Automatic Solar Grass Cutter System

A report submitted to the Department of Mechanical, Sonargaon University of Bangladesh in partial fulfillment of the requirements for the Award of Degree of Bachelor of Science in Mechanical Engineering.

Submitted by

Koshik Nath	**ID: ME2002021245**
Abdullah	**ID: ME2002021272**
Amjad Hossen	**ID: BME1801014184**
Shujan Mahmud	**ID: ME2002021283**
MD Hasibul Hasan	**ID: ME2002021291**



Supervised by

MD Misbah Uddin (Lecturer)
Department of Mechanical Engineering
Sonargaon University (SU)
147/1 Green Road, Panthapath. Dhaka-1215,
Bangladesh

MAY 2024

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Submitted By-

Koshik Nath
ID: ME2002021245

Abdullah
ID:ME2003022136

Amjad Hossen
ID: BME1801014184

Shujan Mahmud
ID: ME2002021283

MD Hasibul Hasan
ID: ME2002021291

Supervised By-

MD Misbah Uddin
Lecturer
Department of ME
Sonargaon University

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[Authors]

Koshik Nath
ME2002021245

Abdullah
ME2002021272

Amjad Hossen
BME1801014184

Shujan Mahmud
ME2002021283

MD Hasibul Hasan
ME2002021291

ABSTRACT

This project is proposing an effective goal for developing a machine that will perform useful task independently with minimal supervision. The objective of this project is to discover the current issues in implementing the design of a automatic solar powered grass cutter system for house gardens, and fields with a specified area. It has achieved by doing research on current issues in designing the mechanism with electronic control circuitry. The simplicity of making this automated grass cutter has made it very versatile and flexible. The main objective of this automatic solar powered grass cutter machine is to cut grass using solar power or by using battery power which is stored by using solar panel. It is also very useful for low cost of fabrication and maintenance. Performance of machine area of ground grass 0.2084 square meter cutting time 2 minutes and 12.504 square meter cutting time 1 hour.

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CHAPTER 1

INTRODUCTION

1.1 Introduction

The automation is useful at various stages of human life. The beautiful evenly cut grass increases the beauteousness of any hotel, house, park, meeting hall etc. Hence uniform grass cutting is important to maintain the prestige of any house or hotel. The manual grass cutting is possible using human being but it usually consumes time and energy of human being. Also the manual grass cutting is inefficient and many time results in non-uniform structure of grass. Hence to avoid all these issues it is better to use automated grass cutting robot machine which can be operated through android phone.

The grass is a very common plant that grows naturally on earth which covers up to 40% of earth‘s land surface [1]. Grasses are highly beneficial to nature and to mankind. It provides food, fuel, medicine, shelter and transportation. It provides protection against soil erosion and improves air quality and filter pollution. While grasses improve both human and animal life it can also be a pest, invasive and bringer of death and destruction. Invasive grass species when dried can cause fire. Some grass species can kill plants by choking and displacing them and competing to the soil nutrients and water resources. The invasive and uncontrollable nature of some species of grasses can greatly impact the environment and the economy [2].

In order to address these issues it needs scientific and technological solutions. The solution can either be through chemical, organic and/or mechanical means. The grass can be controlled chemically by herbicides; however herbicides cause injury to non-target plants. During the Vietnam War in 1961-1971, the Americans used the infamous herbicides called ‗Agent Orange‘ to clear vegetation in large areas of Vietnam, Laos and Cambodia [3]. It did successful defoliation but it caused huge amount of destruction to agricultural land and forest. Other forms of killing weeds is by organic means, solutions such as vinegar, dish soap, Epsom salts and borax which are low cost and can kill weeds [4]. However, most of the organic weed killers are at a much lower strength compared to the harsh chemical-based solutions and it doesn't travel down the weed and attack the root system. This means the weed can start to grow back within a short period of time. There are many manual means of controlling grasses.

In this solar based grass cutter, the advantage of powering a grass cutter by solar rather than by gasoline is mainly ecological. The advancements are mostly designed to reduce the manual work and save power by utilizing the solar power to generate the electricity. This project is designed to reduce the labour power required in grass cutting at residences, agricultural areas

etc.Here the solar energy generated from solar panel is stored in the battery and used to run DC motor in the system.The DC motor is attached with blade to trim the grasses.

1.2 Objective:

In the course of design and installation of a **Automatic Solar Grass Cutter Machine**, the following criteria are set to fulfill its objectives:

- To reduce the human efforts by using fully automatic solar grass cutter.
- The project is powered by solar energy hence the consumption of fossil fuel is reduced.
- It is an eco-friendly, No pollution, less economical, Efficient , Unmanned vehicle
- Whole object will be controlled through Wi-Fi module.
- Without using any external power supply the machine is going to perform its own operation.
- Using solar energy (renewable source), the battery will charge automatically.
- To provide an automated grass cutter which follows a programmed path of data .

1.3 Methodology

- Creating an idea for Design and construction of **Automatic Solar Grass Cutter Machine**. And designing a block diagram & circuit diagram to know which components need to construct it.

- Collecting the all components and programming for the micro controller to controlled the system.

- Setting all components in a PCB board & soldering. Then assembling the all block in a board and finally run the system & checking.

CHAPTER 2

LITERATURE REVIEW

2.1 LITERATURE REVIEW

A Solar grass cutter is a machine that uses sliding blades to cut a lawn at an even length. 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, colleges etc. Rapid growth of various high-tech tools and equipment's makes our jobs done comfortable and sophisticated.

The project aims at fabricating a grass cutting machine system which makes the grass cutter based motor running through solar energy. Power plays a great role wherever man lives and works. The cutting mechanism is made of a flat blade rigidly fixed to the frame behind the spiral arrangement which is configured to contact at least one reel bar of the spiral blades during the rotation of the spiral mechanism .The cutting effectiveness was achieved with a total power of 934.3watts at a rotary speed of 1000rpm of shaft. For designing of Automatic Lawn Cutter various literature, papers were referred. The review of previous method used given below: In this lawn mower uses an solar based energy source, which is easier to use, more advantageous comparing to other energy source especially for gas based source of power .But the lawn cutter is not based on solar because of its cost and may create some complexity during working .

In this hydrogen based lawn mower, the advantage of powering a lawn mower by hydrogen rather than by gasoline is mainly ecological. It not used this for our lawn cutter because it is very old method and many overcome produced from this type lawn cutter. The self- powered design objective is to come up with a mower that is portable, durable, easy to operate and maintain. It also aims to design a self- powered mower of electrical source; a cordless electric lawn mower. The heart of the machine is a battery-powered dc electric motor. It is also useful method for our lawn mower. It is similar to the lawn cutter using display and keypad.

CHAPTER 3

THEORY & WORKING PRINCIPLE

3.1 System Description

The Solar Panel will be connecting through pin 1 and 16 to solar charger controller, the out pins (2 and 4) are connected to battery pin as shown in the circuit diagram now we are more than half way mark. Connect the gear motors to the shown pin of Motor Driver and the motor driver will connect to Arduino pin 6,7,8,9,10. Now comes the Bluetooth module and which will have its Rx,Tx pin connected with Tx,Rx pin of Arduino respectively. Battery or power adapter of 5-6V is required. So, data sent to the Bluetooth module using mobile or any Bluetooth enabled devices through Bluetooth terminal apps are fetched to the **Automatic Solar Grass Cutter Machine**.

This document deals with an innovative rather an interesting manner of intimating the message to the people using a wireless electronic display board which is synchronized using the Bluetooth technology. This proposed technology can be used in colleges many public places, malls or big buildings to enhance the security system and also make awareness of the emergency situations and avoid many dangers.

3.2 Block Diagram

In this project we have used Bluetooth module for wireless communication between our smart phone & our designing project. This Bluetooth module connected the Arduino RX & TX pin. And control the movement of that lawn mower.

