1. ABSTRACT

The idea to use the abundantly available solar power in a very unique method for reducing human efforts in a Garden/Park. This concept explains how technology can be used to reduce human efforts as well as to efficiently utilize renewable sources of energy. A detailed documentation of a Solar Powered Gardner has been made. 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, and college's etc. We have made some changes in the existing machine to make its application easier at reduced cost. Our main aim in pollution control is attained through this. Unskilled operation can operate easily and maintain the lawn very fine and uniform surface look.

2. INTRODUCTION

Solar Energy is one of the most abundantly available forms of energy exposed to humans. A large part of this energy gets wasted. Efficient use of Solar Energy can significantly reduce the scarcity of our day to day energy requirement for present as well as future generations. An example of how solar energy can be harvested by implementing it with the available technology is shown with an example of solar powered Gardner.

The Solar Powered Gardner is an automated grass cutting vehicle powered by solar energy. It is designed such that it can avoid the obstacles automatically, while carrying out its operations of grass cutting and/or water sprinkling. The system uses 12V batteries to power the robotic assembly.

A Solar Panel is used to charge these batteries. A microcontroller is used as the brain of the system. The grass cutter, water sprinkler motors and the wheel motors are interfaced to the microcontroller that controls the working of all the motors. Detection of objects is a very important factor for safety of the assembly as well as human safety, so the microcontroller is interfaced with a sensor unit that carries out object detection. On detection of object or obstacle a preprogrammed action is taken by the controller as per the conditions sensed by the sensor.

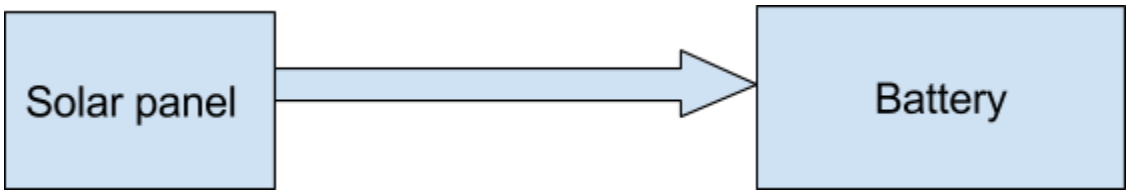
3. COMPONENT LIST

SR.NO	COMPONENT	QUANTITY	ESITIMATE
1	Obstacle Sensor	2	150
2	Controller Board	1	135
3	Power Supply	1	120
4	Bluetooth Module (HC-05)	1	150
5	Voltage Regulator IC7805	1	05
6	Fuse	3	15
7	Connectors	1 packs	70
8	Motor Driver Kit	3	585
9	DC Motor	5	900
10	Brushless DC Motor	1	30
11	Wires	3 packs	210
12	Solder Wire	1 roll	45
13	IR Sensors	4	260
14	Solar Panel 12v	1	299

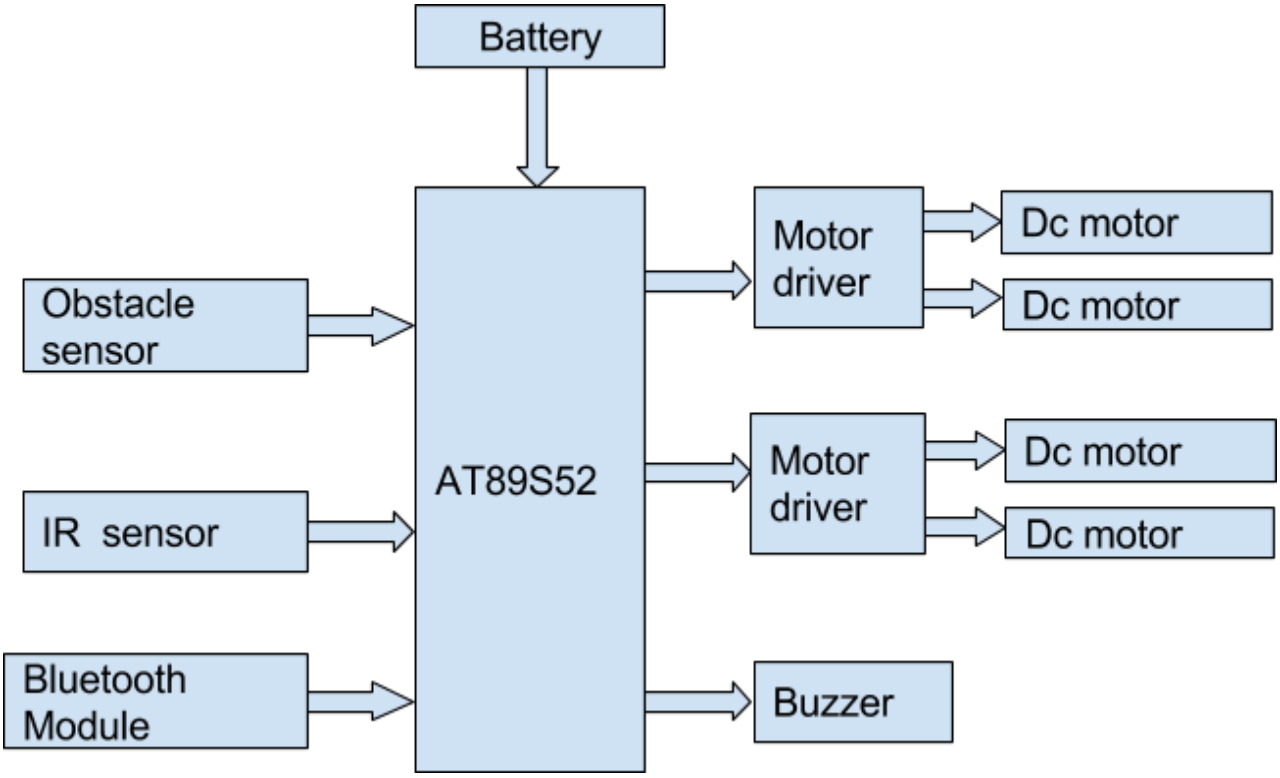
15	Battery 12v & 9v	2	520
16	Fitting Material	Set up	300
17	Glue Gun	1	299
18	Glue Stick	1 pack	110
19	Pipe	1	35
20	Metal Sheet	2	250
21	Blade	3	35
22	Wheels	4	80
23	Spare Parts	Set up	200
24	Gear	1	27
25	Conveyor Belt	2	65
26	Buzzer	1	40
27	Wooden Ply	1	45
28	Photodiode	2	40

