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# Iot Base Solar Grass Cutter

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**ABSTRACT**

The twentieth century is most known for being really a century that was so much full of automation and development Day by day, we witness the automation of daily life becoming a habit in every field, such as manufacturing industries, automobile industries, farming, and many more.

Introducing the ground breaking IoT-based solar grass cutter. IoT, which stands for interrelated digital machine mechanical and people, is a system used to data in an efficient way. In the IoT-based solar cutter, controls are smartly made by a smart phone which is become a use of everyone. This device is where we utilized an Arduino software, and all the programming is done on it. An ultrasonic sensor detects a problem, and the BLDC motor proves to be a useful part providing a motion upward or downward. Solar panels, the source of solar energy, offers energy to the system. Renewable source of energy, like, this one, you know, super used in summer and probably, like, other seasons as well

**Keywords:**ESP32 CAM Module, Ultrasonic sensor, BLDC Motor

## INTRODUCTION

Introducing an IoT-based grass cutter involves combining traditional grass cutting machinery with modern IoT (Internet of Things) technology to create a more efficient and smarter tool for lawn maintenances, here's a brief overview of what you could include in your introduction. The grass cutter and vehicle motors are interfaced to an ESP 32 cam that controls the working of all the motors. This combination allows for precise detection and avoidance of obstacles in the environment. The ESP cam moves the vehicle motors in forward direction in case no obstacle is detected. On obstacle detection the ultrasonic sensor monitors it and the ESP 32 thus stops the grass cuter motor to avoid any damages to the object/human/animal whatever it is. ESP 32 then turns the vehicle as long as it gets clear of the and then moves the grass cutter in forward direction again, This project of a solar powered automatic grass cutter will relieve the consumer from moving their own lawns and will reduce both environmental and noise pollutions Ultimately, the consumer will be doing so much more for the environment while doing much less work in their daily lives but it's not like they will notice The fully automated solar grass cutter is being. It's a grass cutting robotic vehicle that's powered by solar energy that avoids obstacles and cuts grass without needing any human interactions, We don't use, you know, 12V batteries to power the vehicle movement motors as well as the grass cutter motor. We also, like, use a solar panel to charge the battery, so it's not like anyone needs to charge it externally or anything! The grass cutter and vehicle motors are connected, kind of, to a family ESP 32 that controls the working of all the motors??? It is always, like, interfaced to an ultrasonic sensor for obstacle detections. The ESP 32 moves the vehicle motors in forward direction in case no obstacle is detected. On obstacle detection the ultrasonic sensor monitors it and the ESP 32 thus stops the grass cuter motor to avoid any damages to the object/human/animal whatever it is ESP 32 then turns the vehicle as long as it gets clear of the and then moves the grass cutter in forward direction again. This project of a solar powered automatic grass cutter will relieve the consumer from moving their own lawns and will reduce both environmental and noise pollutions. Ultimately the consumer will be doing more for the environment while doing less work in their daily lives.

**Study Area:**

1. **Requirement Analysis**:

- Define the study area: Determine the size, terrain, and types of grass.
- Identify the specific requirements: For example, cutting frequency, grass height, battery life, etc.

2. **System Design**:

- Solar Panel: Select appropriate solar panels based on energy requirements and available sunlight.
- Battery System: Design a battery system to store solar energy for powering the grass cutter, ensuring uninterrupted operation.
- Cutting Mechanism: Choose a cutting mechanism suitable for the grass types in the study area.
- IoT Connectivity: Integrate IoT modules for remote monitoring and control.
- Sensors: Incorporate sensors for obstacle detection, grass height measurement, and environmental monitoring (temperature, humidity).
- Microcontroller: Select a microcontroller to process sensor data and control the grass cutter's operation.

3. **Hardware Implementation**:

- Assemble the components according to the system design.
- Implement the cutting mechanism and ensure its efficiency and safety.
- Install sensors and calibrate them as necessary.
- Integrate the IoT module for connectivity.

4. **Software Development**:

- Develop firmware for the microcontroller to control the grass cutter's operation based on sensor inputs.
- Implement algorithms for obstacle avoidance and grass cutting.
- Create a user interface for remote monitoring and control via IoT.

5. **Testing and Optimization**:
- Test the system in the study area under various conditions.
- Optimize algorithms and parameters for better performance.
- Evaluate energy efficiency and make adjustments as needed.

