MINOR PROJECT REPORT

ON

ELECTRO-MECHANICAL ROBOT

Submitted in the fulfilment of the requirements for the

Award of the degree of

Bachelor in Technology

In

MECHATRONICS ENGINEERING

Submitted to: -

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DECLARATION

I, GOPAL KRISHNA BASUDEVAN, student of B.tech Mechatronics, declare that the report titled “ELECTRONICS MECHNICAL ROBOT” which is submitted by me to Delhi Institute of Tool Engineering, Okhla, New Delhi.

DATE: - 15th January 2022

GOPAL KRISHNA BASUDEVAN

CERTIFICATION

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This is to certify that the project report entitled "Electromechanical Robot" was successfully completed by students of 7th SemesterB.Tech in Mechatronics Engineering. (Batch2018-22)

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In partial fulfilment of the requirements for the award of the degree of Btech in Mechatronics Engineering submitted to the department of Delhi Institute of Tool Engineering.

Work carried out during the period of the academic year of 2021-2022 as per curriculum.

SIGNATURE OF HOD (v)

ACKNOWLEDGEMENT

I take this opportunity to express my sincere gratitude to the people who have been helpful in the successful completion of Minor Project of Electro-Mechanical Robot.

Irespect and thank Dr Arun Gupta sir, for providing us an opportunity to do the project work in [Delhi Institute Of Tool Engineering] and giving us all support and guidance which made us complete the project duly. I am extremely thankful to him for providing such a nice support and guidance, although he had busy schedule managing the corporate affairs.

I owe my deep gratitude to our project guide ie. YOUTUBE, who guided us all along, till the completion of our project work by providing all the necessary information for developing a good product.

I would like to show my greatest appreciation to my Group members for helping me to complete this entire project.

GOPAL KRISHNA BASUDEVAN

00170208419

B.Tech (Mechatronics)

ABSTRACT

This project is based on the IOT (internet of things) and machine learning concept where this robot can perform a lot of tasks when a user gives him the instructions to do so. The robot is made to be like a family part and can have expression like of human and other living creature. Robot can help in exploration of the place where a normal person cannot go like a cave or a very small area and can-do live streaming there. It's easy to use and can be used by a person who do not have any kind of robotics knowledge as its interface of application is easy to use and provide a user-friendly environment. The robot is basically a social interactive robot that can ask question also to you when it seem to necessary to ask the question and even it can wish you in morning, on your birthday, can welcome while coming to home.

Artificial intelligence (AI) and robotics are a powerful combination for automating tasks inside and outside of the factory setting. In recent years, AI has become an increasingly common presence in robotic solutions, introducing flexibility and learning capabilities in previously rigid applications. The answer is simple. Artificial Intelligence or AI gives robots a computer vision to navigate, sense and calculate their reaction accordingly.

While AI is still in its nascent stages, it's been a transformative technology for some applications in the manufacturing sector, although there are many that have yet to feel the impact.

MAIN OBJECTIVES: -

This project is providing the user a friendly environment in which user can use its all feature without any grata knowledge of Robotics system. The GUI (graphic user interface) is too easy to use. It has simple instruction on it for moving the robot and camera opens automatically, and a voice button to give in instruction to the robot.

The user can use a lot of features like surveillance to keep track on something he wants. This will help the scientist in exploration of things where a human cannot go directly like in caves and a very small passage with some scientific instrument without any harm to human life. The robot contains a 1 watt led on it so even in dark it can take images and live streaming can be seen perfectly whit the help of this robot.

The robot can do facial recognition and object tracking. Face recognition is a technology capable of identifying or verifying a subject through an image, video or any audio-visual element of his face. As FRT increasingly moves from the research laboratory into the world of socio-political concerns and practices there is a need to bridge the divide between a purely technical and a purely socio-political analysis of FRT. This is the aim of this report.

Social (or sociable) robots are designed to interact with people in a natural, interpersonal manner – often to achieve social-emotional goals in diverse applications such as education, health, quality of life, entertainment, communication, and collaboration.

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CHAPTER 1

INTRODUCTION

1.1 Description:

Our Robot is based upon Internet of Things and machine learning concept where this robot can perform a lot of tasks when a user gives him the instructions to do so.

The robot is basically a social interactive robot that can ask question also to you when it seem to necessary to ask the question and even it can wish you in morning, on your birthday, can welcome while coming to home.

This project is providing the user a friendly environment in which user can use its all feature without any grata knowledge of Robotics system. The GUI (graphic user interface) is too easy to use. It has simple instruction on it for moving the robot and camera opens automatically, and a voice button to give in instruction to the robot.

The user can use a lot of features like surveillance to keep track on something he wants. This will help the scientist in exploration of things where a human cannot go directly like in caves and a very small passage with some scientific instrument without any harm to human life. The robot contains a 1 watt led on it so even in dark it can take images and live streaming can be seen perfectly whit the help of this robot.

