Smart solar grass cutter with lawn coverage

A PROJECT REPORT

Submitted by: Group No.: 11

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In fulfilment for the award of the degree
Of
BACHELOR OF ENGINEERING

In

Department of Electronics and Communication Engineering

C.K.Pithawalla College of Engineering and Technology

Surat

Gujarat Technological University

Ahmadabad

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Academic year
(2018)

GUJARAT TECHNOLOGICAL UNIVERSITY

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CERTIFICATE

This is to certify that Kapuriya Jasmin G.(150093111007),Kapadia Ammar I. (150093111005),Patel Parth H. (150093111012), Rangrej Shreya H.(140090111049) of BE Electronics & Communication Engineering have Successfully completed the Term-Work of Final year project (**"SMART SOLAR GRASS CUTTER WITH LAWN COVERAGE"**) offered during the academic year 2016,requisite to complete BE Engineering.

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This is to certify that the project entitled "SMART SOLAR GRASS CUTTER WITH LAWN COVERAGE" has been carried out by

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It gives us great pleasured and deep satisfaction in presenting this report of our project work as part of BE in Electronics and Communication Engineering Course, arranged in order to gain the practical knowledge in the system development. This times particularly WHAT to learn and how to learn have help us stepping into professional world as well as be a better person.

We are thankful to **Prof. Sharmila Rana** for providing us the knowledge for getting a better understanding of the project solving problem encounter. The encouragement and help received from our HOD **DR. Ninad S. Bhatt**.

During project implementation as well as project testing, for suggestion and helping us taking our decision and choosing, initiating and getting on with the project through their experience in project development. Last but not least, to **Our Faculty of E.C.C. Department** for providing us platform to represent the project.

THANK YOU VERY MUCH TO ALL.

ABSTRACT

A Solar grass cutter is a machine that used spiral BLDC to cut a lawn and as well as frame at a faster rate. Solar grass cutter as operate automatic and motor driven. Reel cutter of the grass cutter is given adjust height and distance. Power consumption becomes fundamental need for future. Solar grass cutter is a very useful device which is very easy and simple in construction. It is used to maintain and upkeep lawns in gardens, schools, college's, frames etc. We have made some changes in the existing machine to make its application easy and reliable at reduced cost. Our main aim to project on this topic is to pollution control and unskilled person can also operate easily and maintain the lawn very fine and uniform surface look. In our project, solar grass cutter is used to cut the different grasses for the different application and energy conversions.

LIST OF FIGURES

TABLE OF CONTENTS

Chapter no. Or name **Page no.**

CHAPTER 1: INTRODUCTION

1.1 Introduction:

The smart grass cutter system puts forth a completely automated lawn mover mechanism. The robotic vehicle is equipped with a grass cutter blade that allows for grass cutting at high RPM. The system has a smart functionality that allows it to cover the complete area of a lawn or garden by detecting corners using ultrasonic sensor and moving in a zigzag manner in order to cover the entire area. PIR sensor was chosen based on short range abilities.

This efficient system uses a microcontroller based circuit in order to achieve this functionality. It is a battery operated system that uses 2 batteries. One battery is used to run the vehicle movement DC motors and the other one is used to power the grass cutter motor. Also the system uses a solar panel to demonstrate the charging of vehicle movement battery. The microcontroller operates the vehicle movement dc motors as well as the grass cutter at the same time as monitor.

CHAPTER 2: LITERATURE REVIEW

2.1 Brief literature review and Prior Art Search (PAS):

2.1.1 A REVIEW OF SMART SOLAR GRASS CUTTER [1]

By using this system we can preserve the non-renewable sources of energy such as petrol, gasoline etc. We can also reduce various forms of pollutions such as air pollution and noise pollution. Electricity is saved as we utilize solar energy that is renewable source of energy and is present in abundance.

2.1.2 MODIFICATION OF SOLAR GRASS CUTTING MACHINE [2]

A Solar grass cutter is a machine that uses spiral roller blades to cut a lawn at a faster rate. Solar grass cutter can operate manually and motor driven. Reel cutter of the grass cutter is given adjustable height. Even more sophisticated devices are there in every field. Power consumption becomes essential for future. Solar grass cutter is a very useful device which is very simple in construction. It is used to maintain and upkeep lawns in gardens, schools, college's etc. We have made some changes in the existing machine to make its application easier at reduced cost. Our main aim in pollution control is attained through this .we added remote control for unskilled person can operate easily and maintain the lawn very fine and uniform surface look. In our project, solar grass cutter is used to cut the different grasses for the different application.

2.1.3 SOLAR BASED GRASS CUTTER [3]

From time immemorial, the sun has been the major source of energy for life on earth. The solar energy was being used directly for purposes like drying clothes, curing agricultural produce, preserving food articles, etc. Even today, the energy we originate from fuel-wood, petroleum, paraffin, hydroelectricity and even our food originates obliquely from sun. Solar energy is almost unbounded. The total energy we obtain from the sun far exceeds our energy demands. Ever since

the industrial revolutions human have been dependent on fuels, electricity and wind energy. For human enlargement in many countries there is study and trials are going on the solar energy and the wind energy, So we make our new concept solar powered grass cutting machine in these concept we cut grass s on the agricultural products or on small plants in lawns and gardens. Remote controlled grass cutter can be described as the application of Radio frequency to power a machine on which electric motor rotates which in turn rotates a blade which does the mowing of a grass.

2.1.4 SMART LAWN MOWER OF GRASS TRIMMINIG [4]

The present technology commonly used for trimming the grass is by using the manually handle device. In this project we have automated the machine for trimming the grass. The device consists of linear blade which is operated with the help of the motor the power supply for the motor is by using battery. The battery can be charge by using power supply and solar panel. In case of any obstacles in the path it is sensed by using an IR sensor. If there is any variation then the device using free direction sensor and find the new path to travel. The above feature is enabled so that the damage to the hardware of the device is avoided. In future the automation of the device will play a vital role in world wide.

2.1.5 SMART SOLAR GRASS CUTTER ROBOT FOR GRASS [5]

The present technology commonly used for trimming the grass is by using the manually handle device. In this project we have automated the machine for trimming the grass. The device consists of linear blade which is operated with the help of the motor the power supply for the motor is by using battery. The battery can be charge by using power supply and solar panel. In case of any obstacles in the path it is sensed by using an IR sensor. If there is any variation then the device using free direction sensor and find the new path to travel. The above feature is enabled so that the damage to the hardware of the device is avoided. In future the automation of the device will play a vital role in world wide.

2.1.6 SMART SOLAR GRASS CUTTER FOR LAWN COVERAGE [6]

The device with different combinations of technology this will helps to reduce the human effort and give maximum efficient output for the work. The device proves the possible replacement for the gasoline powered grass cutter. In order to enhance the beauty of home lawns and gardens, smart solar grass cutter device is the best option. People can easily maintain and gardens without any problem. Now days there

2.2 Work Plan:

7th semester	
JUNE	Deciding field planning & consulting with the field and guide.
JULY	Finding definition and we visited at different garden of our city frame and also visit collected that all data required for our project
AUGUST	Start learning and searching about project related work software.
SEPTEMBER	Learning on literature survey and study of component.
OCTOBER	Check feasibility of component and work on PMMS.
NOVEMBER	Work on ppt and report and hardware model.

8th semester	
JANUARY	Working on programming of soft software.
FEBRUARY	Learning script ultrasonic sensor, moisture sensor, humidity sensor Kinect sensor , DC motor
MARCH	REPORT and PPT making work.
APRIL	Completed project.

