# IoT based-Solar Powered Grass Cutting Robot

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**ABSTRACT-The beauty of the grass can be enhanced by the proper cutting and adjusting of its length. In the traditional method of grass cutter, IC engines use fossil fuels to run and thus causing environmental pollution. This conventional engine also requires manpower to handle. This problem can be overcome by using an IOT-based grass cutter using solar energy. The proposed grass cutter is totally based on IOT and robotics. The special feature of the proposed model is that it can be controlled from any part of the world by using Cell Phone. It is also capable of fully automated grass-cutting without the need for any human involvement.**

## I.INTRODUCTION

Traditionally and even now in many places like institutions, organizations, sports grounds, industries, hotels, public centers, cutting grass was done with a cutlass. This manual method is time-consuming, and an inaccuracy level of cutting is observed. With the advent of technology, cutting grass is done with single or more blades to cut the grass surface to a uniform height. Normally, the height of the grass cutting will be adjusted or fixed from the operator's end either by lever or nut adjusted to the machine wheels. This trims the grass utilizing very little time and optimizes the human power involvement to a minimum level. Based on one requirement several types of Grasscutters are available to assist one in having the best Grasscutter. Even the power source for the grass cutter plays a vital role while designing the best tool for the user end. Technology-oriented cutting down the grass has been implemented by adopting modern energy sources such as petrol, electricity, propane, etc. Petrol-powered Grass cutter pushes the rotary mowers powered by an internal combustion engine of four-stroke used for maximum torque and cleaner combustion. The power consumption generally ranges from HP (horsepower) equipped with a single cylinder having a carburetor, so the engine needs to be started in the manual pull crank method even though few models provided an electric starter [8,9]. Electric-powered Grasscutter is available in two types such as corded and cordless electric Grasscutter both producing an average of fewer than 75 decibels compared to more than 95 decibels of petrol-powered Grasscutter. Corded Grasscutter limits its range depending on the cable.

## II . PROJECT DESCRIPTION

The Proposed system consists of a solar panel that generates electricity and stores the DC voltage in a battery. The operating voltage needed for the motor used in the cutter is 12V and is fed to a NODEMCU microcontroller board for controlling the motor. The motor driver acts as an interface between the control circuit and the motors. The motor requires a high amount of current whereas the controller circuits work on low-current signals. So, the function of a motor driver is to take a low current control signal and then turn it into a higher current signal that can drive a motor. If any obstacle is detected, the robot will change its direction.

## III . HARDWARE MODULES

### *Processor*

The NodeMCU ESP8266 development board comes with the ESP-12E module containing the ESP8266 chip having Tensilica Xtensa 32-bit LX106 RISC microprocessor. This microprocessor supports RTOS and operates at 80MHz to 160 MHz adjustable clock frequency. NodeMCU has 128 KB RAM and 4MB of Flash memory to store data and programs. Its high processing power with in-built Wi-Fi / Bluetooth

and Deep Sleep Operating features make it ideal for IoT projects. NodeMCU can be powered using a Micro USB jack and VIN pin (External Supply Pin). It supports UART, SPI, and I2C interfaces.

*Power supply*

Renewable energy is used to charge the battery, where photovoltaic cells in the solar panel convert the sunlight radiation into voltage. Monocrystalline silicon cells type of solar panel is opted due to highest energy efficiency of around 22.5% compared to polycrystalline and thin-film silicon cells. Normally, a single photovoltaic cell can produce around 0.5V at room temperature and to achieve the higher voltage levels multiple cells are cascaded in connection and encapsulated in an environmentally friendly casing with protection from the weather, moisture, pollution, and corrosion. Here standard 36 crystalline silicon cell photovoltaic panels are used to charge the 12V battery.

*Bluetooth module HC-05*

HC-05 Bluetooth module is an SPP (Serial Port Protocol) module designed to transfer data serially (USART) from the controller or PC through a transparent wireless serial connection setup. Wireless Personal Area Network (WPAN) has been built within a range of 100m, which uses an FHSS (Frequency Hopping Spread-Spectrum) technology to transfer data over an air medium. It detects the 3.3V level voltage for transmitting or receiving from the microcontroller and has two modes for operation such as data mode and command mode with a default band.

