AISSMS
INSTITUTE OF INFORMATION TECHNOLOGY
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A
PROJECT REPORT ON

"SOLAR BASED GRASS CUTTING ROBOT"

SUBMITTED TO THE SAVITRIBAI PHULE PUNE UNIVERSITY,
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THE DEGREE
OF
BACHELOR OF ENGINEERING IN

ELECTRONICS AND TELECOMMUNICATION
BY

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UNDER THE GUIDANCE OF

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AISSMS INSTITUTE OF INFORMATION TECHNOLOGY, PUNE
ACADEMIC YEAR: 2020-21

CERTIFICATE

This is to certify that Project Report entitled

"SOLAR BASED GRASS CUTTING ROBOT"

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is the record of bonafide work carried out by them in partial fulfillment of the requirement for the award of the Degree of **Bachelor of Engineering (Electronics and Telecommunication),** as prescribed by the Savitribai Phule Pune University in the Academic Year 2020-2021.

This project report has not been earlier submitted to any other Institute or University for the award of any degree or diploma.

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Lastly, I am thankful to those who have directly or indirectly supported our work.

Sign	Sign	Sign
Shravan N Deshpande	**Aahan N Devadiga**	**Nikhil B Kuhike**

ABSTRACT

Now a days we are facing the problems like pollution,power cut problems etc., in order to avoid or overcome this problem we have planned to make a device which does not face such problems, so we have thought about the device which can perform its function without causing any problem ,so we have decided to make a project on solar based grass cutting Robot ,this project uses the renewable energy source, because of power storage for its operation, here we are using solar energy ,the aim of our project to develop portable fully automated solar based grass cutter. Solar panel is connected to the battery then by connecting the node MCU.It will provide the supply for DC motor,It consist of cutting blades on its shaft during ON condition,shaft will rotate due to this grass will cut with the help of blades connected to the shaft ,this project will help in building eco-friendly system current technology commonly used for cutting the grass is by the manually handled device, in this project we are using digital technology by using an android app, so in this project we are trying to make a robot vehicle which is able to cut the grass cutter in lawn and small farm etc. the all over system will have fully automated and manual work for guidance and other obstacle detection,obstacle will be detectedt by the help of ultrasonic sensor.

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LIST OF ABRREVIATIONS

GPS	**Global Positioning System**
DC	**Direct Current**
BLDC	**Brushless Direct Current Motor**
PCB	**Printed Circuit Board**
IDE	**Integrated Developement Environment**
IC	**Integrated Circuit**

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1. INTRODUCTION

1.1.1 Due to the continuous increase in the cost of fuels like petrol diesel and the effect of emission of gases from the burnt fuel into the atmosphere, this necessitated the use of the abundant solar energy from the sun as a source of power to drive a Grass Cutter.

That time is not far when all energy sources will be consumed so alternative sources can be utilized such as solar energy to avoid an energy crisis in the future. A solar panel contains cells and designed to produce electricity by capturing sunlight and does not make any pollution like fossil fuels and nuclear energy. Solar grass cutting robots are convenient to cut grass and cost-effective because of cordless electric mowers and cutter powered of solar that lasts a long time and have low running costs.

A solar powered Grass Cutter was designed and developed, based on the general principle of mowing. The designed solar powered Grass Cutter comprises of direct current (D.C) motor,IP Camera for live streaming,GPS for location tracking, a rechargeable battery, solar panel, a stainless steel blade and a Android application to control the entire system. Cutting is done by the BLDC motor which provides the required torque needed to drive the stainless steel blade.

It is a Android controlled solar grass cutter controlled by android application installed on Smartphone. This project is made of four wheel robotic vehicle driven by four separate DC motors. At the front side of robot grass cutting mechanism drove by high rpm BLDC motor. As a roof to this robot solar panel is mounted at top. On chassis PCB and battery is mounted. This robots motion forward, backward, left turn, right turn and grass cutter on/off is controlled by android application.

We have implemented two modes in this project,i.e Automatic mode and manual mode.In automatic mode ,first we need to set checkpoints according to that it will operate automatically.Ultrasonic sensors are used to detect obstacles, if any obstacle is found in front of the robot while traveling; it avoids the barrier by taking a right/right turn or stop automatically, thereby preventing the collision.In manual mode we need to operate the grass cutting robot manually by using and android application.

The sun provides sustainable amount of the energy used for various purposes on earth for atmospheric system. The difference is just the application of the energy source. It is assumed that a Grass Cutter using solar as the energy source will address a number of issues that the standard internal combustion engine and electric motors lawn mowers do not.

A Grass Cutter with solar energy will be easier to use, it eliminates down time by frequent trips to the gas station for fill-ups and danger associated with gasoline spillage. The dangerous emissions generated by the gasoline spillage and that of the internal combustion engine into the atmosphere are eliminated. The solar powered Grass Cutter will help to reduce air pollution. Thus solar grass cutter is used.

The experimental results prove that the proposed work has all in one capability (Simple grass cutting with mobile-application, obstacle detection,Live Streaming,GPS Location), is very easy to use, and can be easily assembled in a simple hardware circuit.The system proposed can be implemented on a large scale under real conditions in the future, which will be useful in robotics applications and cutting grass in playing grounds such as cricket, football, and hockey, etc.