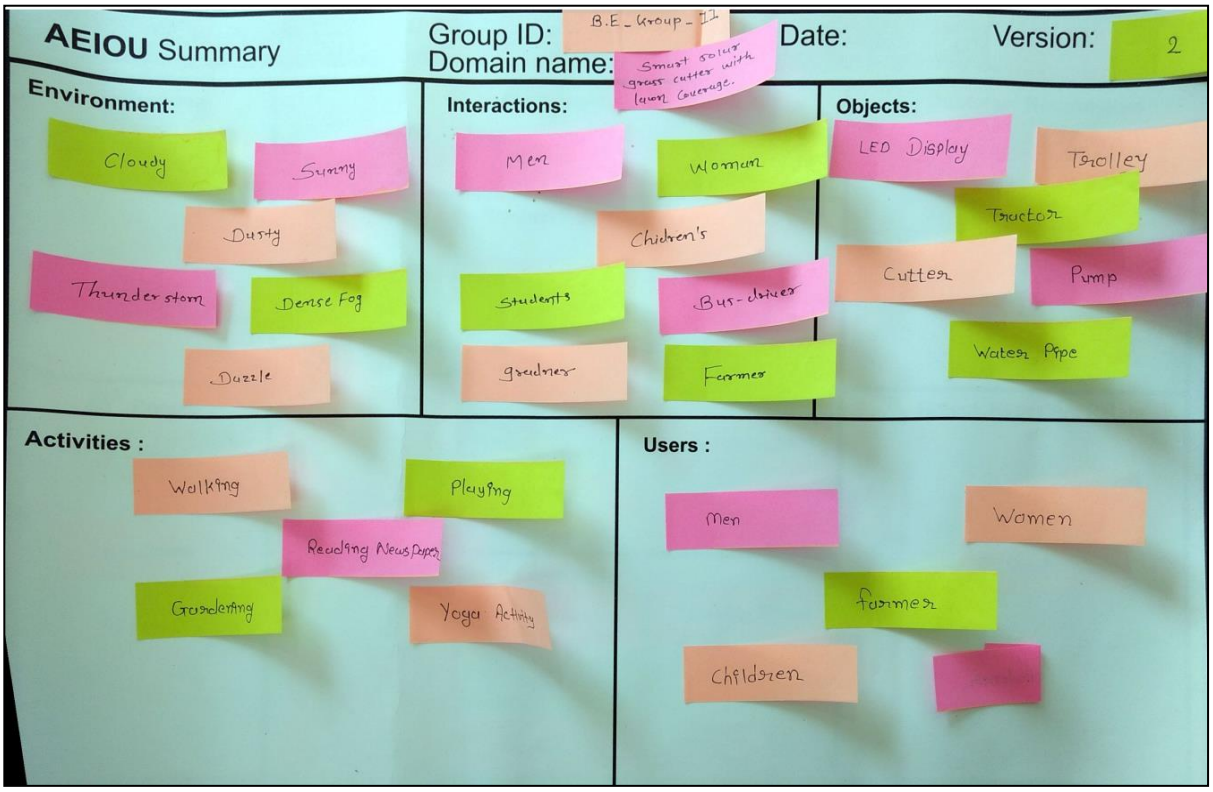
CHAPTER 3: Design- Analysis, Design Methodology and Implementation Strategy

3.1 AEIOU Sheet:

This AEIOU sheet is for the which environment relates to the dam area, which interactions occurs, which objects are used to do this activity and which users are related with this project. In the environment, cloudy, sunny, agriculture, rainy season, etc. Are included. The sunny and normal weather more suitable for our project and other are challenges for us.

In the object, which objects are related this project are introduced like LED Display, tractor, trolley, solar panel, cutter etc.The activity and interaction are as shown in figure.
The user of our project is framer, housewives, Gardner.

FIG.3.1 AEIOU SHEET



3.2 Ideation canvas:

In the ideation canvas, the person who is related with Gardeners and farmers are introduced. In the activity which activities are done for what we observe and what actually done are given? In the situation different situation are there. And in the props/possible solution different types of components are used and either using this component, we can use also different component.The some microcontroller also used.

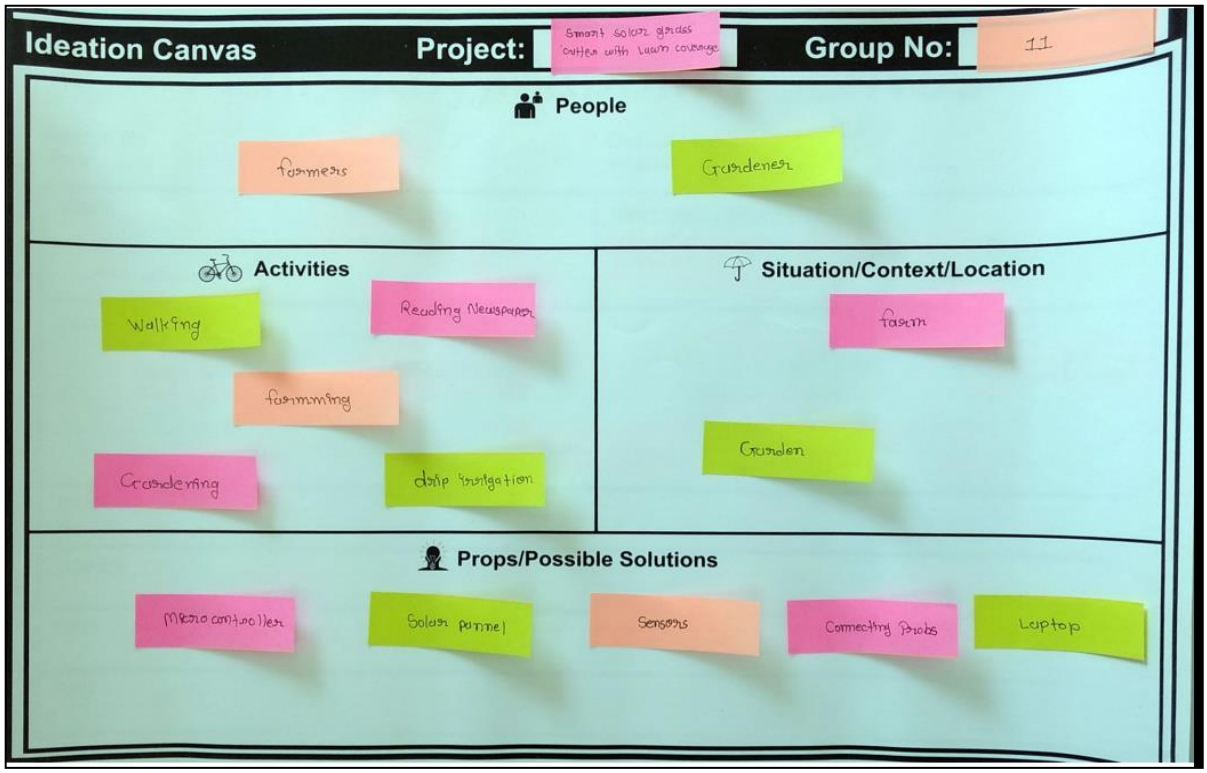


FIG.3.2 IDEATION CANVAS

3.3 Product Development canvas:

In the product development canvas, purpose for the whole system, product expense, which people is related, product function, product features, which components are used are introduced.

Purpose for this system is to reduce the man work and to increase the efficiency. Product expense is easy to operate because with the solar and microcontroller whole system is more reliable. Its maintenance is easy and its controlling is easy. People which are related to this is operators which operates the whole plant.

