# DESIGN AND FABRICATION OF SOLAR POWERED GRASS CUTTER

Submitted in partial fulfilment of the requirements for the award of

Bachelor of Engineering degree in Mechanical Engineering

By

**Sayan Das (38150103)**
**M.V. Pranav Chandran (38150081)**


**DEPARTMENT OF MECHANICAL ENGINEERING**
**SCHOOL OF MECHANICAL ENGINEERING**

**SATHYABAMA**
**INSTITUTE OF SCIENCE AND TECHNOLOGY**
**(DEEMED TO BE UNIVERSITY)**
**Accredited with Grade "A" by NAAC**

**JEPPIAAR NAGAR, RAJIV GANDHI SALAI, CHENNAI - 600 119**
**MAY – 2022**

SATHYABAMA
INSTITUTE OF SCIENCE AND TECHNOLOGY
(DEEMED TO BE UNIVERSITY)
Accredited "A" Grade by NAAC | 12B Status by UGC | Approved by AICTE
www.sathyabama.ac.in

## DEPARTMENT OF MECHANICAL

## BONAFIDE CERTIFICATE

This is to certify that this Project Report is the bonafide work of **Sayan Das (38150103), M.V. Pranav Chandran (38150081)** who have done the Project work as a team who carried out the project entitled **"Design and Fabrication of Solar powered Grass Cutter"** under our supervision from Nov 2021 to Apr 2022.

22/4/22

**Internal Guide**
**Dr. M.PURUSOTHAMAN, M.E., Ph.D.,**

22/4/22

**Head of the department**
**Dr. G. ARUNKUMAR, M.E., Ph.D.,**

---

**Submitted for Viva voce examination held on**_____

**Internal Examiner** **External Examiner**



ii

# DECLARATION

We, **SAYAN DAS (38150103) and M.V. PRANAV CHANDRAN (38150081)** hereby declare that the Project Report entitled **"DESIGN AND FABRICATION OF SOLAR POWERED GRASS CUTTER"** done by us under the guidance of **Dr. M. PURUSOTHAMAN, M.E., Ph.D.,** is submitted in partial fulfilment of the requirements for the award of Bachelor of Engineering in Mechanical Engineering.

1. 
2. 

**DATE: 22/4/2022** **SIGNATURE OF THE CANDIDATE**

**PLACE: CHENNAI**

# ACKNOWLEDGEMENT

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

I am grateful to them convey me sincere thanks to **Dr. S. Prakash, M.E., Ph.D.,** Dean, School of Mechanical Engineering and **Dr. G. ArunKumar, M.E., Ph.D**., Head of the Department, Dept. of Mechanical Engineering for providing me necessary support and details at the right time during the progressive reviews.

I would like to express my sincere and deep sense of gratitude to my Project Guide **Dr. M. Purusothaman, M.E., Ph.D.,** for his valuable guidance, suggestions and constant encouragement paved way for the successful completion of my project work.

I also express my thanks to all Teaching and Non-teaching staff members of the Department of Mechanical Engineering who were helpful in many ways for the completion of the project.

# ABSTRACT

The Internal Combustion motor was used in older lawn shaper models and thus as a result of its natural effect contamination level ascents ic motor driven shaper is all the more exorbitant support of such traditional machine is more to stay away from these downsides arranging of building new sort of grass shaper which runs on sunlight based energy and this model is efficient contrasted with past one the point of our undertaking is to make the grass cutter which works on sunlight based energy henceforth save the power and decreases labor. This solar grass cutter uses sharp edges to cut a yard to an exact length. It is used to maintain yards in gardens, institutions, and even sports fields. The operations of a grass cutter are governed by this microprocessor. Two ultrasonic sensors, one for obstruction detection and the other one for blades damage management, are also included in the grass cutter, as well as a sensor that monitors the engine's temperature.

These modifications have been made to the current machine in order to make it easier to use and least expensive. Our primary point is to limit pollution while also making efficient use of solar energy. Based on the model’s performance some calculation had been made, where total power consumption is 65w/hr and power required for working one day for four hours is 260w/hr. Therefore, to generate this required power the solar panel should be kept seven days for charging. Other than that, based on the output of solar panel, temperature, voltage data various graphical were also being made which can be seen in upcoming pages.

# TABLE OF CONTENTS

# LIST OF TABLES

# LIST OF FIGURES

# CHAPTER 1

# INTRODUCTION

Using a traditional engine-driven grass cutter to operate the grass cutters is a task that no one appreciates. Cutting grass will take longer with the help of a matured cutter, then younger cutter. Lawn cutters with motors cause commotion pollution as a result of the noisy motor, as well as contamination in the surrounding air as a result of the motor's ignition. Similarly, an engine-controlled motor necessitates routine maintenance, such as changing the motor oil. Despite the fact that electric operated solar directed grass cutters are environmentally friendly, they might be inconvenient. Electric powered grass cutters, like engine operated grass cutters, are dangerous and cannot be used by everyone without problems. Furthermore, if the electric lawn cutter is corded, cutting should be demonstrated to be dangerous and harmful. By integrating sun boards, the model may potentially be charged from the sun.

## 1.1 SOLAR ENERGY

The power of sunlight is an immense, limitless wellspring of force. The power from the sun based on earth is roughly 1.8/10MW, which is several times greater than the present usage cost of all power assets on this planet. The amount of energy that India's geographical region receives from the sun is equivalent to a fifteen-thousand-time daily usage requirement (500 billion kWh) in 2010. Regardless of its length, sun-oriented energy is supported by a number of variables. In contrast to petroleum products and atomic power, it's a naturally smooth wellspring of cooperation right off the outset. It's also far away and available in sufficient quantities in almost every part of the area where people live. In any case, there are a few concerns with it. The true test of utilizing solar energy is a financial barrier. To reduce the massive beginning speculations predicted at pre-set in biggest bundles, work must be made toward the development of less expensive assortment and carport systems. Sun power in India: A massive amount of sunlight-based radiation is falling on India and a huge chunk of it. A couple of days have gone by without seeing the sun. India is located between 7- and 37-degrees north latitude, with yearly average solar radiation of 500 to 600 cal/cm/day, with better protection available in arid and semi-dry regions. In bone-dry and semiarid areas of India, typical solar radiation is 7.5 w h/m/day. Sun-based power has a 5-10 ×10 w h/yr, capability to meet the basic energy needs of the many millions

of people who live in rural India. Daylight-derived power is an enormous, smooth, mild, and inexhaustible form of power. Sunlight and warmth are transmitted by the sun. The sun's rays and gentle warmth contribute to the planet's climate, with noticeable natural consequences.

• Earth's temperature security

• image blend using natural blooms, oxygen and natural compounds production, normal synthetic substance production, and biomass production

• Wind, due to the uneven warming of sea and land surfaces.

• Sea tides: energy generating within the sea (due to gravitational forces).

• sea water temperature rises due to Marine nuclear power (OTEC)

• Sea waves: energy from the sea waves

Through supported atomic combination responses, the sun provides a vast measure of solidarity of hotness with sunlight. The energy from the sun, which appears as radiation on Earth, is used to warm the planet and produce electric power. The most encouraging is a significant number of non-standard supplies of force sunshine-based power. As a result, our business is primarily dependent on the solar energy is converted into mechanical energy for the operation of a standard grass cutter.

**Table 1.1: Comparison Between Solar system**

| s.no | SOLAR SYSTEM | FUEL SYSTEM |
|---|---|---|
| 1 | Pollution free | Major factor is pollution |
| 2 | Absence of Consumption of fuel | Major requirement is fuel |
| 3 | Less reciprocating parts | More reciprocating parts |
| 4 | Great reduction in Friction | High Frictions in-between the parts |
| 5 | Lower cost and maintenance | Maintenance is difficult & high |
| 6 | capacity of Load carrying is low | high Load carrying capacity |
| 7 | Continuous operation not possible for hours | Continuous ride for hours together is possible |
| 8 | speed reduction ratio is increased when weight is increases very much | Speed reduction ratio does not vary and is less |

## 1.2 PROBLEMS IDENTIFICATION

Previously, the majority of the activities were completed manually. Step by step, a plethora of large and little machines have been developed to facilitate human activities and, as a result, to reduce human effort in accomplishing tasks. Most activities that previously required human effort are now replaced or automated by the use of

machines or other types of equipment in the afternoon. Traditional lawn cutters necessitate the use of professional humans. Because we employ animals such as bulls here. The era has progressed in many arms professional personnel with traditional grass cutter have been reduced. Nowadays, there is a strong desire to rely on technology. Because of the dangers of using a traditional lawn cutter, only a small number of people choose this way of grass cutting these days. In addition, adolescent education in India is improving. Because of this, people are becoming increasingly unwilling to use traditional grass cutters.

### 1.3 SIMILAR PRODUCT

ELECTRIC LAWN MOWER

- The electrically powered mowers are appropriate for land under 1/3 acres. They provide similar functions to that of gasoline-powered mowers together with 3-in-1 characteristic, push or self-propel, wide reducing and so on. but they save the fuel and upkeep price.
- Furthermore, they've enormously quieter operation. these machines are surroundings friendly without a carbon emission.
- There are corded and cordless electric mowers to be had and usually have a motor energy among 6-12 amp. Cordless mowers perform on battery providing you with ease of mowing round.
- Those are most suitable for flat surfaces.

RIDING MOWER

- As opposed to stroll-behind garden mowers, the riding garden mowers have a seat to journey on for mowing.
- It consists of diverse controls that enable you to mow your lawn while being seated in this mower.
- these are appropriate for large lawns and are regularly termed as small farm tractor.

  • these machines have effective engines and cutting decks as compared to push mowers.


Fig 1.1: ***Electric Mower***

TOW-BEHIND MOWER

• Tow-behind mowers are used for a lot large regions, like massive fields, and are used much more in agriculture and street sides.

• Tractors or powerful vehicles should tow those gadgets. maximum are mechanical, similar to some of the first garden mowers ever invented.

• They use the rotation and power generated by being pulled across the ground to cut grass, sod, and anything else that needs to be cut.

Fig 1.2: ***Tow-Behind Mower***

SMART SOLAR GRASS CUTTER

This is a straightforward design that emphasizes the use of components. The general dimensions are determined by the solar panel's dimensions or size. For the blade and

rear tyre, three motors are employed. The roof's height is determined by the battery's apex. Because the rubber rotating wheel will automatically adjust the route dependent on the rear tyres, it is employed as the front tyres. Each rear tyre is equipped with its own motor. The design is both functional and cost-effective. The prototype is developed in 3D using SolidWorks software, starting with a hand caricature. The proportions of the plan are crucial, and they must be exact and precise in order to maximise the safety factor.

