

INTERNET CONTROLLED ROBOTIC ARM

Submitted in partial fulfillment of the requirements for the award of
Bachelor of Engineering degree in
Electrical and Electronics Engineering
by

RAJESH B (38140041)

SATHISH KUMAR C (38140048)



**DEPARTMENT OF ELECTRICAL AND ELECTRONICS ENGINEERING
SCHOOL OF ELECTRICAL AND ELECTRONICS ENGINEERING**

SATHYABAMA

**INSTITUTE OF SCIENCE AND TECHNOLOGY
(DEEMED TO BE UNIVERSITY)**

Accredited with Grade “A” by NAAC

JEPPIAAR NAGAR, RAJIV GANDHI SALAI, CHENNAI - 600 119

MAY – 2022



DEPARTMENT OF ELECTRICAL AND ELECTRONICS ENGINEERING

BONAFIDE CERTIFICATE

This is to certify that this Project Report is the bonafide work of **RAJESH.B (38140041)** and **SATHISH KUMAR.C (38140048)** who carried out the project entitled “**INTERNET CONTROLLED ROBOTIC ARM**” under our supervision from December 2021 to March 2022.

A handwritten signature in black ink, appearing to be 'D. Godwin Immanuel', is written over a light blue grid background.

Dr. D. GODWIN IMMANUEL
Internal Guide

Dr.V.SIVACHIDAMBARANATHAN
Head of the Department

Submitted for Viva voce Examination held on _____

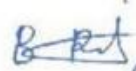
Internal Examiner

External Examiner

DECLARATION

WE **RAJRSH.B** (Reg. No. 38140041) and **SATHISH KUMAR.C** (Reg. No.38140048) hereby declare that the Project Report entitled “**INTERNET CONTROLLED ROBOTIC ARM**” done by us under the guidance of **Dr. D. GODWIN IMMANUEL** is submitted in partial fulfillment of the requirements for the award of Bachelor of Engineering degree in Electrical and Electronic Engineering.

1) RAJESH B



2) SATHISH KUMAR C



DATE:02/05/2022

SIGNATURE OF THE CANDIDATE

ACKNOWLEDGEMENT

We pleased to acknowledge our sincere thanks to Board of Management of **SATHYABAMA** for their kind encouragement in doing this project and for completing it successfully. We am grateful to them.

We convey my thanks to **Dr. N. M Nandhita, Dean, School of Electrical and Electronics Engineering** and **Dr. V. SIVACHIDAMBARANATHAN Head of the Department, Dept. of Electrical and Electronics Engineering** for providing us necessary support and details at the right time during the progressive reviews.

We would like to express our sincere and deep sense of gratitude to our Project Guide Dr. **D. GODWIN IMMANUEL** for his valuable guidance, suggestions and constant encouragement paved way for the successful completion of our project work.

We wish to express my thanks to all Teaching and Non-teaching staff members of the Department of Electrical and Electronics Engineering who were helpful in many ways for the completion of the project.

TABLE OF CONTENTS

CHAPTER NO	TITLE	PAGE NO
	ABSTRACT	VIII
	LIST OF FIGURES	IX
	LIST OF TABLES	X
	LIST OF ABBRRVIATIONS	XI
1	INTRODUCTION	1
	1.1 General Introduction	1
	1.2 Overview of the Project	2
	1.2.1 Transmitting side	3
	1.2.2 Receiving side	3
	1.3 Components used in transmitting side	3
	1.4 Components used in receiving side	4
	1.5 Blynk	5
	1.6 Advantages and Application	5
2	LITERATURE SURVEY	6
	2.1 Existing methods	6
	2.2 Proposed System	9
3	PROJECT PROPOSAL	10
	3.1 Basic Block diagram of transmitting and receiving	10
	3.2 Aim	11
	3.3 Scope	11
4	SIMULATION MODULE	13
	4.1 Proteus software	13
	4.1.1 Features of proteus	13
	4.2 Proteus Simulation	14

4.2.1	Algorithm	15
4.2.2	Code for arduino	17
4.3.	Program for transmitting side	17
4.3.1	Algorithm	17
4.3.2	Coding for microcontroller 1	18
4.4	Program for receiving side	20
4.4.1	Algorithm	20
4.4.2	Coding for microcontroller 2	21
4.5	Arduino IDE	25
4.5.1	How Arduino ide works?	25
4.6	Blynk cloud server	25
5	HARDWARE WORKING AND DESCRIPTION	27
5.1	Degree of freedom	27
5.2	Potentiometer	29
5.2.1	Application	30
5.3	ADS115	32
5.3.1	Features	34
5.4	ESP8266	34
5.4.1	Specifications	35
5.4.2	ESP8266 Options	36
5.4.3	Applications	37
5.5	ESP32CAM	39
5.5.1	Features	40
5.5.2	Specifications	40
5.6	Servo motor	41
5.6.1	MG99R	41
5.6.2	MG958	43
5.6.3	OT5330M	44
5.7	Smoothing Process of servo motor	45
5.7.1	Algorithm	46

6	SUMMARY	48
	6.1 Conclusion	48
	6.2 Future Scope of the Project	48
	REFERENCE	49

ABSTRACT

Nowadays, robotic arm is used in the various industries such as military, defense and medical surgeries. Also, used for the pick and place function in industrial automation application. Arm is flexible and easy to use. Do work properly without any error or mistake. The concept of this project has emerged to enable the benefits of future example such as the industrial Internet of Things and Industry 4.0. The idea is to bring every data source and control interface description related to a product or process available through a single interface, automated communication establishment. We developed a robotic arm to analyze the requirements of communication in a mission - critical application such as mobile networks supported remotely operated robot. Swab sampling is an effective approach for the diagnosis of coronavirus disease .Medical staffs carrying out the task of collecting sample specimens are in close contact with the suspected patient, thereby posing a high risk of cross-infection .We propose miniature robot that can be easily assembled and remotely controlled .The development of this robot is based on the Nodemcu (ESP8266), a wifi inbuilt microcontroller platform that will be interfaced with the wireless controller to the robotic arm. This prototype of the robot is expected to overcome the problem such as picking or placing objects that far away from the user, pick and place a hazardous object in the fastest and easiest way. It is concluded that the proposed robot is promising and could be further developed to be used in medical field to do surgery remotely through internet.

LIST OF FIGURES

FIGURE NO.	TITLE	PAGE NO.
1.1	Overview diagram of the transmitter and receiver	2
3.1	Transmitting side block diagram	10
3.2	Receiving side block diagram	11
4.1	Simulation using Arduino nano(off state)	14
4.2	Simulation using Arduino nano(on state)	15
4.3	Simulation for one pot and one servo(off state)	16
4.4	Simulation for one pot and one servo(on state)	16
4.5	Blynk webpage for controller	26
5.1	Total degree of freedom	28
5.2	Transmitting side circuit diagram	29
5.3	Potentiometer	30
5.4	Transmitting side hardware	31
5.5	Receiving side hardware	31
5.6	ADS115	32
5.7	ESP8266 Pin diagram	34
5.8	Receiving side circuit diagram	38
5.9	ESP32cam	39
5.10	MG99R Servo motor	42
5.11	MG958 Servo motor	43
5.12	OT5330M Servo motor	44
5.13	Smoothing process	45
5.14	Smoothing process for 5 servo motor	47

LIST OF TABLES

FIGURE.

NO	TITLE	PAGE.NO
4.1	Software Requirements	13
5.1	Hardware Requirements	27
5.2	ADS Parameters	33
5.3	Rating catalog	33
5.4	ESP8266 pin out	35

LIST OF ABBRRVIATIONS

V	-	Voltage
A	-	Ampere
DC	-	Direct Current
SM	-	Servo Motor
IOT	-	Internet of Things
USB	-	Universal Serial Bus
POT	-	Potentiometer
DOF	-	Degree of Freedom
MC	-	Microcontroller
Wi-Fi	-	Wireless Fidelity
SBC	-	Session Border Controller
ASCII	-	American Standard Code for Information Interchange
RTOS	-	Real Time Operating System
SDK	-	Software Development Kit
GPIO	-	General Purpose Input / Output
WLAN	-	Wireless Local Area Network
PCB	-	Printed Circuit Board
ADC	-	Analog to Digital Converter
OS	-	Operating System
IDE	-	Integrate Development Environment

CHAPTER 1

INTRODUCTION

1.1 GENERAL INTRODUCTION

Nowadays everywhere machines are used for the work in the industry in Automobile, Electronics or Any other industry. Industry use a robotic arm in their industry. Robotic arm is also known as mechanical arm. It is same act or work like a human Hand and make the human efforts easier. The construction of the manipulator as the arm of the robot is based on the human arm. Sometimes risky works are in the industry. Which is risk for the human lives. So that can be done by the robotic arm. Robots are generally used to perform hazardous, unsafe and unpleasant tasks. Many Elements of robots are built with inspiration from nature. In this highly developing society, time and workforce are critical constraints for the completion of tasks on large scale. The mechanical arm is a Human-controlled based system, which can be operated by the human to do the required task or to move any objects .For the detection of objects, humans detect the presence of objects through a camera module and move machines accordingly. With the rapid increase in the flow of information, People are now used to search for different markets and people are now manufacturing quality products cheaply. In the present study, we aim to develop a low-cost, easy-to-assemble Robot with small footprint to assist swab collections. The swab Collection involves inserting a swab into the patient's nasal cavity. The head of the patient is expected to be tilted back so the nasal passage becomes straight and accessible. The swab is inserted through the nostril parallel to the palate, and to the nasopharynx until resistance forces are identified. The swab is then left in place for several seconds for secretion absorptions and been rotationally Retracted from the nasal cavity slowly. In this article, we aim to present the design concept, the implementation method, the simulation study, and the preliminary phantom. Furthermore, according to this characteristic we can develop surgical robots, by partitioning the coordinate system, the robot in this paper has 6 positioning degrees of freedom. The most important feature Utilized was the robotic arm's ability to replicate human hand Movement, which requires six degrees of freedom. An industrial

robotic arm with six joints fulfills this requirement and thus suits well as a remote replicator of the user's hand movements.

1.2 OVERVIEW OF THE PROJECT

Below Fig 1.1 shows the over view diagram of the transmitter.

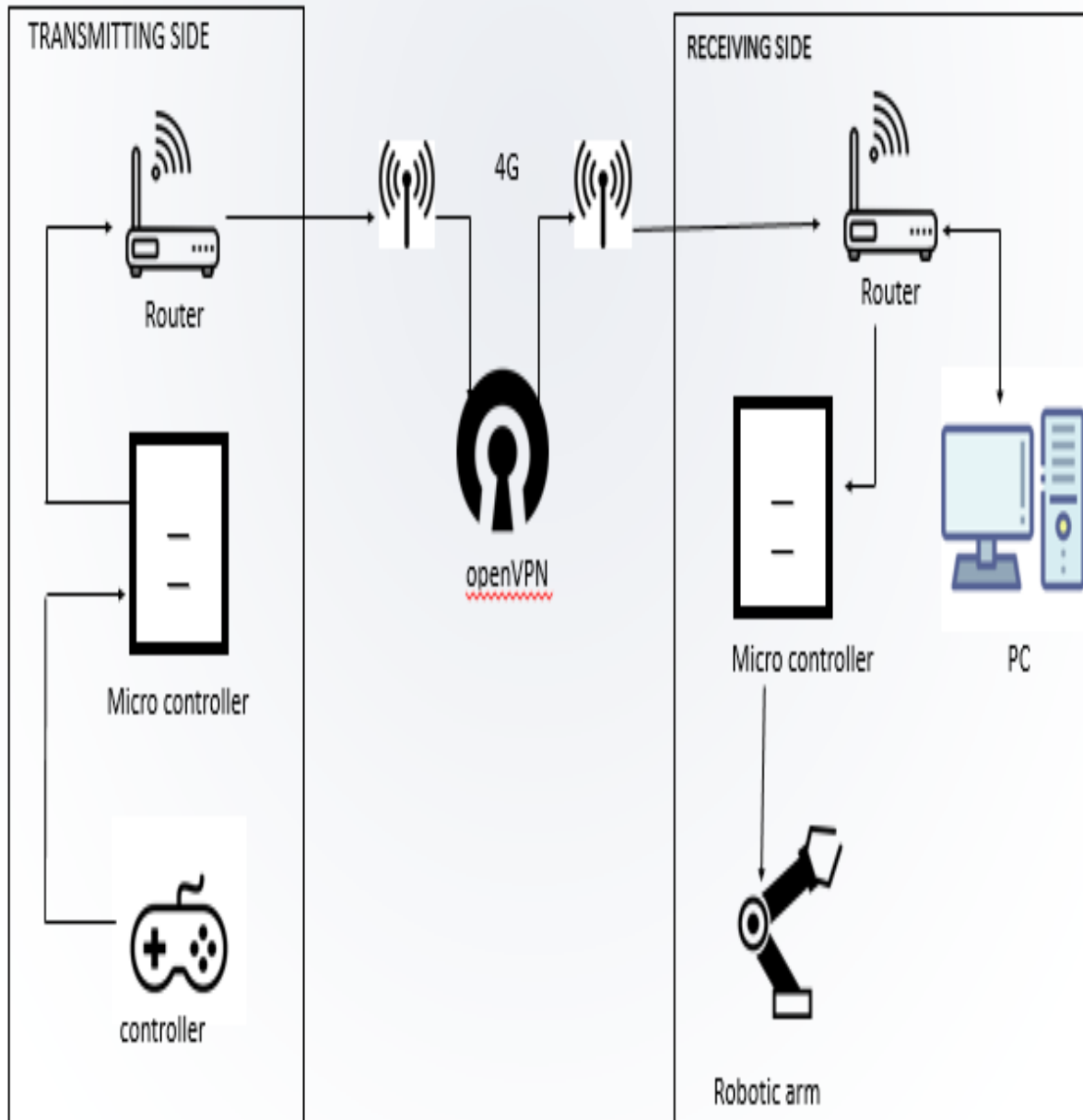


Fig.1.1 Overview diagram of the transmitter and receiver

1.2.1 Transmitting side

The potentiometer is used as a controlling device. A potentiometer is a three-terminal resistor with a sliding or rotating connection that forms an adjustable voltage divider. If only two terminals are used it acts as a Variable resistor or rheostat. The value send from the controller is collected by the MC1.the MC1 used here is ESP8266, which has Inbuilt Wi-Fi module. The MC1 is connected to any WiFi router (wireless).the collected value is converted into angle by the MC1.and the value is sent to the blynk cloud server via 4G network .A router1 connects your devices to each other and, in hard-wired connection setups, to the modem. The router connects to your modem and then to your devices. The router is connected to MC1. The router collects the data from MC1 and send it to the blynk cloud server.