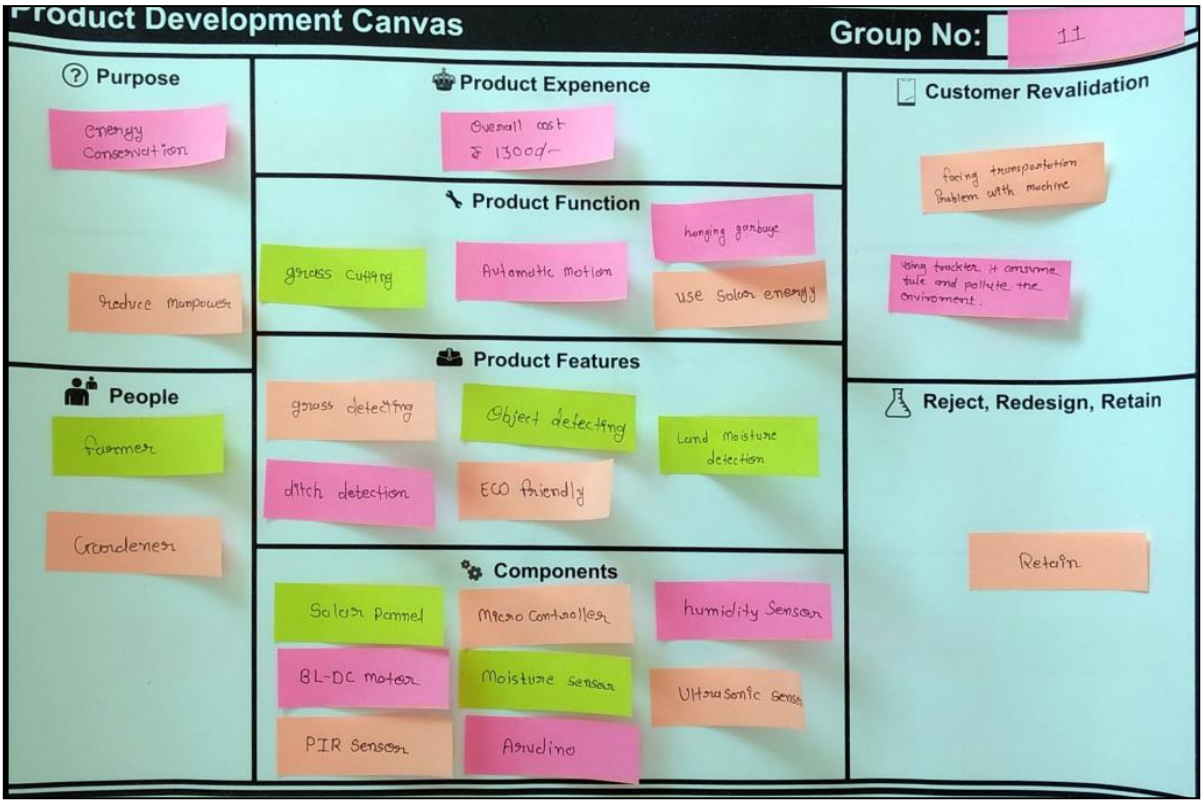


FIG.3.3 PRODUCT DEVELOPMENT CANVAS

3.4 Empathy mapping canvas

In the empathy mapping canvas users who is related to this, stakeholders for which area is related to this system, activities which is done for this area are introduced.

User like gardeners, Farmers are there. In the stakeholder's industrial area, cricket ground is there. Activities which are done are like monitoring, controlling, sensing of water level, supervising, and operating the whole area manually and automatically.