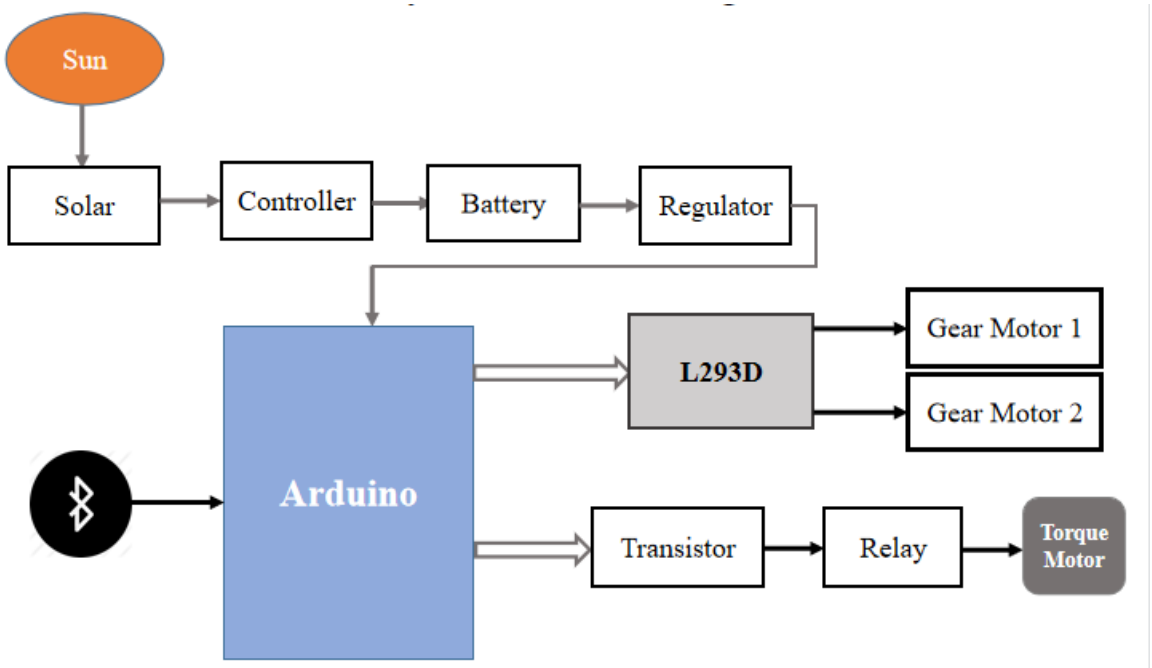


Figure 3.1: Block Diagram of **Automatic Solar Grass Cutter Machine**.

3.3 Schematic Diagram

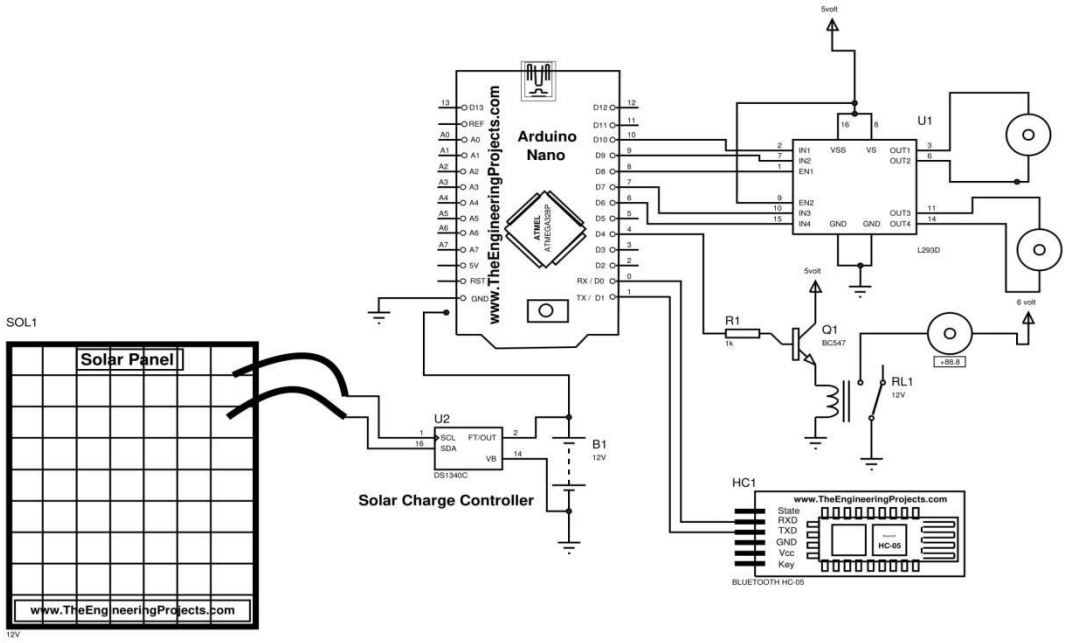


Figure 3.2: Schematic diagram of **Automatic Solar Grass Cutter Machine**.

3.4 Working Principle

This system work with solar panel as the power will be store from solar panel through solar charger control to battery, from there the full function will be power generate, then 2 Gear DC Motors with **L293D** Motor driver will be connect through Arduino nano, so it can move forward and backward. Now we setup a transistor and a relay between the torque motor and Arduino. So we can control a 12 volt torque or any other maximum motor giving input logical high 1 and low 0 from Arduino pin. And last we connect a Bluetooth module with Arduino so we can control this Lawn Mower with our android devices. when the pin get 1 the torque motor will start to cut the grasses. We design a pipe model which will contain the device, motors and battery to work.

3.5 Complete Project Prototype Image :

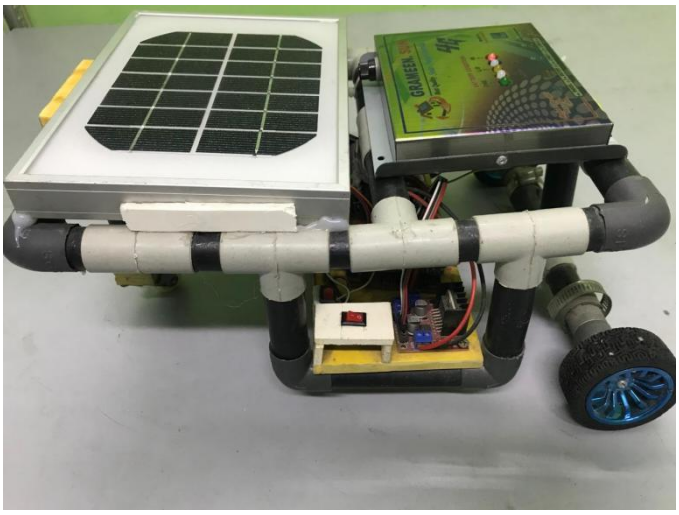


Figure 3.3: Project Prototype Image

3.6 Components List:

1. Arduino Nano
2. Solar Panel
3. Charge Controller
4. Battery
5. Motor Driver
6. Gear Motor
7. Relay
8. Bluetooth Module

3.7 Cost Analysis

Table 01: Instrument list with Cost

Sl.no	Particulars	Specification	Qty.	Unit Price (Taka)	Total Price (Taka)
1	Arduino Nano	Atmega 328p	1	480	480
2	Torque Motor		1	500	500
3	Bluetooth Module		1	350	350
5	Solar Panel		1	450	450
6	Motor Driver IC	L293D	1	250	250
7	Gear Motor		2	220	440
8	Transformer	1A	1	120	120
9	Solar Charger Controller		1	220	220
10	Voltage Regulator	7805	2	7	14
11	Capacitor		2	10	20
12	Others			1200	1200
				Total	4044/=

3.8 Arduino Nano

Arduino is an open-source electronics prototyping platform based on flexible, easy-to-use hardware and software. It's intended for artists, designers, hobbyists, and anyone interested in creating interactive objects or environments. Arduino can sense the environment by receiving input from a variety of sensors and can affect its surroundings by controlling Lights, motors, and other actuators.