Fig 1.3: ***Solar Grass Cutter***

They designed an extensive and commendable range of solar Grass Cutter in conjunction with solar panel. because the energy communique may be very important in the present-day state of affairs and have to be performed to a maximum volume where ever it is viable. nevertheless, these mowers grass cutting machineries all need the equal matters to work right -- a motor, a rotating blade, a way of having round and a way to do away with the grass clippings. The controlling tool of the whole gadget is provided the use of switch on the DC motor interfaced with grass reducing blades. The complete model consists of sections one controlling phase and some other designing segment of the version. Rechargeable batteries, relay switches, and a solar panel make up the controlling phase. The motor of a machine that is powered by a charging circuit can be controlled by a relay switch. The solar energy is stored in a battery before being used to power the motor via a relay switch.

The force required to cut the garden, as well as the force acting on the blade, were taken into account when developing the cutting blade. Any sharp object must exert far less force than 10 Newton to have an effect on the grass. It also depends on the object's peak, density, and the region blanketed by it (Atkins, 1984). As a result, the force necessary for effective mowing must be greater than 10 Newton when

constructing the blade of the solar lawn mower. The cutting blade was made of stainless steel because of its strength and weight, which allowed it to transmit the same velocity as the DC motor with less friction.

Fig 1.4: ***Smart Grass Cutter***

The solar grass cutter's mechanism is that it has a panel positioned in a specific arrangement so that it can capture high-energy sun rays. It converts mild power into electrical electricity. Battery is continuously charging all through grass cutter is in working scenario. When the battery is fully charged, it is automatically disconnected from the panel; on the other hand, when the battery is low, it is automatically connected to the panel for charging. After the ones automobiles are related to battery through connecting wires. DC motor, rechargeable battery, solar panel, blade, and relay for control are the raw materials used in the creation of the solar power lawn cutter. In our task four automobiles are used for shifting purpose, which follow the right, left, forward, backward commands. The motor has a thousand rpm and is connected to the tempered blades. The blades of the grass cutter are rotated at an excessively fast rate, allowing the grass to be cut.

Fig 1.5: ***Solar Grass Cutter***

# CHAPTER 2

# LITRATURE SURVEY

This study offers a solar-powered vision-based robotic lawn mower that is self-sufficient, with the goal of allowing individuals to eliminate grass with minimal effort. Unlike other robotic garden mowers on the market, this design does not require fence wires to keep the robotic inside the yard, and it also takes far less human effort in the guiding mode operation. This robot will not only stay in the garden, but will also avoid and find out goods and persons, thanks to an array of sensors. They performed their assignment with a 12v 310mA solar panel. The sun panel has 24 solar cells, each of which contributes zero.5 volts. They could use a battery, however because to the limited output of the sun panel, the lead acid rechargeable battery used is only rated at 12v 1.2Ah, so it won't be overcharged. They employed IR sensors with a 1m 555 IC to cross the borders. On each facet, there are sensors. This is because if the barrier is to the left, it will pass in the right direction, and if the proper sensor identifies the obstacle, it will move miles to the left. However, one problem is that the system's reaction can be slow at times, therefore real-time high-quit DSP processors are suggested as a speedier alternative. [3]

They may be attempting to develop a general-purpose robot capable of cutting grass in a garden in this paper. The device will have some automation work for guidance and various obstacle detection, and the power source, which will be a battery and a solar panel, will be attached at the top of the robotic to lessen the power issue. The automated sun grass cutter is becoming increasingly sophisticated, with features like as self-docking and, in some cases, rain sensors, essentially eliminating the need for human input. With a boundary wire installed on the lawn's edge, it works similarly to the Rob mow. When the device is turned to automatic mode, infrared sensors on the robotics make a decision between cut and uncut grass. The mower repeats this technique till the task is completed. The lawn cutter engine, as well as the vehicle motion automobiles, are powered by 12-volt batteries. They also employ a solar panel to charge the battery, eliminating the need for external charging. The grass cutter and motor cars are connected to a microprocessor from the 8051 family, which regulates the operation of all the vehicles. It's also connected to an ultrasonic sensor that detects objects. If no impediment is found, the microcontroller moves the motor vehicles ahead of schedule. If an impediment is identified by the sensor, the grass cutter motor is

stopped by the microcontroller to prevent any damage to the item/human/animal approaching.[8]

In this paper, Ms. Lanka Priyanka et al. have designed a lawn cutting machine with tempered blades. In addition to being computerised, this grass cutter can be handled manually. GI sheet, motor, wheel, Al sheet, switch, cable, rectangular tube, and inert material is one of the most suitable materials.[5]

P. Bulski et al. determine that the machine's sound causes noise pollution. He investigates the sound produced by the equipment, with the goal of removing the sound while also reducing the grass mostly on field or even the floor. Because using a motor pollutes the environment, my suggestion is to use an electric lawn mower.[4]

In this paper, Praful P. Ulhe et al. have used a hand grass cutter with spiral roller blades to boost slicing efficiency. The mower has a height-adjustable loop trimming element. The lawn cutter could cut all varieties of grasses equally. [2]

In 1902, Ransoms released the first version of the primary. Around World War I, JP Engineering of Leicester established a line with well chain-driven mowers. Around a certain period, a worker should have had previous expertise driving massive devices drawn by animals. The driven mowers have been the most common. In 1914 ideal energy created the first gasoline-power mower.

Husqvarna, a Swedish company et al, will launch its autonomous lawn cutter in the United States in 2019 (it has been available in Europe for nearly three years). With a boundary string placed on the border of your grass, it functions just like the Rob mow. The Husqvarna model, on the other hand, looks after itself. The Husqvarna automatic grass cutter lives outside, mows when it's programmed to mow, and mechanically returns to its base for recharging, whereas the Rob mow must be taken out and installed and supervised by the proprietor. In addition, the Husqvarna model is substantially lighter than the Rob mow (15 kilos vs. 42 pounds). This, according to Husqvarna, no longer makes it safer, but it does leave no traces in the garden. This complete freedom from ever thinking about mowing, however, comes at a cost: $1,995 plus $200 to $300 for installation. This year, it's only available in limited quantities from a few retailers. The organisation also intends to introduce a solar-powered version in the United States next year. Both the Husqvarna automobile mower and the Husqvarna sun mower are self-contained. The automatic grass cutter is secured to

the garden by a boundary loop wire, and a search loop ensures that it returns to the docking station for battery recharge. The solar-powered version will be available in the next 12 months and will not require a charging point. Each cutter performs comparable functions, with the power supply being the most significant difference. Environmentally friendly and practically silent. The hunt loop cord (yellow) drives the mower to the charging station, while the perimeter loop twine (purple) specifies the cutting area of an automatic cutter. The border loop is also built up around bushes and garden surfaces in such a way that it cannot be reduced any longer. The garden mower adjusts its path if it comes into contact with garden furniture, a tree, or other heavy objects, but it can still cut through bushes and hedgerows. You could set the trimming level in between 30 and 95 mm to get the lawn you want. (L) 71 cm, (W) 60 cm, (H) 26 cm Dimensions: (L) 71 cm, (W) 60 cm, (H) 26 cm [6]

Ms. Lanka Priyanka et al. They have created a sun-powered grass-cutting device with tempered blades attached to this grass cutter on this paper. This lawn cutter may be controlled manually as well as automatically. GI sheet, motor, wheel, Al sheet, transfer, cord, rectangular pipe, and insulating material are the most commonly used materials. Comparator, rechargeable battery, relay, temperature sensor, and DC motor are among the additions employed. The voltage generated by the sun panel is displayed on Dipin's LCD display device. They organised a solar-powered, vision-based fully automated garden mower that could be handled manually with minimal effort. With the help of MATLAB programming and a digital camera positioned above the robot shape, prepared software is sent into the system, and robotic motions are performed in accordance with a predetermined sample. Robots that are designed to reduce human effort can also identify humans and other objects in front of the robot. As a result, it safeguards the gadget from injury while simultaneously reducing the risk to humans. As a species by way of human, the robot cut the grass in a unique method to create unique layout patterns. Sachin Prabha is a Bollywood actor. The author creates a solar grass cutter machine to reduce human labour and to consume non-renewable energy sources on the planet's surface. Solar energy works by capturing sunlight, store energy to charge batteries, and use it as needed. By employing adequate monitoring, all of these features are proceeding according to the schedule. A unique system protects battery from excessive charging, extending their life span. This could potentially be utilised for gardening on a small basis.[5]

# CHAPTER 3

# AIM, SCOPE, OBJECTIVE AND METHODOLOGY

## 3.1 AIM

The goal is to keep our country from experiencing the energy shortage by reducing human labour, operation cost, and maintenance expenses. In addition, a lawn cutter powered by the sun keep the community hygienic. It's utilised to get rid of various types of grasses for various purposes.

## 3.2 SCOPE

The solar panel is coupled to the batteries and therefore will charge them while in drive, ensuring that we have adequate battery capacity even on overcast days. As a result, the battery's energy can be used for this purpose. A static sun panel may also have a guarantee that lasts for decades and requires little to no upkeep. Sun trackers, on the other hand, come with substantially limited warranties and necessitate the use of one or more actuators in order to transport the panel.

## 3.3 OBJECTIVE

This project's objective is to design and develop a solar grass cutter that runs on solar energy and avoids the drawbacks of traditional lawn cutters. The goal is to prevent a power outage in India while also reducing human labour, walking value, and preservation costs. Furthermore, the use of a solar-powered completely lawn cutter assists to take care of the environment and healthy. It has long been used to control a variety of grasses for a variety of purposes. The full version is powered by solar energy collected in the batteries. The Ultra-Sonic sensor will detect obstacles in order to protect humans, objects, and animals. A relay has also been used to operate the motor that drives the blades and wheels.

