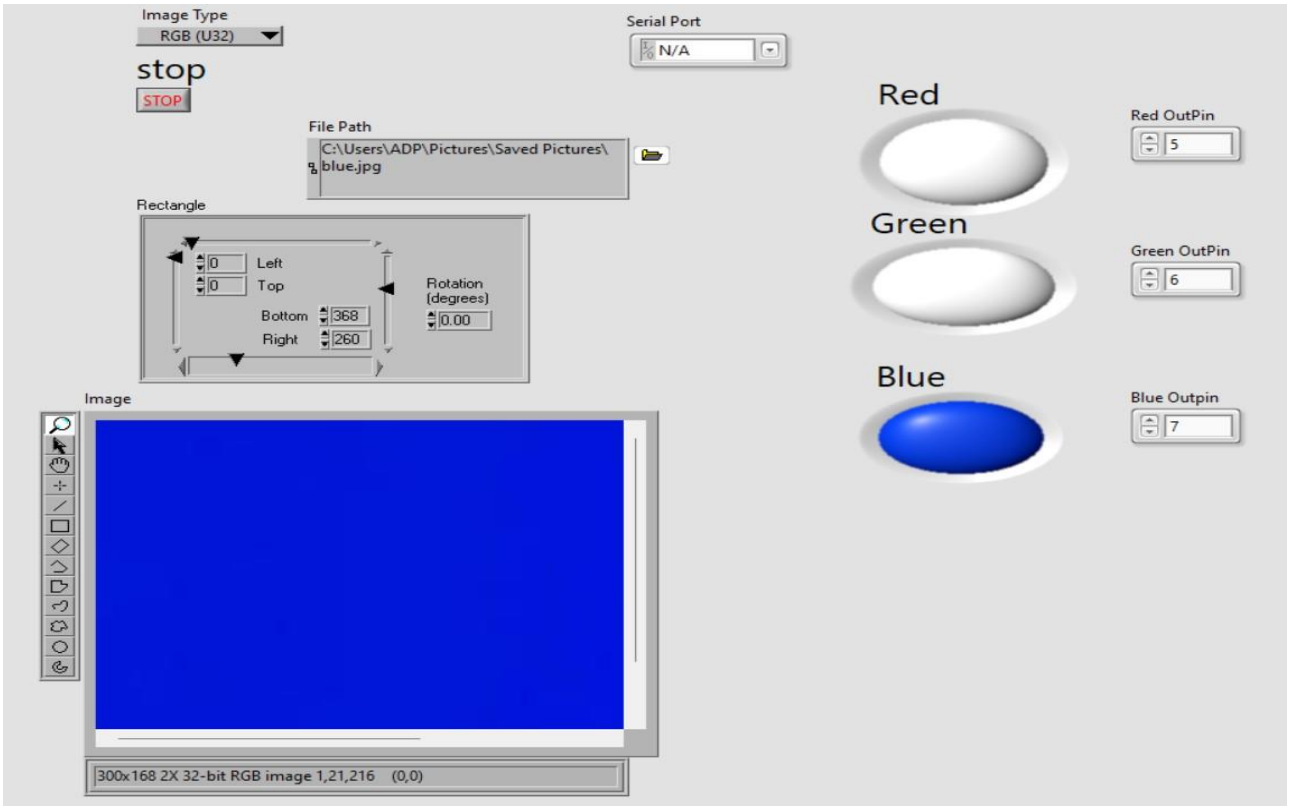
Image Type
RGB (U32)
stop
STOP
Serial Port
N/A
File Path
C:\Users\ADP\Pictures\Saved Pictures\
blue.jpg
Rectangle
Left
Top
Bottom
Right
Rotation
(degrees)
Image
300x168 2X 32-bit RGB image 1,21,216 (0,0)
Red
Green
Blue
Red OutPin
Green OutPin
Blue Outpin