2. LITERATURE REVIEW

Pratik Patil, Ashwini Bhosale, Prof. Sheetal Jagtap has explained how to extend the design of currently used lawn mowers and to improve the capabilities of standard robotic lawn mowers as well as assuring cost efficiency.This self-propelling lawn mower design is comprised of remote control and autonomous capability that is user friendly so most consumers will be able to use this device. It is safe to use, as well as efficient because it electric powered and cordless. With these objectives mentioned, the paper says that the self-propelling electric robotic lawn mower is environmentally friendly. **[1]**

G. Newstadt, K. Green, D. Anderson, M. Lang, Y. Morton, and J. McCollum has explained A Global Positioning System (GPS) assisted autonomous lawnmower was researched by Newstadt et al. in order to develop a hybrid and potent lawn mower. The system is made up of the following components: modified differential global positioning receiver and chassis system, wheel encoder, advance control system, digital compass and safety system. Coupled with these are acoustic sensors and laser systems for obstacle detection. The path planning was achieved through control software via remote base station for examining purposes. **[2]**

A. Dipin, and T. K .Chandrashekhar has explained a robotic lawn mower powered by solar energy which is based on microcontroller and sensor mechanism. The machine utilises ultrasonic sensor for obstacle detection, humidity sensor for examining the humid condition of the grasses with the lawn. Human intervention on the machine is tracked by passive infrared sensor and images are captured via Android Smart phone. The objective of the design is targeted toward environmental sustainability compare to the conventional environmentally hazardous oil powered counterparts. The system is fashioned on a mobile robotic which gives information via a computer using a zigbee module. A GUI (Graphical User Interface) has been integrated in MATLAB for deciding the cutting arrangement of the lawn by the operator.**[3]**

2.1 SUMMARY OF LITERATURE SURVEY

2.1.1 Existing System:-

The grass cutter usually operates with the help of fuels (diesel). The pesticide sprayer, alphabet printer, grass cutter are available as separate machines. Mostly the machines are manually operated or remote controlled.

2.1.2 Disadvantages of existing system:-

- It causes noise and air pollution.
- Cost is high.
- Large Space Required
- Heavy weight machines.
- May cause injuries to the operators.
- Time consuming.
- Manual operation or remote controlled.

2.2 Proposed System:-

In our proposed system,It is a combination of automatic and manual solar powered grass cutter which is incorporated with ultrasonic sensor for object detection and avoidance mechanism, Motor is used for movement purpose to move front and back. IP camera is used for live streaming over wi-fi and GPS for location tracking, and an Android application to manually control the grass cutting robot.

2.2.1 Advantages of the proposed system:-

- Light weight.
- Easy to carry.
- Requires very less human intervention.
- Less noisy.
- Pollution free.
- Compact in size.
- Cheaper in cost.

3. AIM AND OBJECTIVES

3.1. AIM :

The aim of the project is to design a solar based automatic and manually operated grass cutting machine using an Android application.

3.2. OBJECTIVES :

To design and construct the automated grass cutting robotic vehicle powered by solar energy which avoids obstacles automatically.The project is powered by solar energy hence the consumption of fossil fuel is reduced.

Another objective is that the automatic lawn cutter has to differentiate between grass and concrete while monitoring its surroundings continuously.The system uses 12V batteries to power the vehicle movement motors as well as the grass cutter motor. The system uses a solar panel to charge the battery and also an externally charging slot. Also,The system is implemented with IP camera for live streaming over wi-fi on android application and GPS for tracking location of the robot.

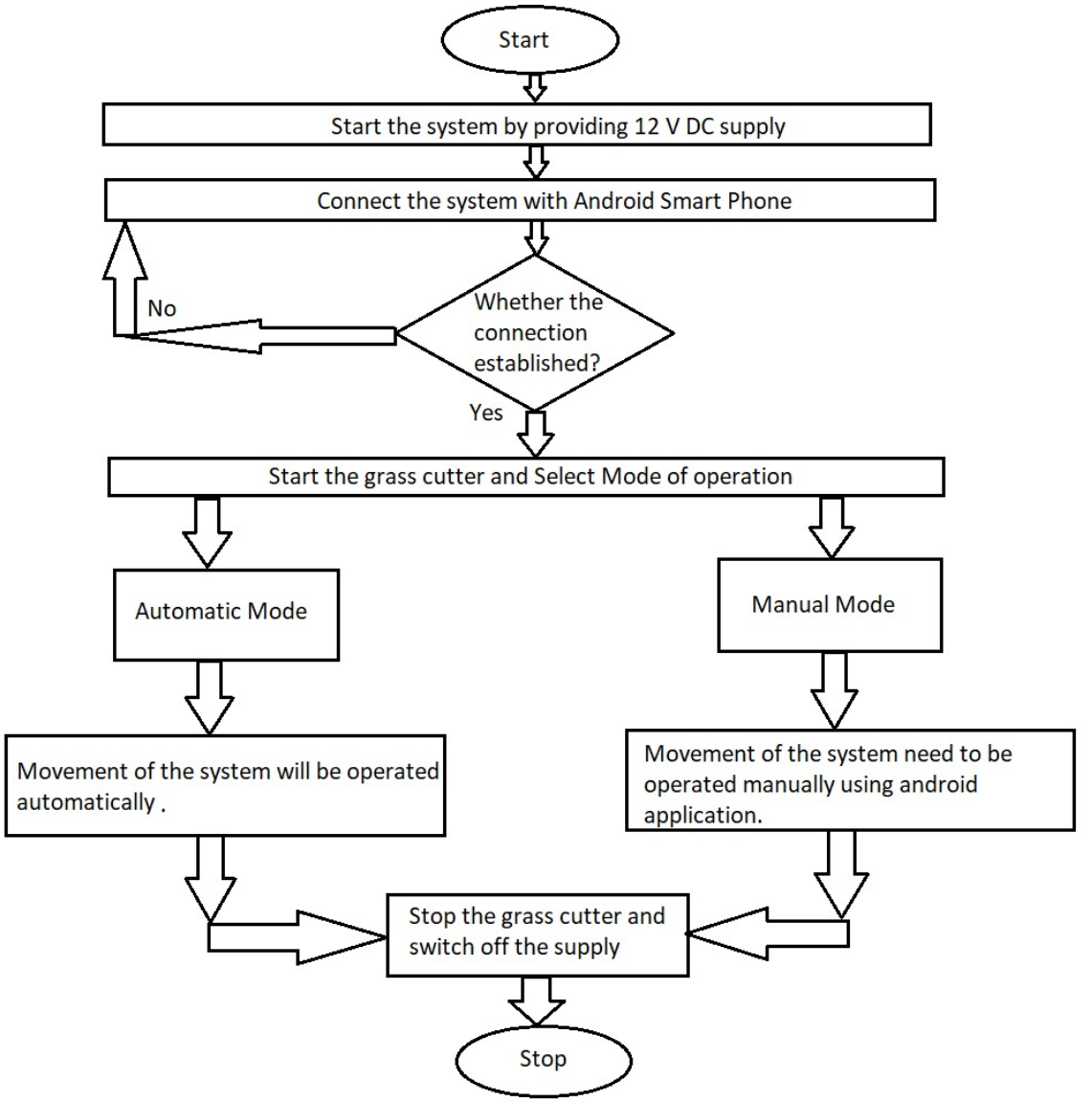
To control this robotic vehicle by an android application installed on Smartphone.It Consists of two modes i.e automatic and manual.Automatic mode is specially designed to achieve our objective i.e to avoid human interaction.