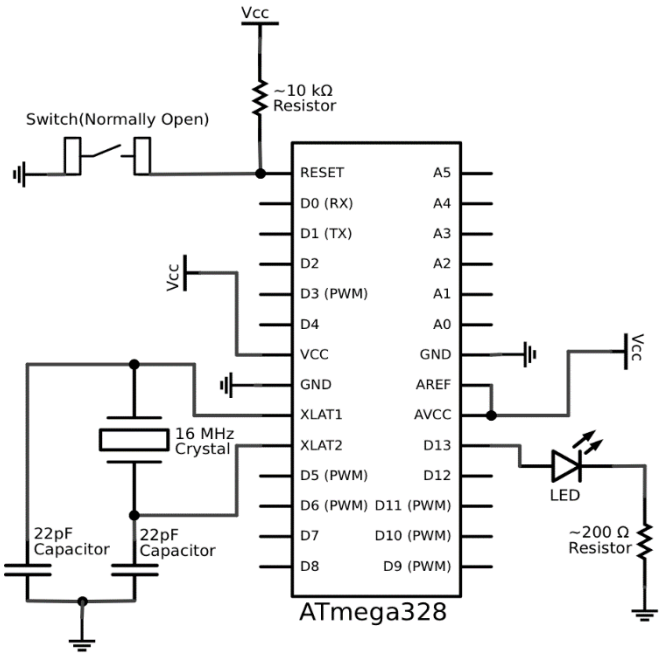
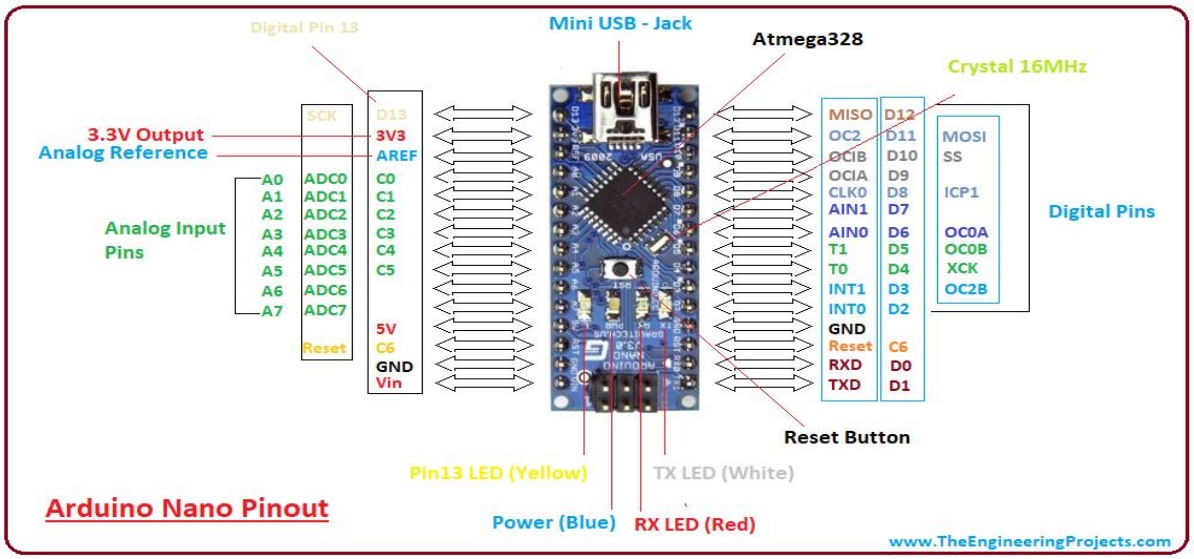


Figure 3.4: Schematic Diagram of Arduino Nano

The microcontroller on the board is programmed using the Arduino programming language (based on Wiring) and the Arduino development environment (based on Processing). Arduino projects can be stand-alone or they can communicate with software on running on a computer (e.g. Flash, Processing, MaxMSP).

Arduino Nano is a surface mount breadboard embedded version with integrated USB. It is a smallest, complete, and breadboard friendly. It has everything that Diecimila/Duemilanove has (electrically) with more analog input pins and onboard +5V AREF jumper. Physically, it is missing power jack. The Nano is automatically sense and switch to the higher potential source of power.

Nano's got the breadboard-ability of the Boarduino and the Mini+USB with smaller footprint than either, so users have more breadboard space. It's got a pin layout that works well with the Mini or the Basic Stamp (TX, RX, ATN, GND on one top, power and ground on the other). This new version 3.0 comes with ATMEGA328 which offer more programming and data memory space. It is two layers. That make it easier to hack and more affordable.



3.5: Arduino Pin Output

Specifications

- Microcontroller: Atmel ATmega328
- Operating Voltage (logic level):5 V
- Input Voltage (recommended):7-12 V
- Input Voltage (limits):6-20 V
- Digital I/O Pins: 14 (of which 6 provide PWM output)
- Analog Input Pins: 8
- DC Current per I/O Pin: 40 mA
- Flash Memory: 32 KB (of which 2KB used by boot loader)
- SRAM : 2 KB
- EEPROM: 1 KB
- Clock Speed: 16 MHz
- Dimensions: 0.70” x 1.70”

Features

- Automatic reset during program download
- Power OK blue LED
- Green (TX), red (RX) and orange (L) LED
- Auto sensing/switching power input
- Small mini-B USB for programming and serial monitor
- ICSP header for direct program download
- Standard 0.1 spacing DIP (breadboard friendly)
- Manual reset switch

Micro Controller IC ATmega328p:

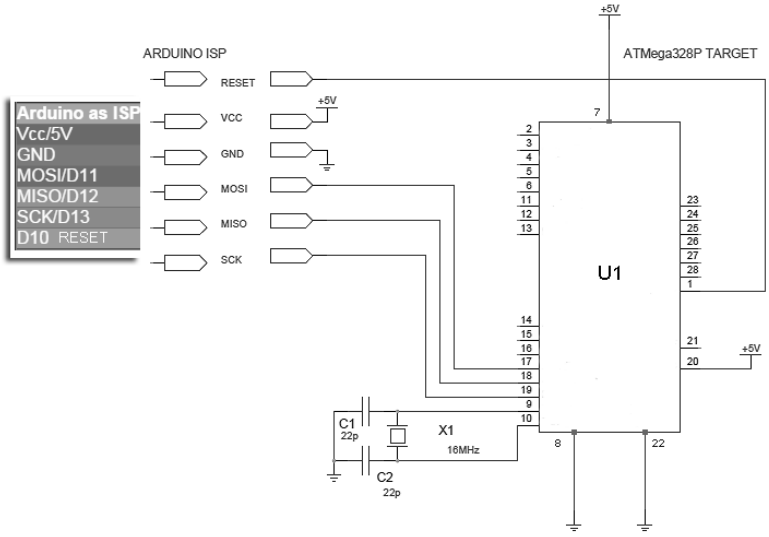


Figure 3.6: Schematic Diagram of Micro controller IC AT mega 328p.

The high-performance Microchip picoPower 8-bit AVR RISC-based microcontroller combines 32KB ISP flash memory with read-while-write capabilities, 1024B EEPROM, 2KB 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, a 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. By executing powerful instructions in a single clock cycle, the device achieves throughputs approaching 1 MIPS per MHz, balancing power consumption and processing speed.

3.9 Bluetooth Module HC-05

Bluetooth is a wireless technology standard for exchanging data between fixed and mobile devices over short distances using short-wavelength UHF radio waves in the industrial, scientific and medical radio bands, from 2.400 to 2.485 GHz, and building personal area networks.