4. BLOCK DIAGRAM

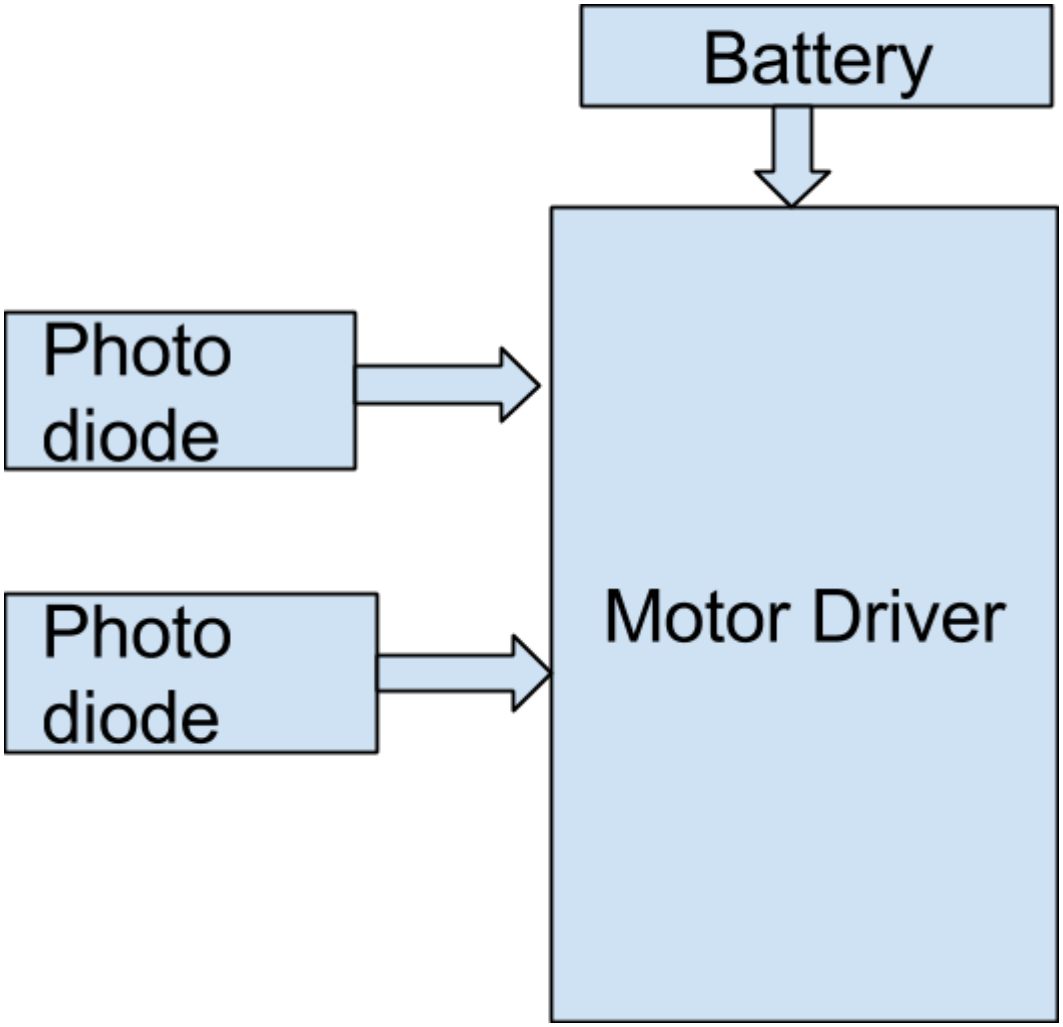
4.1 POWER



4.2 ROBOT SIDE



4.3 SOLAR TRACKING



5. EXPLANATION

5.1 Solar Panel:-

In our project we use 12v Solar Panel .The Solar Panel get the energy from the Sun and stored energy into Lithium-ion (rechargeable battery). To get 12v at the output of the solar panel by using zener diode. The fuel consumption is takes place by using solar panel.

5.2 Battery:-

The battery is main power supply in our project, here we use 12 v L-ion battery to store the energy provide by the solar device. Battery provide 12v supply to our project.

5.3 Controller (89S52): -

Here in our project we use 89S52 µC which is operate on 5v dc. The battery provides supply through voltage regulator IC (7805) which converts 12v DC into 5v DC. The 89S52 µC have 4kb ROM , 128 byte RAM , 2 Timer & Counter , 1 9bit UART (for serial communication) , The 89S52 is used to control the robot.