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SOME FEATURES OF THE ROBOT:-

1. MOBILITY
2. INTERNET CONTROL
3. SPY CAMERA
4. VOICE CONTROLLED

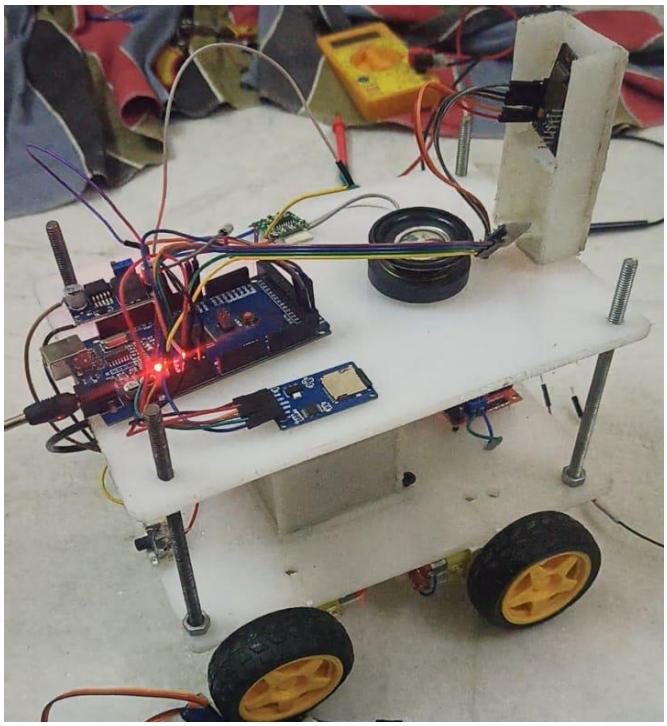

Fig 1.1

1.2 Structure:

This is a captured image of our robot showcasing all the necessary and important parts that have been used in it.

Here you can see that we have used open plastic body so that parts are visible for clear understanding to everyone.

You can see that Arduino and speech related equipment such as SD card module, Speaker, amplifier, wires and Bluetooth for transmission are mounted on the top layer of the robot and Propulsion part of the car is located on the bottom part for the weight management perspective. So that movement is smooth and no major stress is applied on any particular part of the car.

Battery pack is located at the centre of bottom plate so that power can reach every corner without extending too much transmission wires. And weight is also balanced by doing this.

Further we can see here that ESP32 cam is placed on the column that is stick together with the top plastic board to get a clear viewing angle from the camera.

CHAPTER 2

LITERATURE

2.1 TECHNOLOGY USED‘IoT’ :

The Internet of Things describes physical objects, that are embedded with sensors, processing ability, software, and other technologies, and that connect and exchange data with other devices and systems over the Internet or other communication networks.

2.2 FUTURE OF IOT :

The future of IoT has the potential to be limitless. Advances to the industrial internet will be accelerated through increased network agility, integrated artificial intelligence (AI) and the capacity to deploy, automate, orchestrate and secure diverse use cases at hyper scale.

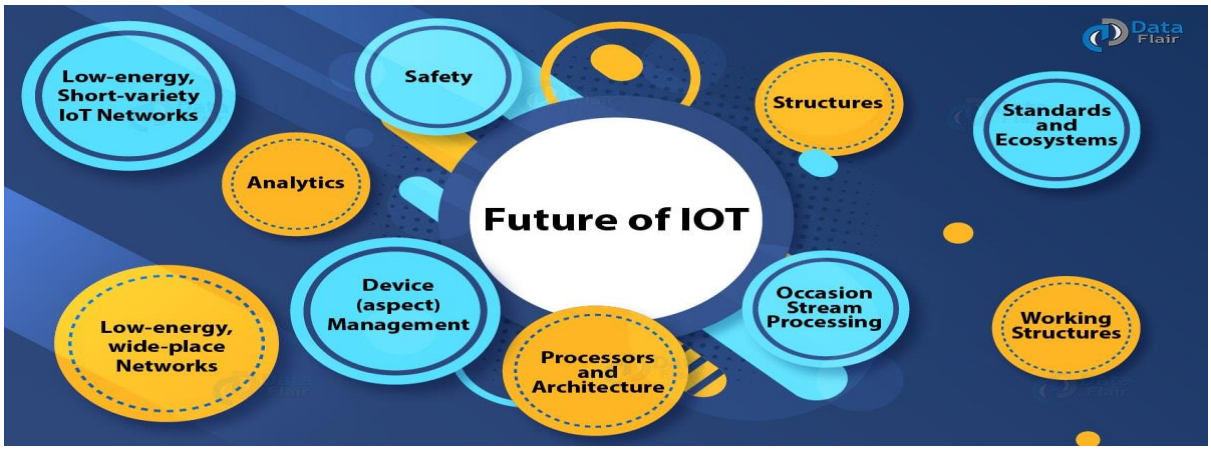

Fig 2.1

Source: Data flair

2.3 Detailed Features of our Robot:

1. LAN/WAN:-

ESP 32 module has inbuilt Wi-Fi that can be connected through Local Area Network. Ngrok platform can further exceed it to Wide Area Network so that it can be controlled via internet through any corner of the world where internet is accessible.