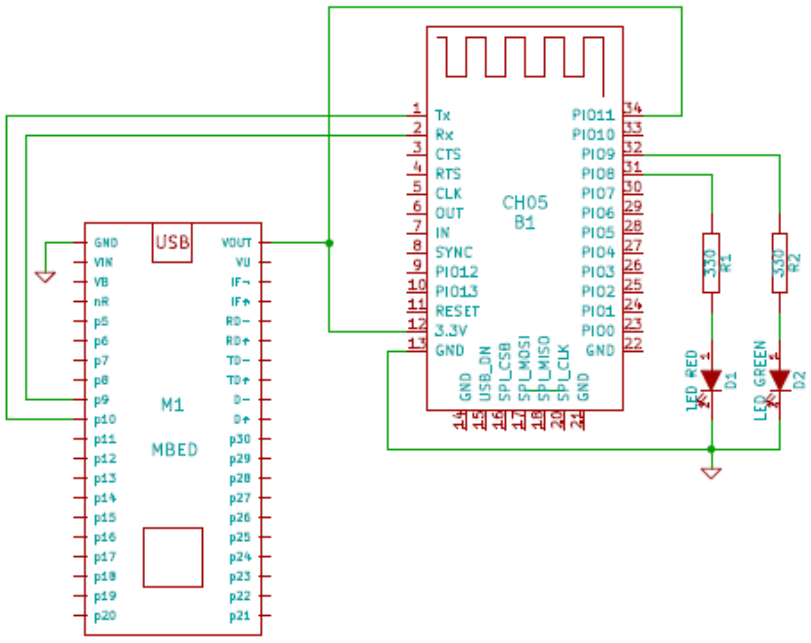


Figure 3.7: Schematic Diagram of Bluetooth Module HC-05

HC-05 Technical Specifications

- Serial Bluetooth module for Arduino and other micro controllers
- Operating Voltage: 4V to 6V (Typically +5V)
- Operating Current: 30mA
- Range: <100m
- Works with Serial communication (USART) and TTL compatible
- Follows IEEE 802.15.1 standardized protocol
- Uses Frequency-Hopping Spread spectrum (FHSS)
- Can operate in Master, Slave or Master/Slave mode
- Can be easily interfaced with Laptop or Mobile phones with Bluetooth
- Supported baud rate: 9600,19200,38400,57600,115200,230400,460800.

Applications

The **HC-05** is a very cool module which can add two-way (full-duplex) wireless functionality to your projects. You can use this module to communicate between two micro controllers like Arduino or communicate with any device with Bluetooth functionality like a Phone or Laptop. There are many android applications that are already available which makes this process a lot easier. The module communicates with the help of USART at 9600 baud rate hence it is easy to interface with any micro controller that supports USART. We can also configure the default values of the module by using the command mode. So if you looking for a Wireless module that could transfer data from your computer or mobile phone to micro controller or vice versa then this module might be the right choice for you. However do not expect this module to transfer multimedia like photos or songs; you might have to look into the CSR8645 module for that.

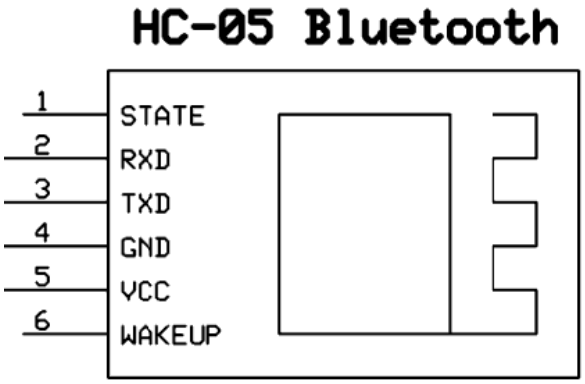
1. Wireless communication between two micro controllers
2. Communicate with Laptop, Desktops and mobile phones
3. Data Logging application

4. Consumer applications
5. Wireless Robots
6. Home Automation

How to Use the HC-05 Bluetooth Module

The **HC-05** has two operating modes, one is the Data mode in which it can send and receive data from other Bluetooth devices and the other is the AT Command mode where the default device settings can be changed. We can operate the device in either of these two modes by using the key pin as explained in the pin description.

It is very easy to pair the HC-05 module with micro controllers because it operates using the Serial Port Protocol (SPP). Simply power the module with +5V and connect the Rx pin of the module to the Tx of MCU and Tx pin of module to Rx of MCU as shown in the figure below



3.8: Pin Output of HC-05

During power up the key pin can be grounded to enter into Command mode, if left free it will by default enter into the data mode. As soon as the module is powered you should be able to discover the Bluetooth device as “HC-05” then connect with it using the default password 1234 and start communicating with it.

Pin Configuration of HC-05 Bluetooth Module

Pin Number	Pin Name	Description
1	Enable / Key	This pin is used to toggle between Data Mode (set low) and AT command mode (set high). By default it is in Data mode
2	Vcc	Powers the module. Connect to +5V Supply voltage
3	Ground	Ground pin of module, connect to system ground.
4	TX – Transmitter	Transmits Serial Data. Everything received via Bluetooth will be given out by this pin as serial data.
5	RX – Receiver	Receive Serial Data. Every serial data given to this pin will be broadcasted via Bluetooth
6	State	The state pin is connected to on board LED, it can be used as a feedback to check if Bluetooth is working properly.
7	LED	Indicates the status of Module • Blink once in 2 sec: Module has entered Command Mode • Repeated Blinking: Waiting for connection in Data Mode • Blink twice in 1 sec: Connection successful in Data Mode
8	Button	Used to control the Key/Enable pin to toggle between Data and command Mode

Table 02: Pin Configuration of Bluetooth Module

3.10 Solar Panel

A solar panel is a set of solar photovoltaic modules electrically connected and mounted on a supporting structure. A photovoltaic module is a packaged, connected assembly of solar cells. The solar panel can be used as a component of a larger photovoltaic system to generate and supply 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 320 watts. The efficiency of a module determines the area of a module given the same rated output - an 8% efficient 230 watt module will have twice the area of a 16% efficient 230 watt module. A single solar module can produce only a limited amount of power; most installations contain multiple modules. A photovoltaic system typically includes a panel or an array of solar modules, an inverter, and sometimes a battery and/or solar tracker and interconnection wiring.

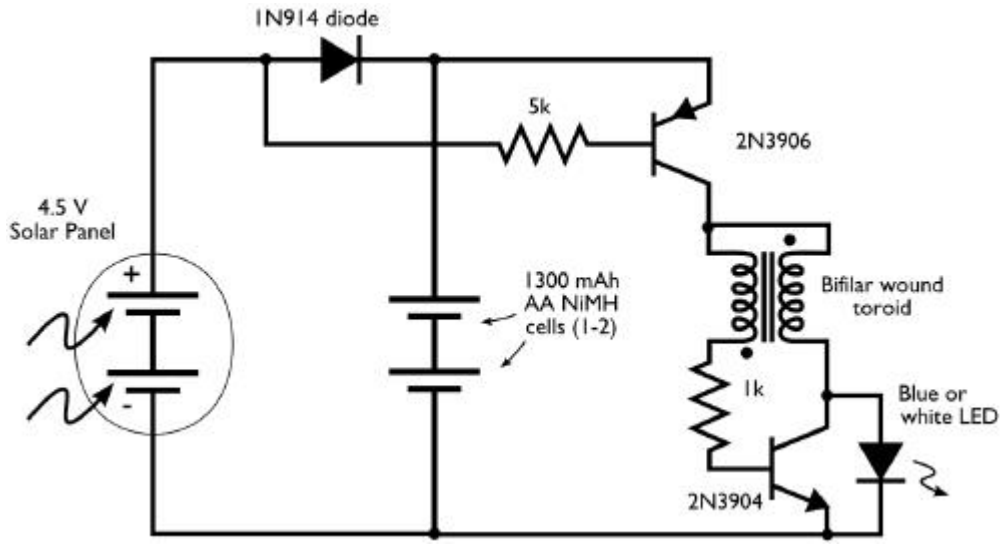


Figure: 3.9 Schematic Diagram of simple Solar panel

Solar cell modules produce electricity only when the sun is shining. They do not store energy, therefore to ensure flow of electricity when the sun is not shinning, it is necessary to store some of the energy produced. The most obvious solution is to use batteries, which chemically store electric energy. Batteries are groups of electro chemical cells (devices that convert chemical energy to electrical energy) connected in series. Battery cells are composed of two electrodes immersed in electrolyte solution which produce an electric current when a circuit is formed between them. The current is caused by reversible chemical reactions between the electrodes and the electrolyte within the cell. Batteries that are re-chargeable are called secondary or accumulator batteries. As the battery is being charged, electric energy is stored as chemical energy

in the cells. When being discharged, the stored chemical energy is being removed from the battery and converted to electrical energy. In East-Africa, the most common type of secondary battery is the Lead-acid battery.