1.2.2 Receiving side

The router is connected to MC2, which collects the data from blynk server and send it to MC2.The value sent by the router is collected by MC2 and the value is send to the servo motor which is at the joints of the arm. The receiving side can also be controlled by a computer or an android device.

1.3 COMPONENTS USED IN TRANSMITTING SIDE

The measuring system known as a potentiometer is basically a potential divider used for measurement potential (voltage); the element is associate degree implementation of constant principle, thus its name. Potentiometers are ordinarily accustomed management electrical devices like volume controls on audio instrumentality. Potentiometers operated by a mechanism are often used as position transducers, for instance, in an exceedingly joystick

ADS1115 16-Bit ADC – four Channel with Programmable Gain electronic equipment is usually used for microcontroller project that desires associate degree digitizer or once you desire a higher-precision ADC. ADS1115 16-Bit ADC- provides 16-bit exactitude at 860 samples/second over I2C. The chip are often organized as four single-end input channels or 2 differential channels. To boot, ADC conjointly includes a programmable gain electronic equipment, up to x16, to assist step up smaller single/differential Signals to the total vary. We tend to like this ADC as a result

of it will run from 2V to 5V power/logic, will live an outsized vary of Signals and it's super straightforward to use. it's an excellent all-purpose 16-bit convertor.

The ESP8266 may be a Wi-Fi semiconductor device, with inherent TCP/IP networking software package, and microcontroller capability. it's a 32-bit architecture silicon chip core supported the Tensilica Xtensa Diamond customary 106Micro running at eighty megacycle per second. The ESP8266 Module permits microcontrollers to attach to a pair of 4 gigacycle Wi-Fi, victimization IEEE 802.11 bgn. It are often used with ESP-AT microcode to produce Wi-Fi property to external host MCUs, or it are often used as an independent MCU by running associate degree RTOS-based SDK. The module features a full TCP/IP stack and provides the power for processing, reads and controls of GPIOs

The ESP32-CAM may be a full-featured microcontroller that conjointly has associate integrated video camera and micro-SD card socket. It's cheap and simple to use, and is ideal for IOT devices requiring a camera with advanced functions like image trailing and recognition.

The sample package distributed by Espressif includes a sketch that permits you to create a web-based D camera with a complicated control board. Once you get the suspend of programming the device you'll realize that it's terribly straightforward to use.

1.4 COMPONENTS USED IN RECEIVING SIDE

A servomotor (or servo motor) may be a mechanism positioner actuator or linear actuator that permits for precise management of angular or Linear position, rate and acceleration. It consists of an acceptable motor coupled to a sensing element for position feedback. It conjointly needs a comparatively subtle controller, typically a fanatical module designed specifically to be used with servomotors. Servomotors don't seem to be a particular category of motor, though the term servomotor is commonly accustomed visit a motor appropriate to be used during a closed-loop system.

A router may be a networking device that forwards information packets between pc networks. Routers perform the traffic directive functions on the net. information sent through the net, like an online page or email, is within the type of

information Packets. A packet is usually forwarded from one router {to associate other to a different} router through the networks that represent an Internetwork till it reaches its destination node.

DC-DC converters are referred to as Choppers. Here the Step Down Chopper or Buck device that reduces the input DC voltage to a specified DC output voltage .The operating of Buck device is slightly just like that of PWM 'dimming'. We've all detected of lights being dimmed by a PWM signal. A tiny low duty cycle implies that the typical voltage seen by the load is little and once the duty cycle is high the typical voltage is high to voltage divider A potential divider may be a straightforward circuit that turns an oversized voltage into a smaller one. Victimization simply 2 series resistors associated an input voltage, we will produce associate output voltage that's a fraction of the input. Voltage dividers are one among the foremost elementary circuits in physical science.

1.5 BLYNK

Blynk may be a Platform with IOS and automaton apps to manage Arduino, Raspberry Pi and therefore the likes over the net. It's a Digital dashboard wherever you'll build a graphic interface for your project by merely dragging and dropping widgets. Blynk Server is associate ASCII text file Netty based mostly Java server, chargeable for forwarding messages between Blynk mobile Application and varied microcontroller boards and SBCs (i.e. Arduino, Raspberry Pi.) Blynk is that the hottest IoT platform to attach your devices to the cloud. It's well-known for permitting users to style apps to manage their IoT devices, analyze mensuration information, and manage your deployed merchandise at scale

1.6 ADVANTAGES AND APPLICATION

1. Pick and place a hazardous object in the fastest and easiest way.
2. For military to defuse bombs form a safe distance.
3. In chemical industry to deal with some hazardous chemicals
4. In hospital to do surgery for long distance patients.
5. With a medical robot arm, you can control all the actions to treat patients from a safe distance.

CHAPTER 2

LITERATURE SURVEY

2.1 EXISTING METHODS

In today's world, most of all sectors, the work is done by robots or robotic arm. Having different number of degree of freedoms (DOF's) as per the requirement as of now the robots are controlled through wired or wireless (short range) manual. A robot arm has a mechanical structure that alters its form using a group of electric motors that behave like servo motors, pneumatic, or hydraulic actuators. They attempt to reproduce movement similar to a human arm. The relative angle of robotic arm controlled by Servomotor is decided by pulse width modulation signal obtained from microcontroller via Bluetooth 4.0 wireless technology. The proposed electronics system recognizes a particular hand gesture that will be performed in front of webcam & transmitted respected signals wirelessly through RF module.

Internet controlled robotic arm could be a new space wherever the IOT aboard cyber-physical systems interconnect in an exceedingly manner wherever the mix of software, sensor, processor, and communication technology plays an enormous role in creating “things” to possess the potential to feed information into it and eventually adds price to producing processes. (Mohid Aiman et al., 2016). Nowadays technology is developing within the same direction in line with apace increasing human wants. The work done to satisfy these needs makes life easier daily, and these studies are targeting robotic arm studies. (Rajashekar K et al., 2020).

Recently, planning an automaton alongside a navigation-computing platform isn't a haul anymore. In AI, navigation refers to the manner an automaton finds its manner into the setting and could be a common demand for nearly any mobile automaton. (G. N. Coelho, 2008). “Today's smartphone is already equipped with multiple intrinsically sensors for navigation functions like accelerometer, gyroscope, camera, GPS, and Wi-Fi transceiver and most of them embedded with quick processors. (W.-W. Kao and B. Q. Huy, 2013). The designers have wide choices to choose any intrinsically sensors to make the navigation platform of their robots. It's like victimization the smartphone as a “brain” for the robots. (R. V Aroca et al., 2012).

In this project, by using android application, the robots might be controlled with a WiFi device, interfaced to the management unit on the automaton for sensing the signals transmitted by the android application within the wide selection space. Traditional follow for the past few years ago, robots are controlled by using RF circuits that have many limitations like operating vary, frequency vary, and management vary. These limitations might be nonexistent by using smartphones for robotic management, it's a lot of benefits like sturdy management, massive operating vary coverage and the biggest advantage is long-lived controlled. (Nik Firdaus, 2015). For comparison, from the definition; "Wi-Fi could be a low-cost answer aimed to hide short distances like airdrome, hotels, and conference areas". From this, Wi-Fi has some limitations in providing a good coverage solution, whereas the Infrared, WLAN, and Bluetooth technology solely ready to remote some equipment within the coverage but Wi-Fi. (S. Tang, 2011).

The pick and place automaton being enforced to ease the method of sorting, the method of moving significant materials, etc. Usually, the transfer method of the significant materials is being carried out, victimization force and if the transfer method is perennial for a jiffy, it will cause injuries to the operator. By victimization the automaton, the operator can now not have to be compelled to bend and raise heavy masses therefore preventing injuries and increasing the potency of the work. Associate degree operator can make mistakes whether or not little or massive in an exceedingly whereas. Within the industrial world, the business cannot afford to require any quite mistake. As each mistake is expensive whether or not interns of your time, money, and material. (Harish K et al., 2017).

Monte Carlo technique was accustomed analyze the operating area of the manipulator, and low-latency management and simulation experiments were dispensed on the movement flight of the manipulator in joint area and mathematician area. The Results show that the low-latency management rule during this paper is effective to manage the mechanical arm of the minimally invasive medical surgery golem. (XIUMEI TIAN AND YAN XU, may 2020).

A mobile golem that useful to try to decide and place golem are one among the technologies in producing industries that are designed to perform decide and place operations and be controlled by employing a smartphone via Bluetooth affiliation. The event of this golem relies on the Arduino Uno platform which will be interfaced with the wireless controller to the mobile robotic arm. This method is meant to eliminate human error and human intervention to induce a lot of precise work (Michael Sillang and Susie Patricia, 2021).

The robotic arm has four servo motor where all servo motors are assigned with single pulse width modulation which can be control separately. Furthermore, the NodeMCU board was used to receive signal from the Blynk app that Authorizes monitoring and controlling the movement of the robotic arm to perform pick and place operations. Meanwhile, the results of this study are justified through Manual test implementation. 2 variety of manual check were finished this project that's decide and place application and time delay to send the information.(Edward Laman1 et al., 2020).

This paper deals with measuring device primarily based gesture recognition for dominant the movements of robotic arm through Wireless management exploitation native server (MQTT Protocol). Measuring device sends the gestures to the Wi-Fi the event of this golem relies on the Arduino Uno platform which will be interfaced with the wireless controller to the mobile robotic arm. This method is meant to eliminate human error and human intervention to induce a lot of precise work. Module (Esp8266). Wi-Fi module can transmit the gesture through native server. It's received by the raspberry pi at the receiver. Rasp-berry pi provides the signal to motor and robotic arm moves as per gestures (R. N. Patil1 et al., 2021).

Consumer net of things analysis typically involves grouping network traffic sent or received by IoT devices. These knowledge are usually collected via crowdsourcing or whereas researchers manually act with IoT devices during a laboratory setting. However, manual interactions and crowd sourcing are typically tedious, expensive, inaccurate, or don't give Comprehensive coverage of potential IoT device behaviors. this approach with Associate in Nursing Arduino-controlled robotic arm, a wise speaker and a wise thermostat, exploitation machine learning to demonstrate that

collected network traffic contains info regarding device interactions that might Be helpful for network, security, or privacy analyses.(Xi Jiang and Noah Apthorpe , 2021)

The purpose of the house Assistant project was to develop a sandbox application to manage good Devices. Within the Home Assistant implementation, a table lamp was label and controlled by Node MCU. After setting up the MQTT broker server on Intel gateway, it was possible to subscribe and publish messages to control the remote ESP. Hence, the result was promising, that has verified that this application can be scaled up and management alternative good devices like Phillips Hue lightweight bulb, good air-conditioner, or good TV. Motion-controlled robotic arms permit a user to act with a distant globe while not physically reaching it. By connecting computer network to the physical world, such interactive Teleoperations are promising to boost remote education, virtual Social interactions and on-line democratic activities. In depth experiments show that our system achieves ninety four accuracy to tell apart users whereas preventing user identity spoofing attacks with ninety fifth accuracy. (Huang.L et al., 2021).

2.2 PROPOSED SYSTEM

The main function of this robots are to help Medical staffs carrying out the task of collecting sample specimens. To bridge the gap of the normal perception of “robots are for the industries only”, internet will be use. This concept requires a **camera module** to monitor robot action which is displayed to the user who controls the robot. So that, the user can be where ever in the world, with Internet facility the user can control it manually. The arm is a size of 1.6 feet (50cm) long, hence we have provided a powerful servo motor of 35 kg-cm at the base. We also introduced a smoothing process in this project, to smooth the action of robot. Hence it will not damage the joins without this smoothing process, if an action is given to change the angle from 0 to 180 degree, the motor turns in a fraction of seconds. So that it makes a sudden impact to the arm. So that the joints of the robot will become weak day by day.

CHAPTER 3

PROJECT PROPOSAL

3.1 BASIC BLOCK DIAGRAM OF TRANSMITTING AND RECEIVING SIDE

Below fig.3.1 and 3.2 shows the basic block diagram of transmitting and receiving side.