### 3.4 METHODOLOGY

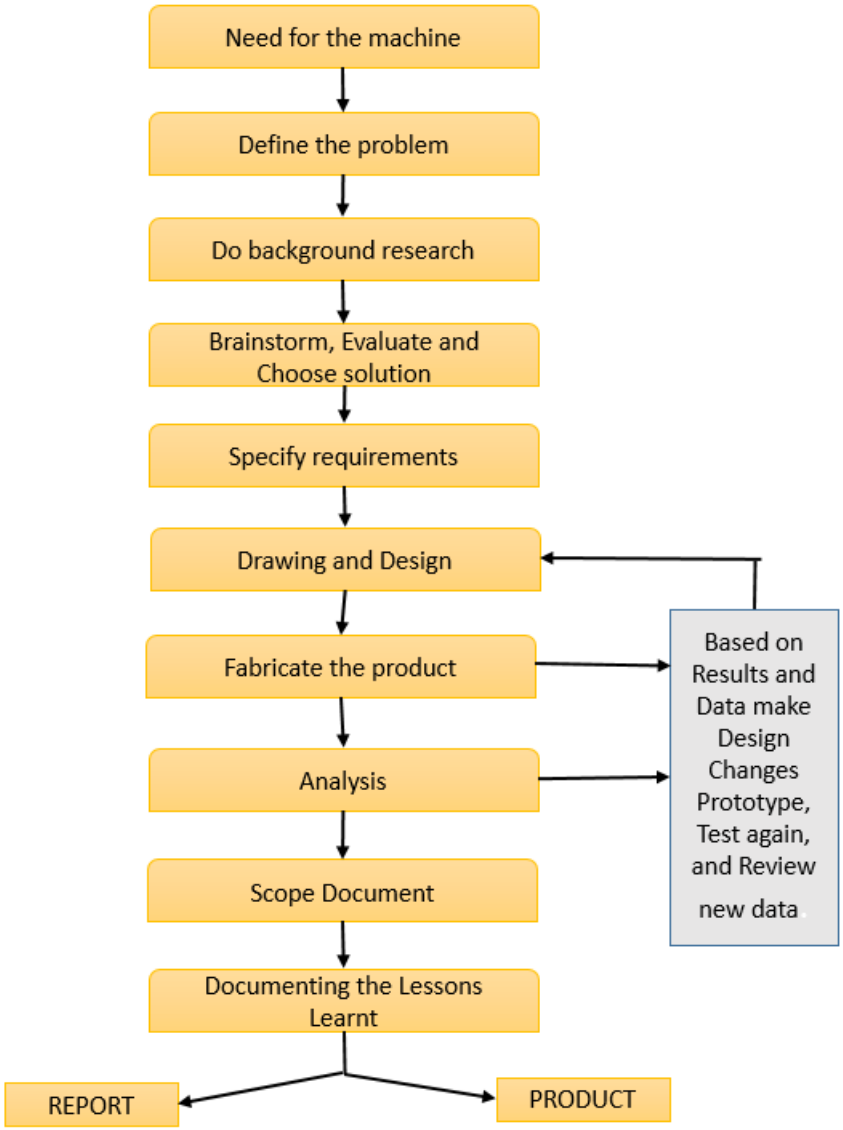



Fig 3.1: ***Methodology***

Methodology is a very important element to be considered to make sure the working of the project goes as per the expected results. In other, words methodology can be described as a fame work which contains the elements of the work base on the objectives and the scope of the project. A good framework can present the overall view of the project and be used to rearrange or abstract the data easily. This include the various steps involved such as Background research, Drawing and Design, Fabrication of product, assembly, testing phase, etc. The project Methodology is shown in fig 3.1

## 3.5 DESIGN AND MODELLING

The following images are taken from the 3D modelling software CATIA V5 .