Specification of Solar Panel

- Size: 4.4" x 5.4" / 110mm x 140mm
- Weight: 3 ounces / 90 grams
- Cell type: Monocrystaline
- Cell efficiency: 19%+
- 2.27 Watts Peak Power
- Technical drawing

Dimensions:

- Length: 111.86mm/4.40in
- Width: 135.83mm/5.34in
- Thickness (without screws): 4.72mm/0.18in
- Thickness (with screws): 9.82mm/0.38in

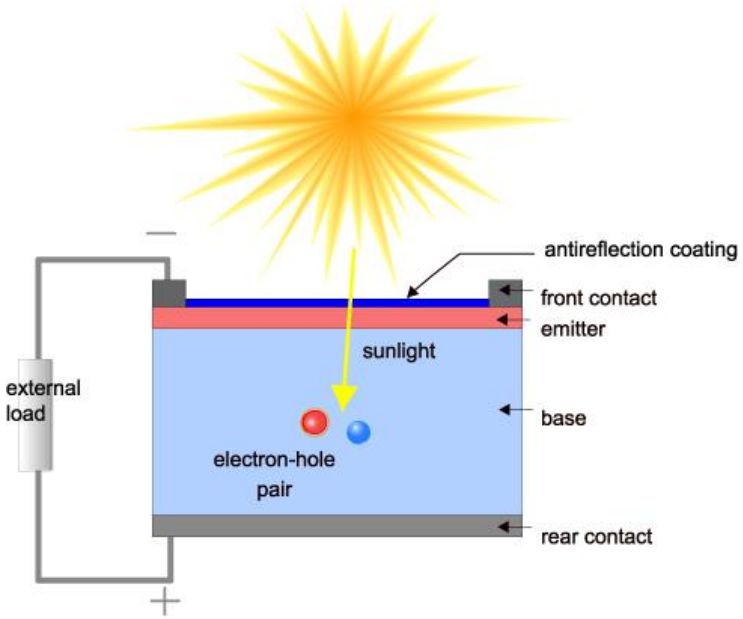


Figure 3.10: Solar Panel Schema Diagram

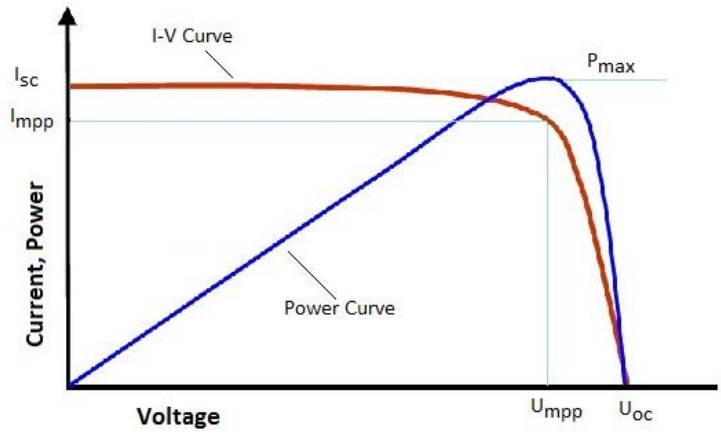


Figure 3.11: Solar Sell System Curve

3.11 DC Gear Motor

A gear motor is an all-in-one combination of a motor and gearbox. The addition of a gear head to a motor reduces the speed while increasing the torque output. The most important parameters in regards to gear motors are speed (rpm), torque (lb-in) and efficiency (%). In order to select the most suitable gear motor for your application you must first compute the load, speed and torque requirements for your application. ISL Products offers a variety of **Spur Gear Motors**, **Planetary Gear Motors** and **Worm Gear Motors** to meet all application requirements. Most of our DC motors can be complimented with one of our unique gearheads, providing you with a highly efficient gear motor solution.

Types of DC Motors/Gear motors

The most common electrical motors convert electrical energy to mechanical energy. These types of motors are powered by direct current (DC).

- Brushed
- Brushless (BLDC)
- Planetary Gear Motors
- Spur Gear Motors
- Stepper
- Coreless & Coreless Brushless
- Servo
- Gear heads

Motor Specifications

Once the design calculations are performed, and the application parameters are defined, you can use this data to determine which motor or gear motor will best fit your application. Some of the most common specs to consider when selecting a motor or gear motor would be:

- Voltage
- Current
- Power
- Torque
- RPM
- Life Expectancy / Duty Cycle
- Rotation (CW or CCW)
- Shaft Diameter and Length
- Enclosure Restrictions

Gear Motor Performance Curves

A motors performance and gearbox performance are combined into one graph by displaying three specific parameters. These three parameters are speed, torque and efficiency. These performance curves are essential when selecting a gear motor for your application.

Speed/Revolutions (N) – (unit: rpm) indicated as a straight line that shows the relationship between the gear motors torque and speed. This line will shift laterally depending on voltage increase or decrease.

Current (I) – (unit: A) indicated by a straight line, from no load to full motor lock. This shows the relationship between amperage and torque.

Torque (T) – (unit: gf-cm) this is the load borne by the motor shaft, represented on the X-axis.

Efficiency (η) – (unit: %) is calculated by the input and output values, represented by the dashed line. To maximize the gear motors potential it should be used near its peak efficiency.

Output (P) – (unit: W) is the amount of mechanical energy the gear motor puts out.

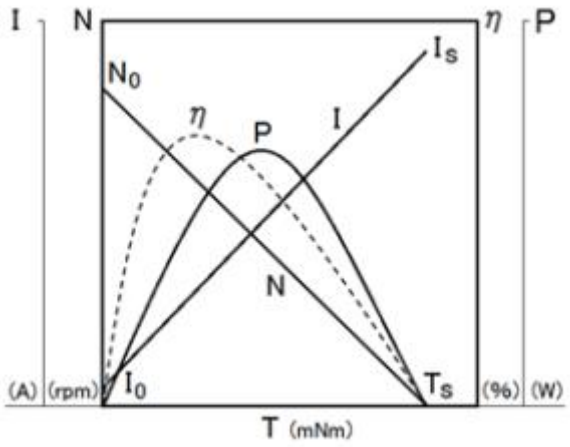


Figure 3.12: Performance Curve

3.12 Blades

A blade is that portion of a tool, weapon, or machine with an edge that is designed to cut and/or puncture, stab, slash, chop, slice, thrust, or scrape surfaces or materials. The blade is seldom sharp enough to give a neat cutting. The blade simply tears the grass resulting in brown tips. However, the horizontal blades are easy to remove and sharpen or replace. Existing engine trimmers suffer from high initial cost, high levels of engine noise, high fuel consumption rates and high operator's fatigue in long-run. Mower blades are the cutting components of lawn mowers. They are usually made of sturdy metals as they must be able to withstand high-speed contact with a variety of objects in addition to grass. The materials used (as well as size, thickness, and design of the blades) vary by manufacturer. A blade may be made from a flaking stone, such as flint, metal (usually steel), ceramic, or other material. Here we used two blades i.e. fixed blade and sliding blade.

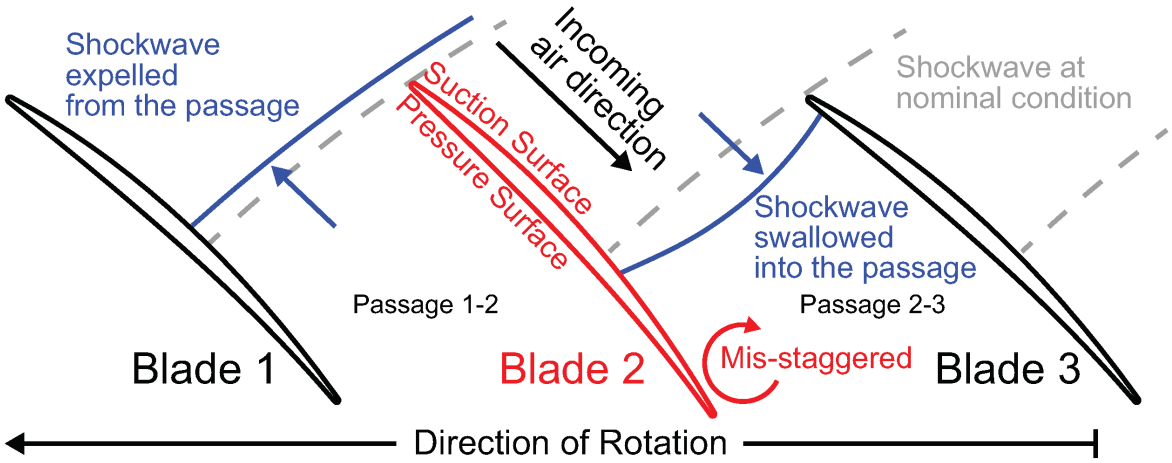


Figure 3.13: Schematic Diagram of Blades

3.13 Solar Charger Controller:

Here is a solar charger circuit that is used to charge Lead Acid or Ni-Cd batteries using the solar energy power. The circuit harvests solar energy to charge a 6 volt 4.5 Ah rechargeable battery for various applications. The charger has voltage and current regulation and over voltage cut-off facilities.