5.4 Obstacle Sensor: -

The obstacle sensor use to sense the obstacle comes in path of the robot and give the output to the µC. µC fetches the program present in the ROM of µC and take action on the input given by the obstacle sensor. If the sense by the left sensor the bot rotate on the right side (i.e. left motor rotate in the forward and right in reverse , and same for the right obstacle sensor.

If obstacle sense by the both sensors then the bot is backward.

5.5 IR Sensor: -

IR sensor is use to indicate level of the tank. Here we use 2 sensors one for high level and another is for low level. When high level sensor is active then the signal is given to the µC and after that µC starts the buzzer and give status to the android application via Bluetooth module.

5.6 Bluetooth module: -

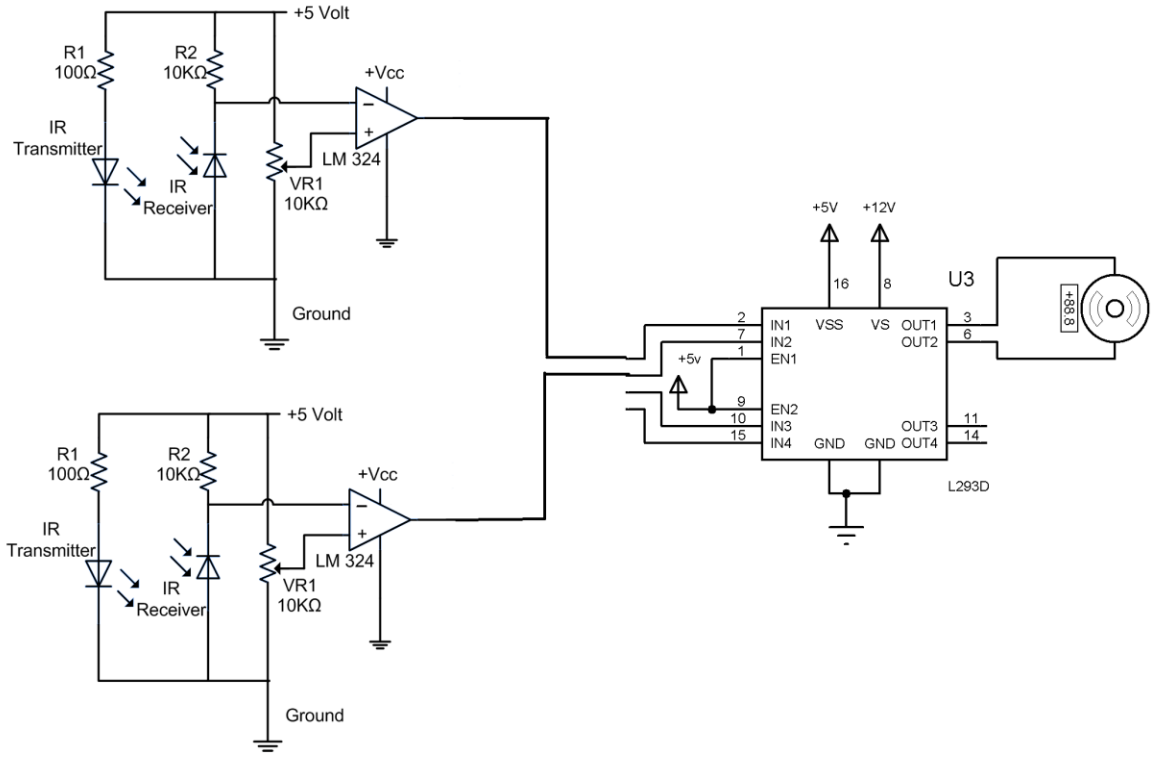
The HC-05 Bluetooth module is use in our project. This device has frequency from 2.4GHz -2.485 GHz and its range is up to 10M. This Bluetooth is pair with android device. Bluetooth module use to transmit and receive the data with the android.

