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# Solar Powered Automatic Grass Cutter

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**ABSTRACT:** Conventional lawn cutting machines are powered by fuel and electrical energy, which are expensive and require high maintenance. To keep the environment clean and reduce fuel use, a solar-powered grass trimmer has been designed in this research work. The purpose of this research is to design and manufacture a solar-powered grass trimmer that is affordable, easy to operate, and environmentally friendly. The grass trimmer uses a 12V, - 100AH battery to power a 12V DC motor of 180W. A solar panel 1000V system voltage is used to charge the battery. A solar charge controller of 20A is used to direct the energy into the battery. The machine uses metal plate blade to cut the grass. It can run for almost two hours when fully charged and there is no sun. It's easy to tell if the battery is fully charged or flat.

## I. INTRODUCTION

Much of the park's lawn, schools, and university are maintained manually. The gardener used hand shears to mow and maintain the lawn regularly, which also takes more time. It is not easy and also very difficult to maintain a uniform size. So, this works to make a solar lawn mower without any power source due to reduced energy consumption. The inexperienced gardener is enough to operate the solar lawn mower.

Lawn mowers have become very popular nowadays. Most of the time, lawn mowers are used for soft grass furniture. In an age where technology merges with environmental awareness, consumers are looking for ways to contribute to the alleviation of their own carbon footprint. Pollution is man-made and can be seen in our own daily lives, more specifically in our own homes. In this work, a model of an automatic lawn mowing machine powered by solar energy (non-renewable energy) is proposed. Automatic lawn mower machine is a machine that will perform the lawn mowing operation by itself. This model reduces both environmental and noise pollution.

Our new design for an old and outdated habit will help both the customer and the environment. This project of an automatic solar-powered lawn mower will relieve the consumer from mowing their own lawn and reduce environmental and noise pollution. This design is meant to be an eco-friendly alternative to the popular and dangerous lawn mower that runs on environmentally hazardous fuel. Ultimately, the consumer will do more for the environment and work less in their daily lives. The hope is to keep working on this project until a proper design can be implemented and then finally put on the market.

Moving lawn mowers with a standard powered lawn mower is inconvenient and no one enjoys it. Lawn mowing may not be easy to achieve by older, younger people, lawn mowers who move with the engine create noise pollution due to the noisy engine and local air pollution due to combustion in the engine. In addition, an engine-to-engine requires regular maintenance, such as changing engine oil. Although electric solar grass is environmentally friendly, it can also be an inconvenience. Along with the motorized lawn mower, electric lawn mowers are also dangerous and cannot be easily used by everyone. Also, if the electric lawn mower has a cord, mowing the lawn could prove problematic and dangerous. The prototype will also be charged by the sun through the use of solar panels.

## II. RELATED WORK

Ashish Kumar Chaudhari :- In this paper they have prepared a hand-handled device that is capable of cutting grass. This device consists of linear knives and is not affected by weather conditions. They have used the following components to prepare the lawn mower: If any obstacle is in front of the lawn mower, it detects using an IR sensor and sends a signal to the microcontroller to change direction or stop the mower until the obstacle is removed. The main purpose of this document is to move the lawn mower in different directions to prepare various designs as per the requirements. By using the linkage mechanism, the height of the cut can be adjusted. Unskilled labor can easily operate this device.

Vicky Jain: - They've set up a cordless lawn mower. There are two main components, such as the transmitter and receiver. The transmitter continuously transmits the rays, if any obstacle is in front of the lawn mower, the rays are

reflected back to the receiver. The receiver receives the signals in the encoder in series, but the microcontroller requires parallel data for communication, so the receiver sends data to the decoder to convert the data in parallel and then passes it to the microcontroller. They have used a solar panel, so there is no need to charge the battery externally and the battery is continuously charged at constant voltage when the lawn mower is running. The battery is charged during the day by using a solar panel and stored so that we can use the lawn mower during the night as well. Due to two DC motors, both forward and backward movement of the lawn mower can be possible simultaneously.