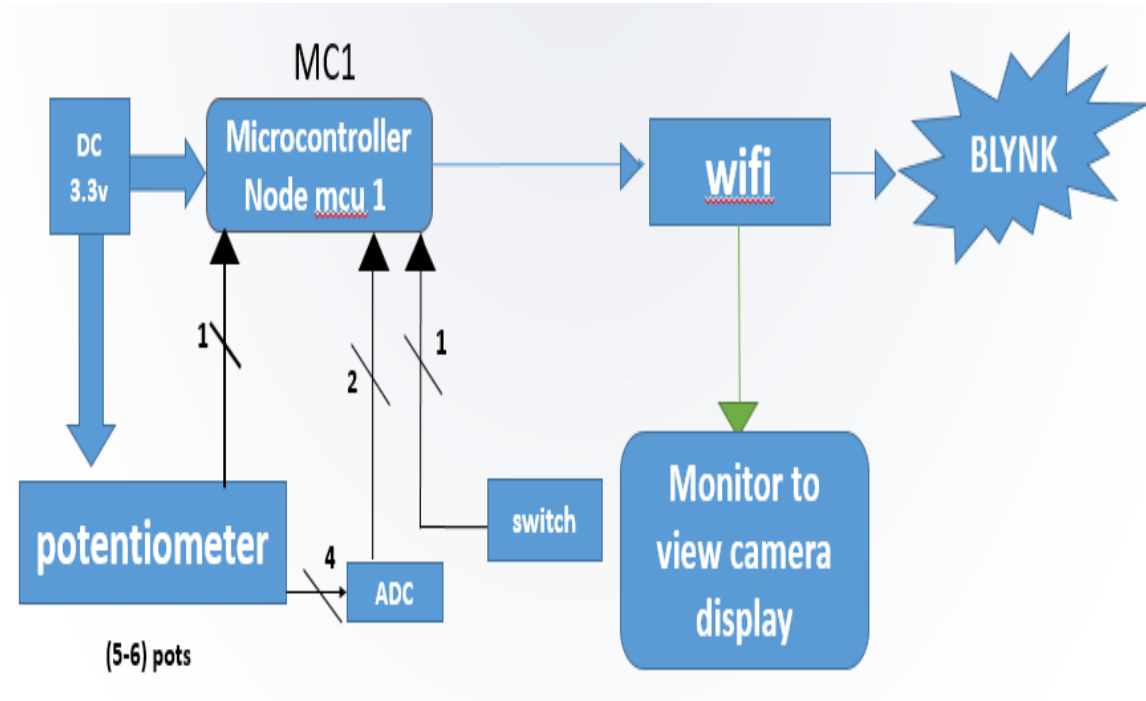


Fig .3.1 Transmitting side block diagram

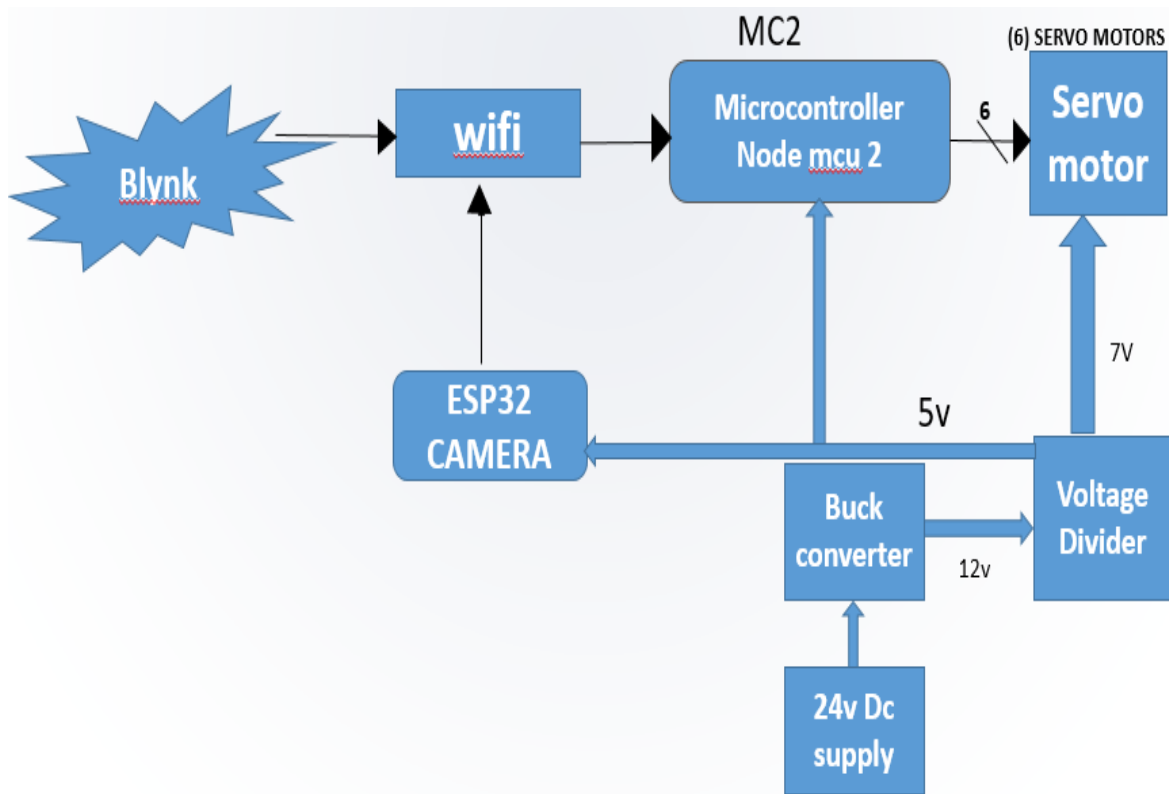


Fig .3.2: Receiving side block diagram

3.2 AIM

Main aim is of our project is to help in medical field and decrease the human efforts and easy to use. We developed a robotic arm to analyze the requirements of communication in a mission - critical application such as mobile networks supported remotely operated of robot. Swab sampling is an effective approach for the diagnosis of coronavirus disease. Medical staffs carrying out the task of collecting sample specimens are in close contact with the suspected patient, thereby posing a high risk of cross-infection. We propose miniature robot that can be easily assembled and remotely controlled.

3.3 SCOPE

Robotic arm may be a reprogrammable and multifunctional manipulator style to help human in varied surroundings. the aim of this analysis is to style and build a six degree of freedom robotic arm. Our robotic arm is divide into 2 main components. One is transmitter and another is Receiver. Transmittal a part of the arm transmit the

info that is collected by the utilization of potentiometer to the blynk cloud server. Receiving half needs to receive the info from the blynk server and method on it and supply the info to the robotic arm. web of things (IoT) permit knowledge to be exchange between devices through the association of the many devices. The mechanism controller may be a potentiometer device {computer system computing system automatic knowledge processing system ADP system ADPS system} that connects to the net to send data that is received by a controller so as to manage the movements of the mechanism arm. Additionally to the mechanism arm, the controller is additionally answerable for the end-effector and to stop interference from occurring inside the robots work space. Usage of electronic elements and new technologies may end up in development of a totally designed mechanism. the combination of web of things with robotic arm permits sensible business to be completed. The robotic arm is controlled remotely through mechanical man mobile device or through any dominant device exploitation NodeMCU controller.

CHAPTER 4

SIMULATION MODULE

Table 4.1 software requirements

S.NO	Name of the Hardware component	QUANTITY
1	Proteus Software	1
2	arduino ide	1
3	blynk cloud server	1

4.1 PROTEUS SOFTWARE

It is a designing software for circuit fabricated by Lab center Electronics. It wont to style totally different circuits on PCB (printed circuit board) and simulation of various circuits. The use of proteus for any electronic circuit project Makes that project cost-effective and less error due to schematic construction on the proteus. Proteus is used to design, drawing and simulation of electronic circuits. It was discovered by the Labcenter electronic.

By exploitation proteus you'll build two-dimensional circuits styles still with the utilization of this engineering software package, you'll construct and simulate totally different electrical and electronic circuits on your personal computers or laptops. There area unit varied edges to simulate circuits on proteus before build them much.

4.1.1 Features of Proteus

There area unit two main elements of proteus initial is employed to style and draw totally different circuits and therefore the second is for planning of PCB layout.

First is ISIS that won't to style and simulate circuits. Second is ARES that used for planning of a computer circuit board. It also provides features related to the three-dimensional view of design in PCB.

4.2 PROTEUS SIMULATION

The project has been simulated in the Proteus 8.0 program, a virtual terminal has been programmed to demonstrate the working. We use this software to simulate a basic part of our project. Here is an arduino Nano, 5 pots, 5 servo motors are used. The connections Are made as shown in the diagram. To upload code we use arduino ide.as the code is uploaded ,now when u increase the value of Resistance(pot),you can see the angle of the servo motors is also increased and vice versa.

The below diagram Fig 4.1 shows the simulation using proteus simulation in off state.

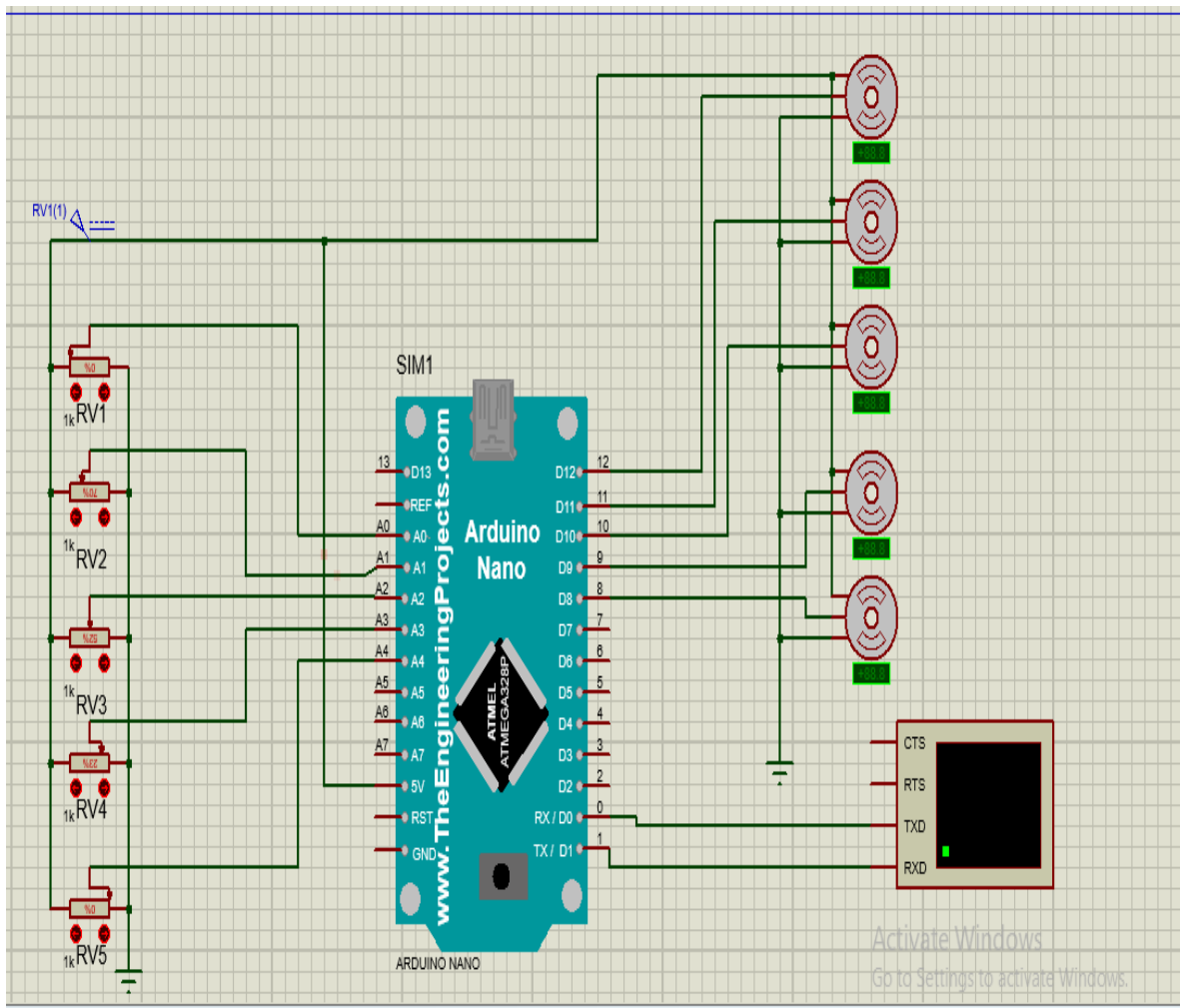


Fig.4.1 Simulation using arduino nano (off state)

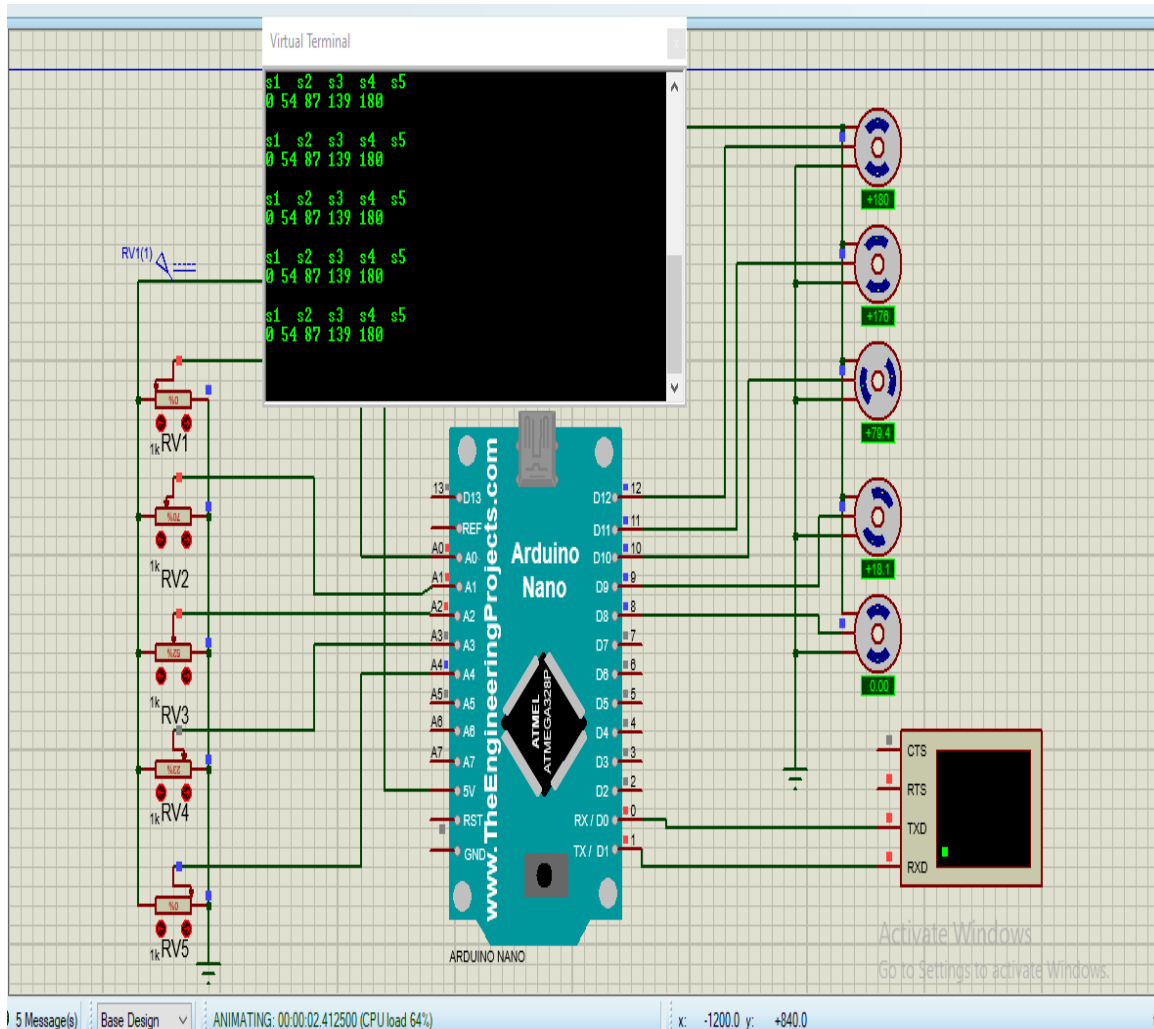


Fig.4.2 Simulation using arduino nano (on state)

The above diagram Fig 4.2 shows the working state simulation using proteus simulation.