5.7 Motor Drive: -

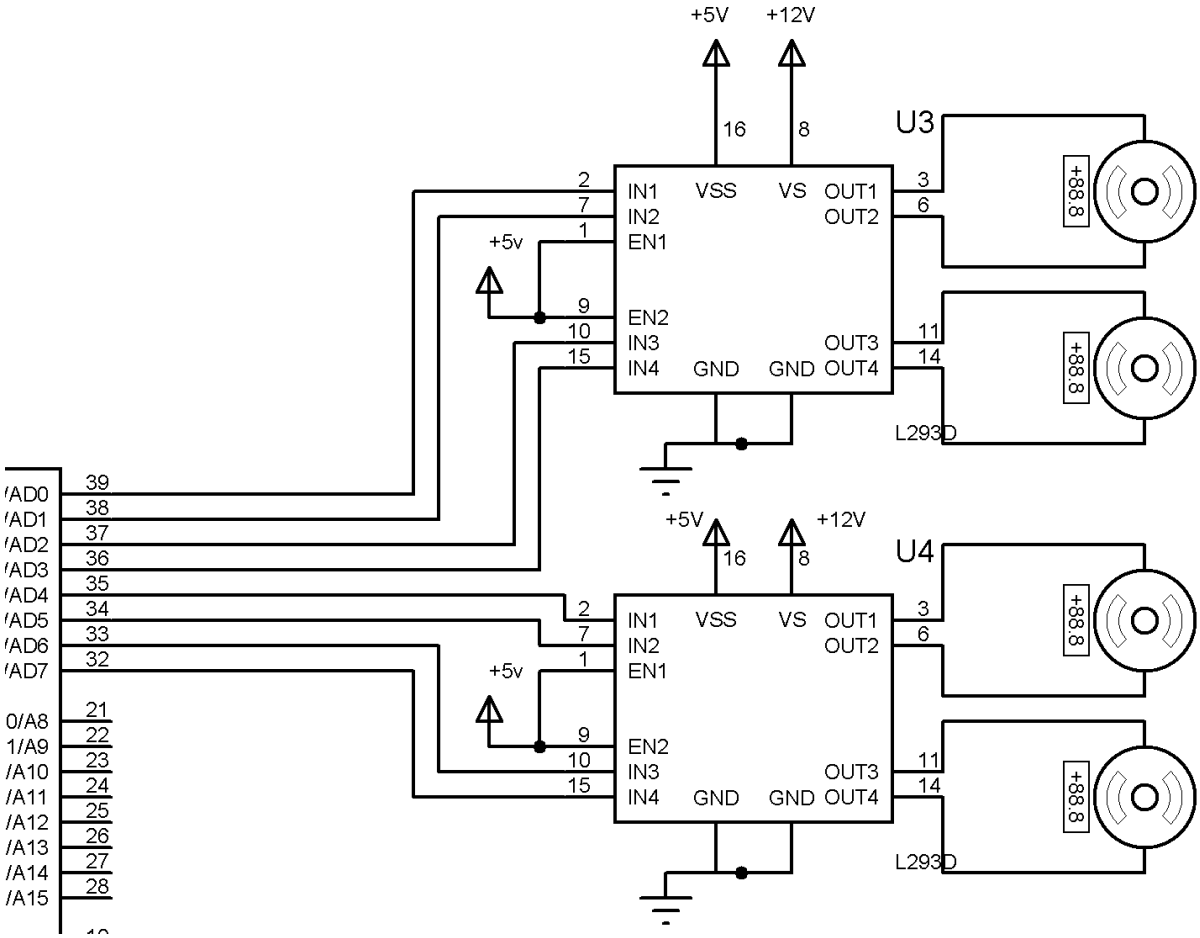
Here we use L293D motor driver. We use 2 motor driver one for the bot movement and one for the cutter. (i.e. Cutter up/down , Cutter on/off)