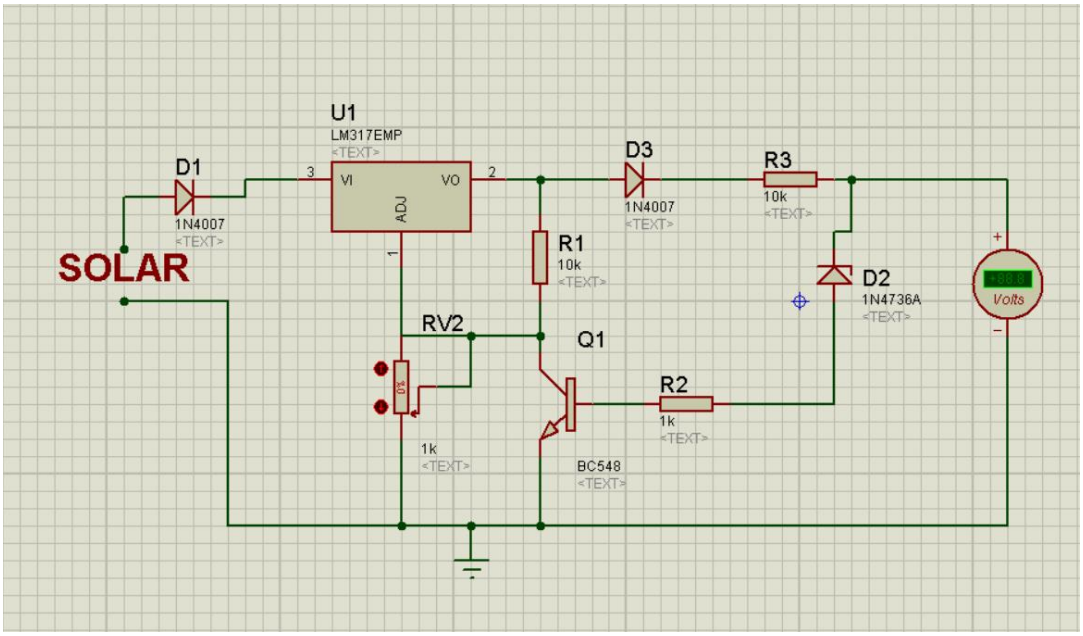


Figure 3.14: Solar Charger Controller Circuit.

The circuit uses a 12 volt solar panel and a variable voltage regulator IC LM 317. The solar panel consists of solar cells each rated at 1.2 volts. 12 volt DC is available from the panel to charge the battery. Charging current passes through D1 to the voltage regulator IC LM 317. By adjusting its Adjust pin, output voltage and current can be regulated. VR is placed between the adjust pin and ground to provide an output voltage of 9 volts to the battery. Resistor R3 Restrict the charging current and diode D2 prevents discharge of current from the battery.

Transistor T1 and Zener diode ZD act as a cut off switch when the battery is full. Normally T1 is off and battery gets charging current. When the terminal voltage of the battery rises above 6.8 volts, Zener conducts and provides base current to T1. It then turns on grounding the output of LM317 to stop charging.

3.14 Battery

The Battery is an electric device, that is used to store current which is produced from the solar panel and supplied to the corresponding loads. The number of batteries required depend on the load requirement.

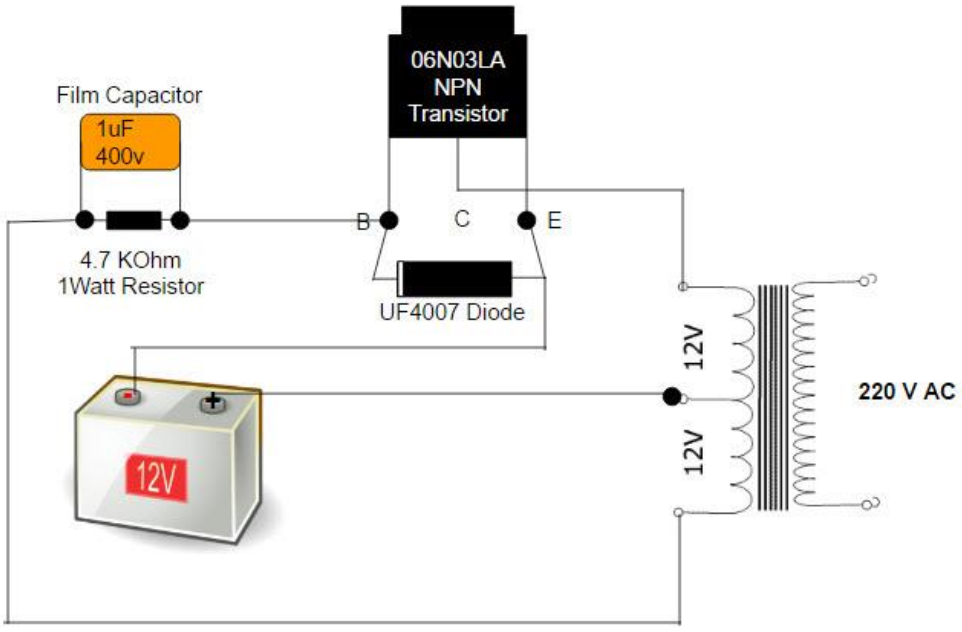


Figure 3.15 Battery

These are small Sealed Lead Acid batteries that are generally used for semi-portable appliances that need more power or a fair bit of power (more than can be provided by D, C or AA cells) for a longish time. They are typically used for people who go caving, or for lighting for an overnight camping trip where you are travelling on foot. They are not ridiculously heavy or bulky. They are good to drive a lantern on a tinny for that night fishing expedition. Being sealed, you cannot fear that the battery acid (which is actually a GEL) will spill. The amp-hour rating tells you how long the battery will last before it goes flat. For example, a 7.2Ah battery will give 7.2 amps for one hour or 3.6 amps for 2 hours or 1.8 amps for 4 hours, etc. Generally an adequate amount of current for a lantern. They are ideally charged by solar panels.

3.15 Arduino software

The smart microcontroller unit named as Arduino Nano can be programmed with the Arduino software. There is no any requirement for installing other software rather than Arduino. Firstly, Select "Arduino Nano from the Tools, Board menu (according to the microcontroller on your board). The IC used named as ATmega328 on the Arduino Nano comes pre burned with a boot loader that allows you to upload new code to it without the use of an external hardware programme

Communication is using the original STK500 protocol (reference, C header files). We can also bypass the boot loader and programs the microcontroller through the ICSP (In Circuit Serial Programming) header. The ATmega16U2 (or 8U2 in the rev1 and rev2 boards) firmware source code is available. The ATmega16U2/8U2 is loaded with a DFU boot loader, which can be activated by: On Rev1 boards: connecting the solder jumper on the back of the board (near the map of Italy) and then resetting the 8U2. On Rev2 or later boards: there is a resistor that pulling the 8U2/16U2 HWB line to ground, making it easier to put into DFU mode.