fig 5.3

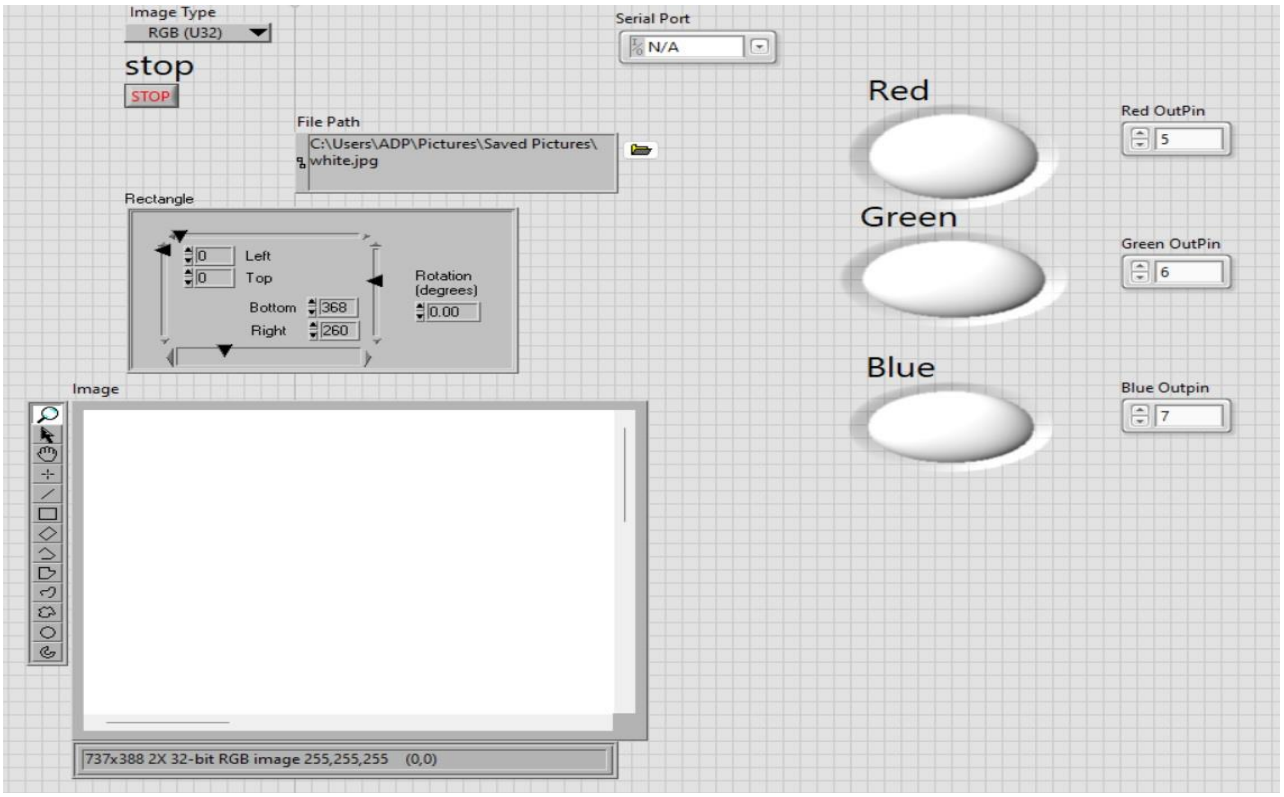
Image Type
RGB (U32)
stop
STOP
Serial Port
N/A
File Path
C:\Users\ADP\Pictures\Saved Pictures\
white.jpg
Rectangle
Left
Top
Bottom
Right
Rotation
(degrees)
Image
737x388 2X 32-bit RGB image 255,255,255 (0,0)
Red
Green
Blue
Red OutPin
Green OutPin
Blue Outpin

fig 5.4

6. Conclusion:

We believe that even though we made it look easy, color detection using robotics automation is a very complex task, and requires hours and hours of research, time, and patience but still, we enjoyed learning more about something that we have never learned about before. During our free time, we hope to go further into the topic of big warehouse robotic automation system.

We hope that, this project will helpful at warehouses by reducing human efforts and mistakes. In further this presentation inspires you too, take this topic of color detection based robotic automation system creates a new invention that would change the warehouses loses and take them in a better way. We hope new invention implementation has been takes place by taking inspiration from our project, for making human efforts simple, time saving and accurate.

7. References:

[1] P. Ragu Raman, A. Meghana, "Color detection of RGB images using OpenCV and Python" by IJS CSEIT publications on September 26th 2015 https://www.researchgate.net/publication/349355136_Color_Detection_of_RGB_Images_Using_Python_and_OpenCv [1].

[2] Emma Ashley, "what is Arduino uno" Design Sparkle https://www.rs-online.com/designspark/what-is-arduino-uno-a-getting-started-guide#:~:text=Arduino%20UNO%20is%20a%20low,and%20motors%20as%20an%20output [2].

[3] Apoorve, "Understanding the servo motor" published by August in 1st, Circuit Digest https://circuitdigest.com/article/servo-motor-working-and-basics [3].

[4] Owen Bishop, Keith Brindley, on January 26th 2001 board Transactions https://www.sciencedirect.com/topics/engineering/breadboard#:~:text=A%20breadboard%20(sometimes%20called%20a,the%20components%20in%20another%20circuit [4].