4. SPECIFICATIONS OF THE SYSTEM

Our system is divided into two parts.Hardware and Software.Hardware section comprises of direct current (D.C) motor,IP Camera for live streaming,GPS for location tracking, a rechargeable battery, solar panel, a stainless steel blade.Cutting is done by the BLDC motor which provides the required torque needed to drive the stainless steel blade.This project is made of four wheel robotic vehicle driven by four separate DC motors. At the front side of robot grass cutting mechanism drove by high rpm BLDC motor. At the roof of this robot,solar panel is mounted. On chassis PCB and battery is mounted. This robot moves forward, backward, left, right and grass cutter on/off is controlled by an android application.

Software section consist of an Android application to control the grass cutter.We have implemented two modes in this application,i.e Automatic mode and manual mode.Ultrasonic sensors are used to detect obstacles, if any obstacle is found in front of the robot while traveling; it avoids the barrier by taking a left/right turn or stop automatically, thereby preventing the collision.In manual mode we need to operate the grass cutting robot manually by using and android application.

5 . METHODOLOGY



Our project grass cutting robot is basically divided in two parts :
i.e Hardware and Software .

[1] First we have to start motor by giving 12V DC supply

[2] Then we have to establish connection over wifi with an android application.

[3] The we have to select mode of operation,here we have provided two modes i.e Automatic and Manual

[4] In Automatic mode,system will work automatically by detecting obstacles and operate accroding to it,If any obstacle found in front of the robot,it will avoid the barrier by taking appropriate turn.

[5] In Manual mode,we need to operate the system manually by using an android application.

6. HARDWARE

6.1 BLOCK DIAGRAM OF THE SYSTEM

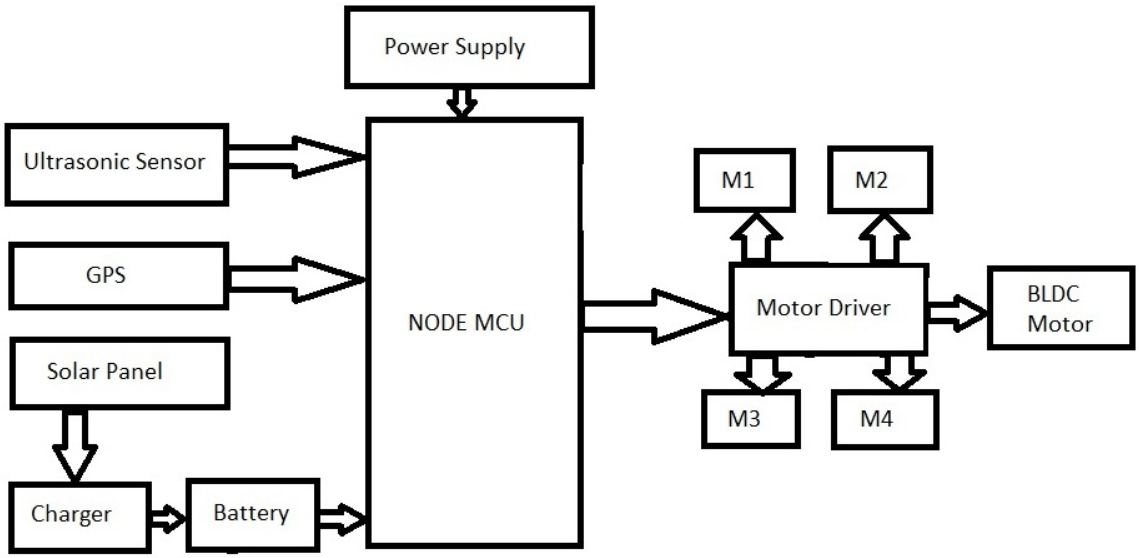


Fig 5.2: Block Diagram of System

6.2 COMPONENTS:-

6.2.1 Solar Panels:-

The solar panel are used to generate electrical power. The photo voltaic effect can be observed in nature the variety of material that have shown that the best performance instant light is the semiconductor as stated above when photon from the sun are absorbed in a semiconductor that create free electron with higher energy