4.2.1 Algorithm

- 1 Servo motor and potentiometer is attached to D8 and A0 of the arduino respectively
- 2 Read the data from A0.
- 3 Map the data to (0-180) or multiply with $180/1023$.
- 4 Write the updated data to D8, where the servo motor is attached.
- 5 Repeat step 2 to 4.

The below diagram Fig 4.3 shows the simulation using one pot and one servo motor off state.

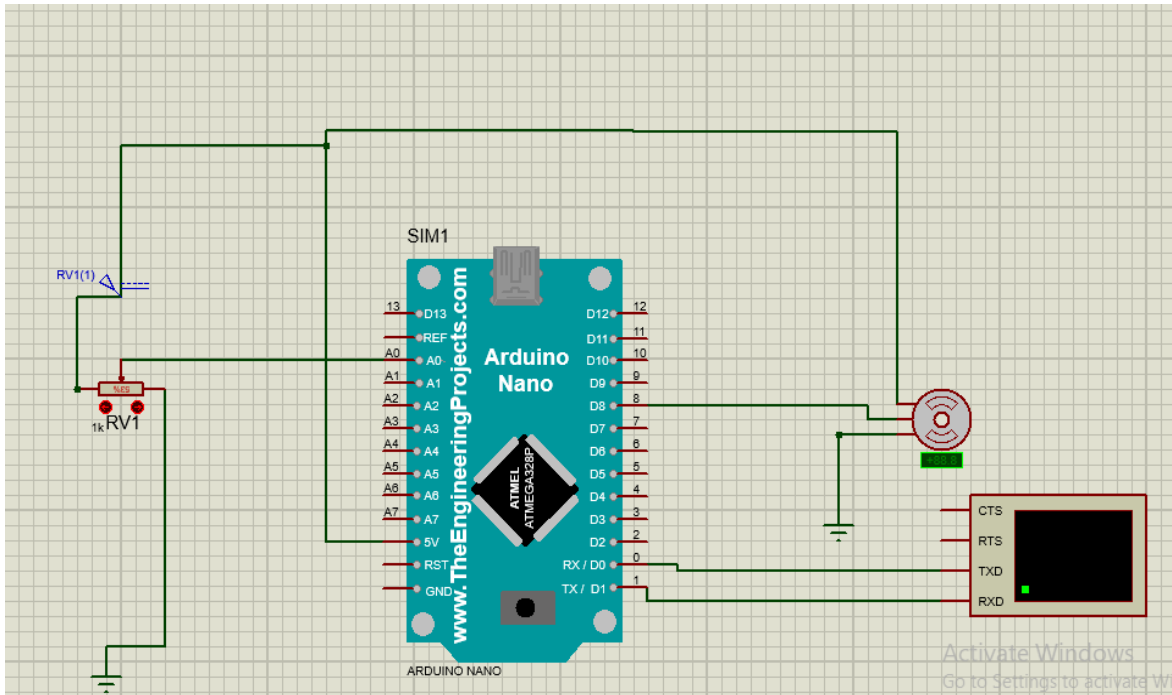


Fig.4.3 Simulation for one pot and one servo (off state)

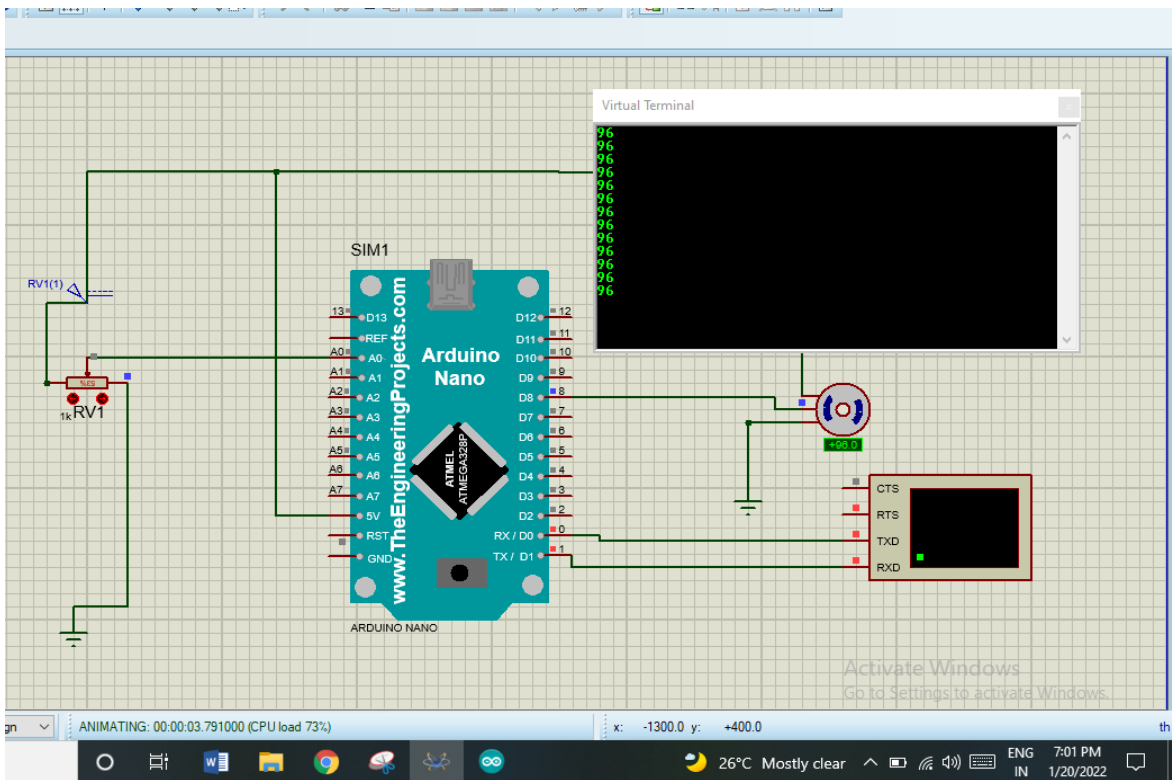


Fig.4.4 Simulation for one pot and one servo (on state)

The above diagram Fig 4.4 shows the working state simulation using one pot and one servo motor.

4.2.2 Code for Arduino

```
#include <Servo.h>

Servo s0;

#define a0 A0

void setup()
{
  pinMode (a0, INPUT);
  s0.attach (8);
  Serial.begin(9600);
}

void loop() {
  int a=analogRead (a0);
  a=map (a, 0,1023,180, 0);
  s0.write (a); Serial.println (a) ;
  delay (300);
}
```

4.3 PROGRAM FOR TRANSMITTING SIDE

4.3.1 Algorithm

1. Include esp8266wifi, blynk and analog to digital converter.
2. Define your Wi-Fi ssid, password, Blynk server id, and user name, key.
3. Connect to the internet through Wi-Fi using the ssid and password. And also setup the pins of the potentiometer.
4. Connect to Blynk through if not, check and reconnect.
5. Read the value of potentiometer through 16 bit ADC.
6. Convert the value to angle by mapping it with 0-180,0-32767 or multiplying it with 180/32767.
7. Virtual write the converted value to the Blynk virtual terminal respectively.
8. Repeat step 4 to 7 for all potentiometer.
9. Repeat step 4 to 8 for full process.

4.3.2 CODING FOR MICROCONTROLLER 1

```
#define BLYNK_TEMPLATE_ID "TMPLAL7AHrmg"
#define BLYNK_DEVICE_NAME "project a"
#define BLYNK_AUTH_TOKEN "fc9qc6DAUJFT1FCVUd9IcQRKimAN8zav"
#define BLYNK_PRINT Serial
#include <ESP8266WiFi.h>
#include <BlynkSimpleEsp8266.h>
char auth[] = BLYNK_AUTH_TOKEN;
char ssid[] = "Chandran2.4";
char pass[] = "S191422@2.4";
BlynkTimer timer;

#include <Adafruit_ADS1X15.h>
Adafruit_ADS1115 ads; /*16-bit version */
#define pot1 A0
#define grip D0
void myTimerEvent()
{
  int x = analogRead(pot1);
  int y=digitalRead(grip);
  ////////////////////////////////////ADS////////////////////////////////////

  int16_t adc0, adc1, adc2, adc3;
  adc0 = ads.readADC_SingleEnded(0);
  adc1 = ads.readADC_SingleEnded(1);
  adc2 = ads.readADC_SingleEnded(2);
  adc3 = ads.readADC_SingleEnded(3);
  int a,b,c,d,e;
  a=map(adc0,6074,15020,45,135);
  b=map(adc1,7525,16200,45,135);
  c=map(adc2,6800,16300,45,135);
  d=map(adc3,-1,29119,0,180);
```

```

e=map(x, 0, 1023, 0, 180);
Serial.println("-----");
Serial.print("AIN0: "); Serial.print(adc0); Serial.print(" "); Serial.print(a);
Serial.println("V");
Serial.print("AIN1: "); Serial.print(adc1); Serial.print(" "); Serial.print(b);
Serial.println("V");
Serial.print("AIN2: "); Serial.print(adc2); Serial.print(" "); Serial.print(c);
Serial.println("V");
Serial.print("AIN3: "); Serial.print(adc3); Serial.print(" "); Serial.print(d);
Serial.println("V");
Serial.print("AIN4: "); Serial.print(x); Serial.print(" "); Serial.print(e);
Serial.println("V");
delay(10);

Blynk.virtualWrite(V0, a);
Blynk.virtualWrite(V1, b);
Blynk.virtualWrite(V2, c);
Blynk.virtualWrite(V3, d);
Blynk.virtualWrite(V4, e);
Blynk.virtualWrite(V5, y);
}
void setup()
{
  // Debug console
  Serial.begin(115200);
  Blynk.begin(auth, ssid, pass);
  timer.setInterval(1000L, myTimerEvent);
  // You can also specify server:
  //Blynk.begin(auth, ssid, pass, "blynk.cloud", 80);
  //Blynk.begin(auth, ssid, pass, IPAddress(192,168,1,100), 8080);
  //////////////////////////////////////
  pinMode(pot1, INPUT);

```

```

pinMode(grip,INPUT);
////////////////////////////////////

Serial.println("Hello!");
ads.setGain(GAIN_TWOTHIRDS); // 2/3x gain +/- 6.144V 1 bit = 3mV
0.1875mV (default)
if (!ads.begin()) {
  Serial.println("Failed to initialize ADS.");
  while (1);
}
////////////////////////////////////
}

void loop()
{
  Blynk.run();
  timer.run(); // Initiates BlynkTimer
}

```

4.4 PROGRAM FOR RECEIVING SIDE

4.4.1 Algorithm

- 1 Include esp8266wifi, Blynk, servo.
- 2 Define your Wi-Fi ssid, password, Blynk server id, and user name, key.
- 3 Connect to the internet through Wi-Fi using the ssid and password. And also setup the pins of the servo motors.
- 4 Connect to blynk cloud server.
- 5 Check for any update in in blynk and sync all the virtual pins.
- 6 If the updated value is for servomotor 1, then read the last updated value.
- 7 Since this value is already an angle, send this value directly to servo motor 1.
- 8 Repeat step 5 to 7 for full process.