*Ultrasonic sensor*

HC-SR04 sensor (SONAR) emits an ultrasound frequency at 40 kHz to measure the distance between the sensor and an object or obstacle. To generate Ultrasound frequency, the trigger pin is set to high for 10μs and the echo pin measures the sound travelled in us, which travels through an air medium and bounces back to the sensor module once it strikes the object or obstacle. The speed of the sound is taken as 0.034 cm/s or 340 m/s to calculate the object distance and bounce back.When the power supply is given to this module, it generates the sound waves to travel throughout the air to hit the necessary object. These waves strike and come back from the object, then collects by the receiver module. Here both the distance as well as time has taken is directly proportional because the time taken for more distance is high. If the trigger pin is kept high for 10 μs, then the ultrasonic waves will be generated which will travel at the sound speed. So it creates eight cycles of sonic burst that will be gathered within the Echo pin. This ultrasonic sensor is interfaced with Arduino to gauge the necessary distance between sensor & object.

*Motor driver*

The L298N motor driver controls the speed and rotation/direction of the DC motor using PWM (Pulse Width Modulation) and H-Bridge driver. PWM technique controls the speed of the motor by varying its input voltages through sending a series of on-off pulses known as duty cycle, for example, the duty cycle of 25% leads to 3V, 50% leads to 6V, 75% leads to 9V and 100% leads to 12V. H-bridge contains 4 switches, where the motor is connected to the centre of the switches. The spinning direction of the motor is controlled by changing the polarity of its input voltage. Normally, two switches are closed and another two switches are openly connected to spin the motor in a clockwise direction, at the same time reversing the connectivity of switches to spin the motor in an anti-clockwise direction.

## IV.SOFTWARE MODULE

- Android Application
- Code implementation

### a) ANDROID APPLICATION:

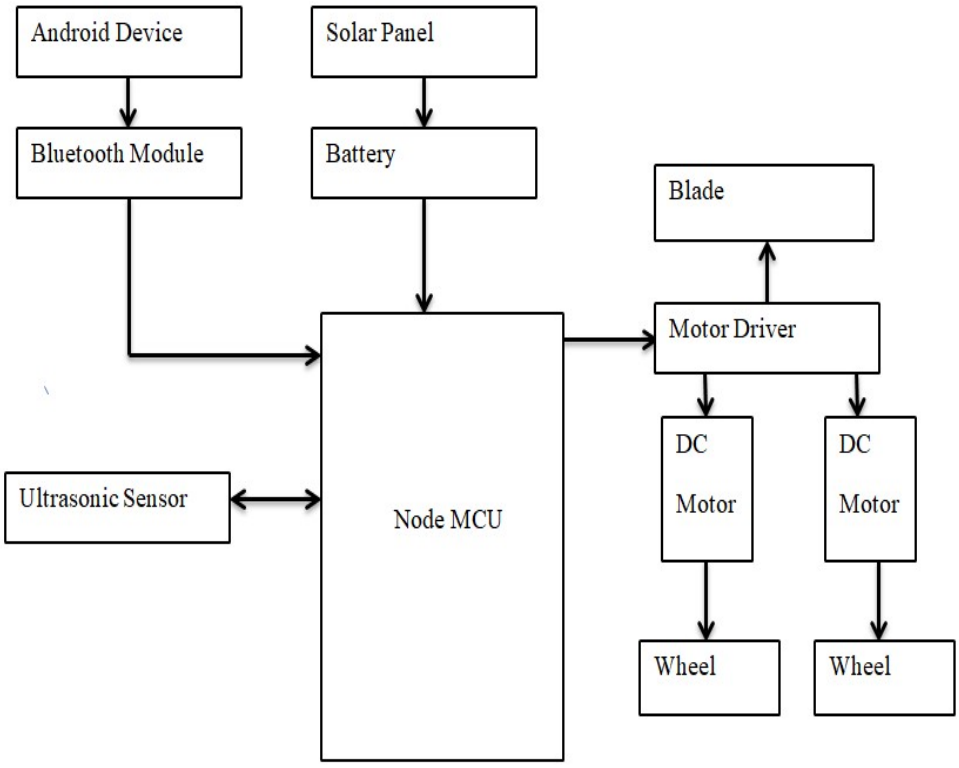
An Android app is a software application running on the Android platform. Because the Android platform is built for mobile devices, a typical Android app is designed for a smartphone or a tablet PC running on the Android OS. Users may download the Android software development kit (SDK) from the Android website. After installing the application, the controls of the robot will be regulated by the user or customer.

### b) CODE IMPLEMENTATION:

A node MCU is an open-source platform whose hardware design is open for editing, modification, and building It includes firmware that runs on the ESP8266 Wi-Fi SoC from Espressif Systems and hardware that is based on the ESP-12 module. The firmware uses the Lua scripting language. Lua scripting language is a scriptural embedded language.
By using this language, the entire software coding for the grass-cutting robot is implemented which includes wheel driving, cutting blades, charging of the battery, and includes the direction and movement of a robot.