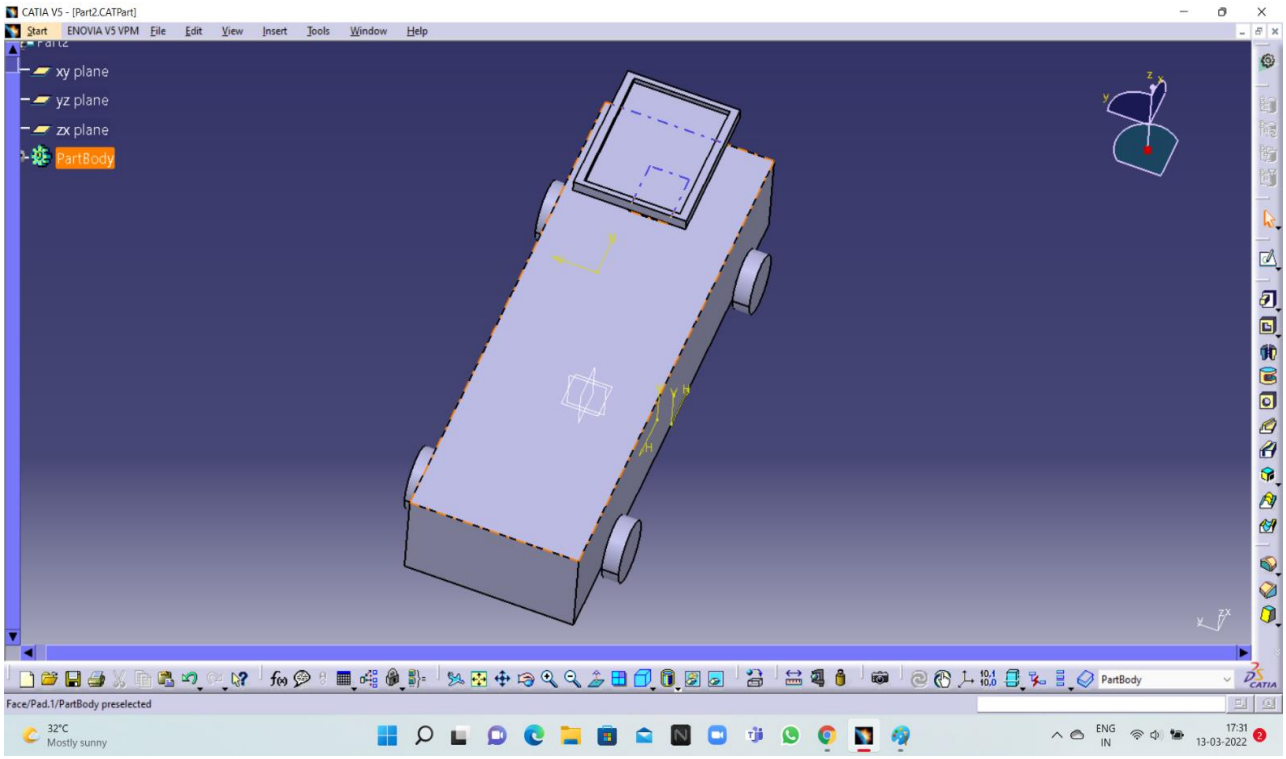



Fig 3.2: ***Top View***

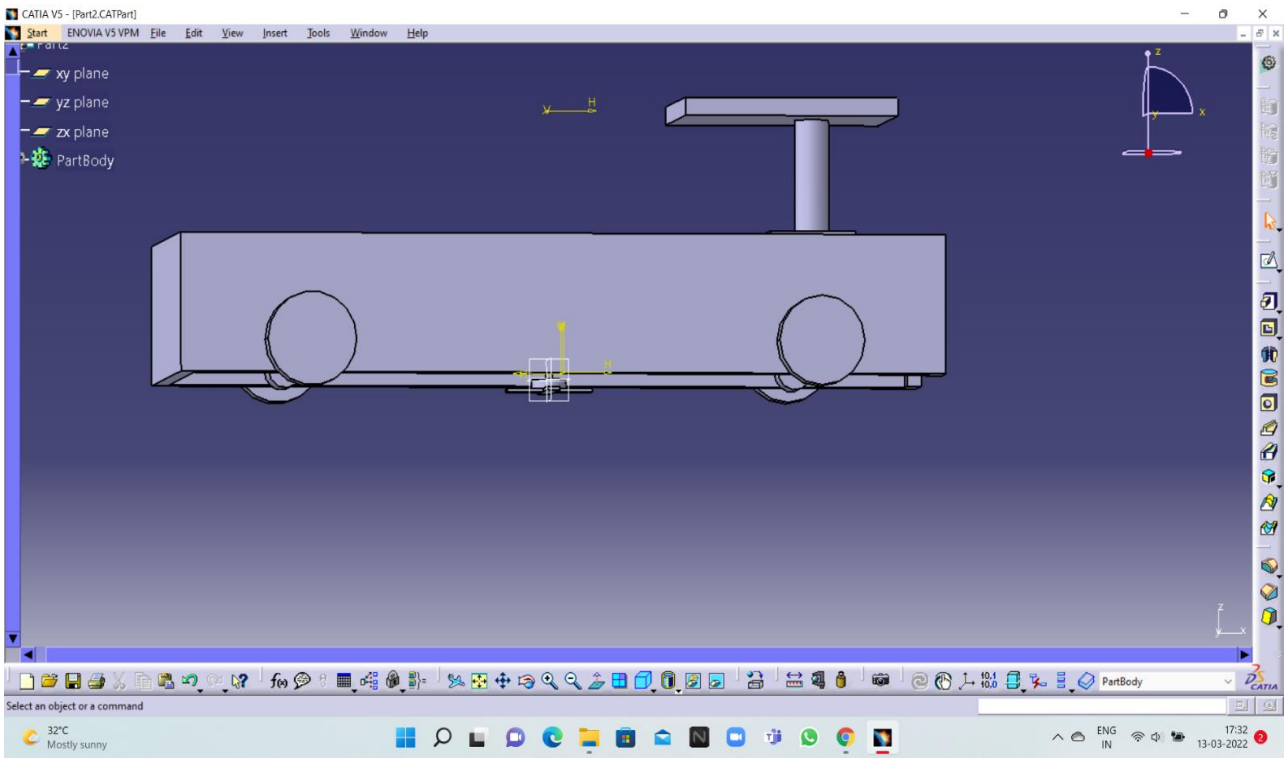



Fig 3.3: ***Side View***

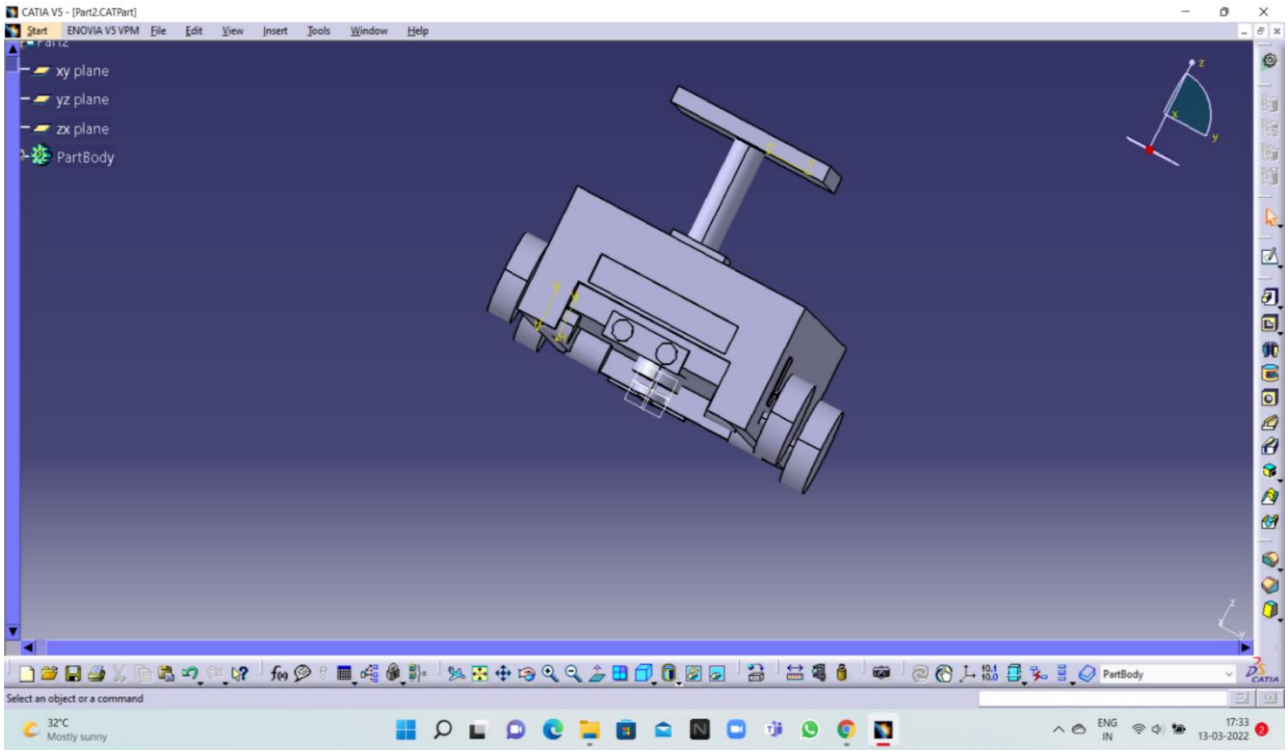



Fig 3.4: ***Front View***

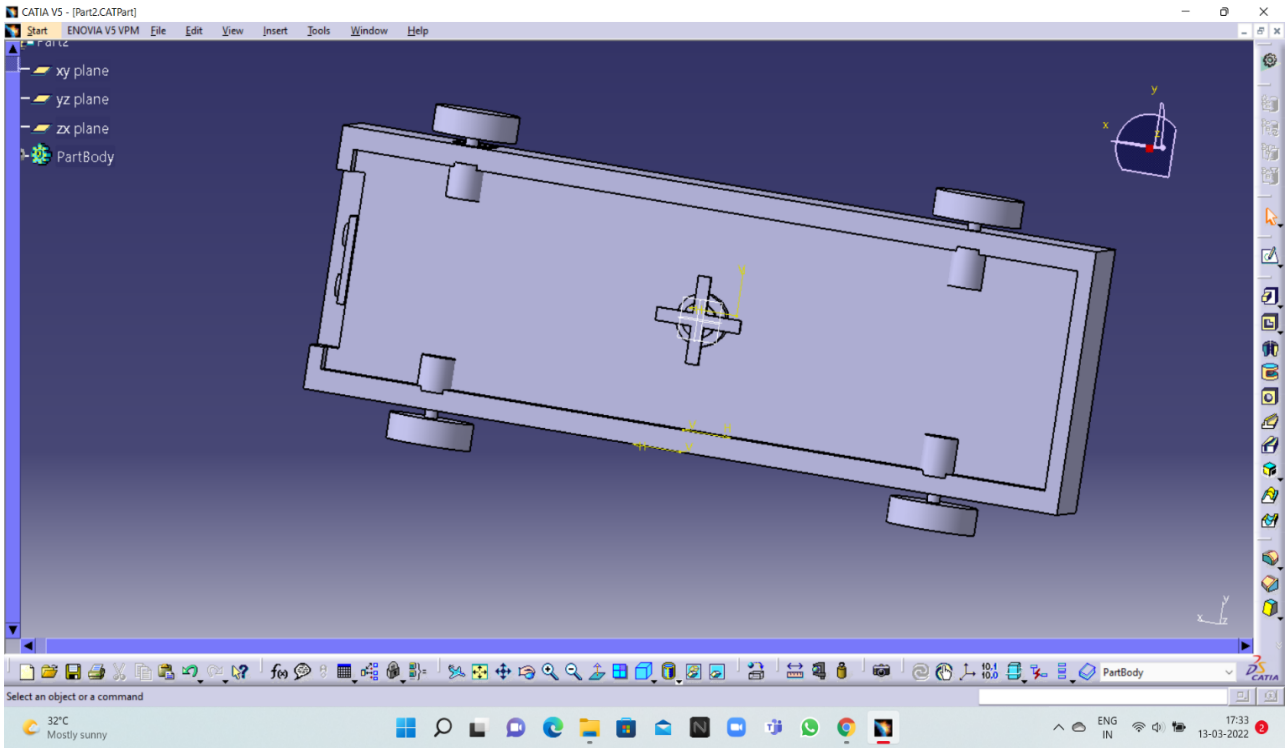



Fig 3.5: ***Bottom View***

CHAPTER 4

# COMPONENTS AND DESCRIPTION

A survey had been made to check which parts are needed for fabrication of the model. Then some brainstorming had been done to find out what material will be suitable for completion of the model, how the model will look and how it will function. Then all the major parts which were required for the model were being bought from different sources. The major parts that are effectively employed in the Design and Fabrication of Solar powered grass cutter are described below: -

- Solar Panel
- Motor
- Display
- Motor driver
- Ultra-Sonic Sensor
- Temperature sensor (LM35)
- Battery
- IR Sensor
- 1 Channel Relay
- 4 Channel Relay
- ATmega 32A Microcontroller
- Solar tracker 5w

## 4.1 SOLAR PANEL

Fig 4.1: ***Solar Panel***

### 4.1.1 *Product Details*

The photovoltaic effect helps to convert light energy (photons) from the sunlight into electricity. Wafer-based crystalline silicon cell or slender cells are used in most module. The best layer or the rear layer of a module is oftenly the architectural (load-bearing) member. Moisture and mechanical damage to cells must be prevented. The preponderance of the modules is firm, however there are some that are semi-bendy and accommodate slender cells. Electrically, the cells are interconnected in series, one to a fixed voltage, then in parallel to increase amperage. The watts of a module is the product of its voltage and thus its ampere. The assembly decisions on solar-powered chargers are made under well-known conditions, which aren't always the most severe working conditions that solar-powered chargers are exposed to at the setup site. As the result interface, a PV intersection field is connected to the back of the sunlight-based charger. For some photovoltaic modules, MC4 connectors are used to function with easy weatherproof connections with the rest of the device. It's also possible to use a USB energy point of engagement.

### 4.1.2 *Order of configuration*

A solar panel or PV machine's electrical connections are either in series to achieve a specific voltage output or in parallel to provide preferred current-day functionality (amperes). The conducting wires that transmit electricity outward from the modules must be constructed of silver, copper, or other non-magnetic conductive transition metals and scaled to the ampacity. In the case of partial module shading, two diodes can be added or used remotely to optimise the output of module areas that are still light. [need a source] In a few unique sun PV modules, concentrators are used to focus light through lenses or mirrors onto smaller cells.

### 4.1.3 *Efficiency*

Every module is evaluated based on its DC yield power under standard test conditions (STC), and the on-discipline yield energy may fluctuate as a result. The power fluctuates between 100 and 365 Watts on a regular basis (W). Given a comparable evaluated yield, a module's proficiency determines its earth - an 8% green 230W module can have twice the earth of a 16 percent green 230 W module. Sun-oriented modules can produce up to 24 percent more revenue than conventional modules. By and large, the most easily completed sunlight transformation expenditure (sun module execution) in new current product is about 21.5%, which is not quite the efficiency in

their cells in detachment. The most green 759af83dbac04511979469e6f58100a3 sunlight based modules [disputed - discuss] have energy thickness upsides of up to 175 W/m2 (16.22 W/ft2).

Researchers at Boeing's Spectro lab have proposed a 40 percent efficiency increase in multi-intersection sun-oriented cells, which might be used to replace solar photovoltaic cells. In the long run, the Spectro lab researchers predict concentrator sun-powered cells to achieve efficiencies of around 45 percent or half, with efficiencies of around 58 percent feasible in cells with several intersections.

### 4.1.4 *Specifications*

- Polycrystalline Solar Panel.
- Wattage: 3W.
- Voltage: 12V.
- 3W-12V Polycrystalline Solar Panel System for 9 V Battery Charge with 3 meter Dc 5521 Cable
- Length- 28cm
- Breadth- 12.5cm
- Thickness- 1.5cm
- Efficiency- 18.6%

## 4.2 MOTOR

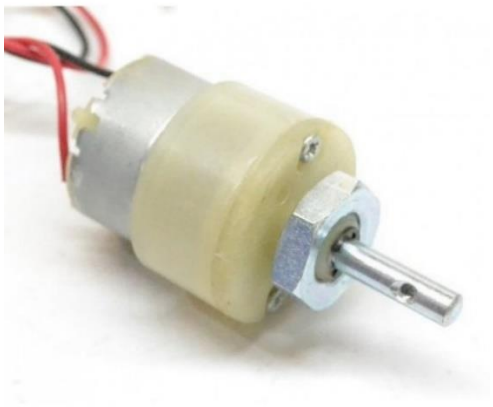


Fig 4.2: ***Motor***

### 4.2.1 *Product Details*

A gear motor is usually a simple DC electric motor with a gear mechanism attached to it. DC Motor – 1000RPM – 12Volts It will be involved across all robots and robotic packages in varying sorts. Those electric motor include a three-millimetre thread drill hole in the middle of a rod, making it simple to link them to tyres or other gear devices. Robotics packages commonly employ 1000 RPM 12V DC geared motors. It's easy to use and comes in a standard length. Users also do not have to spend a fortune to operate cars to use an Arduino or a comparable device. With such motor, that has a voltage around 5 and 35V DC, you can use the most prominent L298N H-bridge device with inbuilt voltage regulator motor driving force, or one can choose the most appropriate motor diver module from the expansive range available in our Motor divers' category, depending on your particular needs.

Internally attached shaft with screw and thread for connecting it to the wheel with ease. DC Geared vehicles with a sturdy steel gearbox for high-reliability applications, available in a wide RPM range and particularly suited for robotics and business. It's simple to use and comes in a regular size. Interior threaded shaft with screw and thread to connect it to the wheel without difficulty.

### 4.2.2 *Specifications and Features*: -

• RPM (revolutions per minute): 1000

• DC 12 volt Operating Voltage

• Gearbox: Plastic (spur) Gear attached

• Internal hole with 6mm shaft dia.

• Torque (kg-cm): 0.5

• Current with no load = 60 mA (Max)

• 300 mA load current (Max).

### 4.2.3 *Product Details*

Robotics programs involve 30RPM 12V DC geared motors. It also has a large torque of 32kgcm. The motor seems to have a metal gearbox and a driveshaft that is stale-cantered.

### 4.2.4 *Specifications and Features*

- 30RPM 12V DC motors with Metal Gearbox and Metal Gears
- Díameter shaft of 6mm with thread hole of  M3
- 37mm Dia Gearbox.
- Motor 28.5 mm Diameter
- Length 63 mm without shaft
- Shaft length 30mm
- 180gm weight
- 32kgcm Holding Torque
- No-load current = 800 mA, Load current = up to 7.5 A(Max)
- Should be applied with Dual DC Motor driver 20 recommended

## 4.3 LCD DISPLAY

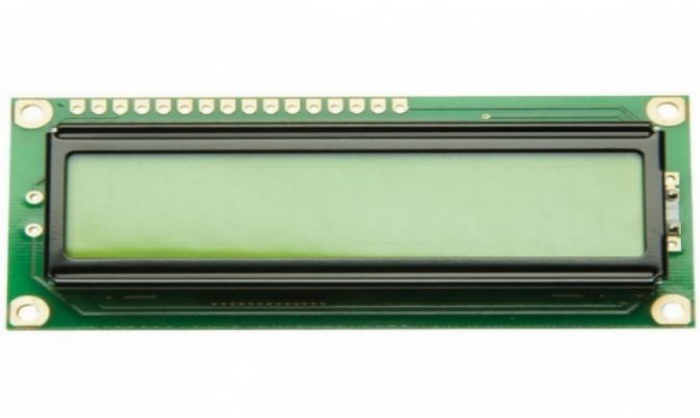


Fig 4.3: ***LCD Display***

### 4.3.1 *Product Details*

It is a basic Alphanumeric screen featuring 16 characters and two lines. On a green background, black writing is displayed. utilizes the HD44780 parallel connection chipset, that is highly ubiquitous. The source code for such interface is easily accessible. To connect to this LCD panel screen, you'll need at least 6 well-known I/O pins. LED backlight is included. It works in both four-bit and eight-bit modes.