4.4.2 CODE FOR MICROCONTROLLER 2

```
#define BLYNK_TEMPLATE_ID "TMPLAL7AHrmg"
#define BLYNK_DEVICE_NAME "project a"
#define BLYNK_FIRMWARE_VERSION "0.1.0"
#define BLYNK_PRINT Serial
#define BLYNK_DEBUG
#define APP_DEBUG
//#define USE_SPARKFUN_BLYNK_BOARD
//#define USE_NODE_MCU_BOARD
//#define USE_WITTY_CLOUD_BOARD
//#define USE_WEMOS_D1_MINI
#define g D5
#include "BlynkEdgent.h"
#include<Servo.h>

Servo s1;
Servo s2;
Servo s3;
Servo s4;
Servo s5;
Servo s6;
int x1;
int x2;
int x3;
int x4;
int x5;
int x;
int x6;
float sm1;
float sm2;
float sm3;
float sm4;
float sm5;
```

```

float pre1;
float pre2;
float pre3;
float pre4;
float pre5;

BLYNK_WRITE(V3)
{
    x1 = param.asInt();
}
BLYNK_WRITE(V2)
{
    x2 = param.asInt();
}
BLYNK_WRITE(V1)
{
    x = param.asInt();
}
BLYNK_WRITE(V0)
{
    x4 = param.asInt();
}
BLYNK_WRITE(V4)
{
    x5 =param.asInt();
}
BLYNK_WRITE(V5)
{
    x6 = param.asInt();
}
void setup()
{

```

```

Serial.begin(115200);
delay(100);
pinMode(g, OUTPUT);
BlynkEdgent.begin();
//////////servo//////////

s1.attach(D8, 500, 2450);
s2.attach(D6, 500, 2450);
s3.attach(D5, 500, 2450);
s4.attach(D4, 500, 2450);
s5.attach(D1, 500, 2450);
s6.attach(D0, 500, 2450);
}
void loop()
{
  BlynkEdgent.run();
  Blynk.syncVirtual(V0);
  Blynk.syncVirtual(V1);
  Blynk.syncVirtual(V2);
  Blynk.syncVirtual(V3);
  Blynk.syncVirtual(V4);
  Blynk.syncVirtual(V5);
  /*sm=(x*0.40)+(pre*0.60);
  pre=sm;
  s1.write(sm);
  Serial.println(sm);*/
  x3=180-x;
  for (int k = 0; k < 20; k++)
  {
    sm1 = (x1 * 0.05) + (pre1 * 0.95);
    pre1 = sm1;
    s1.write(180-sm1);
  }
}

```

```

sm2 = (x2 * 0.05) + (pre2 * 0.95);
pre2 = sm2;
s2.write(sm2);
sm3 = (x3 * 0.05) + (pre3 * 0.95);
pre3 = sm3;
s3.write(sm3);
sm4 = (x4 * 0.05) + (pre4 * 0.95);
pre4 = sm4;
s4.write(sm4);
sm5 = (x5 * 0.05) + (pre5 * 0.95);
pre5 = sm5;
s5.write(sm5);
if(x6==1){
s6.write(0);}
else{
s6.write(130);}
Serial.print(sm1);
Serial.print(" ");
Serial.print(x2);
Serial.print(" ");
Serial.print(sm3);
Serial.print(" ");
Serial.print(sm4);
Serial.print(" ");
Serial.print(sm5);
Serial.print(" ");
Serial.println(" ");
}
}

```

4.5 Arduino IDE

Arduino IDE (Integrated Development Environment) is that the software package for Arduino. It's a text editor sort of a tablet with completely different options. It's used for writing code, collection the code to ascertain if any errors are there and uploading the code to the Arduino. it's a cross-platform software package that is on the market for each software package like Windows, Linux, mac OS. It supports C/C++ languages. Its ASCII text file software package, wherever the user will use the software package as they require it to. They will conjointly create their own Modules/functions and add them to the software package. It supports each out there Arduino board as well as Arduino mega, Arduino Leonardo da Vinci, Arduino local area network and a lot of. Word file is named a Documents equally, Arduino file is named a Sketch wherever the user writes code. The format of Arduino is saved as .ino

4.5.1 How arduino ide works?

When a user writes code and compiles, the IDE can generate a Hex file for the code. (Hex file are Hexa-Decimal files that are understood by Arduino) so sent to the board employing a USB cable. each Arduino board is integrated with a microcontroller, the microcontroller can receive the hex file and runs as per the code written.

4.6 Blynk cloud server

The below diagram Fig 4.5 shows the blynk web page for controllers. Blynk may be a Platform with IOS and mechanical man apps to regulate Arduino, Raspberry Pi and therefore the likes over the net. Digital dashboard wherever you'll be able to build a graphic interface for your project by merely dragging and dropping widgets. Blynk Server is associate degree ASCII text file Netty based mostly Java server, answerable for forwarding messages between Blynk mobile application and numerous microcontroller boards and SBCs (i.e. Arduino, Raspberry Pi.)Blynk is that the preferred IoT platform to attach your devices to the cloud. It's well-known for permitting users to style Apps to regulate their IoT devices, analysis measuring knowledge, and manage your deployed product at scale. Blynk largely depends on

business standards – transport layer security protocol, referred to as TLS. Blynk server by default tries to use the newest



Fig. 4.5 blynk webpage for controllers

CHAPTER 5

HARDWARE WORKING AND DESCRIPTION

5.1 HARDWARE IMPLEMENTATION

Table 5.1 hardware requirements

S.NO	Name of the Hardware component	QUANTITY
1	ESP8266	2
2	servo motor	6
3	Pot	5
4	Switch	1
5	ADC	1
6	ESP32 cam	1
7	buck converter module	1

5.2 DEGREE OF FREEDOM

The below diagram Fig 5.1 shows the total degree of freedom used in our project .The degrees of freedom, or DOF, may be a important term to know. Each degree of freedom may be a joint on the arm, an area wherever it will bend or rotate or translate. You can usually determine the amount of degrees of freedom by the amount of actuators on the robotic arm. every degree needs a motor, typically associate encoder, and exponentially complicated algorithms and value. as an example, vi-DOF robotic arm has vi joint and 6 motor is needed to be utilized in that robotic arm.

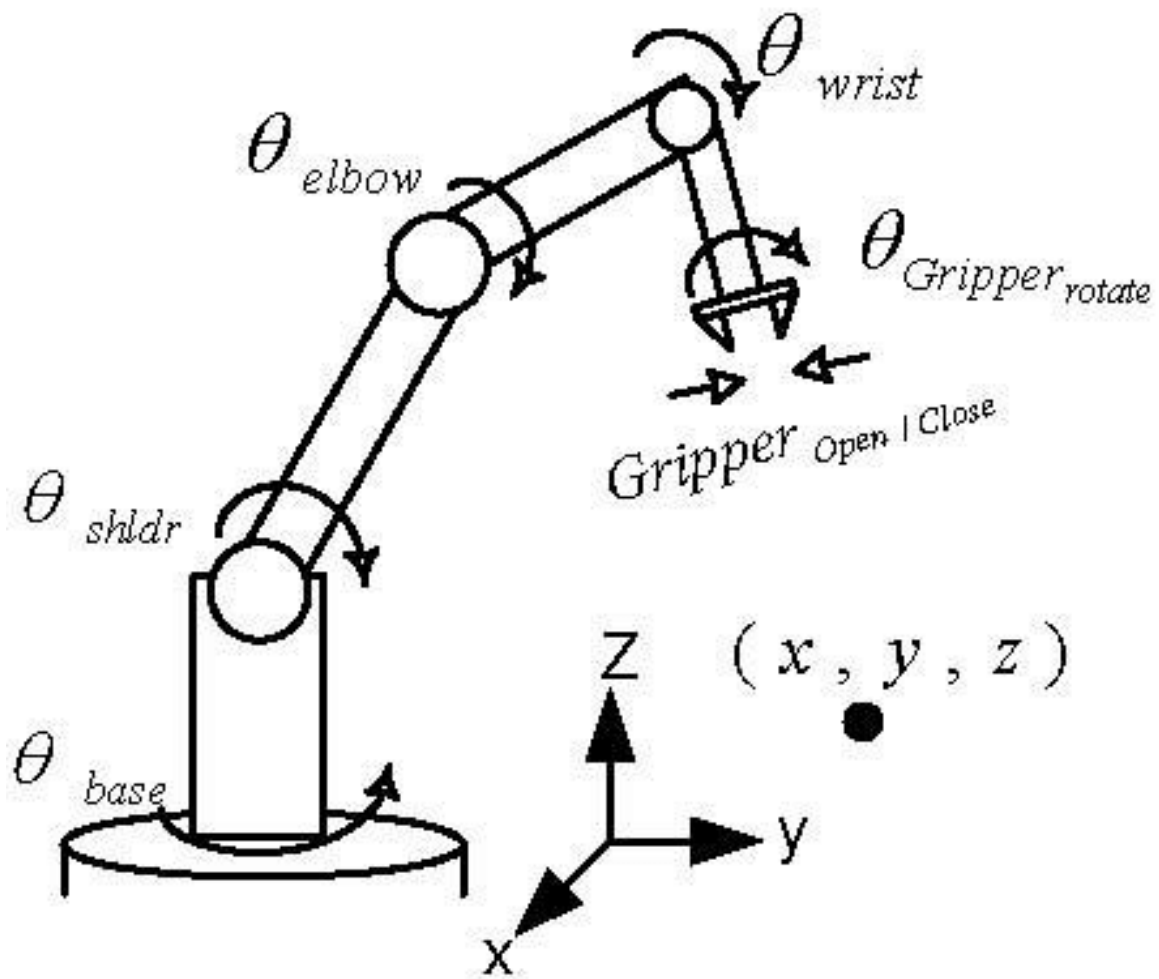


Fig. 5.1 Total degree of freedom

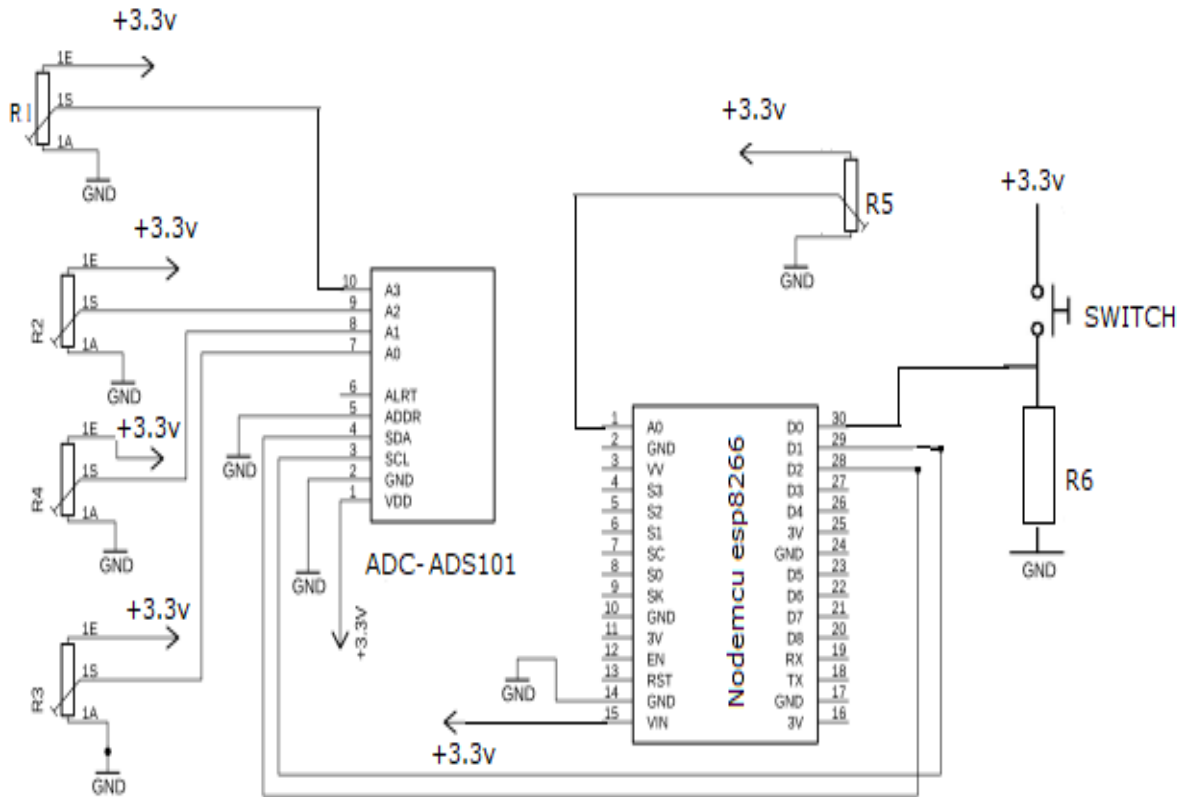


Fig. 5.2 Transmitting side circuit diagram

The above diagram Fig 5.2 shows the circuit diagram of total transmitting side of our project.

5.3 POTENTIOMETER

The below diagram 5.3 shows the type of measuring device used. The measuring device referred to as a potentiometer is actually a potential divider used for mensuration potential difference (voltage); the element is Associate in nursing implementation of identical principle, therefore its name. Potentiometers area unit ordinarily accustomed management electrical devices like volume controls on audio instrumentation. Potentiometers operated by a mechanism may be used as position transducers, as an example, in a very joystick. We have a tendency to use five potentiometer .For 5 degree of freedom .The voltage at the pot is supplied to the ADC.