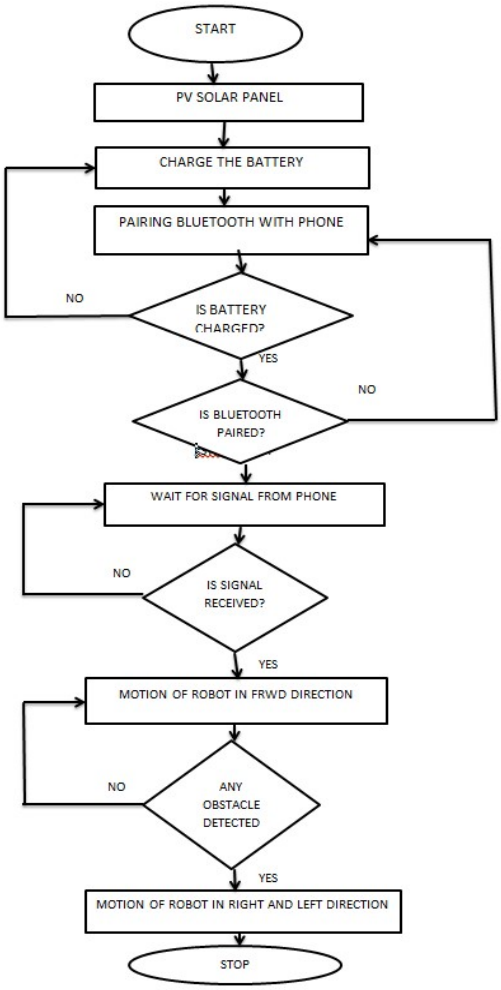
## V - PROPOSED SYSTEM

### *a) Block diagram*




i) **Power source:** This block would include the solar panel and battery used to power the robot.
ii) **Motor control:** This block would include the circuitry and software used to control the robot's motors, including the blades used for cutting grass.
iii) **Sensor interface:** This block would include any sensors used to detect obstacles or other features of the robot's environment, such as ultrasonic sensors.
iv) **nodeMCU:** This block would include nodeMCU used to coordinate the various components of the robot, including receiving sensor data, controlling the motors, and communicating with the IoT network.
v) **Communication:** This block would include the components used to connect the robot to an IoT network, such as a Wi-Fi or Bluetooth module.

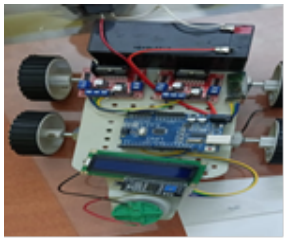
*b) Algorithm Used*

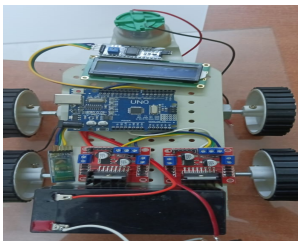



The flow and working of grass cutting robot is explained in step by step manner through this algorithm. The flow starts from the solar panel charging and ends up with the direction of the moving robot. The major work of this robot is to work by automation and as usual by manual mode.

## VI-RESULTS

This system designed a Grasscutter robot using IoT technology powered by a solar energy power supply to control the movement and mechanism of the prototype. The grasscutter robot can cut the shear grass with seven signals controlled remotely using a Bluetooth module. The control mechanism and movements such as Forward movement, backward movement, Right movement, Left movement, On mechanism, Off mechanism and Stop function for the Grasscutter prototype. The component utilization and the power supply through solar panels make the designed Grasscutter economically cheaper.





## VII-CONCLUSION

The use of new technology in the IoT based grass cutter with solar panels is environmentally friendly. Since there is no cost of fuel, no pollution, no fuel residue, and less wear, and tear. The solar panel is sun tracking which will help to increase the efficiency and provide the power source to the battery. IoT is used for the automation of the grass cutter. A special feature of this grass cutter is that it can be controlled from any part of the world because it is connected to the internet, which can be controlled from a cell phone. This grass cutter is used to prevent severe injuries during lawn maintenance and reduce the efforts of a person drastically.

## VIII-FUTURE ENHANCEMENT

The grass cutter is moving in the forward direction and all four wheels are moving because the user pressed the up button on the Android application. For future scope, if the designed Grasscutter connectivity from the Bluetooth module has been replaced with cellular connectivity through COAP-SMS (Constrained Application Protocol), COAP-MQ, etc., then the system can be monitored from anywhere in the world.

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