### 4.3.2 *Specifications*

- 5x7 Dot Matrix Character + Cursor
- Standard Type
- 4-bit or 8-bit MPU Interface
- Works with almost any Microcontroller
- Green Backlight
- 16 Characters x 2 Lines
- HD44780 Equivalent LCD Controller/driver Built-In

## 4.4 L293D MOTOR DRIVER

Fig 4.4: ***L293D Motor Driver***

### 4.4.1 *Product Details*

This Arduino L293D Motor Driver Shield has two servos with four motor interfaces supporting DC or stepper cars, offering one of the most versatile on the market. As a result, it's a wonderful protection for any automated project.

This Arduino-compatible motor driving force protector is a packed solution which can handle four DC motors, two 4-cord steppers, and five-volt servos. It employs one L293D to command the DC motor and stepper, and Arduino pins 9 and 10 to run the servo.

L293D is a four-channel main thrust with a solid coordinated high voltage, high current. Basically, this demonstrates that one can use DC motor and strength parts of up to 36 Volts with this chip, which is a quite large motor, and the chip can deliver a maximum current of 600mA per channel. H-Bridge is another name for the L293D chip. The H-Bridge is an electrical connection that allows voltage to flow in both directions over a stack to a destination, such as an engine. Two L293D engine drivers and one 74HC595 shift check in are included in the shield. The shift check in expands the Arduino's 3 pins to 8 pins to monitor the engine drivers' progress.

### 4.4.2 *Specifications*

- Two 5V 'hobby' servo links to the Arduino's performance as a result timer.
- 4 H-Bridges: The L293D chip produces 0.6A per bridge (1.2A peak) with inbuilt return prevention diodes and thermal cutoff protection. Motors can run at voltages ranging from 4.5 to 25 volts.
- Up to four bi-directional DC motors, each with its own 8-bit speed control (so, about 0.5 percent resolution).
- Maximum of two stepper motors (unipolar or bipolar) with single loop, dual coil, or interleaved stepping (single coil, double coil, or interleaved stepping).
- During power-up, pull-down resistors deactivate motors.
- Large terminal block connectors for connecting wires (18-26AWG) and power with ease.
- The Arduino reset button has already been moved to the top of a screen.

- For separate logic/motor supplies, a 2-pin terminals block and jumper are being used to connect additional power.
- Tested compatible with Arduino Mega 1280 & 2560, Diecimila, Duemilanove, and UNO.
- Weight= 60g.

## 4.5 ULTRA SONIC SENSOR


Fig4.5: ***Ultra-Sonic Sensor***

### 4.5.1 *Product Details*

The ultra - sonic sensor HC-SR04 was introduced. One such practical sensor has a span of 2cm to 400cm of non-contact estimation capacity and a went accuracy of up to 3mm. A ultrasonic transmitter, a beneficiary, and a control circuit are completely remembered for each HC-SR04 module.

The HC-SR04 has four pins something one ought to know about: VCC (power), Trig (trigger), Echo (getting), and GND (ground) . One will uncover that setting up and involving this sensor for your first assortment observing mission is a pleasure. The sensor incorporates progressed control hardware that could likewise assist with keeping away from "bouncy" information from the program.

### 4.5.2 *Specifications*

- Operating Voltage = DC 5V
- Operating Current = 15mA
- Operating Frequency = 40KHz
- Max Range = 4m
- Min Range = 2cm
- Ranging Accuracy = 3mm
- Measuring Angle = 15 degrees
- Trigger Input Signal = 10µS TTL pulse
- Dimension = 45 x 20 x 15mm

## 4.6 TEMPERATURE SENSOR (LM 35)

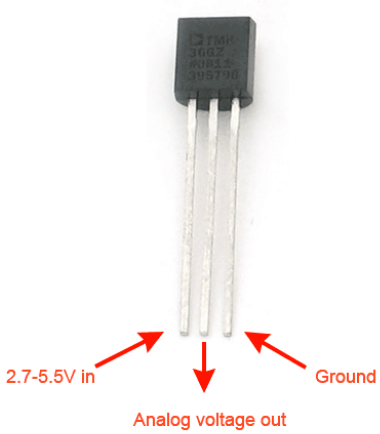



Fig 4.6: ***Temperature Sensor (LM 35)***

### 4.6.1 *Product Details*

One of the most generally observed measurements on the planet is temperature. They can be utilized on regular family things like microwaves, coolers, and forced air systems, as well as in all areas of designing. The glow/cold made by a thing to which it is connected is estimated by a temperature sensor. It then, at that point, gives a proportionate obstruction, current, or voltage yield, which can be observed or handled by our requirements. The LM35 is an incorporated simple temperature sensor with a corresponding electrical result in degrees Celsius. To accomplish standard exactness, the LM35 Sensor requires no outside adjustment or managing.

The LM35 is directly connected to an Arduino board. The LM35 temperature output could provide two comparing circuits, which could be used as an over heating sign or as a temperature regulator with a simple transfer.

### 4.6.2 *Specifications*

- Calibrated directly in Degree Celsius (Centigrade)
- Linear at 10.0 mV/°C scale factor
- 0.5°C accuracy guarantee-able (at a25°C)
- Rated for full -55°C to a 150°C range
- Suitable for remote applications
- Low cost due to wafer-level trimming
- Operates from 4 to 30 volts
- Less than 60 mA current drain
- Low self-heating, 0.08°C in still air
- Non-linearity only 0.25°C typical
- Low impedance output, 0.1Ωfor 1 mA load

## 4.7 RECHARGABLE BATTERY


Fig 4.7: ***Battery***

### 4.7.1 *Product Details*

A 6V battery is a lead-acid kind cell. it's also known as a lantern battery. It usually makes use of 4 big. 6V batteries are used in dog schooling gadgets, clinical units, film and virtual cameras, and plenty of different devices.

6v batteries will commonly hold enough price for 45-60 minutes of continuous use, whilst 12v batteries can maintain enough for two-four hours depending at the power necessities of the mounted motor. 24v batteries range, again relying on the energy usage of the motor, however commonly last between 2-4 hours. The capacity of the battery is given for a particular discharge contemporary. With a higher discharge modern, you will get less electricity from the battery. With a decrease discharge modern, you will get greater power from the battery.

### 4.7.2 *Specifications*

- Nominal voltage: 6V
- Rated capacity :5Ah
- Sealed type: sealed
- Maintenance type: free
- Container material: ABS
- Dimensions: (L*W*H) mm: 70*120*80

- Battery cell composition: Sealed Lead Acid

### 4.7.3 *Applications*

these are used for high stop packages of standby energy like trip on Toys, UPS, electric Converter, Railway Communications, safety structures and many others.

## 4.8 IR SENSOR

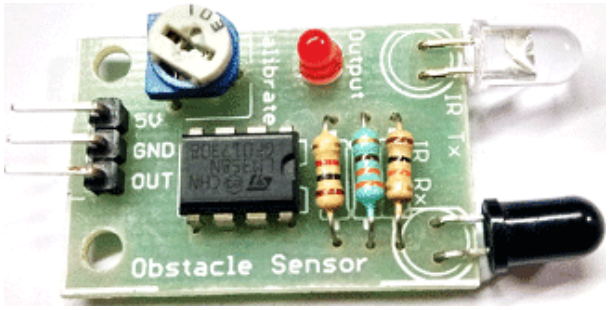



Fig 4.8: ***IR Sensor***

### 4.8.1 *Product Details*

The IR sensor module comprises explicitly of the IR Transmitter and Receiver, Op-amp, Variable Resistor (Trimmer pot), yield LED related to not many resistors.

*IR LED Transmitter*

IR LEDs produce light with a wide scope of infrared frequencies. We can't see infrared light on the grounds that its frequency (700nm - 1mm) is significantly longer than noticeable light. IR LEDs have a gentle discharge point of 20-60 degrees and a scope of a couple of centimetres to a few feet, contingent upon the kind of IR transmitter and the producer. A few transmitters have a reach estimated in kilometres. Since IR LEDs are white or obvious in variety, they can convey a lot of light.

*Photodiode Receiver*

When light strikes on a photodiode, it transmits and acts as an IR receiver. A photodiode is a semiconductor with a P-N junction that works in opposing bias, which indicates that when light falls on it, it proceeds to engage in electricity in the other direction, and the amount of cutting-edge drift is relative to the quantity of light. It is

advantageous for IR detection because of its characteristic. With a black colour coating on its outside surface, the photodiode appears to be a LED. Black colour absorbs the most light.

*LM358 Opamp*

Inside the IR sensor, an Operational Amplifier (Op-Amp) is used as a voltage comparator. The comparator will evaluate the pre-set (pin2) limit voltage as well as the photodiode's assortment resistor voltage (pin3).

The series resistor voltage drop of a photodiode is greater than the threshold voltage, indicating that the Opamp yield is high.

Because the series resistor voltage drop of the photodiode would be less than the threshold voltage, the Opamp yield is low, and the Opamp result is excessive, the LED at the Opamp yield terminal acts (Indicating the recognition of article).

*Variable Resistor*

Here, the variable resistor is pre-set. It's being used to evaluate the detection applications spanning for an objects.