Pankaj Malviya:- The author prepared the manual operating device. The battery can be charged through the use of a solar panel as well as an external power supply and a DC motor that is controllable is used to change the direction of the lawn mower as needed. The most modern regulator is used to prevent battery overcharging and discharging, which saves battery space. Due to industrialization, more electricity is required for various industrial applications and electrical appliances, so solar energy is the best alternative for electricity. Solar panel, battery, DC motor, solar charger, these components are used for the manufacture of lawn mowers. They've used fewer moving parts, so there's less maintenance. This lawn mower will give much more physical exercise to the operator and will be easily operated.

Praful P. Ulhe:- In this work they have prepared a manually operated lawn mower with spiral roller blades because the spiral blades increase the cutting efficiency. To adjust the height, the reel cutter is placed on a component of the lawn mower. This lawn mower used to cut the grass evenly, and it can also cut the different types of grasses. The battery can be charged during working conditions and also has AC charging. For the collection of the cut lawn mower box it is placed on the lawn mower so that the cut grass is placed out of the grass. It has a light weight and compact design.

T. Karthick:- In this article, the author made a lawn mower machine with rotating blades by using solar energy. Solar energy is trapped in the photovoltaic cell to generate electricity. Cells can be grouped together in the form of panels or arrays. The solar panel is positioned in such a way that it absorbs the high intensity of the sun and will tilt at 45°. The main function of the solar charger is to increase the current during charging of the batteries and also to disconnect when they are fully charged.

Tanimola:- The author developed a solar-powered lawn mower. They found several results that are listed below: The average height of the grasses after mowing them was lower than expected after the machine had been adjusted to a height for four species of grasses. Less time is required to mow the lawn. Efficiency also increases

Dipin.A:- They prepared a solar-powered, vision-based robotic lawn mower that operated manually with less effort. The preset program is fed into the system and the robot moves in a predetermined pattern with the help of MATLAB programming as well as the camera installed on the robot

structure. Robots that are produced to reduce human efforts also detect humans and objects that are in front of the robot. Therefore, it protects the equipment from damage and also reduces the risk to the human being. The robot mowed the lawn in different directions to make different design patterns as specified by the human.

Sachin Prabha: - The writer makes a solar lawn mower machine to reduce human labor and also consumes non-renewable energy sources on the earth's surface. Through the use of solar panels, energy is obtained from the sun and stored in batteries and uses this energy as per requirements. All these functions are carried out according to the prescribed time by appropriate monitoring. A dedicated mechanism provides protection of the batteries from additional charging, increasing the life of the batteries. It can also be used on a small scale for gardening.

### III. METHODOLOGY

It is extrapolated from existing technology that, in order to achieve a better end product than currently available and at a lower cost, the overall design of the system described in this report would have to work with the following considerations: The system would have to be made to follow a certain trajectory and a more efficient cutting pattern.

A method of limiting garden area that can be long-term, life-cycle resistant, and more cost-effective; That's a better solution than guide wire.

Good cutting methodology

• More cost-effective sensor array arrangement that would allow the determination of obstacles and garden boundaries.

• Using a two-wheeled vehicle as opposed to any other number would allow the robot to easily navigate the track.

As opposed to the robot relying on additional electronic devices placed in the garden area; It should be chosen that all electronic components are on board and that the device is capable of determining all relevant parameters in this way.