Specifications :

- 12V, 6.5 W
- Weight - 10g
- Work Time - 5hrs

Fig6.2.1: ERH Solar Panel

6.2.2 Battery:-

The energy from the solar panel stored in batteries. The battery are used as a storage device for solar energy, Solar cell modules produce electricity only when the sun is shining they do not store energy it is necessary to store some of energy produced the most obvious solution is used batteries which chemically store electrical energy.

Specifications :

- 12V ,Lithium 1.3 Ah
- High Efficiency
- Low pollution

Fig 6.2.2:-Battery

6.2.3 Ultrasonic Sensor:-

In this project ultrasonic sensor is used to sense the obstacle if there is any, in front of the moving lawn cutter. If in case obstacle is detected by the sensor then the microcontroller stops the motors so as to avoid any damage to the object/human/animal coming.

Fig 6.2.3: Ultrasonic Sensor

Specifications :

- Power Supply: 3.3V – 5V
- Operating Current: 8mA
- Ranging Distance : 3cm – 350cm/3.5m

6.2.4 NodeMCU:-

Node MCU is based on ESP8266 NodeMCU development board which is a true plug-and-play solution for IOT projects. Node MCU is an open source IoT platform and runs on the ESP8266 Wi-Fi SoC from Espressif Systems. The term "Node MCU" by default refers to the firmware rather than the dev kits. ESP8266 Core for the Arduino IDE can be used if you would like to program your Node MCU from the Arduino IDE

Specifications :

- Microcontroller: Tensilica
- 32-bit RISC CPU Xtensa LX106
- Operating Voltage: 3.3V

Fig 6.2.4: Node MCU

6.2.5 DC Motor:- DC motors are compact and display high output, and their speed is easy to control. They may be driven by battery or any other power supply and are therefore easy to use. This motor used to drive the wheels of the robot.In this,We have used 4 DC motors for 4 wheels.2 L293D motor driver is used to drive four motors.

Specifications :

- 12V & 200 RPM
- Speed: 200rpm.
- Power: 8W

Fig 6.2.5:DC Motor

6.2.6 BLDC Motor:-

We have used a BLDC motor to cut the grass.BLDC motor can operate at high-speed under any condition.There is no sparking and much less noise during operation.BLDC motors do not have brushes which make it more reliable, high life expectancies, and maintenance free operation.

Specifications :

- Maximum Efficiency - 80%
- Current Handling Capacity (A) - 12V

Fig 6.2.6: BLDC Motor

6.2.7 L293D Motor Driver:-

L293D is a typical Motor driver or Motor Driver IC which allows DC motor to drive on either direction. L293D is a 16-pin IC which can control a set of two DC motors simultaneously in any direction. It means that you can control two DC motor with a single L293D IC.

Specifications:

- Supply-Voltage Range: 4.5 V to 36 V.
- 36V Output current capability per driver

Fig 6.2.7: L293D Motor Driver

6.2.8 Sim28M GPS Module:-

SIM28M presents a high performance and reliable assisted GPS module with lowest power consumption.

Specifications-

- Support EASYTM self-generated orbit prediction
- Supports serial interface and UART
- Max. update rate- 10Hz