6. CIRCUIT DIAGRAM

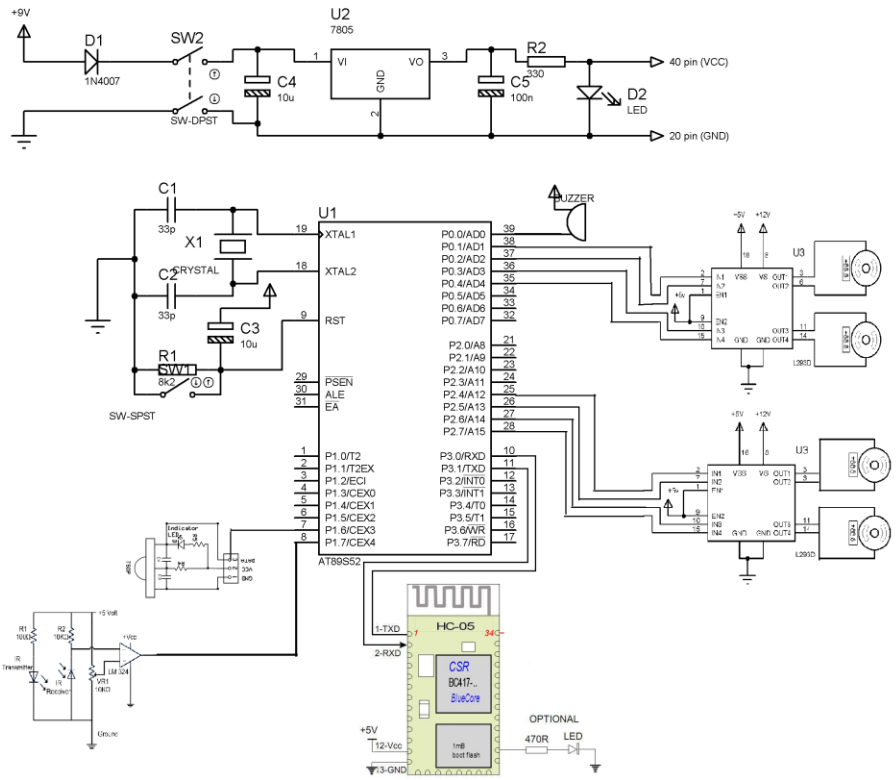
6.1 SOLAR PANEL



6.2 MOTOR DRIVER

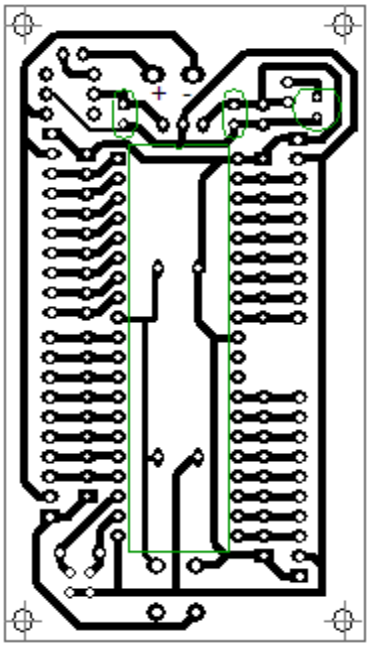


6.3 MAIN CIRCUIT DIAGRAM

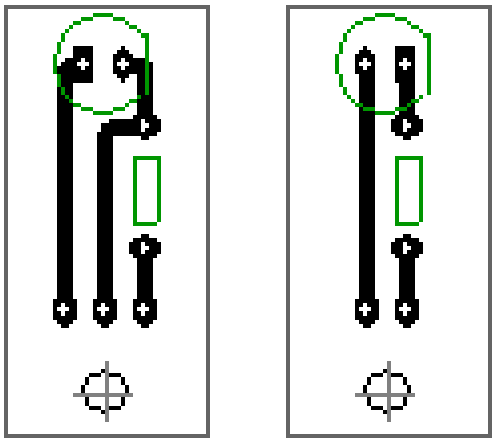


7. PCB LAYOUT

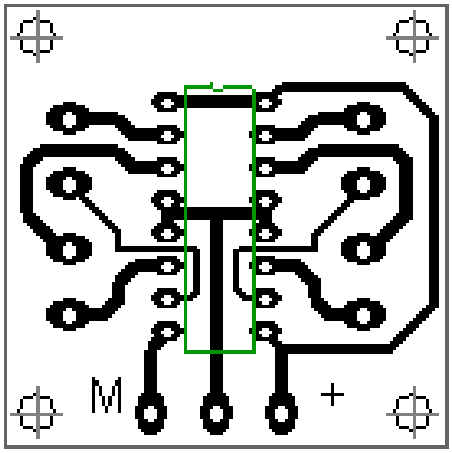
7.1 µc KIT



7.2 IR SENSOR



7.3 MOTOR DRIVER



8. HARDWARE REQUIREMENTS AND DETEALS

8.1 HARDWARE

8.1.1 Microcontroller (AT89s52).

8.1.2 Motor driver.

8.1.3 Dc motor.

8.1.4 IR sensor.

8.1.5 Obstacle Sensor.

8.1.6 Buzzer.

8.1.7 Bluetooth Module.

8.1.8 Solar panel.

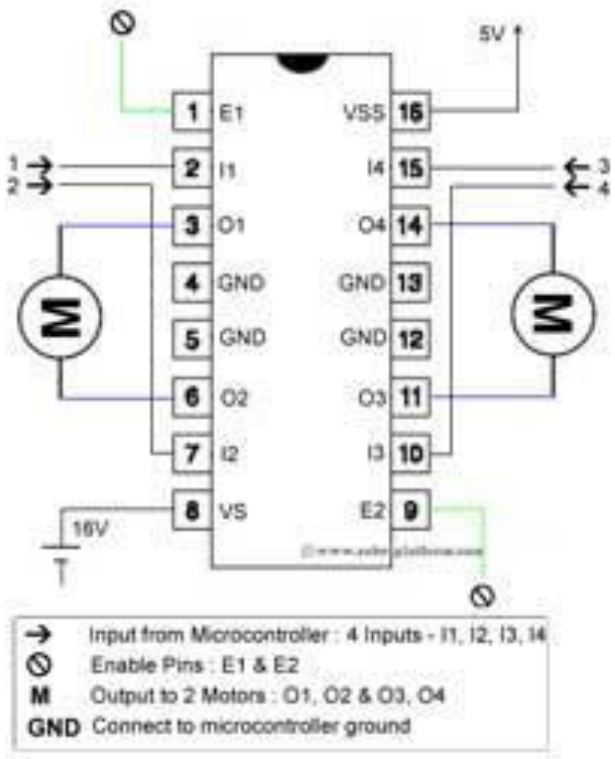
8.1.1 Microcontroller

The AT89S52 is a low-power, high-performance CMOS 8-bit microcontroller with 8K bytes of in-system programmable Flash memory. The device is manufactured using Atmel's high-density nonvolatile memory technology and is compatible with the industry-standard 80C51 instruction set and pin out. The on-chip Flash allows the program memory to be reprogrammed in-system or by a conventional nonvolatile memory programmer. By combining a versatile 8-bit CPU with in-system programmable Flash on a monolithic chip, the Atmel AT89S52 is a powerful microcontroller which provides a highly-flexible and cost-effective solution to many embedded control applications. The AT89S52 provides the following standard features: 8K bytes of Flash, 256 bytes of RAM, 32 I/O lines, Watchdog timer, two data pointers, three 16-bit timer/counters, a six-vector two-level interrupt architecture, a full duplex serial port, on-chip oscillator, and clock circuitry. In addition, the AT89S52 is designed with static logic for operation down to zero frequency and supports two software selectable power saving modes. The Idle Mode stops the CPU while allowing the RAM, timer/counters, serial port, and interrupt system to continue functioning. The Power-down mode saves the RAM con-tents but freezes the oscillator, disabling all other chip functions until the next interrupt or hardware reset.

8.1.2 MOTOR DRIVER

Since motors require more current then the microcontroller pin can typically generate, you need some type of a switch (Transistors, MOSFET, Relay etc.,) which can accept a small current, amplify it and generate a larger current, which further drives a motor. This entire process is done by what is known as a motor driver.

L293D is a typical Motor driver or Motor Driver IC which allows DC motor to drive on either direction. L293D is a 16-pin IC which can control a set of two DC motors simultaneously in any direction. It means that you can control two DC motor with a single L293D IC, Dual H-bridge Motor Driver integrated circuit (IC). The l293d can drive small and quiet big motors as well.