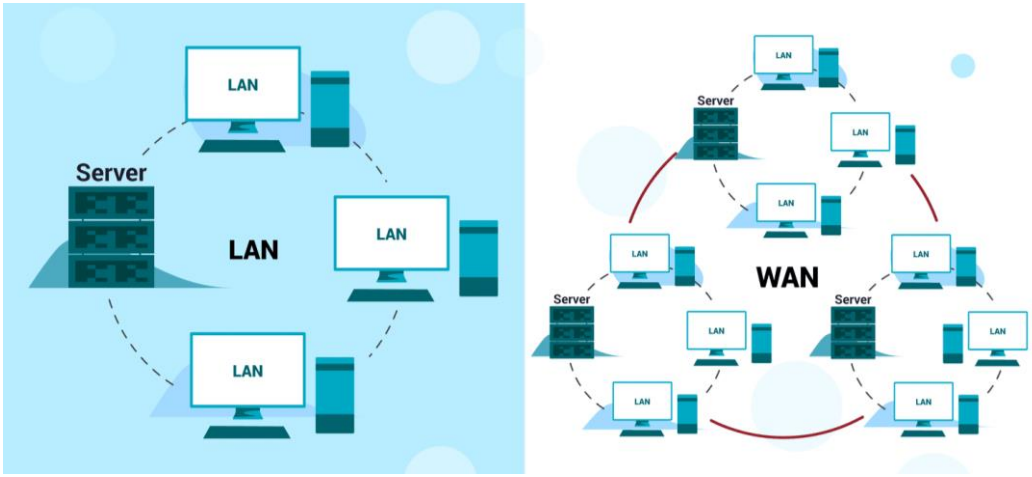

Fig 2.2

Source: Google

2. MOBILITY:-

Robot is equipped with tank wheels attached to 4 * 6v DC BO motors and 3S 3p 6000+ mAH 12V li-ion battery pack for its movement.

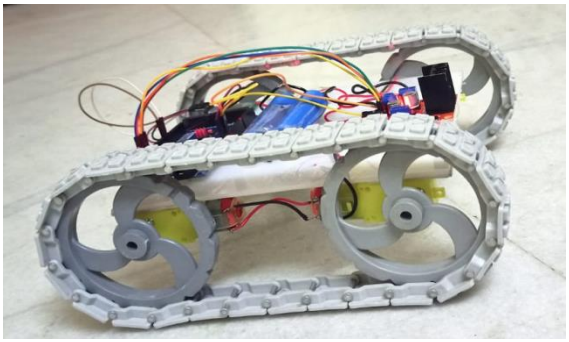

Fig 2.3

3. SPY:-

ESP 32 CAM module has camera also so that live video streaming is also possible through network.

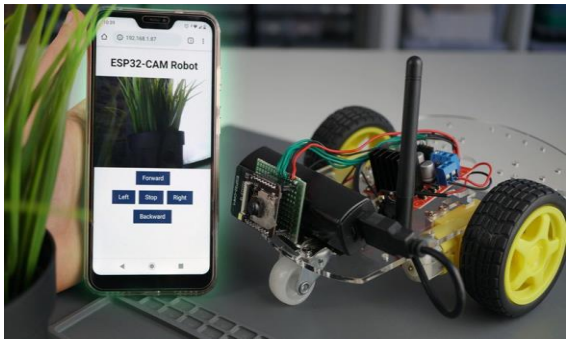

Fig 2.4

4.VOICE RECOGNITION:-

Programming in C++ in ARDUINO IDE allows our robot to perform question answer task in the form of Audios.

2.4 Applications:

- VOICE RECOGNITION
- SECURITY
    - Since video streaming is possible through internet, we can use this as a stationary as well as a mobile CCTV camera to keep an eye on our home 24hrs just by sitting in our office.
- ENTERTAINMENT

Fig 2.5

Source: Google images

2.5 Parts Used:

- PLASTIC BOARD:-

Boards are required to make the casing, frame and structure of the Robot.Thickness of plastic selected for the project is 5 mm.

Fig 2.6

- DC MOTORS 6V:-

Motors are required to convert electric energy received from battery to mechanical energy further into rotatory motion to drive the robot wheels.We have used 4x 6V DC geared motors.

Fig 2.7

- WHEELS:-

Wheels are required here to convert rotatory motion into linear motion and provide mobility to the robot.

Fig 2.8

- JUMPER CABLES (M to M):-

It is used to close connection between two components both having female ports.Similarly there is also use of F to F jumper wires.

Fig 2.9

- JUMPER CABLES (M to F):-

It is used to close connection between two components one having female port and other having male port.

Fig 2.10

- ARDUINO MEGA 2560:-

Arduino is an open-source platform used for building electronics projects. Arduino consists of microcontroller and a piece of software, or IDE that runs on our computer, used to write and upload computer code to the physical board.