Fig 6.2.8 : Sim28 GPS Module

6.3 Circuit Level Design:-

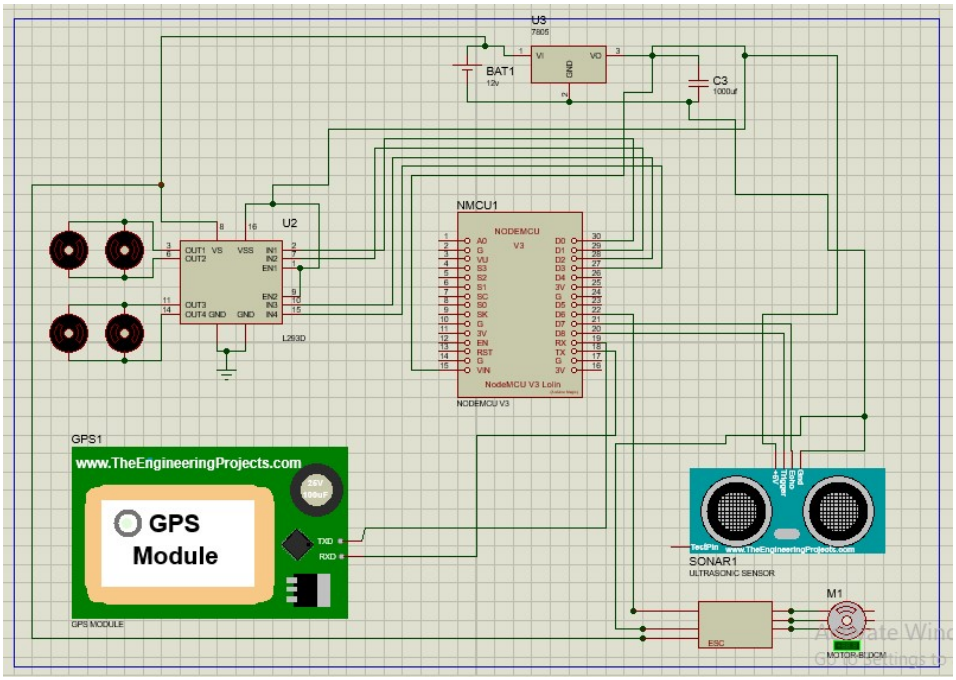


Fig 6.3: Circuit Level Design

6.4 PCB Design:-

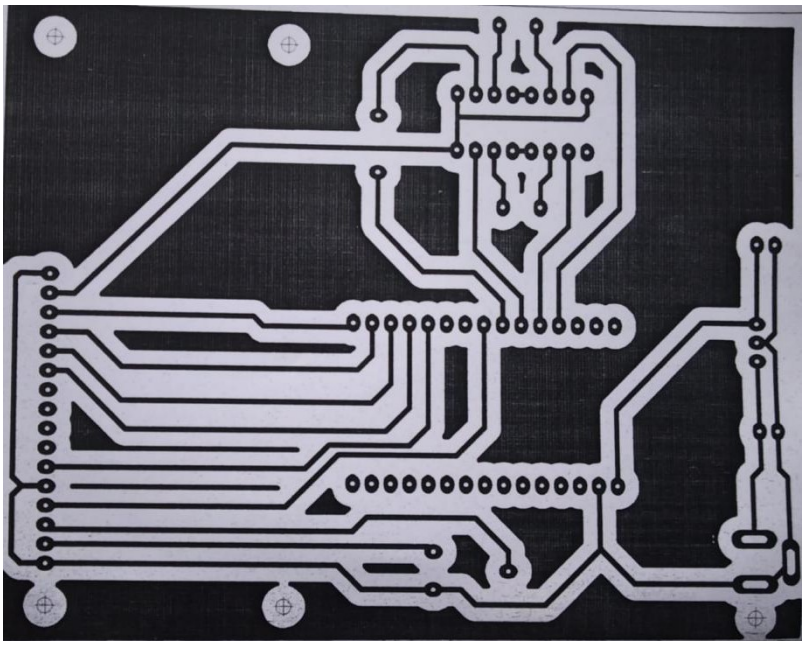


Fig 6.4 : PCB Design

7. SOFTWARE

7.1 APP USER INTERFACE

APP SPECIFICATIONS

- **Two Modes :-**
1) **Automatic**
2) **Manual**

- **Forward,Backward Button**
- **Left,Right Button**
- **Motor ON/OFF Button**
- **IP Address Text Box-To get Location**
- **Robot ON/OFF Button**

7.1.1 Android Mobile Application

MIT App Inventor is a visual programming drag and drops platform for designing and development of fully functional android mobile application. App Inventor's user interface is consists of two parts: a Designer for selecting the components of the app and a BlocksEditor for setting the operations and working for the application. App Inventor's building blocks are simple user interface contains elements such as buttons, labels, list pickers, images, etc., linked with the mobile device's features (Bluetooth, texting, GPS, etc.) Therefore, the fundamental structures of this drag and drop enabled app developer to efficiently manage the functionalities of this portable, touch-enabled sensing devices.By concentrating on the device's services, App Inventor presents an automatic programming metaphor.