The circuit shown above is the most basic implementation of L293D IC. There are 16 pins sticking out of this IC and we have to understand the functionality of each pin before implementing this in a circuit

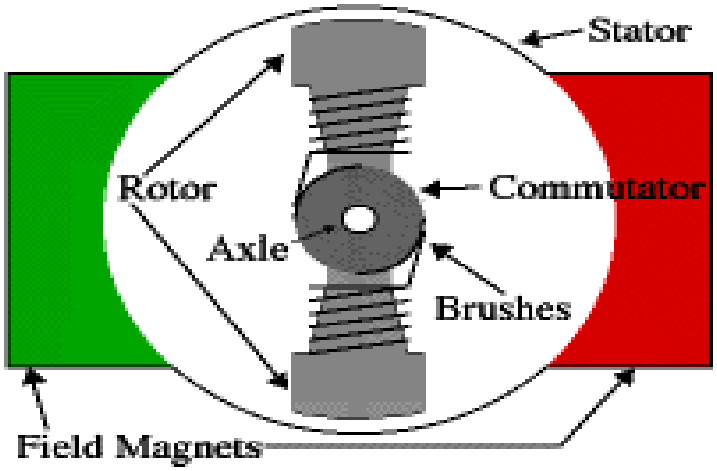
1. Pin1 and Pin9 are "Enable" pins. They should be connected to +5V for the drivers to function. If they pulled low (GND), then the outputs will be turned off regardless of the input states, stopping the motors. If you have two spare pins in

your microcontroller, connect these pins to the microcontroller, or just connect them to regulated positive 5 Volts.

2. Pin4, Pin5, Pin12 and Pin13 are ground pins which should ideally be connected to microcontroller's ground.
3. Pin2, Pin7, Pin10 and Pin15 are logic input pins. These are control pins which should be connected to microcontroller pins. Pin2 and Pin7 control the first motor (left); Pin10 and Pin15 control the second motor (right).
4. Pin3, Pin6, Pin11, and Pin14 are output pins. Tie Pin3 and Pin6 to the first motor, Pin11 and Pin14 to second motor
5. Pin16 powers the IC and it should be connected to regulated +5Volts
6. Pin8 powers the two motors and should be connected to positive lead of a secondary battery. As per the datasheet, supply voltage can be as high as 36 Volts.

8.1.3 DC MOTOR

In any electric motor, operation is based on simple electromagnetism. A current-carrying conductor generates a magnetic field; when this is then placed in an external magnetic field, it will experience a force proportional to the current in the conductor, and to the strength of the external magnetic field. The internal configuration of a DC motor is designed to harness the magnetic interaction between a current-carrying conductor and an external magnetic field to generate rotational motion.



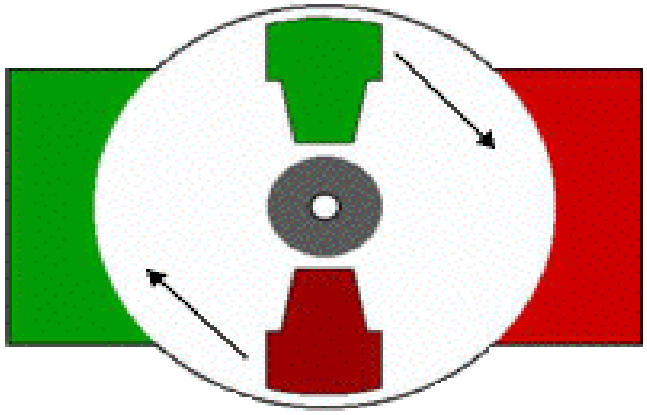
In a simple 2-pole DC electric motor, as shown above (here red (right side) represents a magnet or winding with a "North" polarization, while green (left side) represents a magnet or winding with a "South" polarization).

Every DC motor has six basic parts axle, rotor (a.k.a., armature), stator, commutator, field magnet(s), and brushes. In most common DC motors (and all that Beamers will see), the external magnetic field is produced by high-strength permanent magnets.

The stator is the stationary part of the motor this includes the motor casing, as well as two or more permanent magnet pole pieces. The rotor (together with the axle and attached commutator) rotates with respect to the stator. The rotor consists of windings (generally on a core), the

being electrically connected to the commutator. The above diagram shows a common motor layout with the rotor inside the stator (field) magnets.

The geometry of the brushes, commutator contacts, and rotor windings are such that when power is applied, the polarities of the energized winding and the stator magnet(s) are misaligned, and the rotor will rotate until it is almost aligned with the stator's field magnets. As the rotor reaches alignment, the brushes move to the next commutator contacts, and energize the next winding. Given our example two-pole motor, the rotation reverses the direction of current through the rotor winding, leading to a "flip" of the rotor's magnetic field, driving it to continue rotating.



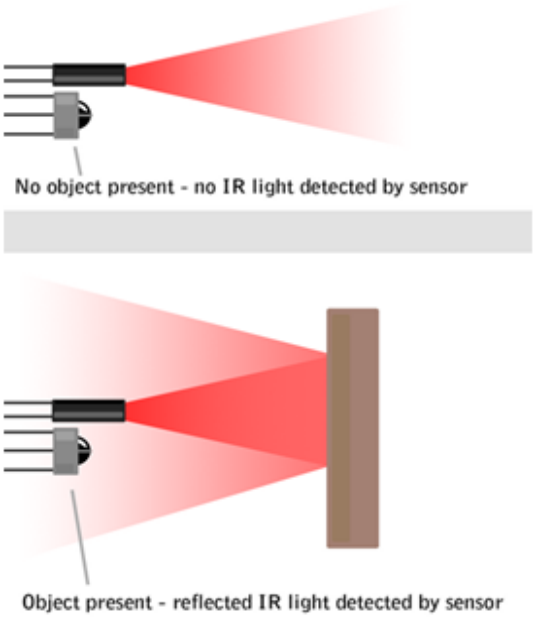
In real life, though, DC motors will always have more than two poles (three is a very common number). In particular, this avoids "dead spots" in the commutator. You can imagine how with our example two-pole motor, if the rotor is exactly at the middle of its rotation (perfectly aligned with the field magnets); it will get "stuck" there. Meanwhile, with a two-pole motor, there is a moment where the commutator shorts out the power supply (i.e., both brushes touch both commutator contacts simultaneously). This would be bad for the power supply, waste energy, and damage motor components as well. Yet another disadvantage of such a simple motor is that it would exhibit a high amount of torque "ripple" (the amount of torque it could produce is cyclic with the position of the rotor).