### 4.8.2 *Specification*

- Operating DC voltage 5 volts
- 5V and 3.3V I/O pins are
- Range can rise Up to 20cm
- Sensing range can be Adjustable
- Ambient Light Sensors are Built-in
- 20mA current supply
- Mounting hole

### 4.8.3 *Application*

- Obstacle Detection
- Wheel encoder
- Industrial safety devices

## 4.9 SINGLE CHANNEL RELAY

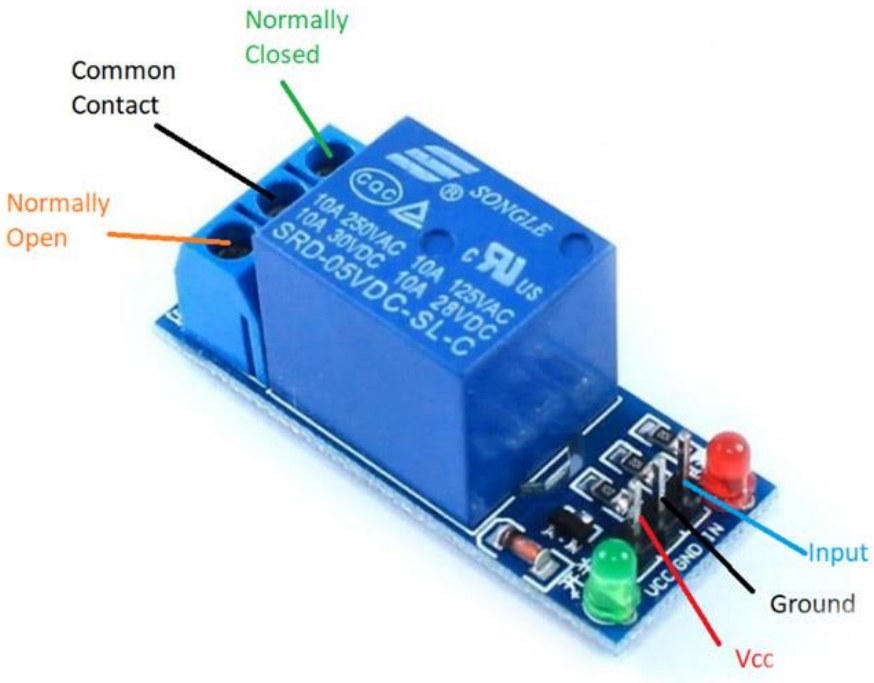



Fig 4.9: ***Single Channel Relay***

### 4.9.1 *Product details*

A relay is an electromechanical device which activates between circuits and transfer using an electric current. The single-channel relay module is more than just a simple relay; it includes additives which facilitate switching and connecting easier, and also indicators that display if the module is charged and whether the relay is operational or not.

**Table 4.1: Pin description (1channel relay)**

| Pin Number | Pin Name | Description |
|---|---|---|
| 1 | Relay Trigger | Input to activate the relay |
| 2 | Ground | 0V reference |
| 3 | VCC | Supply input for powering the relay coil |
| 4 | Normally Open | Normally open terminal of the relay |
| 5 | Common | Common terminal of the relay |
| 6 | Normally Closed | Normally closed contact of the relay |

### 4.9.2 *Specifications*

- 3.75V to 6V is Supply voltage
- 2mA is Quiescent current
- Approx. 70mA supply when the relay is active
- 250VAC or 30VDC - Relay maximum voltage
- Relay maximum current is 10A

## 4.10 4 CHANNEL RELAY

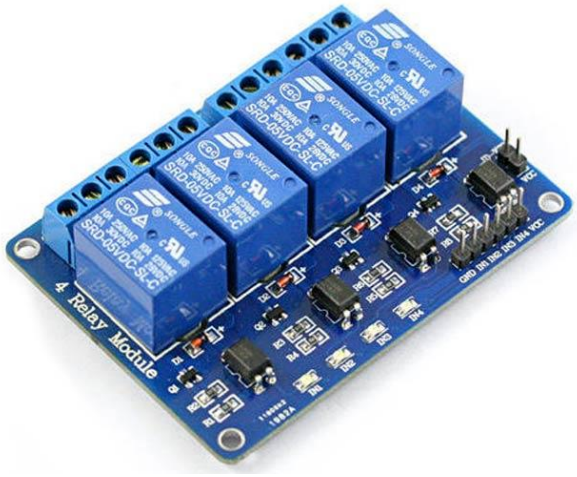


Fig 4.10: ***Four Channel Relay Module***

### 4.10.1 *Product Details*

The four-channel relay module has four 5V relays and also the necessary switching and isolation components, allowing for simple interfacing with a microcontroller or sensor with the minimum level of components and connections. Each relay's connections are labelled on the body for 250VAC, 30VDC, and 10A in each case.

**Table 4.2: Pin description (4 Channel relay)**

| Pin Number | Pin Name | Description |
|---|---|---|
| 1 | GND | Ground reference for the module |
| 2 | IN1 | Input to activate relay 1 |
| 3 | IN2 | Input to activate relay 2 |
| 4 | IN3 | Input to activate relay 3 |
| 5 | IN4 | Input to activate relay 4 |
| 6 | $V_{CC}$ | Power supply for the relay module |
| 7 | $V_{CC}$ | Power supply selection jumper |
| 8 | JD-$V_{CC}$ | Alternate power pin for the relay module |

### 4.10.2 *Specifications*

- Supply voltage is between 3.75V to 6V
- Trigger current is 5mA
- Current when the relay is active during single ~70mA, and when all four are active ~300mA
- Relay maximum contact voltage is determined as 250VAC, 30VDC
- Relay maximum current is 10A

## 4.11 ATMEGA 32A MICROCONTROLLER


Fig 4.11: ***ATmega 32A Microcontroller***

### 4.11.1 *Product Details*

The 8-cycle AVR RISC-based microcontroller from Microchip includes 32 KB of self-programming Flash programme memory, 2 KB of SRAM, 1 KB of EEPROM, an 8-channel 10-bit A/D converter, and a JTAG port for on-chip debugging. The gadget achieves 16 MIPS throughput at 16 MHz and 2.7-5.5V voltage.

By performing solid recommendations in a single clock cycle, the device achieves throughputs approaching one MIPS for each MHz, allowing you to fine-tune power usage and handling speed.

### 4.11.2 *Specifications and Features*

- Fully Static Operation
- Up to 16 MIPS Throughput at 16 MHz
- On-Chip Two-Cycle Multiplier
- 131 Powerful Instructions - Most Single-Clock Cycle Execution
- 32 8 General Purpose Working Registers
- 32 KB of in-system flash programme memory
- 1 KB of EEPROM
- 2 KB of internal SRAM
- 10,000 Flash/100,000 EEPROM write/erase cycles
- In-System Programming via On-Chip Boot Program
- True Read-While-Write Operation
- Programming Lock for Software Security
- JTAG (IEEE std. 1149.1 Compliant) Interface
- Boundary-scan Capabilities According to the JTAG Standard
- Extensive On-Chip Debug Support Programming of Flash, EEPROM, Fuses, and Lock Bits through the JTAG Interface
- Q Touch library support
- Capacitive touch buttons,

## 4.12 SOFTWARE USED

### 4.12.1 *Product Details*

Arduino is an open-source model stage that is based on a simple set of tools and programming. It consists of a programmable circuit board (known as a microcontroller) and an Arduino IDE (included development environment) ready-to-use programming application for writing and transferring PC code to the physical board.

### 4.12.2 *Specification*

•Arduino sheets can assess simple or advanced input markers from different sensors and convert them to results, for example, turning on/off LEDs, associating with the cloud, and numerous different activities.

•You might utilize the Arduino IDE to control the elements of your board by sending a bunch of directions to the board's microcontroller (known as transferring programming program).

•Not like most past programmable circuit sheets, Arduino doesn't need the utilization of a different piece of equipment (alluded to as a developer) to stack new code into the board. You are free to use a USB string.

•also, the Arduino IDE utilizes an improved on type of C++, making it more straightforward to figure out how to program.

•Sooner or later, Arduino will deliver a standard structure issue that isolates the microcontroller's highlights into a different complete bundle.


Fig 4.12: ***Arduino Software***

## 4.13 FINAL PRODUCT


Fig 4.13: ***Solar Powered Grasscutter***

All the components which are mentioned above with there specification were assembled together, and after every part was assembled regular testing was carried out. During the process of testing some alternation were made as per the requirement to provide better performance of the project. Later going through other similar projects, an observation was made where casing of the project was not present, therefore mild steel was used to construct the casing of the project

# CHAPTER 5

# RESULT AND DISCUSSION

## 5.1 PROTO-TYPE ANALYSIS

At a particular time interval, the given readings in Table 5.1 were taken using Temperature Gun, Solar power meter and multimeter.

***Temperature Gun***

It was used to measure the temperature of solar panel by pointing the gun over the panel, and the readings were taken in Celsius.

***Solar Power Meter***

It was used to measure the intensity of the sunlight by pointing the device towards the sun and the similar process was carried out to measure the intensity of the solar panel by pointing the device towards the panel. The given data is measured in $W/m^2$ .

***Multimeter***

It was used to measure the voltage of the solar panel during the specific time interval. The given data is measured in Volts.

**Table 5.1: Solar Panel Analysis**

| Time in hrs | Temperature in Celsius | Voltage in volts | Intensity of sunlight in $W/m^2$ | Intensity of solar panel in $W/m^2$ |
|---|---|---|---|---|
| 9.30 | 49 | 18.9 | 883 | 173 |
| 10.00 | 46 | 19.32 | 948 | 160 |
| 10.30 | 49 | 19.15 | 985 | 191 |
| 11.00 | 50 | 19.10 | 993 | 190 |
| 11.30 | 53 | 18.88 | 1048 | 197 |
| 12.00 | 54 | 18.85 | 1054 | 231 |
| 12.30 | 53 | 19.01 | 1052 | 240 |
| 1.00 | 58 | 18.85 | 1024 | 228 |
| 1.30 | 53 | 19.21 | 1018 | 225 |
| 2.00 | 54 | 19.18 | 1000 | 210 |
| 2.30 | 52 | 19.12 | 996 | 209 |
| 3.00 | 45 | 19.06 | 870 | 197 |
| 3.30 | 39.5 | 18.27 | 730 | 200 |
| 4.00 | 36.5 | 18.15 | 628 | 239 |

## 5.2 CALCULATIONS

Total power consumption = (12w * 5) +5= 65 w/hr

Power required for working 1 day for 4 hrs = 65 * 4 = 260w/hr

Power Generated in 7 days to work for 4 hrs = 260 / 7 = 37w

Below mentioned Fig 5.1 is a graphical representation of Temperature with respect to Time. A Temperature Gun was used to measure the temperature of solar panel at specific time intervals.