7.2 OPERATING INSTRUCTIONS

7.2.1 APP Methodology :

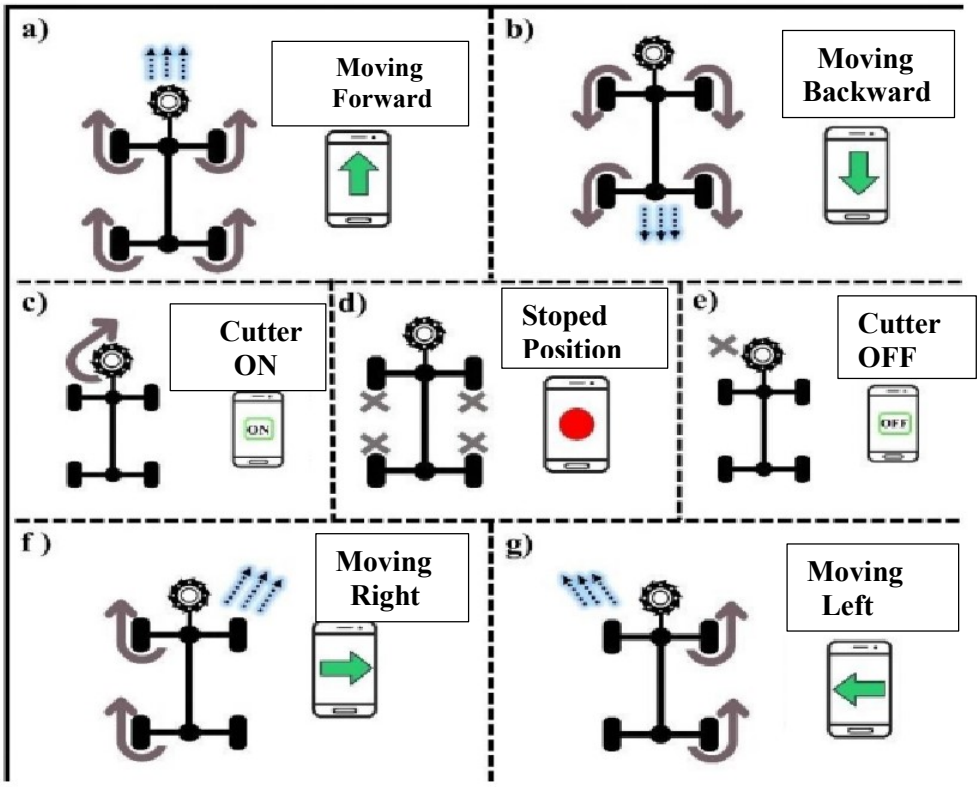


Fig 7.2.1: App Methodology

7.2.2 Working of An APP :

Figure a)represents the main idea of communication and motors movement. When the user presses the Forward touch button all the four wheels of motors will rotate forward and the grass cutter will move in the forward direction which can be easily seen in the fig.

Figure b) illustrates the case when the user presses the Backward touch arrow button all the four wheels of motors will rotate backward, and the grass cutting robot moves in the backward direction.

In Figure c), the user pressed the ON touch button to switch ON the cutter, and none of the wheels of motors will rotate, only cutter motor will rotate.

When the user presses the STOP touch button as to stop the robot; all the four wheels will stop moving as shown in **Figure d)**

When the user pressed the OFF touch button as to turn OFF the cutter, and the cutter motor will stop rotating as illustrated in **Figure e)**.

In Figure f, when the user pressed the Right arrow touch button to turn Right, left diagonal motors (front left and back left motors) will rotate forward, and the grass cutter moves in the right direction. Similarly,when the user pressed the Left arrow touch button to take Left turn, so the right diagonal motors (front right and back right motors) will rotate forward and the grass cutter will moves in the left direction, as represented in fig.