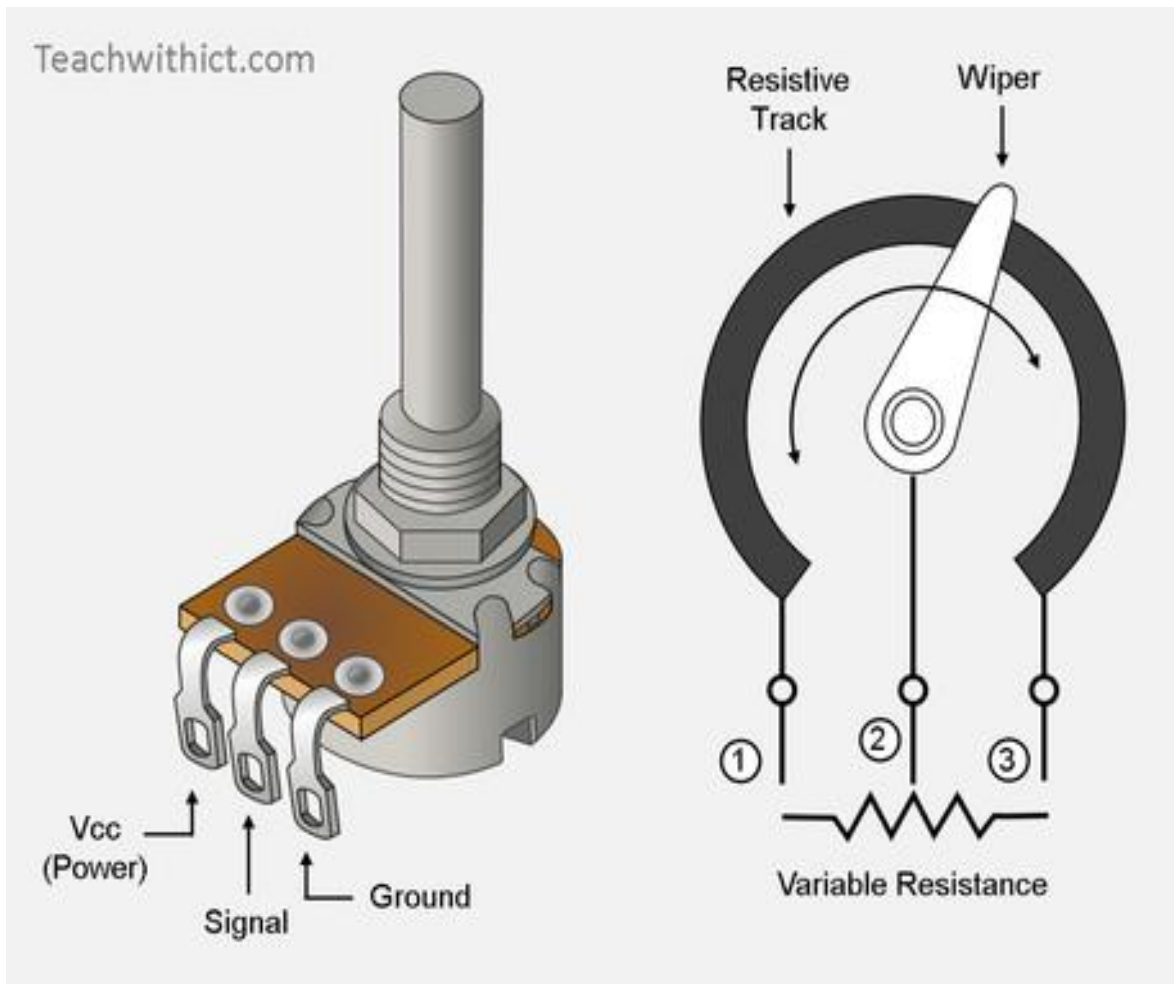


Fig. 5.3 Potentiometer

5.3.1 Applications

- The potentiometer is used as a potential divider within the electronic circuit.
- The potentiometer is used in radio and (TV) receiver for linearity control , tone
- control and volume control.
- It is used in medical equipment.
- It is used in machine, like wood processing.
- It is used in machines, like injection mold.
- Potentiometers are wide used as user controls, and should control a very wide range of equipment functions.



Fig. 5.4 Transmitting side hardware



Fig. 5.5 Receiving side hardware

Fig 5.5 and fig 5.6 shows the geo tagged hardware of the transmitting and receiving side.

5.4 ADS1115

The ADS1113, ADS1114, and ADS1115 devices (ADS111x) are exactness, low-power, 16-bit, I2Ccompatible, analog-to-digital. Incorporate a low-drift voltage reference associated a generator. The ADS1114 and ADS1115 additionally incorporate a programmable gain. Amplifier (PGA) and a digital comparator. These options, alongside a large operational provide vary, create the ADS111x likeminded for power- and space-constrained, sensing element activity applications. The ADS111x perform conversions at knowledge rates up to 860 samples per second (SPS). The PGA offers input ranges from ± 256 mV to ± 6.144 V, permitting precise large- and small-signal measurements. The ADS1115 options associate input electronic device (MUX) that permits 2 differential or four single-ended input measurements. Use the digital comparator within the ADS1114 and ADS1115 for under- and overvoltage detection. The ADS1113, ADS1114, and ADS1115 devices (ADS111x) are exactness, low-power, 16-bit, I2Ccompatible, analog-to-digital.

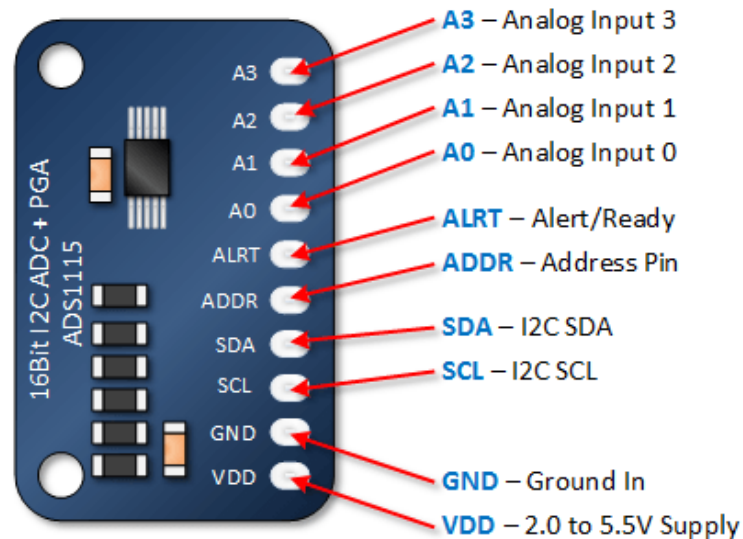


Fig. 5.6 ADS1115

Fig. 5.6 shows the type of analog to digital converter used. The ADS1115 operate in either single-shot mode or continuous-conversion mode. The devices area unit mechanically hopped-up down when one conversion in single-shot mode; thus,

power consumption is considerably reduced throughout idle periods. The integers range from -32,768 through +32,767.

Table 5.2 ads parameters

1	Resolution (Bits)	16
2	Number of input channels	4
3	Sample rate (Max) (kSPS)	0.86
4	Interface type	I2C
5	Architecture	Delta-Sigma
6	Input type	Differential, Single-Ended
7	Multi-channel configuration	Multiplexed

Table 5.3 rating catalog

1	Input range (Max) (V)	5.5
2	Input range (Min) (V)	0
3	Features	Comparator, Oscillator, PGA
4	Operating temperature range °C	-40 to 125
5	Power consumption (Typ) (mW)	0.3
6	Analog voltage AVDD (Min) (V)	2
7	Analog voltage AVDD (Max) (V)	5.5
8	INL (Max) (+/-LSB)	1
9	Digital supply (Min) (V)	2
10	Digital supply (Max) (V)	5.5

5.4.1 Features

- Supply Range is wide: 2.1 V to 5.5 V.
- Low Current Consumption: one hundred fifty μA (Continuous- Conversion Mode).
- Data Rate: 8 to 860 SPS.
- Single-Cycle subsiding.
- Internal Low-Drift Voltage.
- Reference Internal Oscillator.
- I2C Interface: Four Pin-Selectable Addresses.
- Four Single-Ended or 2 Differential Inputs (ADS1115).
- Programmable Comparator (ADS1114 and ADS1115).
- Operating Temperature Range: -40°C to $+125^{\circ}\text{C}$.

5.5 ESP8266

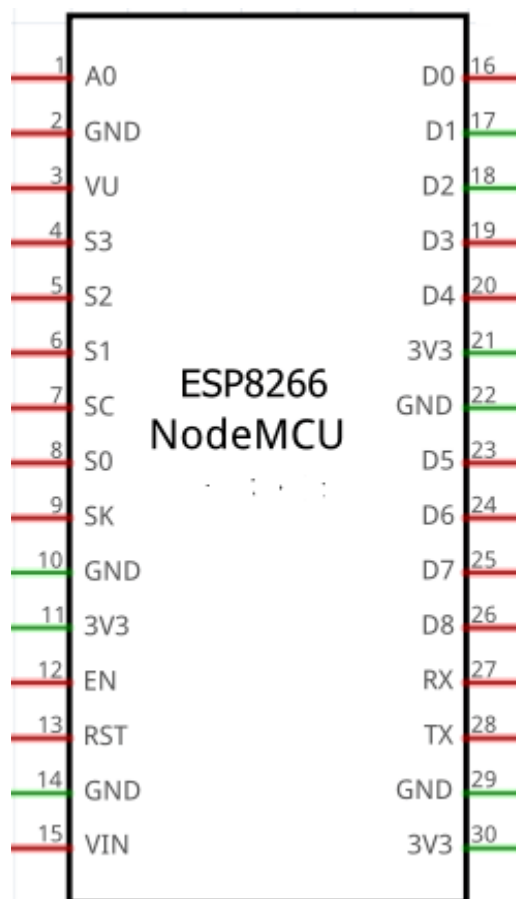


Fig.5.7 ESP8266 pin diagram

The Fig. 5.7 shows the pin diagram of ESP8266 microcontroller. The ESP8266 could be a Wi-Fi semiconductor, with integral TCP/IP networking software package, and microcontroller capability. it's a 32-bit computer architecture microchip core supported the Tensilica Xtensa Diamond commonplace 106Micro running at eighty MHz . The ESP8266 Module allows microcontrollers to attach to a pair of.4 gigacycle Wi-Fi, victimization IEEE 802.11 bgn. It are often used with ESP-AT code to produce Wi-Fi property to external host MCUs, or it are often used as a self-sufficing MCU by running Associate in Nursing RTOS-based SDK. The module encompasses a full TCP/IP stack and provides the power for processing, reads and controls of GPIOs.

Table 5.4 esp8266 pin out

S.NO	Pin Name	Working
1	RX	Serial Receiver Pin
2	VCC	Power Pin (+3.3 V; can handle up to 3.6 V)
3	GPIO 0	General-purpose I/O No. 0
4	RST	Reset
5	CH_PD	Chip power-down
6	GPIO 2	General-purpose I/O No. 2
7	TX	Serial Transmitter Pin
8	GND	Ground

5.5.1 Specifications

- It is predicated on the L106 computer architecture 32-bit microchip core and runs at eighty rate
- It could be a powerful Wi-Fi module accessible in an exceedingly} compact size at a very low value.
- It consumes one hundred mA current

- The most Input/output (I/O) voltage is three.6 Volts.
- It needs solely three.3 Volts power offer
- The current consumption is one hundred m Amps
- It supports serial communication to be compatible with many biological process platforms like Arduino
- The most Input/output supply current is twelve Ma
- The frequency of intrinsic low power 32-bit MCU is eighty rate
- The memory size of instruction cache RAM – thirty two K
- It is employed as either AN access purpose or station or each
- It supports but ten micro Amps deep sleep
- The size of nonvolatile storage is 513 K
- It is programmed exploitation either AT commands, Arduino IDE, or Lua script
- It could be a pair of.4 Gc Wi-Fi module and supports WPA/WPA2, WEP authentication, and open networks.
- Size of ETS systems-data RAM – sixteen K
- It provides 10- bit analog to digital conversion
- The style of modulation is PWM (Pulse dimension Modulation)
- UART is enabled on dedicated pins and for less than transmission, it is enabled on GPIO2.
- It uses 2 serial communication protocols like I2C (Inter-Integrated Circuit) and SPI (Serial Peripheral Interface).
- GPIO pins – seventeen
- Memory Size of instruction RAM – thirty two K
- It is AN IEEE 802.11 b/g/n Wi-Fi module with LNA, power electronic equipment, balun, integrated TR switch, and matching networks.
- Size of User-data RAM- eighty K

5.5.2 Esp8266 options

- It is suggested to not power this device directly with 5V dev board. Doing therefore will severely have an effect on the standard and overall Performance of the device.

- The processor is predicated on Tensilica Xtensa Diamond customary 106Micro and runs at eighty rate.
- It incorporates sixty four KiB boot ROM, eighty KiB user knowledge RAM and thirty two KiB instruction RAM.
- External QSPI nonvolatile storage is accessed through SPI and supports up to sixteen MiB and 512 KiB to four MiB is ab initio enclosed within the module.
- It supports Wi-Fi 802.11 b/g/n around a pair of 4 Gc and alternative options as well as sixteen GPIO, Inter-Integrated Circuit (I²C), Serial Peripheral Interface (SPI), 10-bit ADC, and I²S interfaces with DMA.
- It supports APSD that makes it a perfect selection for VoIP applications and Bluetooth interfaces.
- It is additionally referred to as a system-on-chip (SoC) and comes with a 32-bit Tensilica microcontroller, antenna switches, RF balun, Power electronic equipment, customary digital peripheral interfaces, low noise receive electronic equipment, power management module and filter Capability.
- It could be a major development in terms of wireless communication with very little electronic equipment. And contains aboard regulator that Helps in providing three.3V consistent power to the board.
- You will power up the device with laptop port exploitation USB to Serial device. the two AA and LIPO batteries area unit equally handy for Powering up the device.

5.5.3 Applications

- Access points portals.
- IoT projects.
- Wireless data logging.
- Used in learning the networking fundamentals.
- Sockets and smart bulbs.
- Smart home automation systems.
- Wireless Web Server.
- Geolocation using ESP8266.
- Wi-Fi controlled robot.