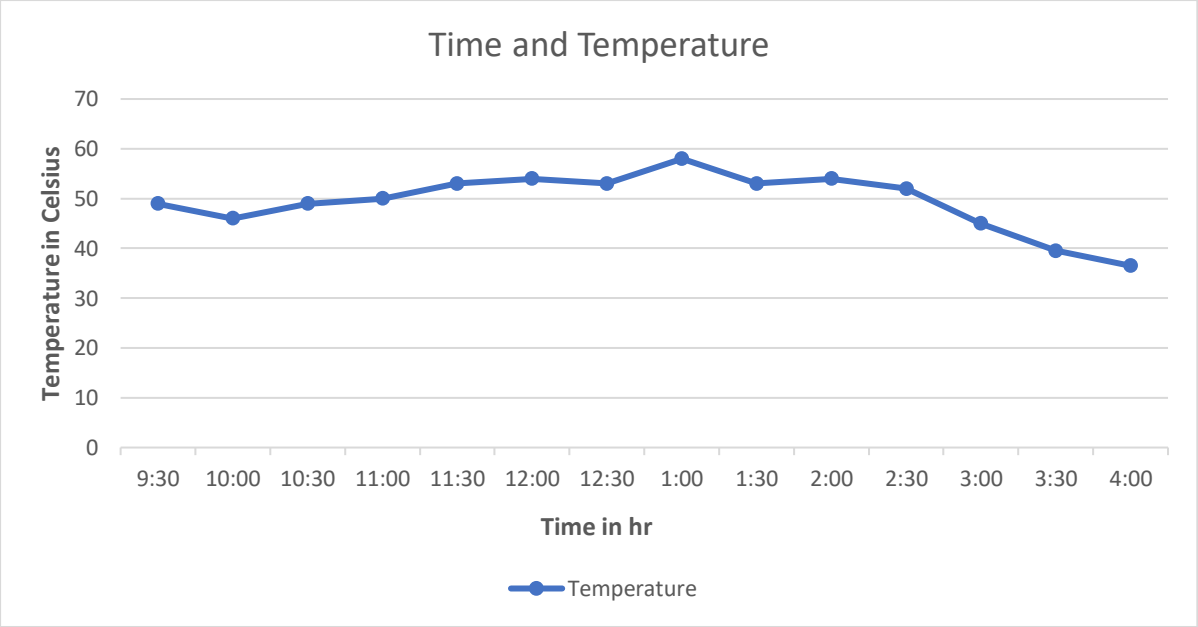



Fig 5.1: ***Graph between time and temperature***

Below mentioned Fig 5.2 is a graphical representation of Voltage with respect to Time. A Multimeter was used to measure the voltage of solar panel at specific time intervals.

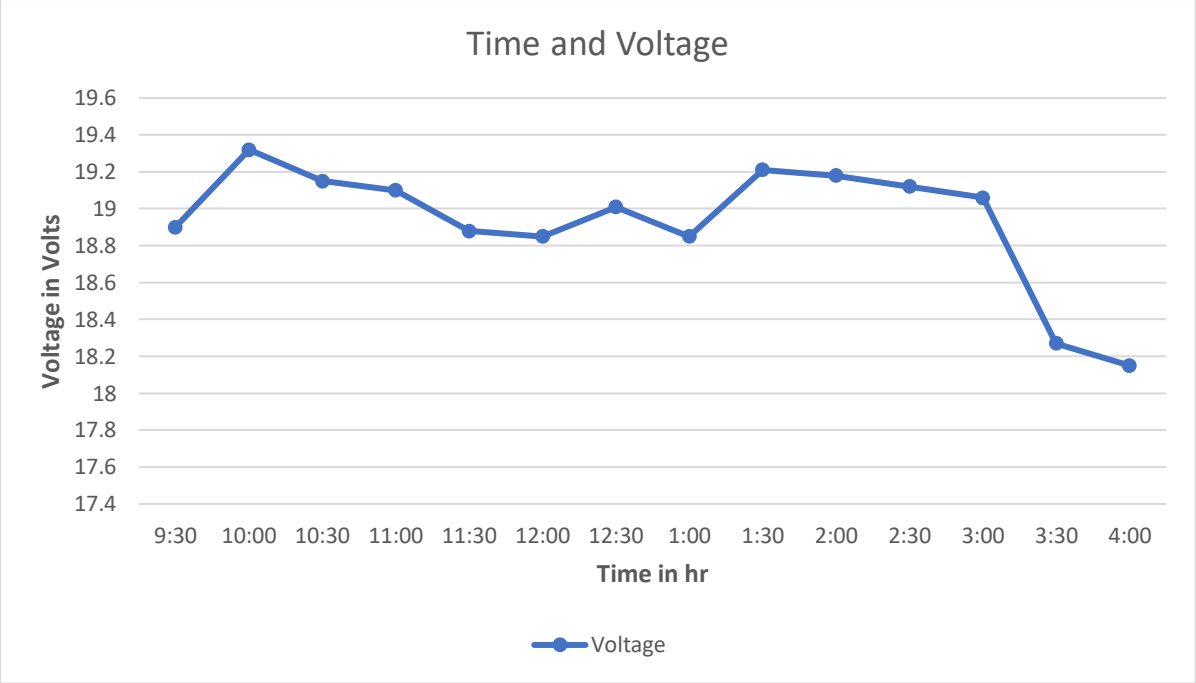



Fig 5.2: ***Graph between time and voltage***

Below mentioned Fig 5.3 is a graphical representation of Intensity of sunlight and solar panel with respect to voltage. A Solar power meter was used to measure the intensity of solar panel and sunlight.

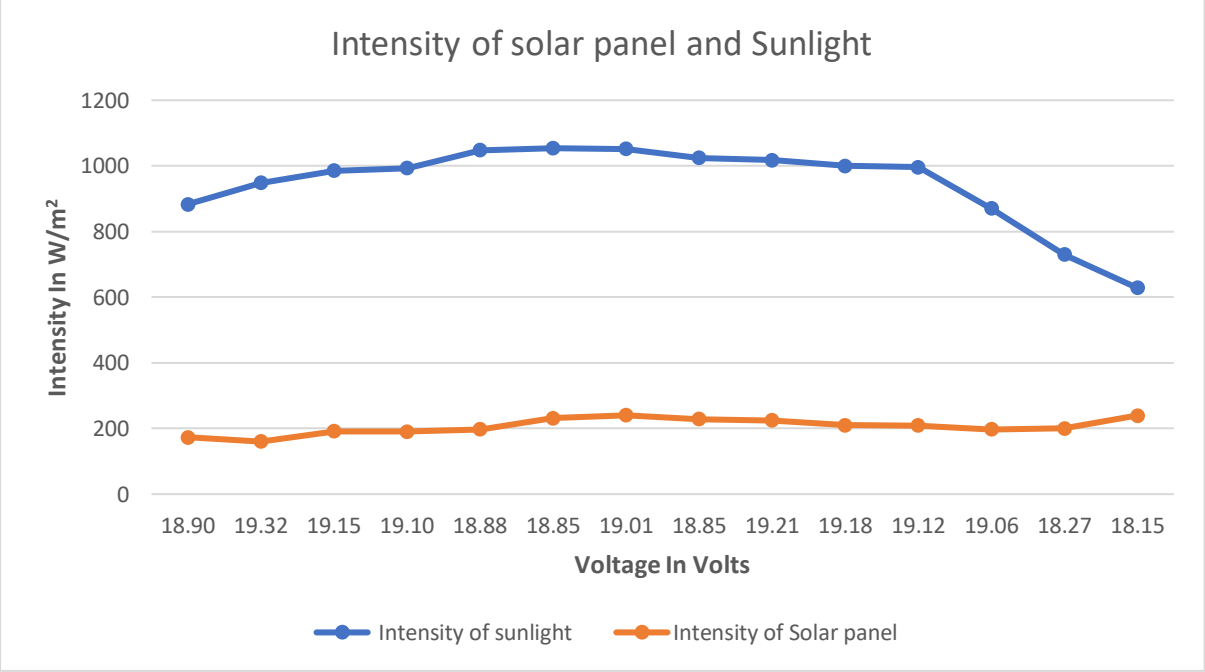



Fig 5.3: ***Graph between Intensity and Voltage***

# CHAPTER 6

## SUMMARY AND CUNCLUSION

The sole purpose of today's equipment is to eliminate greenhouse gas emissions, which seem to be the principal contributor to climate change. This solar-powered lawn cutter will achieve the project's environmental aims while also being low-cost to administer thanks to the shortage of a fuel source. A solar lawn mower has been created for use in homes, institutions, and fields with lawns that cannot be serviced by tractor-driven mowers. The device's capabilities are sufficient for the task at hand. The technology has shown to be a viable alternative to gasoline-powered lawn mowers. The provided document contains fabricated information on the "design and Fabrication of solar Powered Grass Cutter," which is designed in such a way that the solar plate creates solar electricity and uses it to power the grass cutter motor. It has been built with the capability of integrating all of the hardware components needed. Each module's presence has been carefully considered and arranged, ensuring that the unit runs well. Second, the assignment has been successfully implemented thanks to the usage of extremely superior ICs and developing technology. As a result, the task has been well-designed and assessed.

# REFERENCES


[1]. Sujendran S. and Vanitha p., Smart Lawn Mower for Grass Trimming, International Journal of Science and Research, Vol.3, 2014, 2319-7064.

[2]. Praful P. Ulhe, Manish D. Inwate, Fried D. Wankhede and Krushankumar S. Dhakle, Modification of Solar Grass Cutting Machine, International Journal for Innovative Research in Science and Technology, Vol.2,2016,2349-6010.

[3]. Yogita D. Ambekar, Abhishek U. Ghate, "Solar Based Grass Cutter", Second International Conference on latest trend in engineering, science, humanities and management, Page no. 322-326, Feb-2017

[4]. Bulski, P., Yu, S. and E.D., D. (2008) 'Investigation of sound induced by grass cutting blades'.Journal of Engineering and applied science ,3,pp.290-298

[5]. Ms. Lanka Priyanka, Mr. Prof. J. Nagaraju, Mr. Vinod Kumar Reddy, Fabrication of Solar Powered Grass Cutting Machine, International Journal and Magazine of Engineering, Technology, Management and Research, Vol. 2, 2015, 386-390

[6]. Kumar, D. P. et al., n.d. Design and Fabrication of Smart Solar Lawn Cutter, s.l.: university B D T college of engineering.

[7]. K, V., K, P., R, S. & A, S., 2015. Fabrication and Analysis of Lawn Mower. International Journal of Innovative Research in Science, Engineering and Technology, 4(6), p. 606.

[8]. Mohammad, M. S., Ahmad & Prof, 2018. Design and fabrication of two-wheeler operated sickle bar mower. International Research Journal of Engineering and Technology, 05(10), p. 530.

[9]. M, S. M. & Ahmad, P. K., 2018. Design and fabrication of two-wheeler operated sickle bar mower. International Research Journal of Engineering and Technology, 05(10), p. 530.

[10]. Ogiemudia, O., 2016. Design and Improvement of a Solar Powered Lawn Mower from Locally Sourced Material. ELK Asia Pacific Journals, 2(1), p. 1.

[11]. P, B. et al., 2017. Design and Implementation of Automatic Solar Grass Cutter. International journal of advanced research in electrical, electronics and instrumentation engineering, 6(4), p. 2433.

[12]. Satwik, D. & Ramalingeswara, 2015. Design and Fabrication of lever operated Solar Lawn Mower and Contact Stress analysis of Spur Gears. International journal of Science, Engineering and Technology Research, 4(8).

**[13]. https://learnmech.com/solar-based-grass-cutter-project-report-free-download/**

**[14]. https://www.ijser.org/researchpaper/IOT-BASED-GRASS-CUTTER-WITH-SOLAR-PANNEL.pdf**

**[15]. https://www.pantechsolutions.net/arduino-based-solar-grass- cutter-fully-automated/**

**[16]. https://www.youtube.com/watch?v=xaZszXoAMwo**

**[17].** https://nevonprojects.com/fully-automated-solar-grass-cutter/

**[18].** https://www.researchgate.net/publication/326033151_A_Fully_Automated_Lawn_Mower_Using_Solar_Panel

# APPENDIX 1

SOURCE CODE

LiquidCrystal Library - Hello World

Demonstrates the use a 16x2 LCD display. The LiquidCrystal library works with all LCD displays that are compatible with the Hitachi HD44780 driver. There are many of them out there, and you can usually tell them by the 16-pin interface.