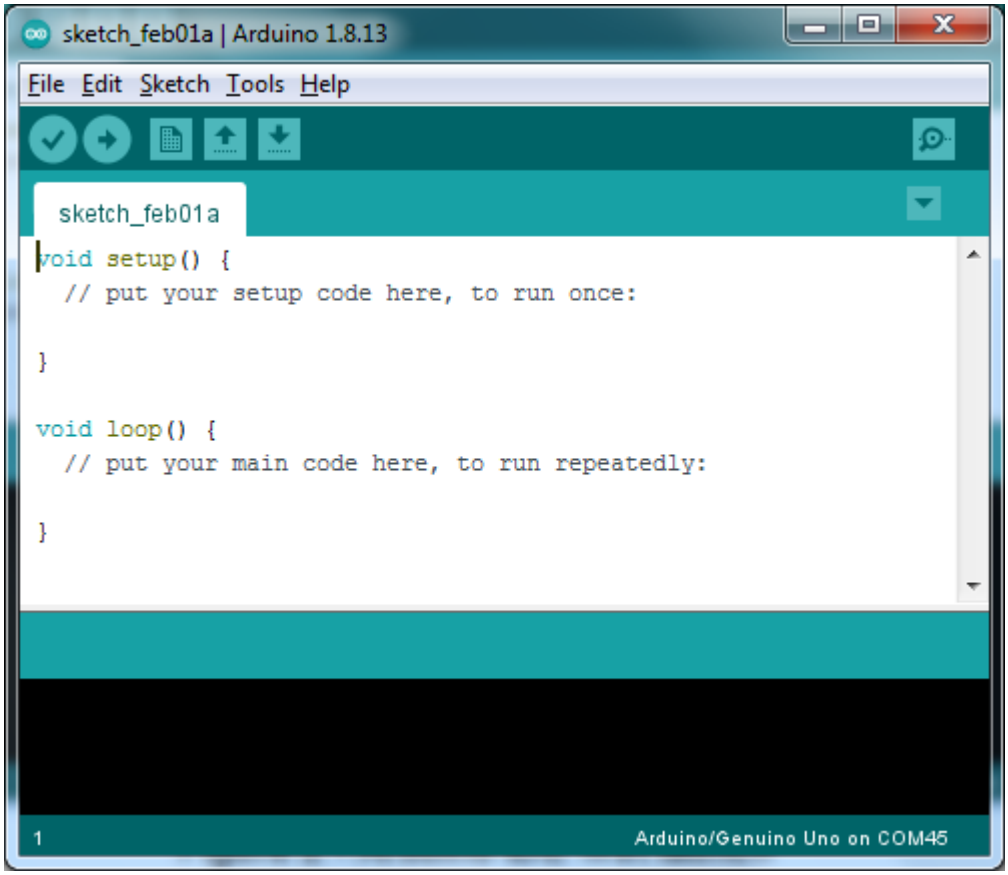


Figure 3.16: Arduino Software Interface IDE.

The Arduino Nano is one of the latest smart microcontroller units and has a number of facilities for communicating with a computer, another Arduino, or other microcontrollers. The ATmega328 provides UART TTL at (5V) with serial communication, which is available on digital pins 0 -(RX) for receive the data and pin no.1 (TX) for transmit the data. An ATmega16U2 on the board channels this serial communication over USB and appears as a virtual com port to software on the computer. The '16U2 firmware uses the standard USB COM drivers, and no external driver is needed. However, on Windows, an .inf file is required. The Arduino software includes a serial monitor which allows simple textual data to be sent to and from the Arduino board.

The RX and TX LEDs on the board will flash when data is being transmitted via the USB-to-serial chip and USB connection to the computer (but not for serial Communication on pins 0 and 1). A Software Serial library allows for serial communication on any of the Nano's digital pins. The ATmega328 also supports I2C (TWI) and SPI communication. The Arduino software includes a Wire library to simplify use of the I2C bus. Arduino programs are written in C or

C++ and the program code written for Arduino is called sketch. The Arduino IDE uses the GNU tool chain and AVR Libc to compile programs, and for uploading the programs it uses avrdude. As the Arduino platform uses Atmel microcontrollers, Atmel's development environment, AVR Studio or the newer Atmel Studio, may also be used to develop software for the Arduino.

3.16 Proteus

The Proteus Design Suite is a proprietary software tool suite used primarily for electronic design automation. The software is used mainly by electronic design engineers and technicians to create schematics and electronic prints for manufacturing printed circuit boards.

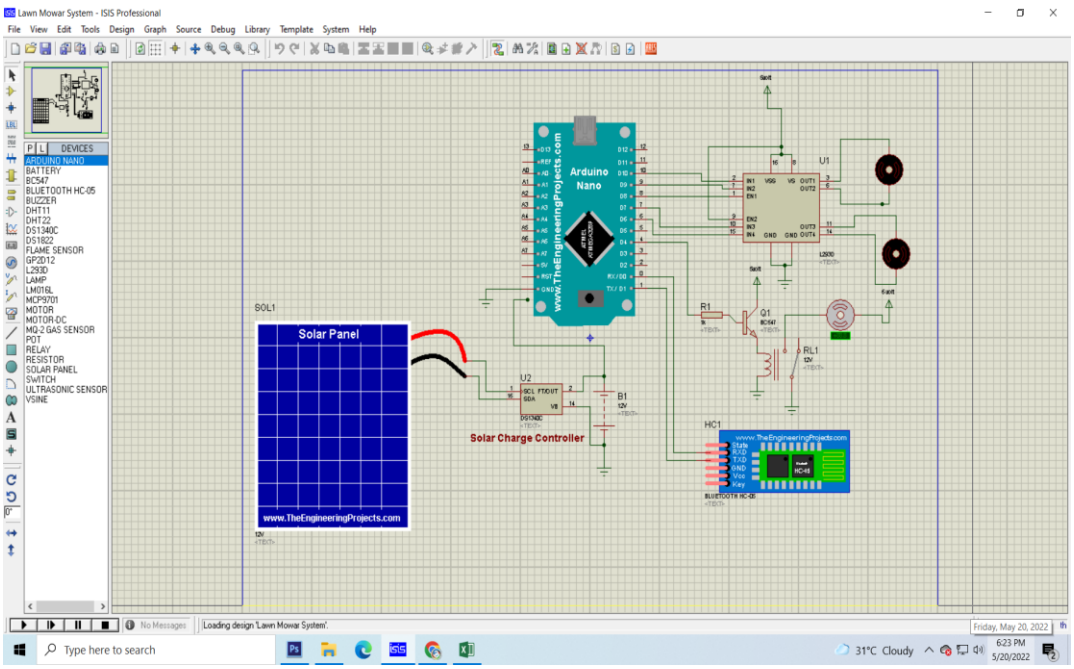


Figure 3.17: Proteus Software Interface.

The first version of what is now the Proteus Design Suite was called PC-B and was written by the company chairman, John Jameson, for DOS in 1988. Schematic Capture support followed in 1990, with a port to the Windows environment shortly thereafter. Mixed mode

SPICE Simulation was first integrated into Proteus in 1996 and microcontroller simulation then arrived in Proteus in 1998. Shape based auto routing was added in 2002 and 2006 saw another major product update with 3D Board Visualization. More recently, a dedicated IDE for simulation was added in 2011 and MCAD import/export was included in 2015. Support for high speed design was added in 2017.Feature led product releases are typically biannual, while maintenance based service packs are released as required.

CHAPTER 4

DISCUSSION & RESULT

4.1 Discussion

From the received data during the tests it has been seen that the total machine consumes a little amount of power which is so effective and cost saving. The discharge rate is so adequate and small in value on the other hand charging capacity is remarkable and is too fast along the requirement. There is no noise during grass cutting and rotating the machine. A little problem arises there and that is the low rpm of torque motor though it has a benefit also and for the low rpm the machine move slowly but cut the grass smoothly.