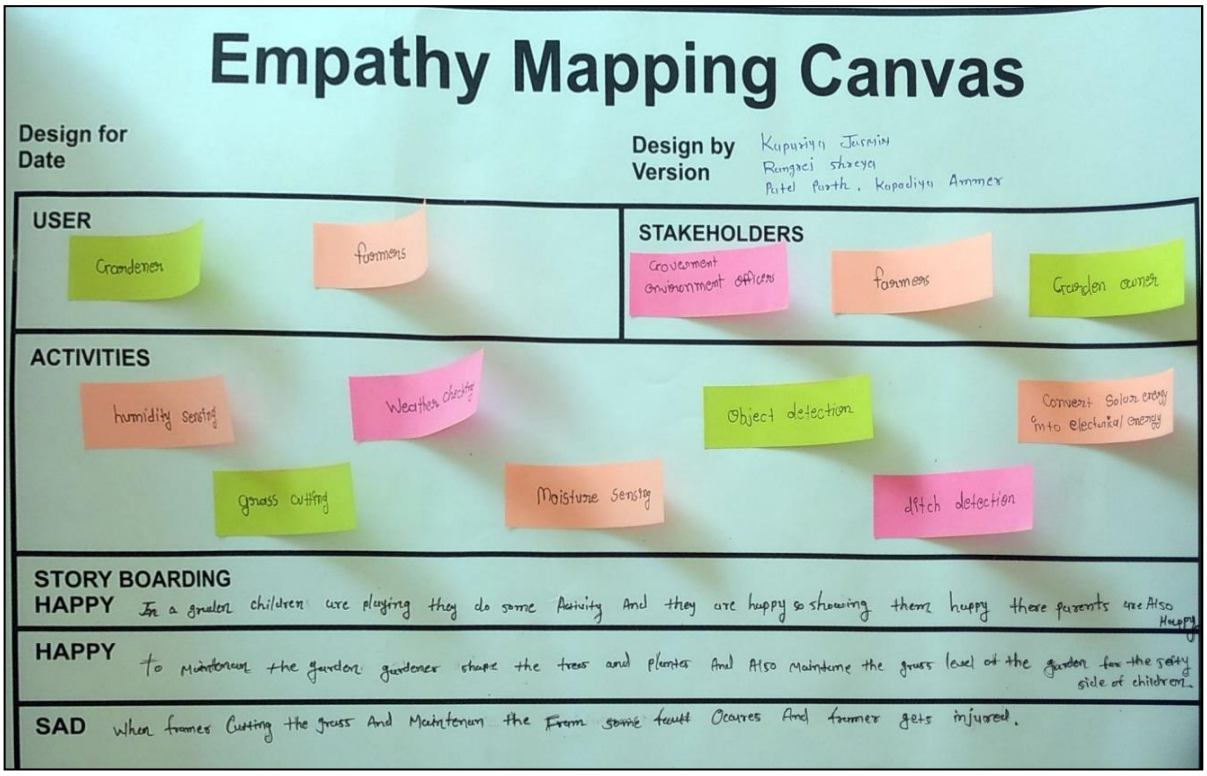


FIG.3.4 EMPATHY MAPPING CANVAS

3.5 Business model canvas

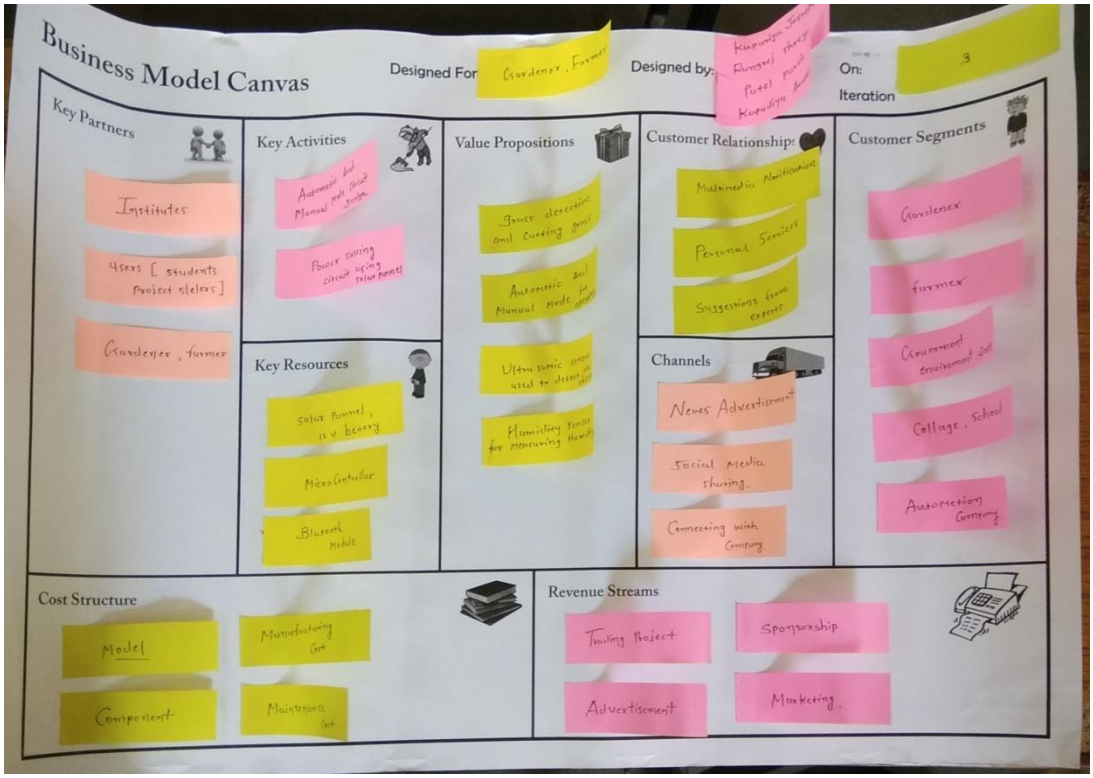


FIG.3.5 BUSSINESS MODEL CANVAS

CHAPTER 4: IMPLEMENTATION

4.1 Block diagram:

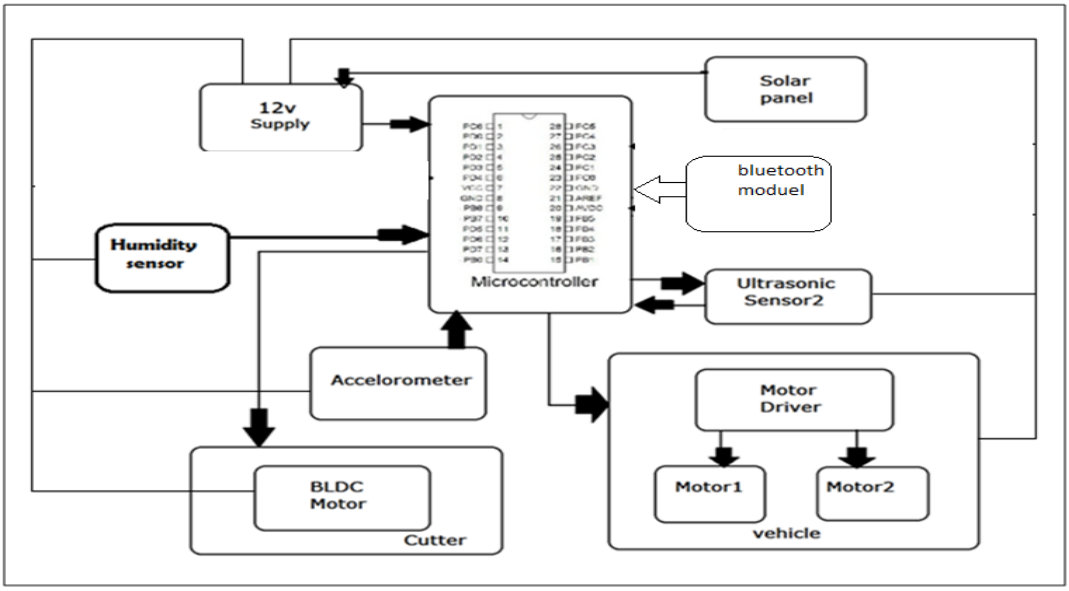


FIG.4.1 BLOCK DIAGRAM OF SMART SOLAR GRASS CUTTER

4.2 Hardware:

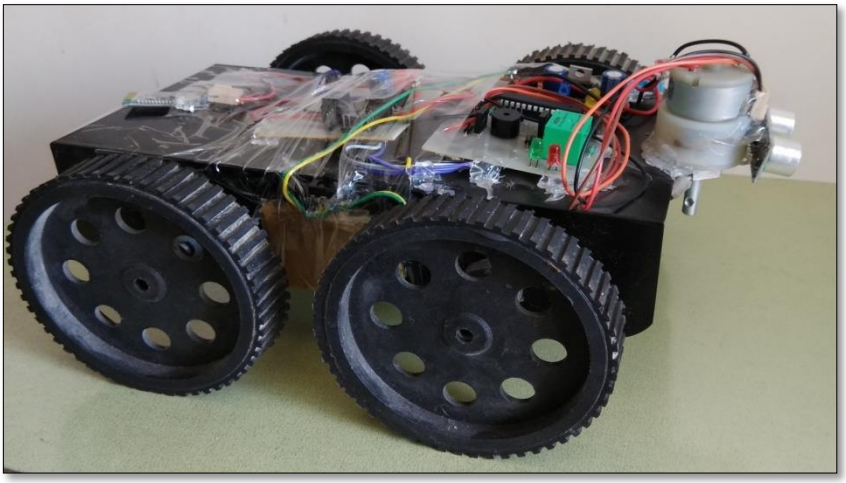


FIG.4.2 WORKING MODEL OF OUR PROJECT

4.3 Working:

I. Automatic mode:

The smart grass cutter system puts forth a completely automated lawn mover mechanism. The robotic vehicle is equipped with a grass cutter blade that allows for grass cutting at high RPM. The system has a smart functionality that allows it to cover the complete area of a lawn or garden by detecting corners using ultrasonic sensor and moving in a zigzag manner in order to cover the entire area. This efficient system uses a microcontroller based circuit in order to achieve this functionality. It is a battery operated system that uses 2 batteries. One battery is used to run the vehicle movement DC motors and the other one is used to power the grass cutter motor.

Also the system uses a solar panel to demonstrate the charging of vehicle movement battery. The microcontroller operates the vehicle movement dc motors as well as the grass cutter at the same time as monitoring the ultrasonic sensors. The microcontroller smartly operates the dc motors using the motor driver IC to achieve desired movement based on ultrasonic inputs.

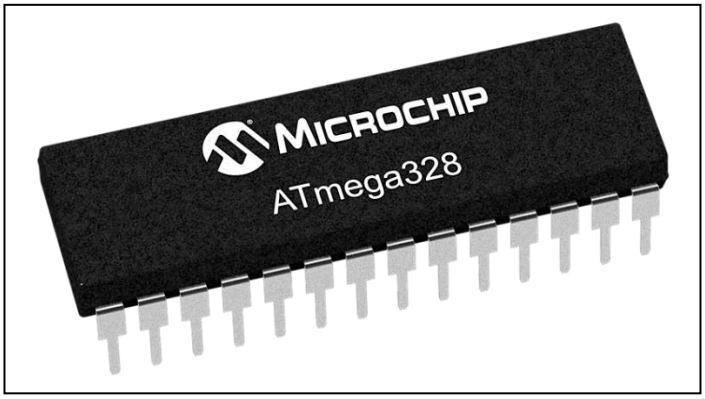
II. Manual mode:

The smart grass cutter also operated in manual mode. In manual mode model operated using Bluetooth module and mobile application. Bluetooth module connected with micro controller and model operated through mobile application which control the model operation like forward, revers, start, stop, shaft on, off. The range of Bluetooth module is between 100 m. Changing the mode switch we change the auto mode tomanual mode then open the application in mobile and scan the model Bluetooth and connect with the application after connection establish between mobile application andmodelwe can operate the module.