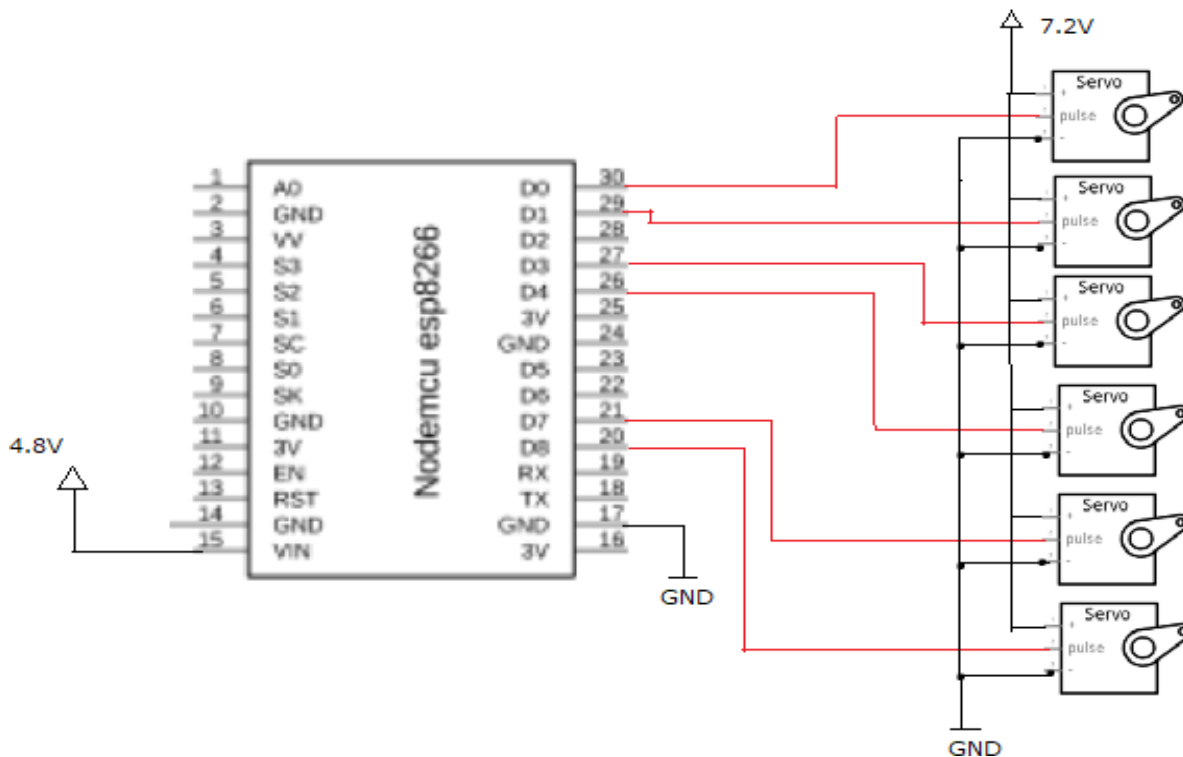
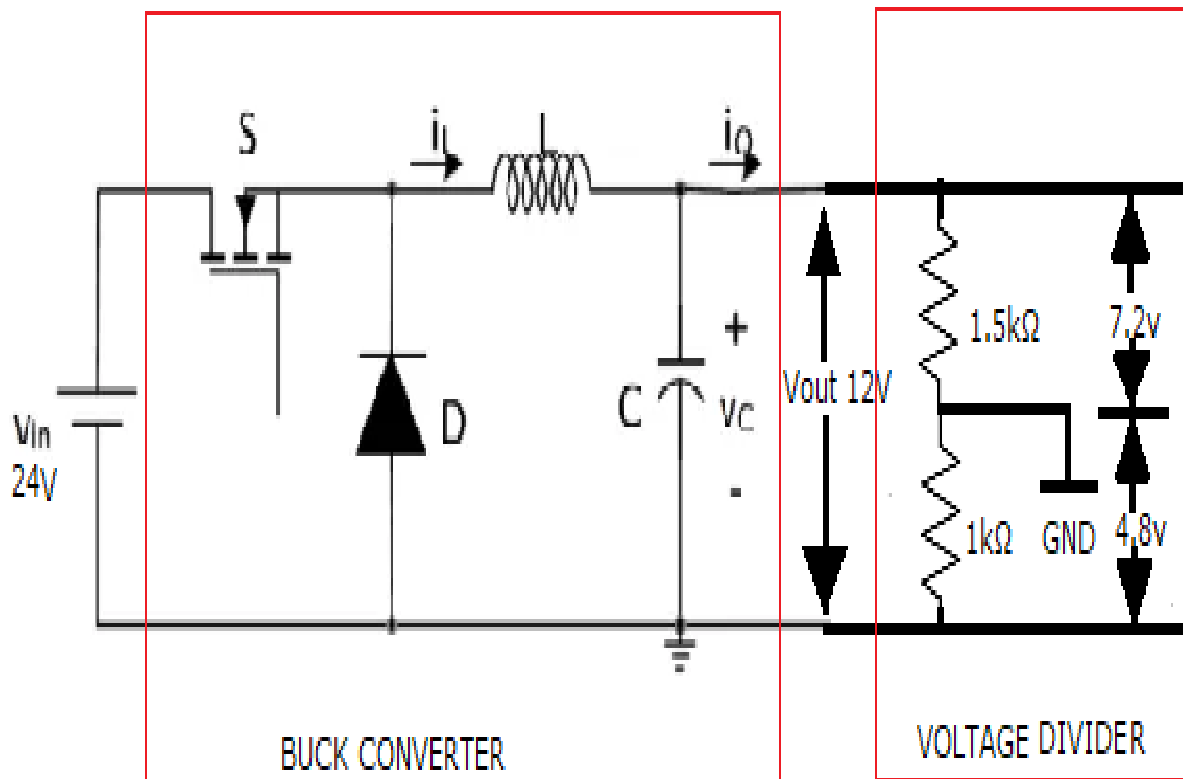


Fig. 5.8 Receiving side circuit diagram

The above diagram Fig 5.6 shows the circuit diagram of total receiving side of our project.

5.6 ESP32CAM

The below fig.5.7 shows the pin diagram of ESP32-CAM. The ESP32-CAM is a full-featured microcontroller that also has an integrated video camera and micro SD card socket. It's inexpensive and easy to use, and is perfect for IoT devices requiring a camera with advanced functions like image Tracking and recognition. The sample software distributed by Espressif includes a sketch that allows you to build a web-based camera with a sophisticated control panel. After you get the hang of programming the device you'll find that it is very Easy to use.

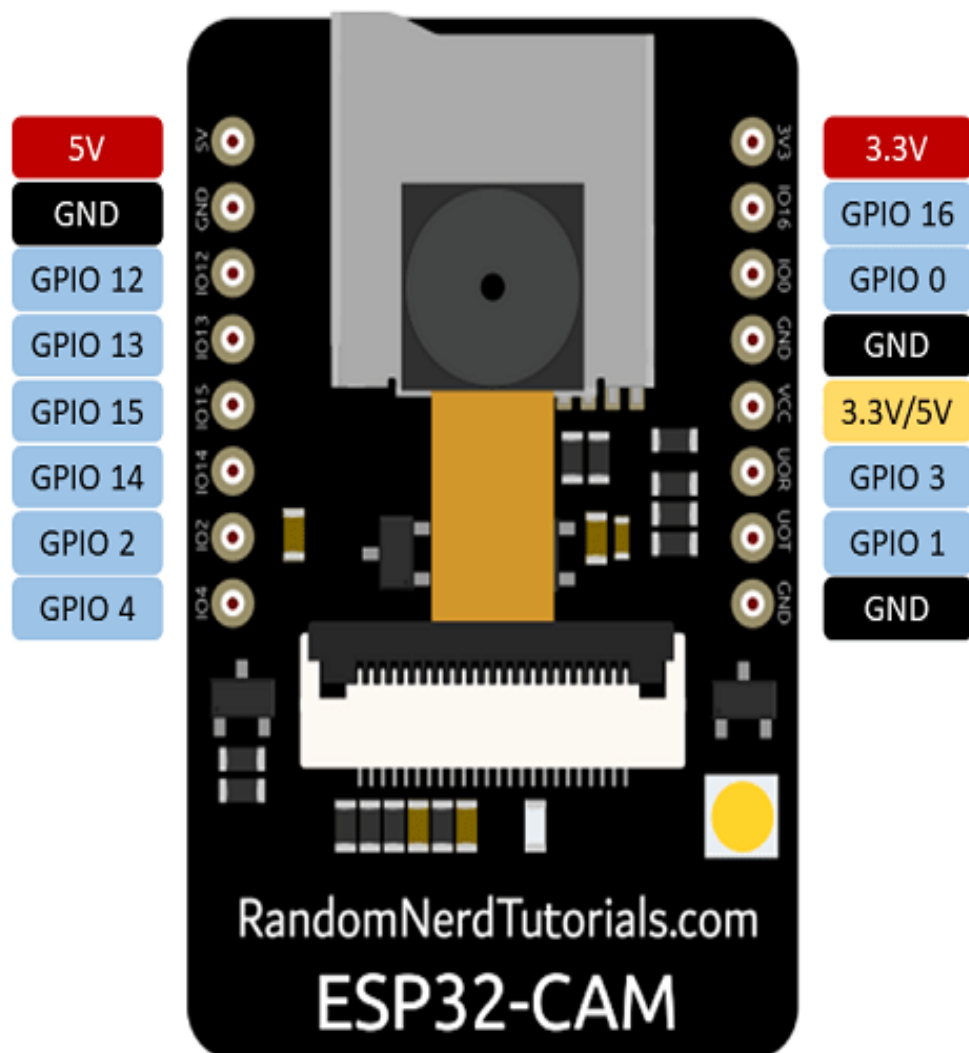


Fig. 5.9 ESP32-CAM

5.6.2 Features

- Up to 160MHz clock speed, up to 600 DMIPS summary computing power.
- Built-in 520 KB SRAM, external 4MPSRAM.
- Supports UART/SPI/I2C/PWM/ADC/DAC.
- Support OV2640 and OV7670 cameras, Built-in Flash lamp.
- Support image Wi-Fi upload.
- Support TF card Supports multiple sleep modes.
- Embedded Lwip and Free RTOS.
- Supports STA/AP/STA+AP operation mode.
- Support Smart Config/Air Kiss technology Support for serial port local and remote firmware upgrades (FOTA).

5.6.3 Specification

- SPI Flash: default 32Mbit.
- RAM: built-in 520 KB+external 4MPSRAM.
- Dimension: 27*40.5*4.5 (± 0.2) mm/1.06*1.59*0.18".
- Bluetooth: Bluetooth 4.2 BR/EDR and BLE standards.
- Wi-Fi: 802.11b/g/n/e/i
- Support Interface: I2C, SPI, And UART, PWM Support TF card: supports maximum 4G.
- IO port: 9.
- Serial Port Baud-rate: Default 115200 bps.
- Image Output Format: BMP, JPEG, GRAYSCALE.
- Spectrum Range: 2412 ~2484MHz.
- Antenna: onboard PCB antenna, gain 2dBi.
- Transmit Power: 802.11b: 17 $\pm$ 2 dBm(@11Mbps); 802.11g: 14 $\pm$ 2 dBm(@54Mbps); 802.11n: 13 $\pm$ 2 dBm (@MCS7) Receiving Sensitivity: CCK, 1 Mbps : -90dBm;
- CCK, 11 Mbps: -85dBm; MCS7 (65 Mbps, 72.2 Mbps): -67dBm, 6 Mbps (1/2 BPSK): -88dBm; 54 Mbps (3/4 64-QAM): -70dBm;
- Power consumption: shut down the flash: 180mA at 5V activate
- The flash and alter the brightness to the maximum: 310mA at 5V

- Deep-sleep: the lowest power consumption can reach 6mA@5V
- Modem-sleep: up to 20mA at 5V
- Light-sleep: up to 6.7mA at 5V
- Security: WPA/WPA2/WPA2-Enterprise/WPS
- Power supply range: 5V
- Operating temperature: -20 °C ~ 85 °C
- Source environment: -40 °C ~ 90 °C, < 90%RH
- Weight: 10g

5.7 SERVO MOTOR

The next hardware that's a drive system of a robotic arm may be a servomotor. They are small but pack a giant punch and square measure terribly energy economical. Servo motors operate from 4.8V to 7.4V, the higher the voltage higher the force we will come through, however most typically they're operated at +7.2V. A servomotor (or servo motor) may be a mechanism positioner actuator or linear actuator that enables for precise management of angular or Linear position, speed and acceleration.

It consists of an appropriate motor coupled to a detector for position feedback. It additionally needs a comparatively refined controller, usually an obsessive module designed specifically to be used with Servomotors. Servomotors don't seem to be a particular category of motor, though the term servomotor is usually wont to seek advice from a motor appropriate to be used in a very closed-loop system.

5.7.1 Mg996r

Fig. 5.8 shows the picture of MG996r servo motor. This high-torque customary servo will rotate some one hundred twenty degrees (60 in every direction). You can use any servo code, hardware or library to control these servos, so it's great for Move without building a motor controller with feedback & Gear box, especially since it will fit in small places.



Fig. 5.10 MG996r servo motor

Specifications

- Operating Voltage (VDC) – 4.8 ~ 6.6
- Temperature Range- 0- 55°C
- Stall Torque-@ 4.8V (Kg-Cm) 9.40
- Stall Torque-@6.6V (Kg-Cm) 11
- Operating Speed-@4.8V 0.19sec/60°
- Operating Speed-@6.6V 0.15sec/60°
- Dead Bandwidth- 1uS
- Gear Type Semi-Metal
- No. of teeth – 25
- Length (mm) – 40
- Width (mm) – 19
- Height (mm) – 41
- Weight (gm) – 56

5.7.2 Mg958

Fig. 5.9 shows the picture of MG958 servo motor .The MG958 High Torque Digital Metal Gear Servo is that the best option if you would like higher torque than 15KG. It provides an Excellent super for RC-cars from ten to six scale truggy monster and 30cc 60cc airplanes. Its shaft is upgraded to aluminum 6061-T6. It's stronger and lighter than copper.