4.2 Result & Calculations

Assume F= 11N

We know

F= T/ R

T= F*R

= 11*0.0521

0.5731 N-m

Where

T= Shaft torque

R= Radius of cutting blades = 5.21cm or 0.0521m

But shaft power is given by

P = 2πNT/60

= 2π*800*0.5731/60

= 48watts

Where

P= power Developed by shaft

N= Shaft speed (rev/min) = 800 rpm

T= Torque required = 0.5731N

Selection of Electric Motor

Motor speed = 800 rpm

Voltage = 12v

Watt = 48 watts

Battery charging and discharging from solar panel

Solar panel maximum power = 20 watts

For Battery power = V*I

= 12*8

= 96 watts

Total power required for motor = 48 watts

Estimate of life of Battery duration or Discharge = 96/48 = 2 hours

Battery takes to charge from solar panel = 96/20 = 4.8 hours

Mechanical calculation of cutting operation

Area of Ground grass	**Time**
0.2084 square meter	**2 minutes**
12.504 square meter	**1 hour**

Blade diameter = 10.42cm =.1042m

For on minute , Blade cuts 2m length of ground grass

Therefore, Total area occupy = width * length
= .1042*2
=0.2084 square meter

For one hour, Area occupy = 60*0.2084
= 12.504 square meter

CHAPTER 5

CONCLUSION

5.1 Conclusion:

Our project entitled Automatic solar grass cutter system is successfully completed and the results obtained are satisfactory. It will be easier for the people who are going to take the project for the further modifications. This project is more suitable for a common man as it is having much more advantages i.e, no fuel cost, no pollution and no fuel residue, less wear and tear because of less number of moving components and this can be operated by using solar energy. This will give much more physical exercise to the people and can be easily handled. As we are nearer to Equator, the solar energy (non-conventional energy) is vastly available, so it is easy to charge the battery and is also pollution free. But the initial investments of the solar powered grass cutter is high. At present in order to curtail global warming and ozone depletion, So in future it is expected to run all equipment's by using solar energy. This system is having facility of charging the batteries while the solar powered grass cutter is in motion. So it is much more suitable for grass cutting also. The same thing can be operated in night time also, as there is a facility to charge these batteries in day light.

5.2 Future Scope

The model can be improved by making some changes in the hardware and components. Some suggestions are given below-

- Work on future for Industrial purpose.
- The future it will be completely online control.

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Appendix

Program:

```
#include <Wire.h>
#include <LiquidCrystal_I2C.h>
LiquidCrystal_I2C lcd(0x27 , 2, 1, 0, 4, 5, 6, 7, 3, POSITIVE);
#include <SoftwareSerial.h>
const int rxPin = 0;
const int txPin = 1;
SoftwareSerial mySerial(rxPin, txPin);
String data;
void setup()
{
  Serial.begin(9600);
  mySerial.begin(9600);
 lcd.begin(16, 2);
lcd.setCursor(0, 0);
lcd.print("Notice Board       ")
}
void loop()
{
   int i=0;
   char ch=0;
   data="";
   while(1)
   {
     while(mySerial.available()<=0);
     ch = mySerial.read();
     if(ch=='#')
     break;
     data+=ch;
   }
```

```
   Serial.println(data);
lcd.clear();
lcd.setCursor(0,1);
lcd.clear();
lcd.print(data);
  for (int positionCounter = 0; positionCounter < 13; positionCounter++) {
    lcd.scrollDisplayLeft();
    delay(150);
  }
  for (int positionCounter = 0; positionCounter < 29; positionCounter++) {
    lcd.scrollDisplayRight();
    delay(150);
  }
  for (int positionCounter = 0; positionCounter < 16; positionCounter++) {
    lcd.scrollDisplayLeft();
    delay(150);
  for (int positionCounter = 0; positionCounter < 13; positionCounter++)
    lcd.scrollDisplayLeft();
    delay(150);
  }
  for (int positionCounter = 0; positionCounter < 29; positionCounter++) {
    lcd.scrollDisplayRight();
    delay(150);
  }
  for (int positionCounter = 0; positionCounter < 16; positionCounter++) {
    lcd.scrollDisplayLeft();
    delay(150);
  }
  for (int positionCounter = 0; positionCounter < 13; positionCounter++) {
    lcd.scrollDisplayLeft();
    delay(150);
  }
  for (int positionCounter = 0; positionCounter < 29; positionCounter++) {
```

```
  lcd.scrollDisplayRight();
  delay(150);
}
for (int positionCounter = 0; positionCounter < 16; positionCounter++) {
  lcd.scrollDisplayLeft();
  delay(150);
}
for (int positionCounter = 0; positionCounter < 13; positionCounter++)
  lcd.scrollDisplayLeft();
  delay(150);
}
for (int positionCounter = 0; positionCounter < 29; positionCounter++) {
  lcd.scrollDisplayRight();
  delay(150);
}
for (int positionCounter = 0; positionCounter < 16; positionCounter++) {
  lcd.scrollDisplayLeft();
  delay(150);
}
for (int positionCounter = 0; positionCounter < 13; positionCounter++) {
  lcd.scrollDisplayLeft();
  delay(150);
}
for (int positionCounter = 0; positionCounter < 29; positionCounter++) {
  lcd.scrollDisplayRight();
  delay(150);
}
for (int positionCounter = 0; positionCounter < 16; positionCounter++) {
  lcd.scrollDisplayLeft();
  delay(150);
}
for (int positionCounter = 0; positionCounter < 13; positionCounter++) {
```

```
  lcd.scrollDisplayLeft();
  delay(150);
 }
 for (int positionCounter = 0; positionCounter < 29; positionCounter++) {
  lcd.scrollDisplayRight();
  delay(150);
 }
 for (int positionCounter = 0; positionCounter < 16; positionCounter++) {
  lcd.scrollDisplayLeft();
for (int positionCounter = 0; positionCounter < 13; positionCounter++) {
  lcd.scrollDisplayLeft();
  delay(150);
 }
 for (int positionCounter = 0; positionCounter < 29; positionCounter++) {
  lcd.scrollDisplayRight();
  delay(150);
 }
 for (int positionCounter = 0; positionCounter < 16; positionCounter++) {
  lcd.scrollDisplayLeft();
  delay(150);
 }
 for (int positionCounter = 0; positionCounter < 13; positionCounter++) {
  lcd.scrollDisplayLeft();
  delay(150);
 }
 for (int positionCounter = 0; positionCounter < 29; positionCounter++) {
  lcd.scrollDisplayRight();
  delay(150);
 }
 for (int positionCounter = 0; positionCounter < 16; positionCounter++) {
  lcd.scrollDisplayLeft();
  delay(150)
 for (int positionCounter = 0; positionCounter < 13; positionCounter++) {
```

```
  lcd.scrollDisplayLeft();
  delay(150);
}
for (int positionCounter = 0; positionCounter < 29; positionCounter++) {
  lcd.scrollDisplayRight();    delay(150);
}
for (int positionCounter = 0; positionCounter < 16; positionCounter++) {
  lcd.scrollDisplayLeft();
  delay(150);
}
for (int positionCounter = 0; positionCounter < 13; positionCounter++) {
  // scroll one position left:
  lcd.scrollDisplayLeft();
  delay(150);
}
for (int positionCounter = 0; positionCounter < 29; positionCounter++) {
  lcd.scrollDisplayRight();    delay(150);
}
for (int positionCounter = 0; positionCounter < 16; positionCounter++) {
  lcd.scrollDisplayLeft();
  delay(150);
}
for (int positionCounter = 0; positionCounter < 13; positionCounter++) {
  lcd.scrollDisplayLeft();
  delay(150);
}
for (int positionCounter = 0; positionCounter < 29; positionCounter++) {
  lcd.scrollDisplayRight();
  delay(150);
}
for (int positionCounter = 0; positionCounter < 16; positionCounter++) {
  lcd.scrollDisplayLeft();
  delay(150);
```

```
}
for (int positionCounter = 0; positionCounter < 13; positionCounter++) {
  lcd.scrollDisplayLeft();
  delay(150);
}
for (int positionCounter = 0; positionCounter < 29; positionCounter++) {
  // scroll one position right:
  lcd.scrollDisplayRight();
  // wait a bit:
  delay(150);
}
for (int positionCounter = 0; positionCounter < 16; positionCounter++) {
  // scroll one position left:
  lcd.scrollDisplayLeft();
  // wait a bit:
  delay(150);
}
delay(1000); }
```