CHAPTER 5: ATMAGA328 MICROCONTROLLER

5.1 ATMAGA328 MICROCONTROLLER

An ATmega328 in DIP package, pre-loaded with the Arduino UNO (16MHz) Boot loader. This will allow you to use Arduino code in your custom embedded project without having to use an actual Arduino board. To get this chip working with Arduino IDE, you will need an external 16MHz crystal or resonator, a 5V supply, and a serial connection. If you are not comfortable doing this, we recommend purchasing the Arduino Duemilanove or Uno board that has all of these built into the board. Atmel's ATMega328 8-Bit Processor in 28 pin DIP package. It's like the ATmega168, with double the flash space. 32K of program space. 23 I/O lines, 6 of which are channels for the 10-bit ADC. Runs up to 20MHz with external crystal. Package can be programmed in circuit. 1.8V to 5V operating voltage!



5.1 ATMAGA328 MICROCONTROLLER

The Atmel 8-bit AVR RISC-based microcontroller combines 32 kB ISP flash memory with read-while-write capabilities, 1 kB EEPROM, 2 kB SRAM, 23 general purpose I/O lines, 32 general purpose working registers, three flexible timer/counters with compare modes, internal and external interrupts, serial programmable USART, a byte-oriented 2-wire serial interface, SPI serial port, 6-channel 10-bit A/D converter (8-channels in TQFP and QFN/MLF packages), programmable watchdog timer with internal oscillator, and five software selectable power saving

modes. The device operates between 1.8-5.5 volts. The device achieves throughput approaching 1 MIPS per MHz.

Programming:

Reliability qualification shows that the projected data retention failure rate is much less than 1 PPM over 20 years at 85 °C or 100 years at 25 °C.

Programming signal	Pin Name	I/O	Function
RDY/BSY	PD1	O	High means the MCU is ready for a new command, otherwise busy.
OE	PD2	I	Output Enable (Active low)
WR	PD3	I	Write Pulse (Active low)
BS1	PD4	I	Byte Select 1 (“0” = Low byte, “1” = High byte)
XA0	PD5	I	XTAL Action bit 0
XA1	PD6	I	XTAL Action bit 1
PAGEL	PD7	I	Program memory and EEPROM Data Page Load
BS2	PC2	I	Byte Select 2 (“0” = Low byte, “1” = 2nd High byte)
DATA	PC[1:0]:PB[5:0]	I/O	Bi-directional data bus (Output when OE is low)

Programming mode is entered when PAGEL (PD7), XA1 (PD6), XA0 (PD5), BS1 (PD4) is set to zero.[2] RESET pin to 0V and V_{CC} to 0V. V_{CC} is set to 4.5 - 5.5V. Wait 60 µs, and RESET is set to 11.5 - 12.5 V. Wait more than 310 µs.[2] Set XA1:XA0:BS1:DATA = 100 1000 0000, pulse XTAL1 for at least 150 ns, pulse WR to zero. This starts the Chip Erase. Wait until RDY/BSY (PD1) goes high. XA1:XA0:BS1:DATA = 100 0001 0000, XTAL1 pulse, pulse WR to zero. This is the Flash write command.[2] And so on..

Serial Programming[2]

Symbol	Pins	I/O	Description
MOSI	PB3	I	Serial data in
MISO	PB4	O	Serial Data out
SCK	PB5	I	Serial Clock

CHAPTER 6: BLUETOOTH MODULE

6.1 Bluetooth Module

Introduction

HC-05 Bluetooth Module is an easy to use Bluetooth SPP (Serial Port Protocol) module, designed for transparent wireless serial connection setup. Its communication is via serial communication which makes an easy way to interface with controller or PC. HC-05 Bluetooth module provides switching mode between master and slave mode which means it able to use neither receiving nor transmitting data.

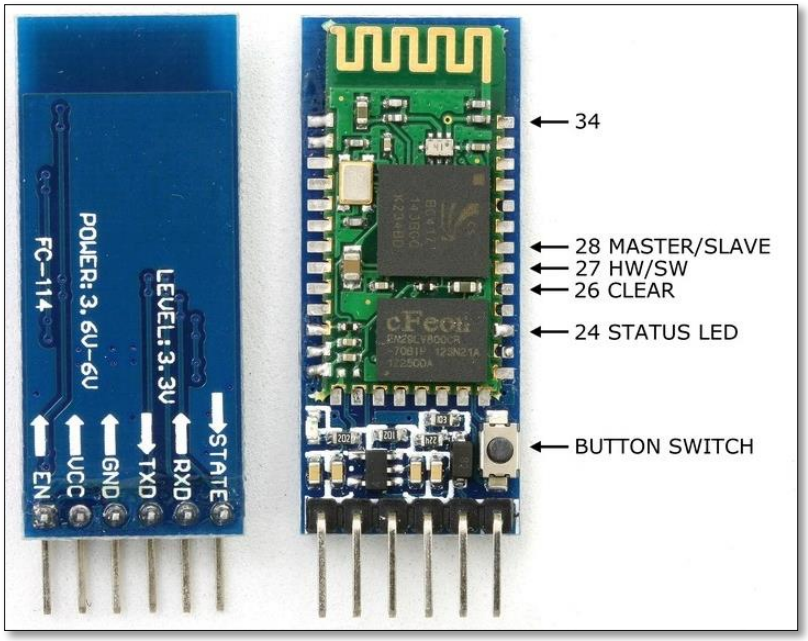
Specification:

Model: HC-05

Input Voltage: DC 5V

Communication Method: Serial Communication

Master and slave mode can be switched



6.1 BLUTTOTH MODULE

Hardware Features

- Typical -80dBm sensitivity.
- Up to +4dBm RF transmits power.
- 3.3 to 5 V I/O.
- PIO (Programmable Input/output) control.
- UART interface with programmable baud rate.
- With integrated antenna.
- With edge connector.

Software Features

- Slave default Baud rate: 9600, Data bits:8, Stop bit:1,Parity:No parity.
- Auto-connect to the last device on power as default.
- Permit pairing device to connect as default.
- Auto-pairing PINCODE:"1234" as default

Pin description:

The HC-05 Bluetooth Module has 6pins. They are as follows:

ENABLE:

When enable is pulled LOW, the module is disabled which means the module will not turn on and it fails to communicate. When enable is left open or connected to 3.3V, the module is enabled i.e. the module remains on and communication also takes place.

Vcc: Supply Voltage 3.3V to 5V

GND: Ground pin

TXD & RXD: These two pins acts as an UART interface for communication

STATE:

It acts as a status indicator. When the module is not connected to / paired with any other Bluetooth device, signal goes Low. At this low state, the led flashes continuously which denotes that the module is not paired with other device. When this module is connected to/paired with when the module is not paired with any other BT device. If the module is connected to any other any other Bluetooth device, the signal goes High. At this high state, the led blinks with a constant delay say for example 2s delay which indicates that the module is paired.

BUTTON SWITCH:

Is used to switch the module into AT command mode. To enable AT command mode, press the button switch for a second. With the help of AT commands, the user can change the parameters of this module but only Bluetooth device, it starts to communicate with that device and fails to work in AT command mode

Program for hc-05 Bluetooth module

The program given below is the HC-05 Bluetooth module program. This process is quite different from others since we are going to use android mobile to control and communicate with arduino.Here the Bluetooth module acts as an interface between our mobile and Arduino board. Before getting into the execution process, follow the given procedure:First of all, the user should install an application called Bluetooth SPP PRO from the play store which is a free application.

After installation, pair the Bluetooth module to your mobile as like connecting one device to other using bluetooth.The default pairing code is 1234.Upload the given program to the Arduino Uno board. After uploading the code, unplug the USB from the Arduino.

Now use external power adapter to power the Uno board.The Bluetooth SPP PRO has three types of communication mode. Here Byte stream mode is used to communicate. So select that mode and give the input as 1,as soon as the input has given the led will turn on and for 0 led will turn off.

