Multipurpose 4DOF Robotic Arm based on Internet of Things

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***Abstract*— In this work, we develop a robotic system that includes the detection of colored objects and their corresponding classification. Objects with three colors, such as red, green, and blue, are identified by the color sensor. The programmable TCS3200 module based on light-frequency converter technology is used to identify different objects by its color. This type of self-intelligent robotic system that performs all activities automatically and manually as the system gets the required energy. Today, these types of robotic systems are more commonly used in various industrial professions where automation and self-intelligence are highly recommended.**

Index Terms: **Robotic arm, ESP32, Servomotor, Color Sensor module, L293D Module.**

I.INTRODUCTION

Currently, many companies around the world are striving to design and produce new hardware platforms that are easier to use in building prototypes for the development of technologies such as IoT. The ongoing internet revolution along with increasing robotics in many activities of daily life, Robotics has become the best technology in today's technological world. The modern world relies more on automation than manual labor. Implementing automation reduces time, labor and cost while providing high performance. Robotics were attacked, how to understand automation.

For people who indulge in electronics both as a hobby or as a profession that arises from having more interest in robotics, this project is the key to most of the specific work that humans do not.

The invention of the modern day required a perfect combination of electronic and mechanical products known as mechatronics.

Mechatronics plays a crucial role in a fast growth of modern technology. Due to the introduction of the modern mechatronics system, the control and change of the robot circuits are very convenient.

In this article we try to provide a brief knowledge of a simple robot architecture that has a powerful programmable platform. We designed a self-intelligent robotic structure capable of recognizing and classifying elements by their color.

The initial color detection process is performed by the TCS3200 color detection sensor, this sensor detects colorusingan8×8photodiodearray.

The hands of the robot are driven by actuators, which are locate data remote location of the hand frame of the robot and connect themselves through tendon cables. The company offers a range of software tools, hardware platforms and documentation that enable electronic projects to be carried out and extend their functionality with other development boards such as: the low-power ESP32 system used in the construction of this prototype. According to Android's official website, there are over 24,000 unique devices, made by 1,300 different brands and at even more affordable prices.

II.INTERNETOFTHINGS

The idea of the "Internet of things" and the time period itself, first seemed in a speech via way of means of Peter T.Lewis, to the Congressional Black Caucus Foundation fifteenth Annual Legislative

Weekend in Washington, D.C, posted in September 1985.

There are many technologies that allow iot. a role capable of responding to different wireless or wired technologies.

III. EXPERIMENTAL SETUP

The complete system block diagram of the color sorting robotic arm is shown in the figure 1. The robot is designed with very basic robotic components.

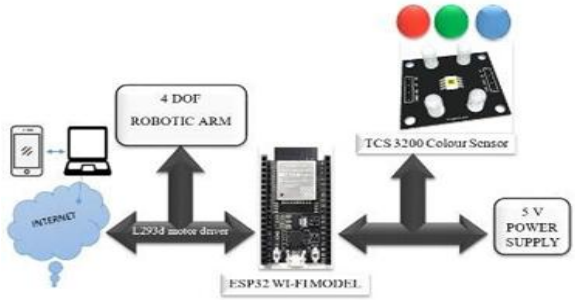

Fig.1:Block Diagram of the system

The main part of the project is the robot arm that can choose the things from one place to another by recognizing its color as red, green, blue using TCS3200 color sensor. Control is via the Internet to the ESP32Wi-Fimodule.Thisactsasareceiver and forwards the received signal to the microcontroller. The signal given to the robotic arm is actually sent over the internet, and hence we can access the robot from anywhere.

HARDWARE DESCRIPTION

A. ESP32

ESP32 normally the ESP32 could be a low-power system on a chip (SoC) series with 2.4 rate Wi-Fi Associate in Nursing Bluetooth capabilities, designed for mobile, wearable electronics, and web of Things (IoT) applications. The ESP32is a extremely integrated answer, with around twenty external components.