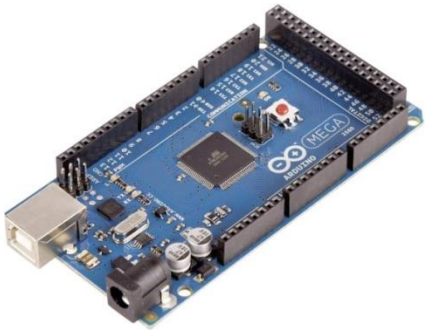

Fig 2.11

- ESP 32 CAM:-

ESP32-CAM is a low-cost ESP32-based development board with onboard camera, small in size. It is an ideal solution for IoT application, prototypes constructions and DIY projects. The board integrates WiFi, traditional Bluetooth and low power BLE , with 2 high- performance 32-bit LX6 CPUs.

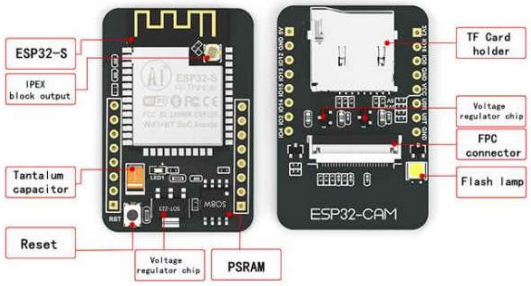

Fig 2.12

- MOTOR DRIVER L298N:-

Motor driver is used here to provide equal amount of energy to all the four motors as well as to reverse the direction of current so that motors can run into anticlockwise direction.

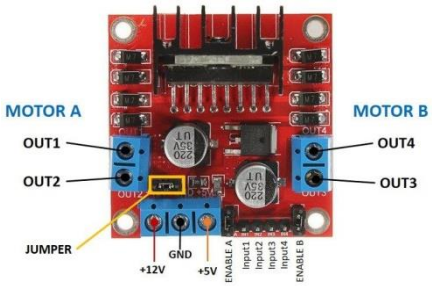

Fig 2.13

- DC BUCK CONVERTOR:-

It is an essential device for majority of the mechatronic projects. DC to DC buck convertor is a device that steps up or down voltage coming through the power supply according to the voltage required by devices connected in the circuit.

Fig 2.14

- BLUETOOTH HC 05:-

Bluetooth is a device that is used to connect and transmit data between two devices wirelessly. HC-05 is a Bluetooth module that often works with Arduino and here it is being used to transmit voice signals towards our robot with the help of an application.

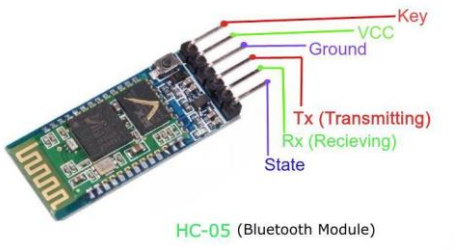

Fig 2.15

- SD CARD MODULE:-

It is a module that works usually with Arduino to read a micro SD card. It can be used to play audio files stored inside the card.

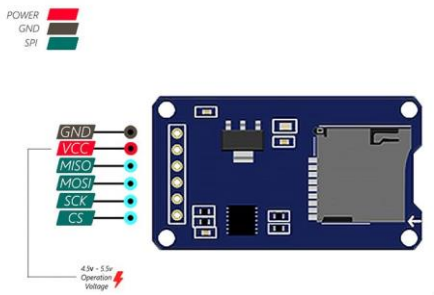

Fig 2.16

- USB to UART BRIDGE CONTROLLER (CP2102):-

It is used to connect ESP 32 CAM with our Laptop and upload Program Code with the help of ARDUINO IDE.

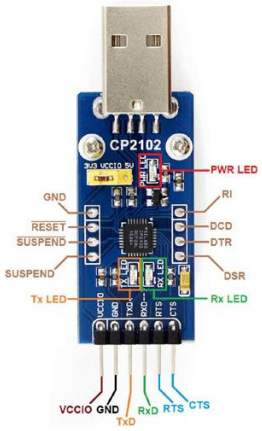

Fig 2.17

- SPEAKER 3W 4 OHM:-

Speaker are being used here to listen what our robot is trying to respond when a command is sent from the microphone that is further connected with bluetooth module.

Fig 2.18

- PAM 8403 AMPLIFIER:-

Amplification of sound frequencies coming out from Arduino pins is necessary because their intensity is very low. PAM8403 is a cheap and reliable sound amplifier that we have used here to increase sound volume so that we can hear it properly.

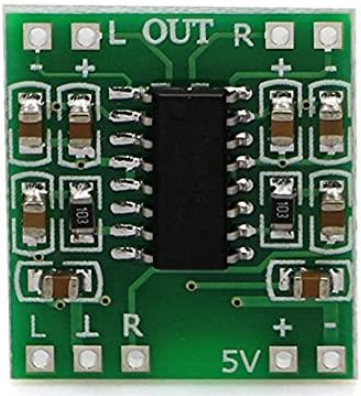

Fig 2.19

- BATTERY PACK:-

Robot is equipped with a Battery pack made up of 9 x Li-ion cells.

Battery composition is of 3 S - 3 P that means three cells are connected in series and then this array is further connected in parallel.