CHAPTER 7: PERIPHERAL COMPONENTS

7.1 SOLAR PANEL

A photovoltaic (PV) module is a packaged, connect assembly of typically 6x10 photovoltaic solar cells. Photovoltaic modules constitute the photovoltaic array of a photovoltaic system that generates and supplies solar electricity in commercial and residential applications. Each module is rated by its DC output power under standard test conditions (STC), and typically ranges from 100 to 365 .

FIG. 7.1 SOLAR PANEL

The efficiency of a module determines the area of a module given the same rated output – an 8% efficient 230 W module will have twice the area of a 16% efficient 230 W module. There are a few commercially available solar modules that exceed efficiency of 22%[1] and reportedly also exceeding 24%.[2][3] A single solar module can produce only a limited amount of power; most installations contain multiple modules. A photovoltaic system typically includes an array of photovoltaic modules, an inverter, a battery pack for storage, interconnection wiring, and optionally a solar tracking mechanism.

7.2 ULTRASONIC SENSOR

The HC-SR04 ultrasonic sensor uses sonar to determine distance to an object like bats or dolphins do. It offers excellent non-contact range detection with high accuracy and stable readings in an easy-to-use package. From 2cm to 400 cm or 1" to 13 feet. It operation is not affected by sunlight or black material like Sharp rangefinders are (although acoustically soft materials like cloth can be difficult to detect). It comes complete with ultrasonic transmitter and receiver module.

FIG. 7.2 ULTRASONIC SENSOR

7.3 HUMIDITY SENSOR

Humidity is the presence of water in air. The amount of water vapor in air can affect human comfort as well as many manufacturing processes in industries. The presence of water vapor also influences various physical, chemical, and biological processes. Humidity measurement in industries is critical because it may affect the business cost of the product and the health and safety of the personnel.

FIG. 7.3 HUMIDITY SENSOR

7.4 DC MOTOR:

A **DC motor** is any of a class of rotary electrical machines that converts direct current electrical energy into mechanical energy. The most common types rely on the forces produced by magnetic fields. Nearly all types of DC motors have some internal mechanism, either electromechanical or electronic, to periodically change the direction of current flow in part of the motor.

DC motors were the first type widely used, since they could be powered from existing direct-current lighting power distribution systems. A DC motor's speed can be controlled over a wide range, using either a variable supply voltage or by changing the strength of current in its field windings. Small DC motors are used in tools, toys, and appliances. The universal motor can operate on direct current but is a lightweight motor used for portable power tools and appliances. Larger DC motors are used in propulsion of electric vehicles, elevator and hoists, or in drives for steel rolling mills. The advent of power electronics has made replacement of DC motors with AC motors possible in many applications.

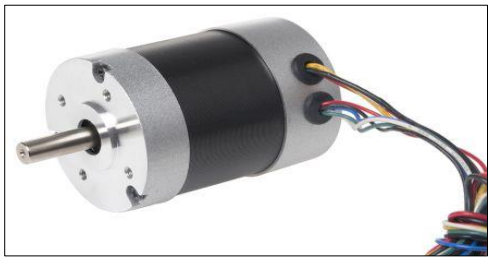


FIG. 7.4 DC MOTOR

7.5 RELAY:

A **relay** is an electrically operated switch. Many relays use an electromagnet to mechanically operate a switch, but other operating principles are also used, such as solid-state relays. Relays are used where it is necessary to control a circuit by a separate low-power signal, or where several circuits must be controlled by one signal. The first relays were used in long distance telegraph circuits as amplifiers: they repeated the signal coming in from one circuit and

re-transmitted it on another circuit. Relays were used extensively in telephone exchanges and early computers to perform logical operations.

FIG. 7.5 RELAY

CHAPTER 8: SOFTWARE

8.1. ARDUINO COMPILER

Arduino is an open source computer hardware and software company, project, and user community that designs and manufactures single-board microcontrollers and microcontroller kits for building digital devices and interactive objects that can sense and control objects in the physical world. The project's products are distributed as open-source hardware and software, which are licensed under the GNU Lesser General Public License (LGPL) or the GNU General Public License (GPL), permitting the manufacture of Arduino boards and software distribution by anyone. Arduino boards are available commercially in preassembled form, or as do-it-yourself kits.

Arduino board designs use a variety of microprocessors and controllers. The boards are equipped with sets of digital and analog input/output (I/O) pins that may be interfaced to various expansion boards (shields) and other circuits. The boards feature serial communications interfaces, including Universal Serial Bus (USB) on some models, which are also used for loading programs from personal computers. The microcontrollers are typically programmed using a dialect of features from the programming languages C and C++. In addition to using traditional compiler toolchains, the Arduino project provides an integrated development environment (IDE) based on the Processing language project.

The Arduino project started in 2003 as a program for students at the Interaction Design Institute Ivrea in Ivrea, Italy,[2] aiming to provide a low-cost and easy way for novices and professionals to create devices that interact with their environment using sensors and actuators. Common examples of such devices intended for beginner hobbyists include simple robots, thermostats, and motion detectors.

The name Arduino comes from a bar in Ivrea, Italy, where some of the founders of the project used to meet. The bar was named after Arduin of Ivrea, who was the margrave of the March of Ivrea and King of Italy from 1002 to 1014.

8.2 MC PROGRAMMING LANGUAGE C

Like most imperative languages in the ALGOL tradition, C has facilities for structured programming and allows lexical variable scope and recursion, while a static type systemprevents many unintended operations. In C, all executable code is contained within subroutines, which are called "functions" (although not in the strict sense of functional programming). Function parameters are always passed by value. Pass-by-reference is simulated in C by explicitly passing pointer values. C program source text is free-format, using the semicolon as a statement terminator and curly braces for grouping blocks of statements.

The C language also exhibits the following characteristics:

There is a small, fixed number of keywords, including a full set of flow of control primitives: for, if/else, while, switch, and do/while. User-defined names are not distinguished from keywords by any kind of sigil. There are a large number of arithmetical and logical operators, such as +, +=, ++, &, ~, etc.

More than one assignment may be performed in a single statement. Function return values can be ignored when not needed. Typing is static, but weakly enforced: all data has a type, but implicit conversions may be performed. Declaration syntax mimics usage context. C has no "define" keyword; instead, a statement beginning with the name of a type is taken as a declaration. There is no "function" keyword; instead, a function is indicated by the parentheses of an argument list. User-defined (typedef) and compound types are possible.

Heterogeneous aggregate data types (struct) allow related data elements to be accessed and assigned as a unit. Array indexing is a secondary notation, defined in terms of pointer arithmetic. Unlike structs, arrays are not first-class objects; they cannot be assigned or compared using single built-in operators. There is no "array" keyword, in use or definition; instead, square brackets indicate arrays syntactically, for example month[11]

Enumerated types are possible with the enum keyword. They are not tagged, and are freely interconvertible with integers.

Strings are not a separate data type, but are conventionally implemented as null-terminated arrays of characters. Low-level access to computer memory is possible by converting machine addresses to typed pointers. Procedures (subroutines not returning values) are a special case of function, with an untyped return type void.

Functions may not be defined within the lexical scope of other functions. Function and data pointers permit ad hoc polymorphism. A preprocessor performs macro definition, source code file inclusion, and conditional compilation. There is a basic form of modularity: files can be compiled separately and linked together, with control over which functions and data objects are visible to other files via staticand extern attributes. Complex functionality such as I/O, string manipulation, and mathematical functions are consistently delegated to library routines.

While C does not include some features found in some other languages, such as object orientation or garbage collection, such features can be implemented or emulated in C, often by way of external libraries (e.g., the Boehm garbage collector or the GLib Object System).