Fig. 5.11 MG958 servo motor

Specifications

- Operating Voltage (VDC) - 4.8 ~ 6
- Operating Temperature (°C)- 0 to 55
- Stall Torque @ 4.8V (Kg-Cm) -18
- Stall Torque - @6.6V (Kg-Cm) -20
- Operating Speed - @4.8V 0.18sec/60°
- Operating Speed - @6.6V 0.15sec/60°
- Current draw (at idle) - 10mA
- Current draw (at no load) - 170mA
- Stall current draw - 1600mA
- Servo wire length - 32 cm
- Servo Plug - JR (Fits JR and Futaba)
- Bearing - Double ball bearing
- Gear Type - Metal gear

- Servo case Alloy case in the middle
- Length (mm) -54.2
- Width (mm) - 20
- Height (mm) - 47.8
- Weight (gm) - 68

5.7.3 OT5330M

Fig. 5.10 shows the picture of OT5330M servo motor This Orange Premium Servo with Steel gear material within gears and a good durable plastic case that makes them water and mud resistant that may be a terribly should feature needed in Boats, and RC Monster Trucks, etc. It equips a 3-wire Junior Servo plug that is compatible with Futaba connectors too. The Orange OT5330M seven.4V 35.5kg-cm 180° Metal Gear Digital Servo Motor with any servo code, library, and hardware. It Rotates just about 120-degree, sixty degrees in every direction.



Fig. 5.12 OT5330m servo motor

Specifications

- Model -OT5330M
- Operating Voltage (VDC) -4.0 ~ 8.4
- No load Speed (RPM) -42@6.0V (0.185sec/60°) 52@7.4V (0.151sec/60°)
- Stall Torque(Kg-Cm) -28.8@6.0V [35.5@7.4](#)
- Operating Temperature Range (°C) -20 to 60

- Maximum Operating Current (A)- 3.8
- Dead Band Width (μ s)- ≤ 4
- Gear Material - Steel
- Rotational Degree -180° Continuous Rotation
- Shaft Type 6 mm (25T-M3)
- Cable Length (cm)- 30
- Command Signal - PWM
- Connector - JR
- Length (mm) -55
- Width (mm) -20
- Height (mm) -43
- Weight (gm)- 70

5.8 SMOOTHING PROCESS OF SERVO MOTOR

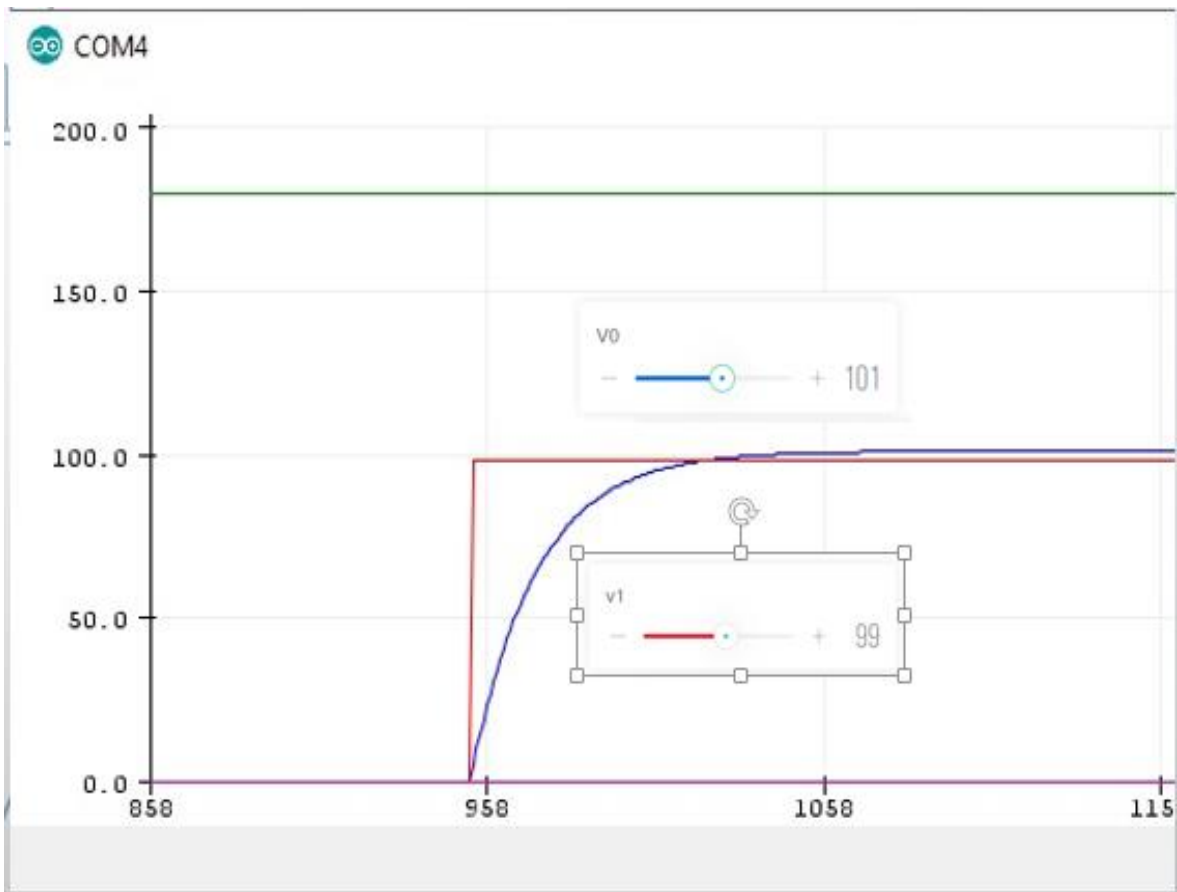


Fig. 5.13 Smoothing process

The above fig.5.11 shows the smoothing process curve. With a normal procedure of changing the servo motor angle by (servo. Write) syntax, the motor changes the angle suddenly. As the fig shows, since the red curve does not have the smoothing process it changes suddenly from 0 to 99 degree. Because of the sudden change the joints of the arm gets weak and even get damaged. So that we introduce a smoothing process in blue curve. As the blue curve changes from 0 to 101 degree in 100 milliseconds. So that the joints of the arm will move smoothly and does not move suddenly and do any damage to the arm.

5.8.1 Algorithm

- Initialize smooth value and previous value is equal to zero.
- Smooth value is equal to sum of the 5% of input value and 95 % of previous value.
- Now previous value is equal to smooth value.

$$sm1 = (x1 * 0.05) + (pre1 * 0.95);$$

$$pre1 = sm1;$$

Where sm1 - smooth value.

x1 - input value.

pre1- previous value.

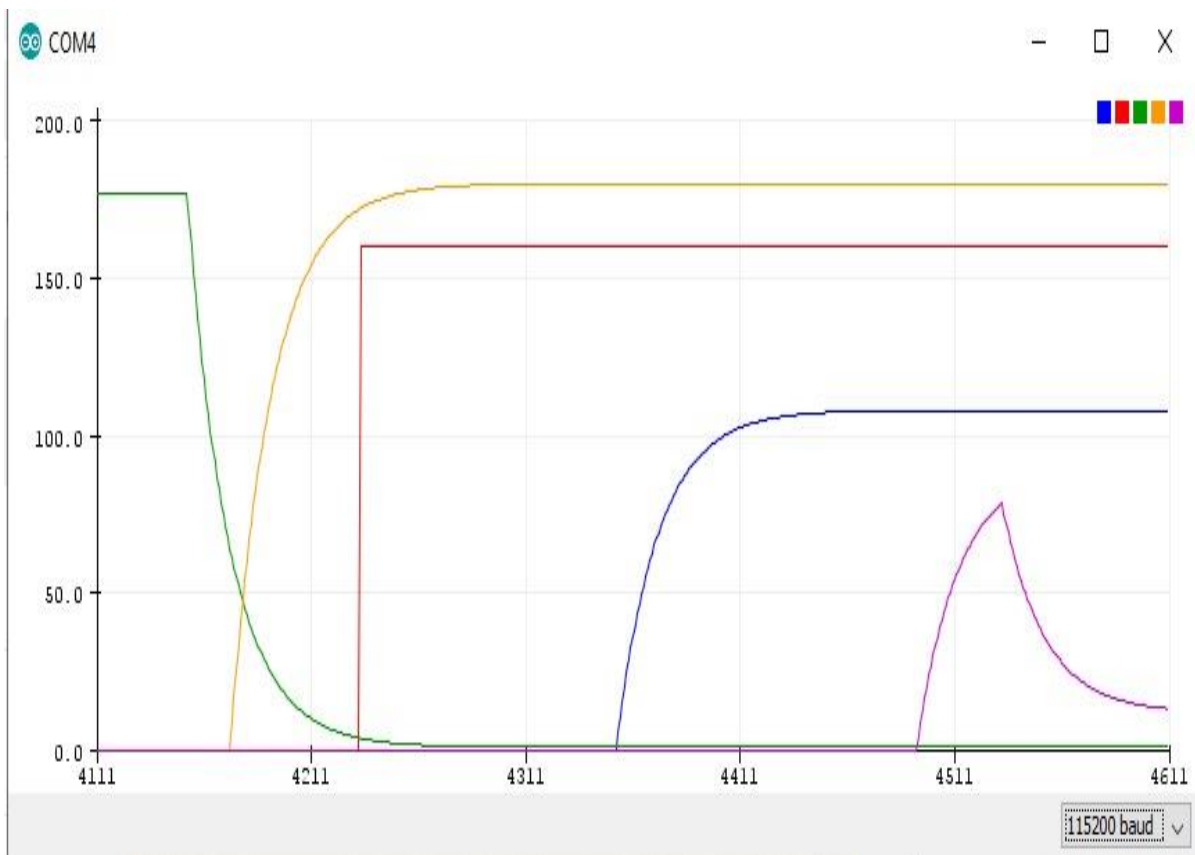


Fig. 5.14 Smoothing process for 5 servo motors except the red curve all other have smoothing process.

The above fig.5.12 shows the smoothing process curves implemented in the project for 5 servo motors.

CHAPTER 6

SUMMARY

6.1 Conclusion

This project can be developed further in the future. Better result and accuracy can be obtained by making speed of data transfer high and implementing artificial intelligent to it. If so, it can be introduced to the surgical field to do surgery with the help of doctors.

Being an extra hand, we can do many things. It finds its application in almost all the areas. Most of the people are working a lot and hard for their benefit. This hand be very helpful in doing such hard jobs. Being wireless, it works more efficiently than the wired one. There are many other communication networks that can be implied on the arm so that interaction can be improved further. Thus, this hand can be a wonderful invention, if it is implemented in the above mentioned fields.

6.2 FUTURE SCOPE OF THE PROJECT

In the future, the scope and flexibility of the surgical work of the telocentric mechanism that pulls the actuator and holds the endoscope will be comprehensively considered, and the freedom of the robot arm configuration will be further studied in order to expect the premise of meeting the requirements to reduce the freedom and mass of the robotic arm.

REFERENCES

- [1] Almurib, H. A. F, Al-Qrimli. H. F., and Kumar. N, "AReview of Application Industrial Robotic Design," in 9th Int. Conf. ICT Knowl. Eng., Bangkok, Thailand, 2012, pp. 105-112: IEEE.
- [2] Hollander.R Here's Why AR and VR are set to Take Off. Accessed: Jan. 5, 2018.: <http://www.businessinsider.com/ar-vr-2017-8?r=US&IR=T>. Aug. 2017.
- [3] Ishak. M. K, Roslan. M. I, and Ishak K. A, "Design of Robotic Arm Controller based on Internet of Things (IoT)," J. Telecommun. Electron. Comput. Eng., vol. 10, no. 2-3, pp. 5-8, 2018
- [4] Kim .S.-H, Shin. Y. J,, "Design and Control of Robot Manipulator with a Distributed Actuation Mechanism," Mechatronics, vol. 24, no. 8, pp. 1223-1230, 2014.
- [5] Kumar. A, Mishra. A., Makula. P, Karan. K, and Mittal. V. K., "Smart Robotic Assistant," in IEEE Reg. 10 Symp., Ahmedabad, India, 2015, pp. 25-28: IEEE.
- [6] Marty .F. M, Chen.K, and Verrill. K. A., "How to Obtain a nasopharyngeal swab specimen," New England J. Med., vol. 382, p. e76, Apr. 2020.
- [7] Mearian. L .Hospital Tests Lag Time for Robotic Surgery 1,200 Miles Away From Doctor. Available: <https://www.computerworld.com/article/2927471/healthcareit/robot-performs-test-surgery-1200-miles-away-from-doctor.html>(Jan. 5, 2018).
- [8] Mearian. L .Hospital Tests Lag Time for Robotic Surgery 1,200 Miles Away From Doctor. Available: <https://www.computerworld.com/article/2927471/healthcareit/robot-performs-test-surgery-1200-miles-away-from-doctor.html>(Jan. 5, 2018).
- [9] Nafea. M, AbuZaiter. A, Kazi. S, and Mohamed Ali. M. S, "Frequency Controlled Wireless Passive Thermopneumatic Micromixer,". Syst., vol. 26, no. 3, pp. 691-703, 2017

- [10] Nafea. M, Badrul Hisham. A. A, Abdul-Kadir. N. A, and Che Harun F. K, "Brainwave-Controlled System for Smart Home Applications," in 2nd Int. Conf. Bio Signal Anal. (ICBAPS 2018), Kuching, Malaysia, 2018, pp. 75-80: IEEE
- [11] Nafea.M , Nawabjan.A, and Mohamed Ali. M. S., " Wirelessly-Controlled Piezoelectric Microvalve for Regulated Drug Delivery," Sens. Actuators, A, vol. 279, pp. 191-203, 2018/08/15.
- [12] Niku. S, Introduction to Robotics: Mechanics and Control, 2nd ed. Hoboken, NJ, USA: Wiley, 2010
- [13] Sharif .N. H, Tameem M. S. P, Chowdhury S. M.H, Kumu M. C, and Hossain M. F, "IoT-Based Robot with Wireless and Voice Recognition Mode," in Emerging Technol. Data Min. Inf. Secur.: Springer, 2019, pp. 743-752.
- [14] Shukla. A and Karki. H, "Application of Robotics in Onshore Oil and Gas Industry - A Review Part I," Rob. Auton. Syst., vol. 75, pp. 490-507, 2016.
- [15] Zhang.Q, Liu.J, and Zhao .G . "Towards 5G enabled tactile robotic telesurgery." [Online]. Available: <https://arxiv.org/abs/1803.03586>. (2018).