Connection in Series increases voltage as well as current reading.

Connection in parallel increases capacity (mAh) of the battery pack.

Battery management system is installed for max 20A load that ensures smooth charging and discharging of each cell in the battery pack.

Charger of 12V - 2A is being used to charge the battery rapidly.

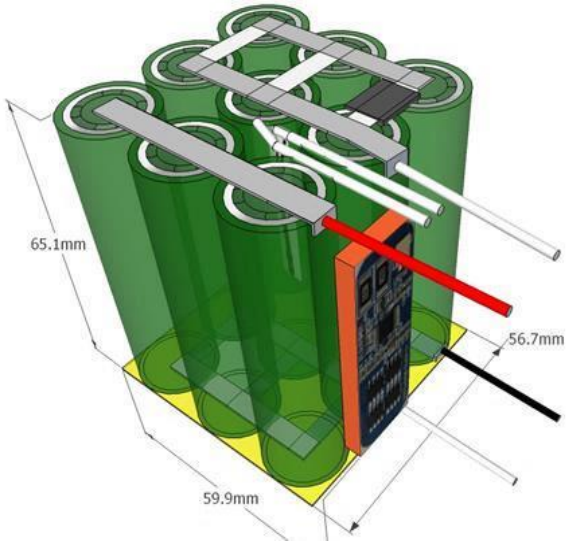

Fig 2.20

2.6 Battery Pack Calculations:

- CELL:-

NOMINAL VOLTAGE = **3.8V**

MAX VOLTAGE = **4.2V**

CURRENT RATING = **2.5A**

MAX CAPACITY = **2200mAh**

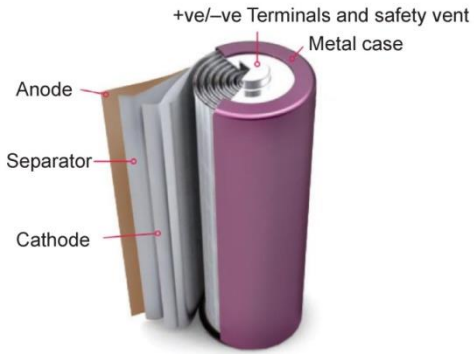

Fig 2.21

- BATTERY:-

NOMINAL VOLTAGE: **3*3.8 = 11.4V**

MAX VOLTAGE: **3*4.2V = 12.6V**

CURRENT RATING:**3*2.5 = 7.5A**

MAX CAPACITY:**3*2200 = 6600mAh**

Fig 2.22

CHAPTER 3

METHODOLOGY

3.1 TOOLS REUIRED:

1) RULER:-

Ruler is used to get rough dimension of the parts for marking purposes. 30 cm steel rule is enough for this project.

Fig 3.1

2) VERNIER CALLIPER:-

Vernier calliper is required to get more accurate measures of small parts and components that are used in this project.

Fig 3.2

3) MARKERS AND SCRIBERS:-

Markers are used to mark the outlines where cutting actions may be taken.

Fig 3.3

4) HACKSAW:-

Hacksaw is used to cut the metallic components wherever it is necessary.

Fig 3.4

5) SCREW DRIVER SET:-

It is used to tighten the fasteners of different sizes.

Fig 3.5

6) HAND DRILLER:-

It is a type of drilling machine that is controllable by hand and is used to drill holes for the passage of fasteners so that we can clamp the components.

Fig 3.6

7) MULTIMETER:-

It is required to check the voltage and current of battery and flow of current throughout the wiring assembly.

Fig 3.7

8) NUT, BOLT & SCREWS:-

Fasteners are required to tighten the clamp and joints.

Fig 3.8

9) SOLDERING IRON & SOLDER:-

Soldering iron is used to melt solder to connect two current conducting wires or terminals.

Fig 3.9

3.2 Procedure:

- First of all after proper marking, cut the plastic board with the help of a Hacksaw in required dimensions ie 15cm in width and 23cm in length.

- Since, there are two layers for the project; we need two board pieces in the form of plastic palates. Height between the two = 20cm.

- After marking spaces for individual projects parts and holed for fasteners, take drilling machines and start drilling carefully.

- Place the components properly and join with the help of fasteners like nut bolts and screws.

- Some small components can be fixed on board with the help of Double sided tapes.

- Fix the motors, Arduino, Esp32 cam, battery pack, motor driver, buck convertor and the rest of the components on the board as desired.

- Now open ARDUINO software and start coding for the features that are required to be performed by the robot.

- Upload the program by selecting proper COM Port and Baud rate, into both the microcontrollers' viz. ARDUINO MEGA and ESP32 CAM.

- Now open Serial monitor (make sure that ESP is still connected to the PC) and press reset button then copy the local IP address.

- Complete the wiring procedure with the help of Block diagram, and respective to pin numbers described in the programming.

- Make sure that all the components are fixed properly and current is flowing after we Switch ON the project. Avoid loose connections.

- Now switch on the Wi-Fi router/hotspot and let ESP connect to it. Then open web browser in any device that is connected with the same local network, and search the IP address.