8.1.4 IR SENSOR

An infrared sensor is an electronic device that emits and/or detects infrared radiation in order to sense some aspect of its surroundings. Infrared sensors can measure the heat of an object, as well as detect motion.

IR Sensors work by using a specific light sensor to detect a select light wavelength in the Infra-Red (IR) spectrum. By using an LED which produces light at the same wavelength as what the sensor is looking for, you can look at the intensity of the received light. When an object is close to the sensor, the light from the LED bounces off the object and into the light sensor. This results in a large jump in the intensity, which we already know can be detected using a threshold.

DETECTING BRIGHTNESS



Depiction of the operation

Of an IR Sensor

Since the sensor works by looking for reflected light, it is possible to have a sensor that can return the value of the reflected light. This type of sensor can then be used to measure how "bright" the object is. This is useful for tasks like line tracking.

Pin No.	Connection	Description
1	OUTPUT	Digital Output(High or Low)
2	VCC	Connected to circuit supply
3	GND	Connected to circuit ground

8.1.5 OBSTACLE SENSOR

It consists of three major components. The first is an Infra-Red (IR) transmitter (usually an IR LED), the second is a TSOP (an Infra-Red receiver) and third IC 555.

The main difference between LED and IR LED is that IR LED emits Infrared Radiations, which we cannot see by our naked eyes. TSOP requires the incoming data to be modulated at a particular frequency and would ignore any other signals. It is also immune to ambient IR light. They are available for different carrier frequencies from 32 kHz to 42 kHz.

The transmitter part of the sensor project is an Infrared (IR) Led which transmits continuous IR rays to be received by an IR receiver. The output of the receiver varies depending upon its reception of IR rays. Since this variation cannot be analyzed as such, therefore this output can be fed to a comparator. Here operational amplifier (op-amp) of LM 339 is used as comparator.

When the IR receiver does not receive signal the potential at the inverting input goes higher than that that at non-inverting input of the comparator. Thus the output of the comparator goes low and the LED does not glow .When the IR receiver receives signal the potential at the inverting input goes low. Thus the output of the comparator (LM 339) goes high and the LED starts glowing. Resistor R1 (100), R2 (10k) and R3 (330) are used to ensure that minimum 10mA current passes through the IR LED, photodiode and normal LED, respectively. Resistor VR2 (preset=5k) is used to adjust the output. Resistor VR1 (preset=10k) is used to set the sensitivity of the circuit.

TRUTH TABLE

High (1): Obstacle not sensed

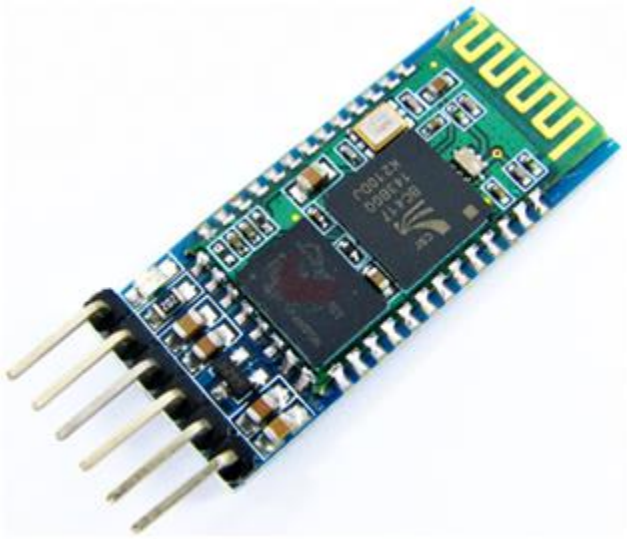
Low (0): Obstacle sensed

8.1.6 BUZZER

The buzzer produces sound based on reverse of the piezoelectric effect. The generation of pressure variation or strain by the application of electric potential across a piezoelectric material is the underlying principle. These buzzers can be used alert a user of an event corresponding to a switching action, counter signal or sensor input. They are also used in alarm circuits.

The buzzer produces a same noisy sound irrespective of the voltage variation applied to it. It consists of piezo crystals between two conductors. When a potential is applied across these crystals, they push on one conductor and pull on the other. This, push and pull action, results in a sound wave. Most buzzers produce sound in the range of 2 to 4 kHz.
One lead is connected to the Input and the other lead is connected to Ground.

8.1.7 Bluetooth Module



Bluetooth is a specification for a small form-factor, low-cost radio solution providing links between mobile computers, mobile phones and other portable handheld devices, and connectivity to the Internet. It will enable users to connect a wide range of computing and telecommunications devices easily and simply, without the need to buy, carry, or connect cables. It is a wireless technology that operates on an unlicensed radio spectrum. There is no charge for communicating between two Bluetooth devices. Bluetooth is intended to get around the problems that come with both infrared and cable synchronizing systems. The hardware vendors, which include Siemens, Intel, Toshiba, Motorola and Ericsson, have developed a specification for a very small radio module to be built into computer, telephone and entertainment equipment. From the user's point of view, there are three important features to Bluetooth:

1. Its wireless. When you travel, you don't have to worry about keeping track of a briefcase full of cables to attach all of your components, and you can design your office without wondering where all the wires will go.
2. it's inexpensive.
3. You don't have to think about it. Bluetooth doesn't require you to do anything special to make it work. The devices find one another and strike up a conversation without any user input at all.