CHAPTER 9: PROGRAMING

Data Initialization

```
#define trigPin1 A2
#define echoPin1 A1
#define cutter 7
void setup() {
 pinMode(trigPin1, OUTPUT);

  pinMode(echoPin1, INPUT);
  pinMode(cutter, OUTPUT);
}

void loop() {
long duration, distance;
digitalWrite(trigPin1, LOW);

delayMicroseconds(2);

digitalWrite(trigPin1, HIGH);

delayMicroseconds(1);

digitalWrite(trigPin1, LOW);

duration = pulseIn(echoPin1, HIGH);

distance = (duration/2) / 29.1;

Serial.print("Front:");
Serial.println(distance);
if (distance < 45)
```

```
{

digitalWrite(cutter,LOW);

} else

{

digitalWrite(cutter,HIGH);

} delay(50);


}
```

Main program:

```
#include <Ultrasonic.h>

#define TRIGGER_PIN  A2
#define ECHO_PIN  A1
int m1=10;
int m2=11;
int m3=12;
int m4=13;
#include "DHT.h"
int mode = A5;
int buzzer = 8;
int led1 = 2;
int led2 = 4;
#define shaft  7
```

```
String voice;
float h ;
float cmMsec, inMsec;

#define DHTPIN 6
#define DHTTYPE DHT11
DHT dht(DHTPIN, DHTTYPE);

Ultrasonic ultrasonic (TRIGGER_PIN, ECHO_PIN);

void humi()
{
    h = dht.readHumidity();
  if(h>60)
  {
   digitalWrite(buzzer,HIGH);
    digitalWrite(m1,LOW);
   digitalWrite(m2,LOW);
   digitalWrite(m3,LOW);
   digitalWrite(m4,LOW);
   digitalWrite(shaft,LOW);
  }
  else
  {
    digitalWrite(buzzer,LOW);
  }

}

void forward() {
Serial.println("Forward");
```

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

void backward() {
  Serial.println("Reverse");
  digitalWrite(m1,LOW);
digitalWrite(m2,HIGH);
digitalWrite(m3,LOW);
digitalWrite(m4,HIGH);
}
void stop1()
{
Serial.println("Stop");
digitalWrite(m1,LOW);
digitalWrite(m2,LOW);
digitalWrite(m3,LOW);
digitalWrite(m4,LOW);
}
void left()
{
 Serial.println("Left");
digitalWrite(m1,HIGH);
digitalWrite(m2,LOW);
digitalWrite(m3,LOW);
digitalWrite(m4,LOW);
}
void right()
{
```

```
Serial.println("Right");
digitalWrite(m1,LOW);
digitalWrite(m2,LOW);
digitalWrite(m3,HIGH);
digitalWrite(m4,LOW);
}
void shaft1()
{
  digitalWrite(shaft,!digitalRead(shaft));
}
void setup()
  {
 Serial.begin(9600);
 pinMode(led1,OUTPUT);
pinMode(led2,OUTPUT);
pinMode(buzzer,OUTPUT);
pinMode(mode,INPUT);
pinMode(m1,OUTPUT);
pinMode(m2,OUTPUT);
pinMode(m3,OUTPUT);
pinMode(m4,OUTPUT);
pinMode(shaft,OUTPUT);
  }
  void breack()
  {
     long microsec = ultrasonic.timing();

  cmMsec = ultrasonic.convert(microsec, Ultrasonic::CM);

  Serial.print(", CM: ");
  Serial.println(cmMsec);
```

```
  if(cmMsec<20)
 {
  digitalWrite(m1,LOW);
  digitalWrite(m2,LOW);
  digitalWrite(m3,LOW);
  digitalWrite(m4,LOW);
  digitalWrite(shaft,LOW);
 }

 }

 void loop()
 {
  while(digitalRead(mode)==LOW)
  {
  digitalWrite(led1,HIGH);
  digitalWrite(led2,LOW);
    breack();
    humi();
  while(Serial.available()) {
    breack();
  delay(10);
  char c=Serial.read();
  Serial.print(c);
if(h<60)
{
 if (c == 'U')
 {forward() ; }
 else if (c == 'D')
 {backward() ; }
  else if (c== 'C')
```

```
  {stop1() ; }
    else if (c == 'L')
  {left() ; }
    else if (c == 'R')
  {right() ; }
      else if (c == 'S')
  {shaft1() ; }
}
voice="";
}
   }
while(digitalRead(mode)==HIGH)
   {
    digitalWrite(led2,HIGH);
    digitalWrite(led1,LOW);
humi();
if(h<60)
{
  float cmMsec, inMsec;
  long microsec = ultrasonic.timing();

  cmMsec = ultrasonic.convert(microsec, Ultrasonic::CM);
  //inMsec = ultrasonic.convert(microsec, Ultrasonic::IN);
  Serial.print(", CM: ");
  Serial.println(cmMsec);



  if(cmMsec<30)
  {
    digitalWrite(shaft,LOW);
    digitalWrite(m1,LOW);
```

```
  digitalWrite(m2,LOW);
  digitalWrite(m3,LOW);
  digitalWrite(m4,LOW);

  delay(1000);

  while(cmMsec<30)
  {
  long microsec = ultrasonic.timing();