7.3 CODE FOR THE PROGRAM :

[1] Software Name : Arduino IDE
[2] Language Used : Embedded C language

```
#include <ESP8266WiFi.h>
#include <SoftwareSerial.h>
#include <TinyGPS.h>

TinyGPS gps;
#include <Servo.h>
// Enter your wifi network name and Wifi Password
const char* ssid = "IDLE";
const char* password = "";
Servo ESC;
// Set web server port number to 80
WiFiServer server(80);
int mod=0;
// Variable to store the HTTP request
String header;

// These variables store current output state of LED

SoftwareSerial sgps(D5, D4);//(D2)5==tx,(D1)4==rx
String outputm1State = "off";
String outputm2State = "off";
String outputm3State = "off";
String outputm4State = "off";
String outputmotorState = "off";
// Assign output variables to GPIO pins
int cm=0;
const int m1= D8;
const int m2= D7;
const int m3= D6;
const int m4= D2;
const int motor=D3;
int trigPin = D0;
int echoPin = D1;
// Current time
unsigned long currentTime = millis();
// Previous time
unsigned long previousTime = 0;
// Define timeout time in milliseconds (example: 2000ms = 2s)
const long timeoutTime = 2000;


void manl()
{
  WiFiClient client = server.available(); // Listen for incoming clients
```

```
if (client) { // If a new client connects,
Serial.println("New Client."); // print a message out in the serial port
String currentLine = ""; // make a String to hold incoming data from the client
currentTime = millis();
previousTime = currentTime;
while (client.connected() && currentTime - previousTime <= timeoutTime) { // loop while the client's connected
currentTime = millis();
if (client.available()) { // if there's bytes to read from the client,
char c = client.read(); // read a byte, then
Serial.write(c); // print it out the serial monitor
header += c;
if (c == '\n') { // if the byte is a newline character
// if the current line is blank, you got two newline characters in a row.
// that's the end of the client HTTP request, so send a response:
if (currentLine.length() == 0) {
// HTTP headers always start with a response code (e.g. HTTP/1.1 200 OK)
// and a content-type so the client knows what's coming, then a blank line:
client.println("HTTP/1.1 200 OK");
client.println("Content-type:text/html");
client.println("Connection: close");
client.println();

// turns the GPIOs on and off
if (header.indexOf("GET /D0/on") >= 0) {
Serial.println("m1 is on");
outputm1State = "on";
fwd();
} else if (header.indexOf("GET /D0/off") >= 0) {
Serial.println("m1 is off");
outputm1State = "off";
stp();
} else if (header.indexOf("GET /D1/on") >= 0) {
Serial.println("m2 is on");
outputm2State = "on";
rvd();
} else if (header.indexOf("GET /D1/off") >= 0) {
Serial.println("m2 is off");
outputm2State = "off";
stp();
} else if (header.indexOf("GET /D2/on") >= 0) {
Serial.println("m3 is on");
outputm3State = "on";
left();
} else if (header.indexOf("GET /D2/off") >= 0) {
Serial.println("m3 is off");
outputm3State = "off";
stp();
}else if (header.indexOf("GET /D3/on") >= 0) {
Serial.println("m4 is on");
```

```
outputm4State = "on";
right();
} else if (header.indexOf("GET /D3/off") >= 0) {
Serial.println("m4 is off");
outputm4State = "off";
stp();
}else if (header.indexOf("GET /D4/on") >= 0) {
Serial.println("motor is on");
outputmotorState = "on";
digitalWrite(motor, HIGH);
} else if (header.indexOf("GET /D4/off") >= 0) {
Serial.println("motor is off");
outputmotorState = "off";
digitalWrite(motor, LOW);
}
// Display the HTML web page
client.println("<!DOCTYPE html><html>");
client.println("<head><meta name=\"viewport\" content=\"width=device-width, initial-scale=1\">");
client.println("<link rel=\"icon\" href=\"data:,\">");
// CSS to style the on/off buttons
client.println("<style>html { font-family: Helvetica; display: inline-block; margin: 0px auto; text-align: center;}");
client.println(".buttonm1 { background-color: #ff0000; border: none; color: white; padding: 16px 40px; border-radius: 60%;");
client.println("text-decoration: none; font-size: 30px; margin: 2px; cursor: pointer;}");
client.println(".buttonm2 { background-color: #ff0000; border: none; color: white; padding: 16px 40px; border-radius: 60%;");
client.println("text-decoration: none; font-size: 30px; margin: 2px; cursor: pointer;}");
client.println(".buttonm3 { background-color: #ff0000; border: none; color: white; padding: 16px 40px; border-radius: 60%;");
client.println("text-decoration: none; font-size: 30px; margin: 2px; cursor: pointer;}");
client.println(".buttonm4 { background-color: #ff0000; border: none; color: white; padding: 16px 40px; border-radius: 60%;");
client.println("text-decoration: none; font-size: 30px; margin: 2px; cursor: pointer;}");
client.println(".buttonmotor { background-color: #ff0000; border: none; color: white; padding: 16px 40px; border-radius: 60%;");
client.println("text-decoration: none; font-size: 30px; margin: 2px; cursor: pointer;}");
client.println(".buttonOff { background-color: #77878A; border: none; color: white; padding: 16px 40px; border-radius: 70%;");
client.println("text-decoration: none; font-size: 30px; margin: 2px; cursor: pointer;}</style></head>");

// Web Page Heading
client.println("<body><h1>GrassCutter Server</h1>");

// Display current state, and ON/OFF buttons for GPIO 2 Red LED
client.println("<p>Direction " + outputm1State + "</p>");
// If the outputRedState is off, it displays the OFF button
if (outputm1State=="off") {
client.println("<p><a href=\"/D0/on\"><button class=\"button buttonOff\">STOP</button></a></p>");
} else {
client.println("<p><a href=\"/D0/off\"><button class=\"button buttonm1\">Forward</button></a></p>");
```

```
}

// Display current state, and ON/OFF buttons for GPIO 4 Green LED
client.println("<p>Direction  " + outputm2State + "</p>");
// If the outputGreenState is off, it displays the OFF button
if (outputm2State =="off") {
client.println("<p><a href=\"/D1/on\"><button class=\"button buttonOff\">STOP</button></a></p>");
} else {
client.println("<p><a href=\"/D1/off\"><button class=\"button buttonm1\">Reverse</button></a></p>");
}
client.println("</body></html>");

// Display current state, and ON/OFF buttons for GPIO 5 Yellow LED
client.println("<p>Direction " + outputm3State + "</p>");
// If the outputYellowState is off, it displays the OFF button
if (outputm3State =="off") {
client.println("<p><a href=\"/D2/on\"><button class=\"button buttonOff\">STOP</button></a></p>");
} else {
client.println("<p><a href=\"/D2/off\"><button class=\"button buttonm3\">Left</button></a></p>");
}
client.println("</body></html>");


// Display current state, and ON/OFF buttons for GPIO 4 Green LED
client.println("<p>Direction  " + outputm4State + "</p>");
// If the outputGreenState is off, it displays the OFF button
if (outputm4State =="off") {
client.println("<p><a href=\"/D3/on\"><button class=\"button buttonOff\">STOP</button></a></p>");
} else {
client.println("<p><a href=\"/D3/off\"><button class=\"button buttonm4\">Right</button></a></p>");
}
client.println("</body></html>");

// Display current state, and ON/OFF buttons for GPIO 5 Yellow LED
client.println("<p>Direction  " + outputmotorState + "</p>");
// If the outputYellowState is off, it displays the OFF button
if (outputmotorState =="off") {
client.println("<p><a href=\"/D4/on\"><button class=\"button buttonOff\">STOP</button></a></p>");
} else {
client.println("<p><a href=\"/D4/off\"><button class=\"button buttonmotor\">ON</button></a></p>");
}
client.println("</body></html>");



// The HTTP response ends with another blank line
client.println();
// Break out of the while loop
break;
} else { // if you got a newline, then clear currentLine
currentLine = "";
```

```
}
} else if (c != '\r') { // if you got anything else but a carriage return character,
currentLine += c; // add it to the end of the currentLine
}
}
}
// Clear the header variable
header = "";
// Close the connection
client.stop();
Serial.println("Client disconnected.");
Serial.println("");
}
}

void aut()
{
  ultra1();
  if(cm<15)
  {
    left();
    delay(3000);
  }
  fwd();
  delay(300);
}


void ultra1()
{
  long duration, distance;
  digitalWrite(trigPin, LOW);
  delayMicroseconds(2);
  digitalWrite(trigPin,HIGH);
  delayMicroseconds(10);
  digitalWrite(trigPin, LOW);
  duration=pulseIn(echoPin, HIGH);
  cm =(duration/2)/29.1;
  delay(10);

}


void fwd()
{
digitalWrite(m1, HIGH);
digitalWrite(m2, LOW);
digitalWrite(m3, HIGH);
digitalWrite(m4, LOW);
}
```

```
void stp()
{
digitalWrite(m1, LOW);
digitalWrite(m2, LOW);
digitalWrite(m3, LOW);
digitalWrite(m4, LOW);
}
void rvd()
{
digitalWrite(m2, HIGH);
digitalWrite(m1, LOW);
digitalWrite(m4, HIGH);
digitalWrite(m3, LOW);
}
void left()
{
digitalWrite(m1, HIGH);
digitalWrite(m2, LOW);
digitalWrite(m3, LOW);
digitalWrite(m4, HIGH);
}
void right()
{
digitalWrite(m1, LOW);
digitalWrite(m2, HIGH);
digitalWrite(m3, HIGH);
digitalWrite(m4, LOW);
}
void mon()
{
ESC.write(100);
}
void mof()
{
ESC.write(0);
}

void gpss()
{
while (sgps.available())
 {
   int c = sgps.read();
   if (gps.encode(c))
   {
float slat,slon,b,a;
     gps.f_get_position(&slat, &slon);
     Serial.print("Latitude :");
      a=(slat);
     Serial.println(a);
    // a=slat, 6);
     Serial.print("Longitude:");
```

```
    b=(slon);
    Serial.println(b);
   }
  }
}
void setup()
{
Serial.begin(115200);
// Initialize the output variables as outputs
pinMode(trigPin, OUTPUT);
pinMode(echoPin, INPUT);
ESC.attach(motor); // (pin, min pulse
pinMode(m1,OUTPUT);
pinMode(m2,OUTPUT);
pinMode(m3,OUTPUT);
pinMode(m4,OUTPUT);
pinMode(motor,OUTPUT);
pinMode(D4,INPUT_PULLUP);



digitalWrite(m1, LOW);
digitalWrite(m2, LOW);
digitalWrite(m3, LOW);
digitalWrite(m4, LOW);
digitalWrite(motor, LOW);

// Connect to Wi-Fi network with SSID and password
Serial.print("Connecting to ");
Serial.println(ssid);
WiFi.begin(ssid, password);
while (WiFi.status() != WL_CONNECTED) {
delay(500);
Serial.print(".");
}

Serial.println("");
Serial.println("WiFi connected.");
Serial.println("IP address: ");
Serial.println(WiFi.localIP());
server.begin();
}



void loop()
{
 mod=digitalRead(D4);
if(mod)
{
  manl();
```

```
}
else
{
  aut();
  stp();
}
}
```