- Hence we would be able to control the robot from our device.

- For Communication feature we need to install the software in our android phone that we have developed on our own. It uses Google speech to text function that allows one to talk with our robot in question answer form.

3.3 Block Diagram:

TEAM AKATSUKIS

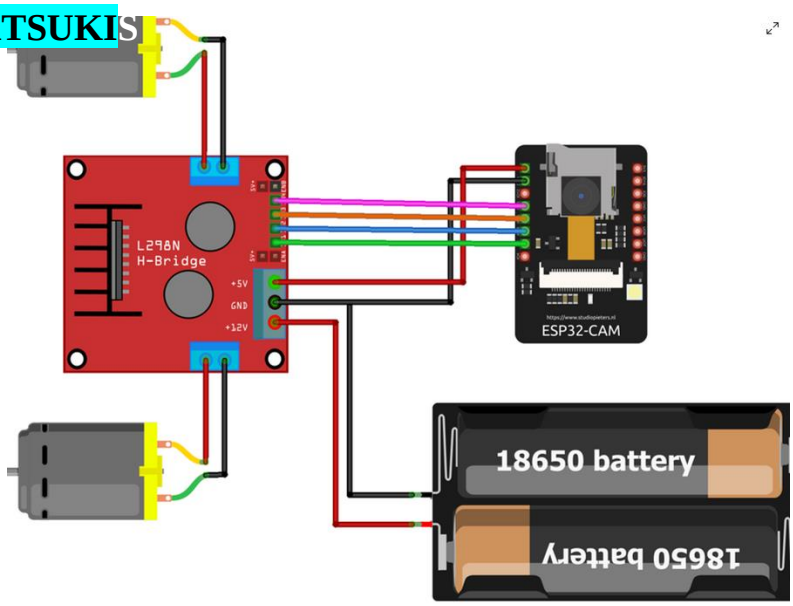

Fig 3.10

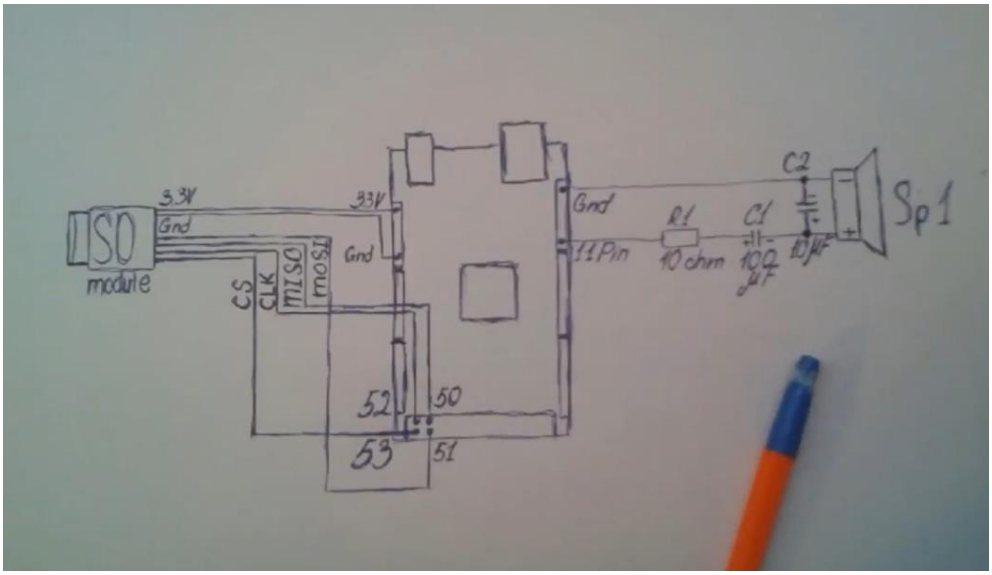

Fig 3.11

3.4 Code (Communication through ARDUINO):

```
#include "SD.h"
#define SD_ChipSelectPin 53
#include "TMRpcm.h"
#include "SPI.h"



TMRpcmtmrpcm;


void setup()


{
tmrpcm.speakerPin = 5; //5,6,11 or 46 on Mega, 9 on Uno, Nano, etc
Serial.begin(9600);
if (!SD.begin(SD_ChipSelectPin)) {  // see if the card is present and can be initialized:
Serial.println("SD fail");
return;   // don't do anything more if not
  }
tmrpcm.play("start.wav"); //the sound file "music" will play each time the arduino powers up, or is reset
}
void loop()
{
if (Serial.available() == 1)
  {
    String val = Serial.readString();
```

```
if (val == "who are you")
    {
tmrpcm.play("name.wav");
delay(100);
}
else if(val == "hello")
   {
tmrpcm.play("hello.wav");
delay(100);
   }
  }
}
```