 cmMsec = ultrasonic.convert(microsec, Ultrasonic::CM);
 //inMsec = ultrasonic.convert(microsec, Ultrasonic::IN);
 Serial.print(", CM: ");
 Serial.print(cmMsec);
  digitalWrite(m1,LOW);
  digitalWrite(m2,HIGH);
  digitalWrite(m4,LOW);
  digitalWrite(m3,HIGH);
  delay(2000);
  }
 }
 else
 {
  digitalWrite(shaft,HIGH);
  digitalWrite(m1,HIGH);
  digitalWrite(m2,LOW);
  digitalWrite(m3,HIGH);
  digitalWrite(m4,LOW);
 }
}
 }
```

CHAPTER 10: RESULT

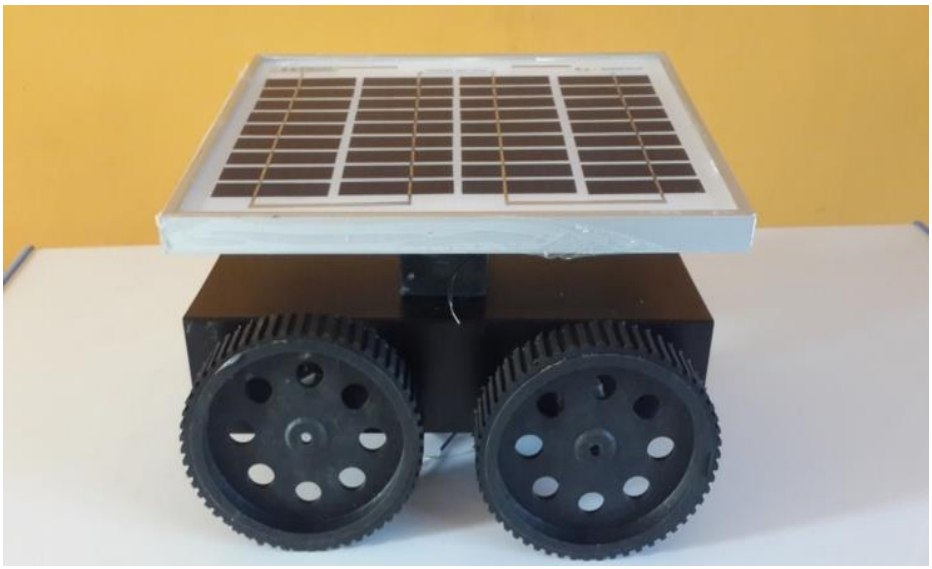


FIG. 10.1 WORKING MODEL

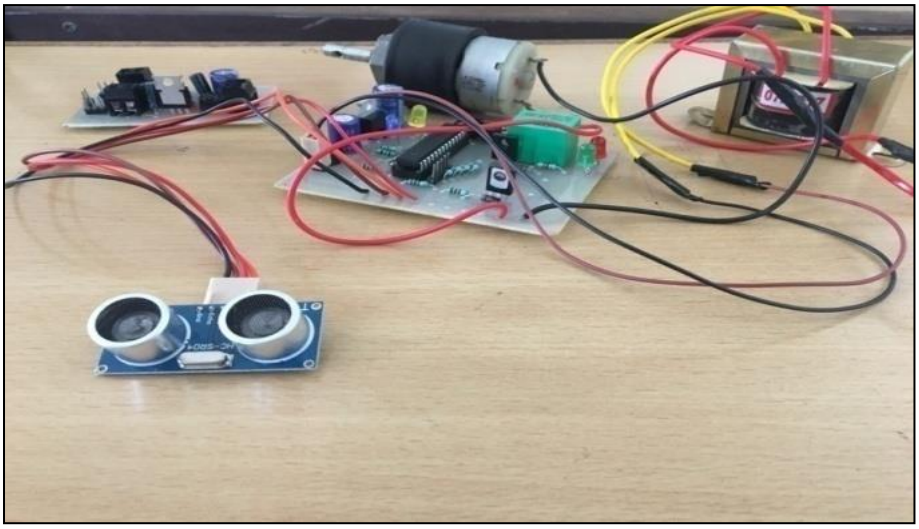


FIG. 10.2 WORKING CIRCUIT

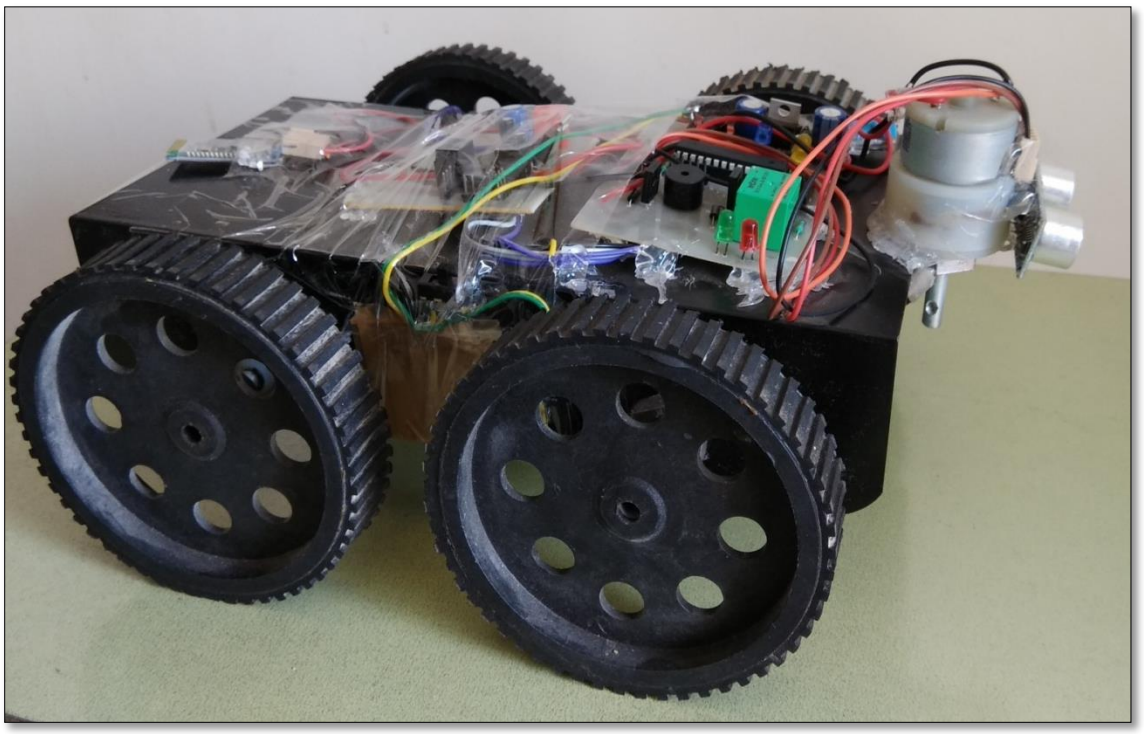


FIG. 10.3 WORKING MODEL WITH CIRCUIT

CHAPTER 11: ADVANTAGES AND APPLICATION

11.1 Advantages

- Manpower reduce
- Save money
- Less maintenance
- controlling and monitoring
- Manually and auto control
- Energy conservation

11.2 Application

- The grass cutter that we have developed can be used in various areas:
- In backyard or garden at home.
- In public parks to remove the unwanted grass/weeds.
- In playgrounds Future.

CHAPTER 12: CONCLUSION

By using this system we can preserve the non-renewable sources of energy such as petrol, gasoline etc. We can also reduce various forms of pollutions such as air pollution and noise pollution. Electricity is saved as we utilize solar energy that is renewable source of energy and is present in abundance.

REFERENCES

Paper search:

1. A Review on Smart Solar Grass cutter with Lawn Coverage Amol T. Bagul1 , Shivani G. Deore2 , Ashish D. Dhage3 & Prof. S. S. Bhardwaj4 1,2,3BE students, Electronics and Telecommunicatuon, SIT Lonavala. 4Associate Professor in Dept. of Electronics And Telecommunication
2. Modification of Solar Grass Cutting Machine Praful P. Ulhe Manish D. Inwate Professor (Guide) Student Department of Mechanical Engineering Department of Mechanical Engineering J.D. College of Engineering & Management Nagpur J.D. College of Engineering & Management Nagpur Fried D. Wankhede Krushnkumar S. Dhakte Student Student Department of Mechanical Engineering Department of Mechanical Engineering J.D. College of Engineering & Management Nagpur J.D. College of Engineering & Management Nagpur

3. SOLAR BASED GRASS CUTTER: A REVIEW Ms. Bhagyashri R. Patil1 , Mr. Sagar S. Patil2 1UG Student, Department of Electrical Engineering, YTC, Satara, (India) 2UG Student, Department of Electrical Engineering, YTC, Satara, (India)

4. Smart Lawn Mower for Grass Trimming Sujendran .S1 , Vanitha .P2 1 Sri Muthukumaran Institute of Technology, Embedded System Technologies, Chikkarapuram, Near Mangadu, Chennai-69, India

5. Smart Solar Grass Cutter Robot for Grass Trimming Ashish kumar chaudhari1 , Yuvraj sahu2 , Pramod kumar sahu3 , Subhash Chandra verma4 1 Ashish kumar chaudhari, Student Mechanical Department, MATS University Raipur , Chhattisgarh, India 2 Yuvraj sahu, Student Mechanical Department, MATS University Raipur , Chhattisgarh, India 3 Pramod kumar sahu, Student Mechanical Department, MATS University Raipur , Chhattisgarh, India 4 Subhash Chandra verma Student Mechanical Department, MATS University Raipur , Chhattisgarh, India

Web link:

6. https://www.onlinejournal.in/IJIRV3I5/064.pdf
7. http://www.ijirst.org/articles/IJIRSTV2I11261.pdf
8. http://www.arresearchpublication.com/images/shortpdf/1483686153_N276_IJEEE.pdf
9. https://www.ijsr.net/archive/v3i3/MDIwMTMxMTE0.pdf
10. http://ijariie.com/AdminUploadPdf/Smart_Solar_Grass_Cutter_Robot_for_Grass_Trimming_ijariie1954.pdf
11. https://www.scribd.com/document/347922063/smart-solar-grass-cutter-for-lawn-coverage