This sketch prints "Hello World!" to the LCD
and shows the time.

The circuit:
* LCD RS pin to digital pin 13
* LCD Enable pin to digital pin 12
* LCD D4 pin to digital pin 5
* LCD D5 pin to digital pin 4
* LCD D6 pin to digital pin 3
* LCD D7 pin to digital pin 2
* LCD R/W pin to ground
* 10K resistor:
* ends to +5V and ground
* wiper to LCD VO pin (pin 3)

Library originally added 18 Apr 2008
by David A. Mellis
library modified 5 Jul 2009
by Limor Fried (http://www.ladyada.net)
example added 9 Jul 2009
by Tom Igoe

```
 modified 22 Nov 2010
 by Tom Igoe

 This example code is in the public domain.

 http://www.arduino.cc/en/Tutorial/LiquidCrystal
 */
#include <LCD_I2C.h>
LCD_I2C lcd(0x27, 16, 2); // Default address of most PCF8574 modules, change according

String inputString = "";         // a string to hold incoming data
boolean stringComplete = false;  // whether the string is complete
int oc;
long duration, inches, cm;
long distance1,distance2;
long ll;

void setup() {
  // set up the LCD's number of columns and rows:
   Serial.begin(9600);

    lcd.begin(); // If you are using more I2C devices using the Wire library use lcd.begin(false)
    lcd.backlight();

  pinMode (3,INPUT);//attach pin 2 to vcc
  pinMode (4,OUTPUT);//attach pin 2 to vcc
  pinMode (5,OUTPUT);//attach pin 2 to vcc
  pinMode (6,OUTPUT);//attach pin 2 to vcc
  pinMode (7,OUTPUT);//attach pin 2 to vcc
```

```
  pinMode (12,OUTPUT);//attach pin 2 to vcc
  pinMode (A1,OUTPUT);//attach pin 2 to vcc
  pinMode (A2,OUTPUT);//attach pin 2 to vcc
  pinMode (A3,OUTPUT);//attach pin 2 to vcc

  pinMode (8,INPUT);//attach pin 2 to vcc
  pinMode (9,OUTPUT);//attach pin 2 to vcc

  pinMode (10,INPUT);//attach pin 2 to vcc
  pinMode (11,OUTPUT);//attach pin 2 to vcc


}

int sp,spt,sptt,spd,spc;


void loop() {
  // set the cursor to column 0, line 1
  // (note: line 1 is the second row, since counting begins with 0):
   // print the number of seconds since reset:

  int temp=analogRead(A0)/7;
  temp=analogRead(A0)/7;

  lcd.setCursor(0, 0);
  lcd.print("T:");
  lcd.write((temp/100)+0x30);
  lcd.write(((temp%100)/10)+0x30);
```

```
lcd.write((temp%10)+0x30);

int ir=digitalRead(3);
lcd.setCursor(8, 0);
lcd.print("SP:");
lcd.write((sp/100)+0x30);
lcd.write(((sp%100)/10)+0x30);
lcd.write((sp%10)+0x30);

sptt++;

if(ir==1)
 {
   if(spc==0)
     {
       spt=1;
       spd++;
     }
 }
 else
 {
   spt=0;
 }

 if(sptt==20)
   {
     sp=spd*10;
     spd=0;
     sptt=0;
   }
```

```
digitalWrite(9, LOW);
delay(2);
digitalWrite(9, HIGH);
delay(5);
digitalWrite(9, LOW);
duration = pulseIn(8, HIGH);
distance1= duration*0.034/2;
lcd.setCursor(0, 1);
lcd.print("                ");
lcd.setCursor(0, 1);
lcd.print("U1:");
lcd.print(distance1);


digitalWrite(11, LOW);
delay(2);
digitalWrite(11, HIGH);
delay(5);
digitalWrite(11, LOW);
duration = pulseIn(10, HIGH);
distance2= duration*0.034/2;
lcd.setCursor(8, 1);
lcd.print("U2:");
lcd.print(distance2);



lcd.setCursor(8, 1);
```

```
lcd.setCursor(15,0);
lcd.print(ll);

if((distance1<10))
{
   if(ll==0)
     {
       oc=1;
       ll=1;
     }
   else if(ll==1)
     {
       oc=2;
       ll=0;
     }

}


if(distance2<20)
{
 digitalWrite(7,0);
digitalWrite(6,0);
digitalWrite(5,0);
digitalWrite(4,0);
digitalWrite(12,0);
digitalWrite(A1,0);
digitalWrite(A2,0);
digitalWrite(A3,0);
  delay(10000);
```

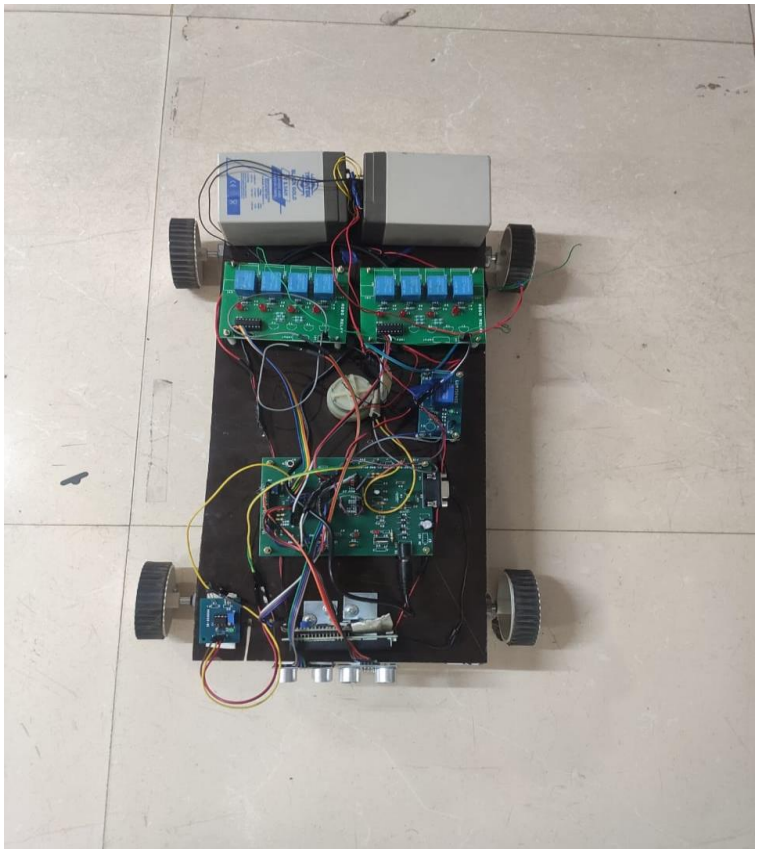
```
  }

if(oc==0)
{
  digitalWrite(7,1);
  digitalWrite(6,0);
  digitalWrite(5,1);
  digitalWrite(4,0);
  digitalWrite(12,1);
  digitalWrite(A1,0);
  digitalWrite(A2,1);
  digitalWrite(A3,0);
}
 if(oc==1)
{
  digitalWrite(7,0);
  digitalWrite(6,0);
  digitalWrite(5,1);
  digitalWrite(4,0);
  digitalWrite(12,0);
  digitalWrite(A1,0);
  digitalWrite(A2,1);
  digitalWrite(A3,0);
  delay(5000);
  digitalWrite(7,1);
  digitalWrite(6,0);
  digitalWrite(5,1);
  digitalWrite(4,0);
  digitalWrite(12,1);
```

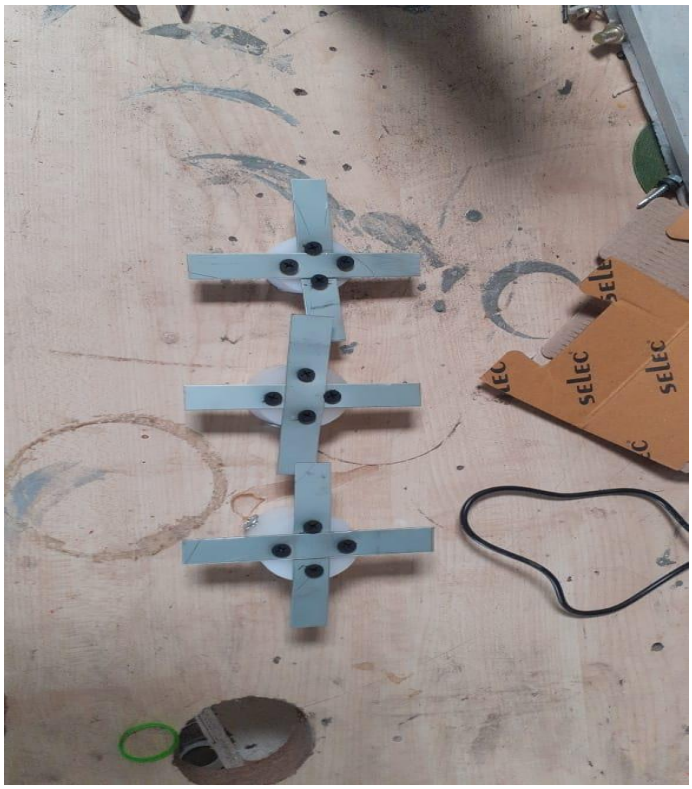
```
  digitalWrite(A1,0);
  digitalWrite(A2,1);
  digitalWrite(A3,0);
  delay(5000);
    digitalWrite(7,0);
  digitalWrite(6,0);
  digitalWrite(5,1);
  digitalWrite(4,0);
  digitalWrite(12,0);
  digitalWrite(A1,0);
  digitalWrite(A2,1);
  digitalWrite(A3,0);
  delay(5
  000);
  oc=0;

}
if(oc==2)
{
  digitalWrite(7,1);
  digitalWrite(6,0);
  digitalWrite(5,0);
  digitalWrite(4,0);
  digitalWrite(12,1);
  digitalWrite(A1,0);
  digitalWrite(A2,0);
  digitalWrite(A3,0);
  delay(1000);
  digitalWrite(7,1);
  digitalWrite(6,0);
```

```
  digitalWrite(5,1);
  digitalWrite(4,0);
  digitalWrite(12,1);
  digitalWrite(A1,0);
  digitalWrite(A2,1);
  digitalWrite(A3,0);
  delay(1000);
    digitalWrite(7,1);
  digitalWrite(6,0);
  digitalWrite(5,0);
  digitalWrite(4,0);
  digitalWrite(12,1);
  digitalWrite(A1,0);
  digitalWrite(A2,0);
  digitalWrite(A3,0);
  delay(1000);
  oc=0;

}


 }
```

# APPENDIX 2

## PROJECT PICTURES




SELEC
SELEC