3.5 Code (ESP 32 CAM part):

```
#include "esp_camera.h"

#include <WiFi.h>

// WARNING!!! Make sure that you have either selected ESP32 WroverModule,or another board which has PSRAM enabled

// Adafruit ESP32 Feather


// Select camera model

//#define CAMERA_MODEL_WROVER_KIT

//#define CAMERA_MODEL_M5STACK_PSRAM

#define CAMERA_MODEL_AI_THINKER


const char* ssid = "--------";   //Enter SSID WIFI Name

const char* password = "--------";   //Enter WIFI Password



#if defined(CAMERA_MODEL_WROVER_KIT)

#define PWDN_GPIO_NUM    -1

#define RESET_GPIO_NUM   -1

#define XCLK_GPIO_NUM    21

#define SIOD_GPIO_NUM    26

#define SIOC_GPIO_NUM    27


#define Y9_GPIO_NUM      35

#define Y8_GPIO_NUM      34

#define Y7_GPIO_NUM      39

#define Y6_GPIO_NUM      36
```

```
#define Y5_GPIO_NUM      19
#define Y4_GPIO_NUM      18
#define Y3_GPIO_NUM       5
#define Y2_GPIO_NUM       4
#define VSYNC_GPIO_NUM   25
#define HREF_GPIO_NUM    23
#define PCLK_GPIO_NUM    22


#elifdefined(CAMERA_MODEL_AI_THINKER)
#define PWDN_GPIO_NUM     32
#define RESET_GPIO_NUM    -1
#define XCLK_GPIO_NUM      0
#define SIOD_GPIO_NUM     26
#define SIOC_GPIO_NUM     27

#define Y9_GPIO_NUM       35
#define Y8_GPIO_NUM       34
#define Y7_GPIO_NUM       39
#define Y6_GPIO_NUM       36
#define Y5_GPIO_NUM       21
#define Y4_GPIO_NUM       19
#define Y3_GPIO_NUM       18
#define Y2_GPIO_NUM        5
#define VSYNC_GPIO_NUM    25
#define HREF_GPIO_NUM     23
#define PCLK_GPIO_NUM     22
```

```
#else
#error "Camera model not selected"
#endif

// GPIO Setting
externintgpLb =  2; // Left 1
externintgpLf = 14; // Left 2
externintgpRb = 15; // Right 1
externintgpRf = 13; // Right 2
externintgpLed =  4; // Light
extern String WiFiAddr ="";

voidstartCameraServer();

void setup() {
Serial.begin(115200);
Serial.setDebugOutput(true);
Serial.println();


pinMode(gpLb, OUTPUT); //Left Backward
pinMode(gpLf, OUTPUT); //Left Forward
pinMode(gpRb, OUTPUT); //Right Forward
pinMode(gpRf, OUTPUT); //Right Backward
pinMode(gpLed, OUTPUT); //Light
```

```
  //initialize
digitalWrite(gpLb, LOW);
digitalWrite(gpLf, LOW);
digitalWrite(gpRb, LOW);
digitalWrite(gpRf, LOW);
digitalWrite(gpLed, LOW);

camera_config_tconfig;
config.ledc_channel = LEDC_CHANNEL_0;
config.ledc_timer = LEDC_TIMER_0;
  config.pin_d0 = Y2_GPIO_NUM;
  config.pin_d1 = Y3_GPIO_NUM;
  config.pin_d2 = Y4_GPIO_NUM;
  config.pin_d3 = Y5_GPIO_NUM;
  config.pin_d4 = Y6_GPIO_NUM;
  config.pin_d5 = Y7_GPIO_NUM;
  config.pin_d6 = Y8_GPIO_NUM;
  config.pin_d7 = Y9_GPIO_NUM;
config.pin_xclk = XCLK_GPIO_NUM;
config.pin_pclk = PCLK_GPIO_NUM;
config.pin_vsync = VSYNC_GPIO_NUM;
config.pin_href = HREF_GPIO_NUM;
config.pin_sscb_sda = SIOD_GPIO_NUM;
config.pin_sscb_scl = SIOC_GPIO_NUM;
config.pin_pwdn = PWDN_GPIO_NUM;
config.pin_reset = RESET_GPIO_NUM;
config.xclk_freq_hz = 20000000;
```

```
config.pixel_format = PIXFORMAT_JPEG;
  //init with high specs to pre-allocate larger buffers
if(psramFound()){
config.frame_size = FRAMESIZE_UXGA;
config.jpeg_quality = 10;
config.fb_count = 2;
  } else {
config.frame_size = FRAMESIZE_SVGA;
config.jpeg_quality = 12;
config.fb_count = 1;
  }

  // camera init
esp_err_t err = esp_camera_init(&config);
if (err != ESP_OK) {
Serial.printf("Camera init failed with error 0x%x", err);
return;
  }

  //drop down frame size for higher initial frame rate
sensor_t * s = esp_camera_sensor_get();
s->set_framesize(s, FRAMESIZE_CIF);

WiFi.begin(ssid, password);

while (WiFi.status() != WL_CONNECTED) {
delay(500);
```

```
Serial.print(".");
  }
Serial.println("");
Serial.println("WiFi connected");

startCameraServer();

Serial.print("Camera Ready! Use 'http://");
Serial.print(WiFi.localIP());
WiFiAddr = WiFi.localIP().toString();
Serial.println("' to connect");
}

void loop() {
  // put your main code here, to run repeatedly:

}
```

CHAPTER 4

RESULT & DISCUSSION

4.1 Result:

Hence our project on Electro-mechanical Robot is successfully completed with the help of deep study, research, friends and references.