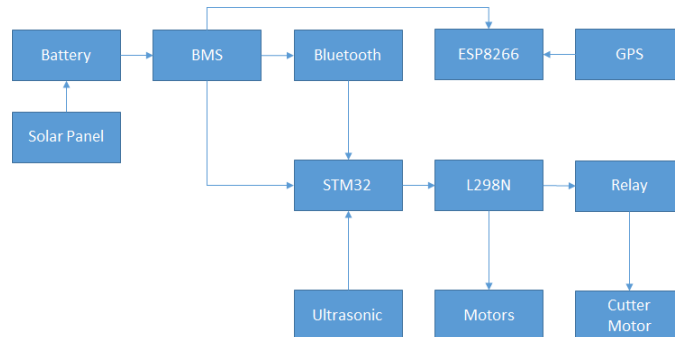


Fig. 1. Automatic Solar Lawn Mower Block Diagram

### A. STM 32 ALGORITHM

- Initialize the STM32 microcontroller and configure the necessary GPIO pins and hardware connections to control the boat's motors, steering, and other functions.
- Deploy a Bluetooth module (for example, HC-05 or HC-06) on the STM32 board to enable Bluetooth communication.
- Set up a Bluetooth connection between the STM32 and a mobile device (e.g., smartphone or tablet) using a Bluetooth terminal app.
- Develop a control interface in the mobile application, which allows the user to send commands to the vessel via Bluetooth. These commands can include forward, backward, left, right, stop, speed control, and any other boat-specific functions.
- On the STM32 microcontroller, create a program that listens for incoming Bluetooth commands from the mobile device.
- Interpret received Bluetooth commands and translate them into control signals for the boat's motors and other actuators. For example, if the user sends a "forward" command, the STM32 must activate the engines to move the ship forward.
- Implement safety and error handling features in your code to ensure the safe operation of the vessel. For example, it includes checks to prevent the ship from running aground or entering dangerous areas.
- Continuously monitor the Bluetooth connection and check for signal loss or disconnection. If a disconnection occurs, the vessel must respond by stopping or taking predefined safety measures.

### B. ESP8266 GPS ALGORITHM

- Initialize the ESP8266 module and connect it to a Wi-Fi network.
- Configure the GPS module for location tracking. Configure the GPS module to receive location data.
- Implement the Blynk library in your code and establish a connection to the Blynk server using the provided authentication token.
- Set a timer or interrupt to read GPS data at regular intervals (e.g., every few seconds) for real-time location updates.
- Analyze GPS data to extract latitude and longitude coordinates.
- Use the Blynk library to send latitude and longitude data to the Blynk application as virtual pins. These virtual pins can be configured in the Blynk app to display the live location in a map widget.
- Make sure the ESP8266 maintains a stable Wi-Fi connection to transmit data continuously.
- Implement error handling and reconnection mechanisms to handle any loss of Wi-Fi or Blynk server connection.

### C. WORKING

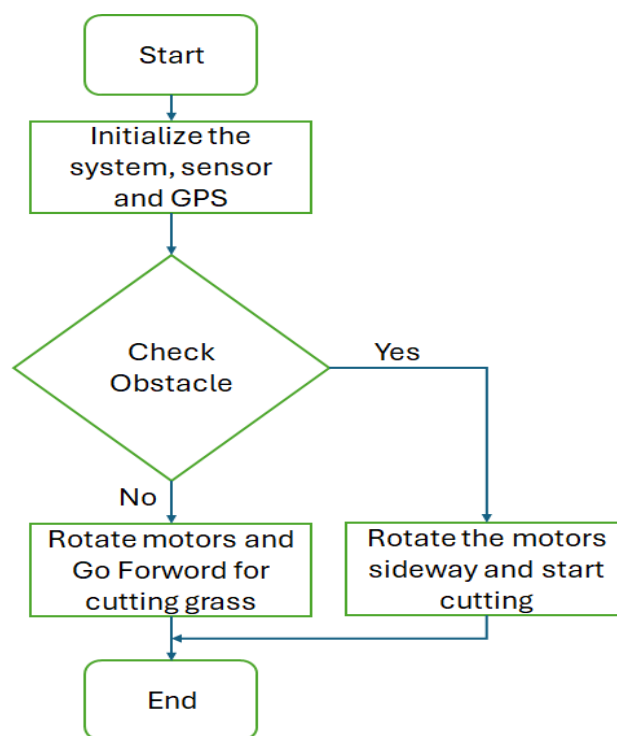
- The solar-powered lawn mower project works through a well-coordinated sequence of processes and components. It all starts with the use of solar energy. The solar panels are strategically mounted on the



lawn mower to capture sun- light. These panels incorporate photovoltaic cells that quickly convert solar energy into electrical energy. Importantly, this conversion process occurs continuously as long as sunlight is available, ensuring a constant source of energy.