6. **Data Analysis and Reporting**:

- Collect data from the IoT sensors during operation.
- Analyze the data to assess the grass cutter's performance and efficiency.
- Generate reports and insights for further improvements or research.

7. **Maintenance and Upkeep**:

- Establish a maintenance schedule for regular inspection and servicing.
- Provide user training for operation and troubleshooting.
- Monitor system performance and address any issues promptly.

**Need for translocation**

"To incorporate translocation into the IoT-based solar grass cutter, you would need to integrate additional sensors and algorithms for navigation, obstacle detection, and path planning. This could involve technologies such as GPS, proximity sensors, and mapping algorithms to enable the grass cutter to navigate autonomously or with remote guidance. Additionally, connectivity features such as IoT can facilitate remote monitoring and control of the translocation process, enhancing overall efficiency and effectiveness."

1. **Efficient Coverage**: By allowing the grass cutter to move between different areas within the study site, you can ensure more comprehensive coverage of the entire area without leaving any patches of uncut grass.
2. **Adaptability to Changing Conditions**: Translocation capability enables the grass cutter to respond to changes in grass growth patterns, environmental conditions, or specific areas that require more frequent cutting.

3. **Optimized Energy Usage**: By moving to areas with higher grass growth or avoiding areas with minimal growth, the grass cutter can optimize its energy usage and maximize its operating time between recharging sessions.
4. **Reduced Human Intervention**: With translocation capability, the need for manual intervention to move the grass cutter between areas is minimized, allowing for more efficient operation and freeing up human resources for other tasks.
5. **Enhanced Flexibility**: Translocation capability adds flexibility to the operation of the grass cutter, allowing it to adapt to varying terrain, obstacles, and spatial constraints within the study area

## METHODOLOGY

1. **Research and Requirement Gathering**:

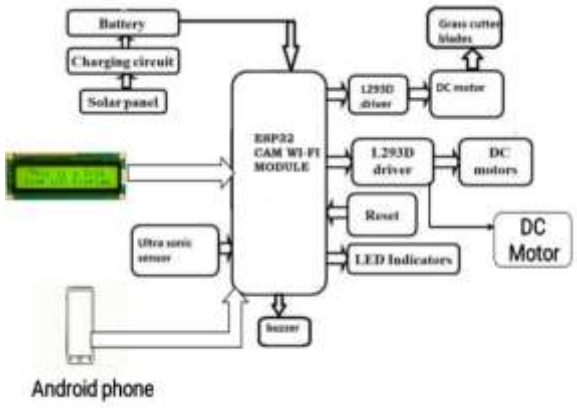
- Conduct a thorough literature review to understand existing technologies and methodologies related to solar-powered grass cutters and IoT integration.
- Define the specific requirements of the project, including the size of the study area, types of grass, cutting frequency, energy consumption constraints, and desired features such as remote monitoring and control.

2. **System Design**:

- Design the overall architecture of the grass cutter system, considering components such as solar panels, batteries, cutting mechanism, sensors, microcontroller, and IoT module.
- Determine the placement and integration of each component to optimize energy efficiency, cutting performance, and connectivity.
- Develop algorithms for grass cutting, obstacle detection, translocation, and remote control.

3. **Hardware Implementation**:

- Procure the necessary components based on the system design.
- Assemble the hardware components, including mounting solar panels, installing the cutting mechanism, integrating sensors, connecting the microcontroller, and adding the IoT module.
- Ensure proper wiring, connections, and waterproofing (if applicable) to withstand outdoor conditions.




4. **Software Development**:

- Develop firmware for the microcontroller to control the operation of the grass cutter, including motor control, sensor data processing, and communication with the IoT module.
- Implement algorithms for autonomous operation, such as obstacle avoidance, grass detection, and path planning.
- Create a user interface for remote monitoring and control, accessible through a web application or mobile app.

5. **Testing and Optimization**:

- Conduct thorough testing of the grass cutter system in a controlled environment to evaluate its performance under various conditions.
- Optimize algorithms and parameters for energy efficiency, cutting accuracy, and reliability.
- Validate the effectiveness of the translocation feature in covering the study area efficiently.

6. **Field Deployment and Validation**:

- Deploy the IoT-based solar grass cutter in the actual study area.
- Monitor its performance in real-world conditions, including different weather conditions, terrain types, and grass growth patterns.
- Collect data on energy consumption, cutting effectiveness, and user feedback for validation and further refinement.