It is a wireless protocol that is used to communicate from one device to another in a small area usually less than 30 feet. Bluetooth communicates on a frequency of 2.45 gigahertz, which has been set aside by international agreement for the use of industrial, scientific and medical devices (ISM). Bluetooth's founding members include Ericsson, IBM, Intel, Nokia and Toshiba.

8.1.8 Solar Panel

What is solar panel?

Essentials solar panels are group of silicon cells used to convert light energy into electricity. Solar panels are thin silicon cells that are grouped together into a simple frame with one wire works. The panel harness daylight and process it for human use by absorbing electrons from the sun rays. These electrons help to extract energy from the silicon, which is unstable due to a chemical combination of boron and phosphorus combined in each cell. When the silicon heats up from the sun, it reacts with the other chemical additives and becomes unstable. Then the electrons in the sun are absorbed by the silicon and the unstable silicon elements are forced through the wires established in the panel this becomes D.C. energy.

Energy Flow for Solar Grass Trimmer:-

The energy from the sun strikes the earth throughout the entire day. However, the amount of energy changes due to the time of day. Weather conditions, and geographic location. The amount of available solar energy is known as the solar isolation and is most commonly measured in watts per squared or W/m^2. In India on a bright sunny day in the early afternoon the solar isolation will be roughly around 1000 W/m^2, but in the mornings, evenings, or when the skies are overcast, the solar, the solar isolation changes in order to capture as much of the available energy as possible.

There is a general idea how energy flows in a solar grass trimmer. The sunlight hits the cells of the solar array, which produces an electrical current. The energy (current) can travel to the batteries for storage; go directly to the motor controller, or a combination of both. The energy send to the controller is used to power the motor that turns the wheel and makes the car moves.
Generally if the car is in motion, the converted sunlight is delivered directly to the motor controller, but there are times when there is more energy coming from the may than the motor controller needs. When this happens, the extra energy gets stored in the batteries for later use.
When the solar may can't produce enough energy to drive the motor as at the desired speed the array's energy is supplemented with stored energy from the batteries.

Of course, when the car is not in the motion, all the energy from the solar may is stored in batteries. There is also a way to get back some of the energy used to propel the car. When the car is being slow down, instead of using the normal mechanical brakes, the motor is turned into a generator and energy flows backward through the motor controlled and into the batteries for storage. This is known as regenerative breaking. The amount of energy returned to the batteries is small but every bit helps.

9. ADVANTAGE

9. ADVANTAGES

9.1 Easy to move from one place to another place.

9.2 Compact size and portable.

9.3 Operating principle is simple.

9.4 Set the Grass size as we required.

9.5 Time consuming.

9.6 Fuel consumption take place because of solar panel.

9.7 Easy to use.

10. APPLICATION AND FUTURE SCOPE

10.1 APPLICATION

10.1.1 For Cricket Ground.

10.1.2 The Football Ground.

10.1.3 All Gardens.

10.1.4 All Playgrounds**.**

10.2 FUTURE SCOPE

10.2.1. In future we use sharp blade mechanism and by improving the operating power we make it fast.

10.2.2. By improving the battery we make to use in rainy season.

11. CONCLUSION

This lawn mower will meet the challenge of environmental production and low cost of operation since there is no cost for fueling. A lawn mower has been developed for the use of residences and establishments that have lawns where tractor driven mowers could not be used.

The machine's capacity is adequate for its purpose. The machine has proved to be a possible replacement for the gasoline powered lawn mowers. We have developed “Solar Grass Trimmer” by using phone and for this we are using battery hence it works automatically.

12. BIBLIOGRAPHY

[1] “Design and Development of a Solar Powered Lawn Mower”: International Journal of Scientific & Engineering Research, Volume5, Issue 6, June-2014.

[2] “Hydrogen Powered Lawn Mower”.Int. J. Hydrogen Energy 1993; 18,345-348.

[3] “Simple Design of Self-Powered Lawn Mower”: International Journal of Engineering and Technology Volume 3 No. 10, October, 2013.

[4] “Smart Lawn Mower for Grass Trimming”: Volume 3 Issue 3, March 2014/www.ijsr.net

[5] “Obstacle Avoidance Robotic Vehicle Using Ultrasonic Sensor for Obstacle Detection” https://www.elprocus.com/obstacle-avoidance-robotic-vehicle/

[6] “Smart Solar Grass Cutter Robot for Grass Trimming” Student Mechanical Department, MATS University Raipur, Chhattisgarh, India.

[7] “Solar Grass Cutter With Linear Blades” By Using Scotch Yoke Mechanism - A.P, India,2Student,B.Tech(Mechanical Engineering), Merits ,A.P, India, 3Asst.Professor,Mechanical engineering, MeRITS,A.P,India.

[8] Int. Journal of Engineering Research and Applications ISSN: 2248-9622, Vol. 4, Issue 9(Version 3), September 2014, pp.10-21

[9] Obstacle detection using ultrasonic sensor (https://www.elprocus.com/obstacleavoidance-robotic-vehicle\) by - jenitharani.L.

[10] Batteries in series and parallel connections (battery packs) http://benignblog.com/2012/04/how-to-make-battery-banks-battery-packs-faqs.html/

14.DATA SHEET