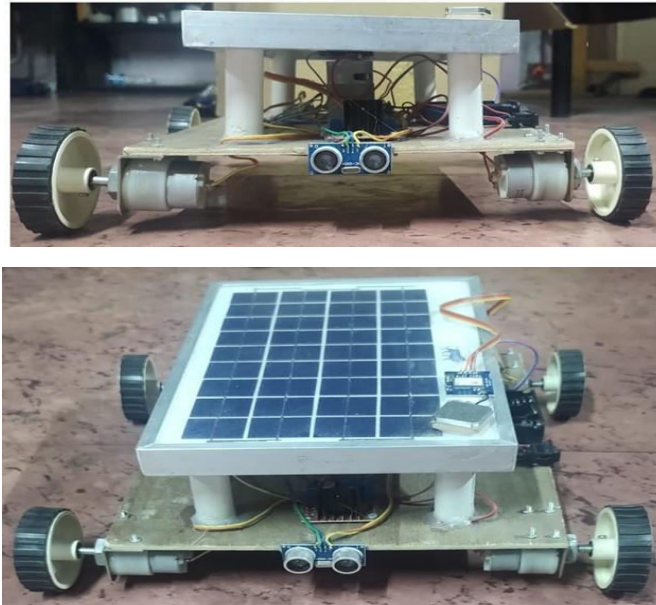
- b. The electrical energy generated is stored in a rechargeable battery. This battery serves as a vital energy reservoir, allowing the lawn mower to run smoothly even in the absence of direct sunlight. This feature ensures uninterrupted lawn mowing functionality, providing reliability and efficiency.
- c. For the actual lawn mowing operation, a direct current (DC) motor is used. This motor is powered by the energy stored in the battery. It plays a crucial role in delivering the torque needed to drive the mower blades, ensuring effective lawn mowing.
- d. To enhance user control and convenience, the lawn mower is equipped with Bluetooth connectivity. Users can start, pause, or stop lawn mowing activities and monitor the status of the lawn mower from their smartphones or tablets using a dedicated mobile app. This feature offers a high degree of flexibility and control.
- e. The mobile app includes two distinctive modes of operation: Ultrasonic mode: In this mode, the lawn mower operates autonomously. It uses ultrasonic sensors to detect obstacles in its path and efficiently navigate through the lawn mowing area.
- f. This self-contained approach ensures systematic and effective cutting of the grass.
- g. Manual Mode: For those who prefer a more hands-on ap- proach, users can take control of the lawn mower through the app. Manual mode allows for user-guided operation, offering flexibility to mow the lawn according to individual preferences and needs.
- h. Both modes are designed to ensure that the mower delivers a clean, well-maintained lawn. Importantly, the entire project emphasizes respect for the environment by reducing depen- dence on fossil fuels and minimizing environmental impact. The solar-powered lawn mower contributes substantially to a greener environment by reducing the noise and air pollution

**D. Functional Flow Diagram**



**Figure 2 Functional Flow Diagram**

#### IV. RESULTS



**Figure 4 Hardware Implementation**

The project aims to use renewable energy sources such as solar electricity and operate a mower equipped with various attachments and mow and collect grass. The DC motor, powered by a battery, where charge is held through a solar panel, has a spiral-shaped lawn cutting blade. This is also shown in Fig. 4.2. In a frame of metal rolls, the entire structure is supported. The solar panel attaches to the structure and charges if the system is down, transferring charges to the battery through the circuit. During the day and night, the solar lawn mower uses both. The lawn mower's battery backup is 30 to 60 minutes, so at night, we simply use a mower. The chassis is powered by the paddle motor, DC motors, solar panel, and batteries.

#### V. CONCLUSION AND FUTURE SCOPE

This system is very simple to use and cost-effective as it is much more advantageous, i.e. no fuel cost, no pollution or fuel waste, less wear and tear due to fewer moving parts, and can be powered by solar energy. It can be easily addressed. This system is capable of charging the battery while the solar energy mowing the lawn is in motion. Therefore, it is also much more suitable for mowing lawns. The outcome of this project can be improved by increasing cost reduction, increasing blade efficiency and weight reduction. The sensors are not affected by the environment or animals.

It is very useful for the user. The DC motor maintains a constant speed in the used load condition. The battery is charged by the solar panel in a stable trend. The output of the photovoltaic panels is different, but STM 32 Bluepill acts as a voltage regulator and takes a different input from the photovoltaic and gives it a stable performance

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