8. TEST RESULTS

The following results have made from this project:

- The device cuts the grass in short span of time and it is also time saving.
- Motors of the grass cutter are working efficiently.
- An ultrasonic sensor avoids obstacles and provides safety to the cutter.
- This device is more safe to handle than more manual bulky machines.
- The device requires human effort only to ON the robot and hence reduces the labor cost.
- This device reduces the risk of workers getting hurt while operating the manual operating grass cutter.

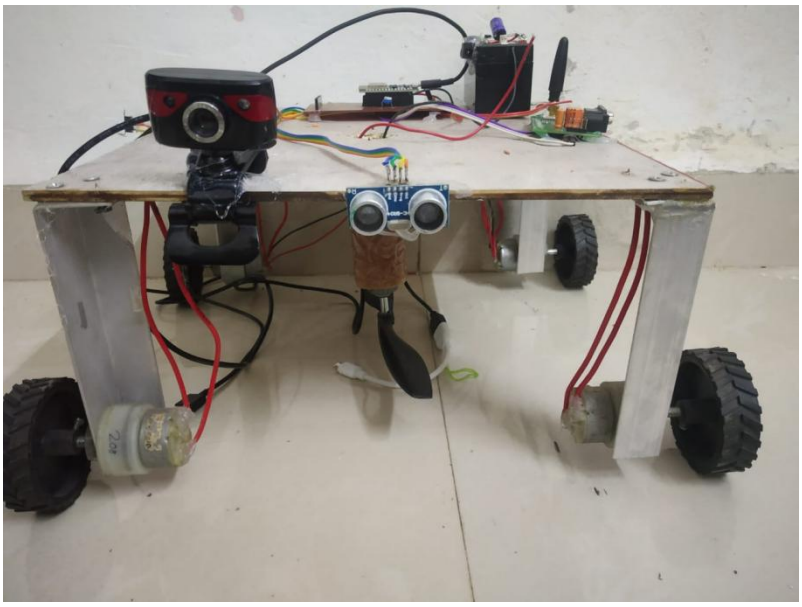


Fig 8.1: Final Design Of The Project

9. CONCLUSION AND FUTURE SCOPE

9.1 CONCLUSION :

Our project solar powered grass cutter is successfully completed and the results obtained are satisfactory. It will be easier for the people who are going to take the project for the further modifications.

This project is more suitable for a common man as it is having much more advantages i.e, no fuel cost, no pollution,less wear and tear because of less number of moving components and this can be operated by using solar energy.The project is presented with mainly two operational modes in which the system is using a mechanism of controlling the grass cutting robot based on touch arrow buttons (grass cutter moves similarly to the direction of the button presses).This system have capabilities to identify the obstacles in front of the grass cutting robot.

The project which we have done surely will reach to the average families, because the grass can be trimmed with minimum cost and with minimum time. Finally this project may give an inspiration to the people who can modify and can obtain better results.

9.2 FUTURE SCOPE :

- The project can be extended to provide proper turning after detection of objects and cut the grass present behind the object without taking an U-turn.
- The grass can be mowed to even heights and objects can be detected on both sides by using two ultrasonic sensors.
- Reduction of power consumption,Collection of fallen grass after cutting and efficient detection of objects can also be possible.

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