Now we are able to stream video through local area network, control it's propulsion and talk with it for some entertainment purposes.

4.2 Discussion:

To complete this Minor project we have researched a lot. Each member was assigned with a different task, for example one was focussed on software part, other one focussed on mechanical part, and so on.

Though, no project is satisfactory in someone's eye, we still tried our best and did it without copying anyone.

This gives us hope, courage and determination to advance it to the next level for the major project for major upgrade. And further to the increment levels along with our increasing knowledge.

During all these tasks, we got many obstacles in between that I want to discuss in the next heading.

4.3 Problems occurred during project:

- BATTERY PACK:

  Battery Pack is one of the most important parts of any project especially if it is movable. We thought of buying one but it was too much expensive. So we decided to make our own by joining number of Li-ion Cells together in such a way that we get the required output. We connected it in 3 Series & 3 Parallel design; it increased our battery current rating as well as its capacity. We added BMS of 20A load capacity; it increased the overall performance and reduced the danger of getting towards low voltage or too high voltage.

- PROGRAMMING:

  Since, we were the students of Lateral Entry in our classroom and all of us were from Mechanical engineering background that we have done after 10^{th} class. So, we don't have not much prior knowledge of programming or coding. It forced us to learn it before we could apply this kind of skill into our project. We took reference of many YouTube videos and other references to learn coding especially that of ARDUINO.

- DISTANCE:

Since this project was carried out during lockdown time. That's why we didn't get opportunity to work inside our Campus. We made our project location to one of our member's house and planned fixed dates so we could complete the project on time without delay.

4.3 Behind the scenes (captured images):

Fig 4.1

Fig 4.2

CHAPTER 5

CONCLUSION & FUTURE

5.1 Conclusion:

We want to conclude that our project has sufficient potential for the market point of view after some major advancement that we will be discussing in heading 5.3 later. We tried to complete this minor project by spending least possible money & resources and would like to share costing details in table 5.1

5.2 Total Project Cost:

S No.	Component	Price(In Rupees)	Quantity	Amount
01	Plastic Board	500	2	500
02	Lithium Ion Cell	30	9	270
03	ARDUINO MEGA	1000	1	1000
04	ESP 32 CAM	650	1	650
05	Motor Driver L289N	200	1	200
06	Bo Motor	50	4	200
07	Wheel	30	4	120
08	DC to DC Buck Convertor	90	2	180
09	Jumper Cable(Male to Female)	60	1 Set	60
10	Jumper Cable (M to M)	60	1 Set	60
11	Jumper Cable (F to F)	60	1 Set	60
12	SD Card reader Module	100	1	100
13	CP 2102	200	1	200
14	Bluetooth HC 05	250	1	250
15	Amplifier PAM8403	50	1	50
16	Speaker	50	1	50
17	Fasteners	200	NA	200
18	Wires	150	NA	150
19	miscellaneous	700		700
		TOTAL		₹5000

Table 5.1

5.1 Future Work:

Although, no project on the earth is perfect we can say that we can do n number of improvement in the project but our plans to do some major changes we can tell only. This minor project has a lot of potential and can upgrade according to the need of the uses of once user. In our project we are going to improve the features and add some component that we are going to explain below,

#. ADDITIONAL COMPONENTS:

1. SMALL SIZE DISPLAY: - A 3.5 mm size oled display for displaying expression or the robot would be installed.

2. SERVO MOTOR: - to move the display according the expression and to move camera according the user need.

3. TANK WHEEL: - this type of wheel can take more load and best suitable for the harsh road.

4. HEAVY MOTOR: - 12 dc geared motor for the heavy torque is need to give a good force whenever the wheel get stuck somewhere.

#. IMPROVEMENT IN FEATURES:

1. We are going to make it more interactive by using more expressive sound which when a user hear feels that it is more like a friend and a like family member, we also going to add more question so it can ask when it may require to be asked.

2. We are going to add expression on display so it can give expression like happy, sad, angry and laughing etc. so when a user shouts, or say good bye it can express about itself.

3. There it's going to be additional component so structural changes are going to happen also we are going to make movable when user want using servo motor.

4. Heavier wheel is going to be inserted to lift heavy load and also to manage movement in harsh area like uneven roads and area like mountainous etc.

5. Heavy motor of 12v dc are going to be installed in this project and it will be help full in giving our project a heavy torque so it would not stuck anywhere in harsh surface , road or anywhere.

6. Connective through internet and data stores on server is going to improve so one can store same data on server if requires and no additional storage needed to add in the project itself, in this manner data will be more safe and user no need to worry about the storage space.

7. The user interface is also going to improve so user of less knowledge of robotics can use it very easily. It will be made interactive more user-friendly etc.

CHAPTER 6

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