7. **Documentation and Reporting**:

- Document the design, implementation, and testing process, including hardware specifications, software architecture, and experimental results.
- Prepare a comprehensive report summarizing the project objectives, methodology, findings, and recommendations for future improvements or applications.

8. **Maintenance and Support**:

- Establish a maintenance schedule for regular inspection, cleaning, and servicing of the grass cutter system.
- Provide user training and technical support for operators and administrators.
- Continuously monitor the system performance and address any issues or updates as needed.

By following this methodology, you can systematically design, implement, and validate an IoT-based solar grass cutter for your study area, ensuring efficient grass cutting while leveraging renewable energy and advanced technologies.

## RESULT & DISCUSSION

The project entitled "IOT Based Grass Cutter with Solar energy" is successfully completed and the results were obtained in a satisfactory manner. The project is way more suitable for a common man as it is having much more advantageous features, and it can be operated by using solar energy. This system will give less physical exertion to the people and can be easily handled. This system has the feature of charging the batteries while the solar-powered grass cutter is in motion. The grass cutter can also be operated in night time, as there is a feature to charge these batteries in daylight. A workable IoT based solar grass cutter prototype is focusing on the renewable energy as the primary source of energy has been successfully fabricated with high working efficiency as shown in the Figure 4

**Figure 4: Working Model**

"The grass cutter is moving to the forward direction and all the four wheels are moving because the user pressed the up button on the android application. As the user pressed the down button the grass cutter starts to move in a backward direction. The cutter is working because the user pressed the cutter on button as illustrated. The grass cutter will stop working as the user pressed cutter off button. As the user pressed the right button in the android application, the grass cutter

will start to move in the right direction. Similarly, the grass cutter will start to move in the left direction as the user pressed the left button as shown in Figure 5.".

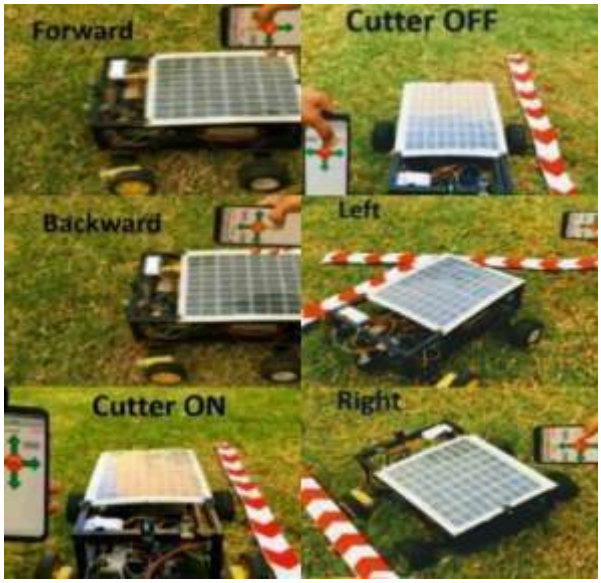



Figure 5: Different Movements of Grass Cutter The final demonstration of the proposed grass cutting robotic system with four different types of pattern like Circle, Spiral, Rectangle and Continue shapes designing on the grass is as shown in Figure 6.


**Figure 6: Different Patterns of Grass Cutting**

## CONCLUSIONS

The use of newfangled technology in the Iot oriented grass cutter that has a solar panel is environmentally favorable. As there is no cost of fueling, no pollution, no fuel residue, less wear and tear. The solar panel is sun-tracking, which will help to increase the efficiency and providing the power source to the battery. Iot is being 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 from the internet, which can be controlled from the cell phone. This grass cutter is used for preventing severe injuries during lawn maintenance and also reducing the efforts of a person drastically. By implementing this grass cutter in our society, even the senior citizens and non-skilled individuals can make access over it so that they are need not to be dependent on others. The operating principle is simple so that the work can be carried out even more easily. This project is successfully completed with the available resources and the results obtained are satisfactory. The designed model is highly efficient and the path of the mower is changed by the user by providing an instruction through the mobile phones. Therefore, equipment can be protected from damages and reduces the risk on humans. Thus, the newly designed robot will meet the challenge of low cost of operation, easy maintenance, and renewable energy.

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