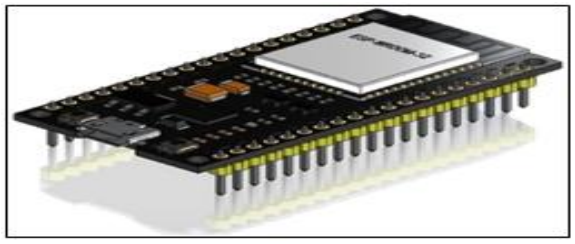

Fig.2:ESP32 WiFi Module

B. SERVO MOTOR

It consists of three parts Feedback system, Controlled device, Output sensor. this servo motor has great accuracy to rotate in different directions.

Fig.3: SERVO MOTOR

C. TCS3200ColorSensor Module

It is type of color sensor which has an array of photodiodes. this detect color by the photodiodes that arranged in colors in a groups such as red ,green ,blue and no filter on the fourth. This module adapts to a standard cutting board, but transmits the width of standard prototyping pins, which require theconnectionofthewirestoconnecttothebreadboardunderthemodule.asshowninfigure4.

Fig.4 TCS3200 Color Sensor Module

Specifications:

SupplyVoltageVCC	2.7to5.5V
LogicLevel	SameasVCC
Dimensions	
Length	32mm(1.26")
Width	24.7mm(0.97")
Weight	4.17g(0.148oz)

Color Filter Selection:

The pin S2 and pin S3 are used to check color filters like Red, Green, Blue, Clear. LOW and HIGH these combination allows different photodiodes. As shown in table below.

Colors	S2	S3
Red	LOW	LOW
Blue	LOW	HIGH
Nofilter	HIGH	LOW
Green	HIGH	HIGH

D. Robotic Arm

we are exploitation this four-dof Mechanics arm as a result of it's simple to regulate . it control4 servos motors. Material: Acrylic + Metal. as shown in figure 5.

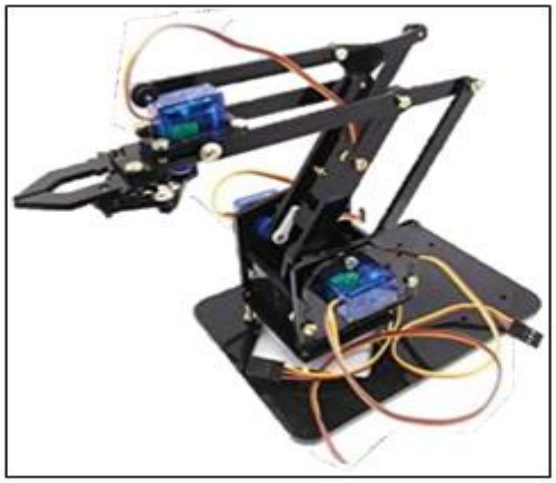

Fig.5:4-DOFRoboticArm

E. L293DMotorDriver

It is basic motor driver integrated chip and it control the speed of the motor. The L293D has 16 pin of IC, each side 8 pins. Shown below

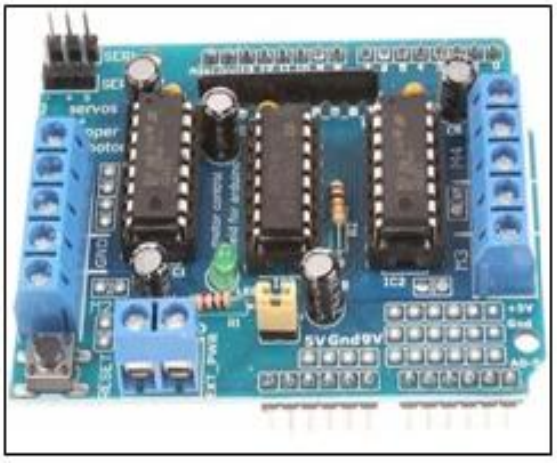

Fig.6:L293DMotorDriver

Complete circuit diagram of the system is shown below:

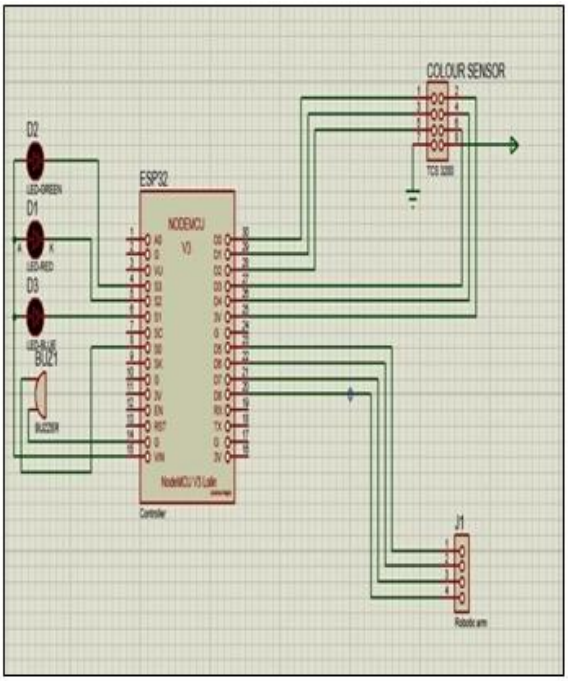

Fig.7: Complete Circuit diagram of the system

SOFTWAREDISCRIPTION

ArduinoIDE: Arduino is associate degree open supply platform developed to create electronic projects. the integrated development environment is IDE programming software. This IDE is works on the computer. it is employed to write, edit or load the code on the board physics or electronic module.

Arduino Libraries

a) ESP32 BLE Arduino: This library offers a low power Bluetooth implementation or Bluetooth Low Energy for ESP32with the Arduino platform.

b) ESP32 Servo: This library can handle many types of servos library. It uses the ESP32 PWM timers: the library can manipulate as much as sixteen servos on individual channels. At the instant, no try has been made to aid a couple of servos according to channel. With using this library lets in the ESP32 plates to govern the servo motors the usage of the semantics of Arduino.

Android Studio IDE

FLOWCHART:

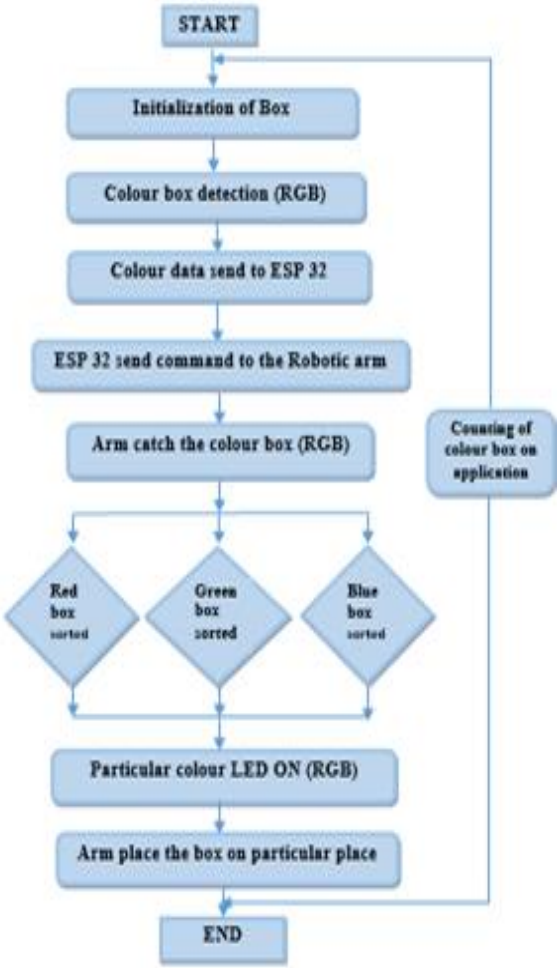

Fig.8: Flow chart of the programme

CODESOURCE:

```
#define S0 15
#defineS1 2
#defineS2 5
#defineS3 4
#define sensor Out 18intfrequencyR = 0; intfrequencyG = 0; intfrequencyB = 0; intsetb=20;
voidsetup()
{
pinMode(S0, OUTPUT);pinMode(S1, OUTPUT);pinMode(S2, OUTPUT);pinMode(S3, OUTPUT);pinMode(sensorOut,INPUT);
pinMode(21, OUTPUT);pinMode(19, OUTPUT);pinMode(23, OUTPUT);pinMode(13,OUTPUT);
// Setting frequency-scaling to 20%digitalWrite(S0,HIGH);
 digitalWrite(S1,HIGH);
Serial.begin(9600);
}
digitalWrite(19,LOW);digitalWrite(21,LOW);digital Write(13,LOW);
}
voidloop()
{
//Settingredfilteredphotodiodestobereaddigital Write(S2,LOW);digitalWrite(S3,LOW);
//Readingtheoutputfrequency
delay(50);
}

BOONS
frequencyR=pulseIn(sensorOut,LOW);
// Printing the value on the serial monitorSerial.print("R=");//printingnameSerial.print(frequencyR);//printing RED color frequencySerial.print("");
delay(50);
//SettingGreenfilteredphotodiodestobereaddigitalWrite(S2,HIGH);digitalWrite(S3,HIGH);
// Reading the output frequencyfrequencyG=pulseIn(sensorOut,LOW);
// Printing the value on the serial monitorSerial.print("G= ");//printing nameSerial.print(frequencyG);//printing RED color frequencySerial.print("");
delay(50);
// Setting Blue filtered photodiodes to be readdigitalWrite(S2,LOW);digitalWrite(S3,HIGH);
// Reading the output frequencyfrequencyB=pulseIn(sensorOut,LOW);
// Printing the value on the serial monitorSerial.print("B= ");//printing nameSerial.print(frequencyB);//printing RED color frequencySerial.println("");
delay(50);
if(frequencyG<setb&&frequencyB<setb&&frequencyR<setb)
{Serial.print("NOCOLOUR");digitalWrite(13,HIGH);digitalWrite(23,LOW);digitalWrite(19,LOW);digitalWrite(21,LOW);}
elseif(frequencyR<frequencyB&&frequencyR<frequencyG)
{Serial.print("RED ");digitalWrite(21,HIGH);digitalWrite(19,LOW);digitalWrite(23,LOW);digitalWrite(13,LOW);
}
```

```
elseif(frequencyB<frequencyR&&frequencyB<frequ
encyG)
{Serial.print("BLUE");digitalWrite(19,HIGH);digital
Write(21,LOW);digitalWrite(23,LOW);digitalWrite(
13,LOW);
}
elseif(frequencyG<frequencyR&&frequencyG<frequ
encyB)
{Serial.print("GREEN");digitalWrite(23,HIGH);
```

- Lift and move heavy objects.
- Increased productivity, safety, efficiency and product quality.
- Achieve greater accuracy than humans. Easy to follow and control.

BANES

- The robot has no emergency response capability.
- Loss of security and privacy.

APPLICATIONS

- Industrial applications –pick and place.
- Third Hand - The arm holds the object while the operators work on it.
- Small drill in production processes.

FUTURESCOPE

Medical field requiring minor surgeries.
Recovery of suspicious objects without endangering people.

VI.RESULT

In this project, not only could we control the robotic arm with the wired controllers, but with the help of Internet of Things, Technology that grows in recent times, we successfully controlled the robotic arm through the Internet of Things interface. This can be useful for various industrial applications where machines need to be controlled from remote locations. This project not only responds to sent controls, but also records movements and can run the same tasks repeatedly, reducing human effort.

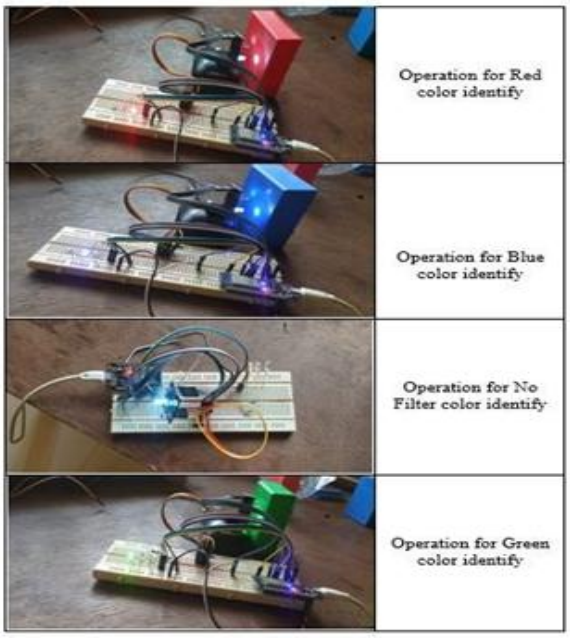

Fig.9:Snapshot of Color identify in operation

V.CONCLUSIONS

The tested system is very stable and does the job exactly. The developed system can be widely used in industry and research for specific color classifications.

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