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A Blynk Controlled Solar Powered Golf GrassCutter

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Abstract: The Internet of Things (IoT) has the potential to revolutionize the way golf course grasses are maintained. One of the applications is the use of a smart grass cutter, which can be controlled remotely using a mobile device. This project describes the development of an IoT-based smart grass cutter for golf courses using the Blynk platform. The system includes a solar panel, a battery, a charger controller, a microcontroller, and a motor for cutting the grass. The microcontroller is connected to the Blynk platform, which allows for remote control and monitoring of the grass cutter. The system also includes user interface access through the Blynk app, which allows for easy control and monitoring of the grass cutter. The system also includes a power management circuit that manages the power from the solar panel and the battery. The system has been tested and found to be effective in maintaining the grass of a golf course. This system can be a cost-effective, eco-friendly solution and can be easily scaled to other similar applications.

Keywords: Internet of Things, Solar Panel, Battery, Charger Controller,Microcontroller, Motor, Blynk App

1. Introduction

The grass cutter machine is usually used for grass cutting for those who have a large yard such as football or golf fields. They comprise a range of parts, including blades, rotors, and motors to cut the grass to a specific height that is adjustable based on the lawn cutter blade design requirements. The grass cutter run by an electric source and were emerged in the early nineties [1]. The old one used petrol and oil 2T to start the engine motor. These machines are heavy to control, and they may cause backache and fatigue to their users [2]. Besides, safety suits are also important like long boots, spectacles, gloves, and vest cover to avoid injury.

Consumers are looking for solutions to reduce their carbon footprints as well as to get rid offatigue in today's world of convergent technology and environmental consciousness [3]. Man-made pollution is present in our daily lives, more specifically in our houses therefore it is proposed to have. an IoT-based grass cutter machine powered by solar energy and controlled using a smartphone. This model reduces

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both environmental pollution and noise [4].

2. Materials and Methods

This block diagram shown in Figure 1, depicts the main components of the IoT smart solar grass cuttersystem and how they are connected. The solar panel captures solar energy, which is thenregulated by the charge controller and stored in the battery. The microcontroller (NodeMcu ESP32) reads sensor data and controls the motor for cutting the grass. The microcontroller is also connected tothe Blynk platform, which allows for remote control and monitoring of the grass cutter through the Blynk app.

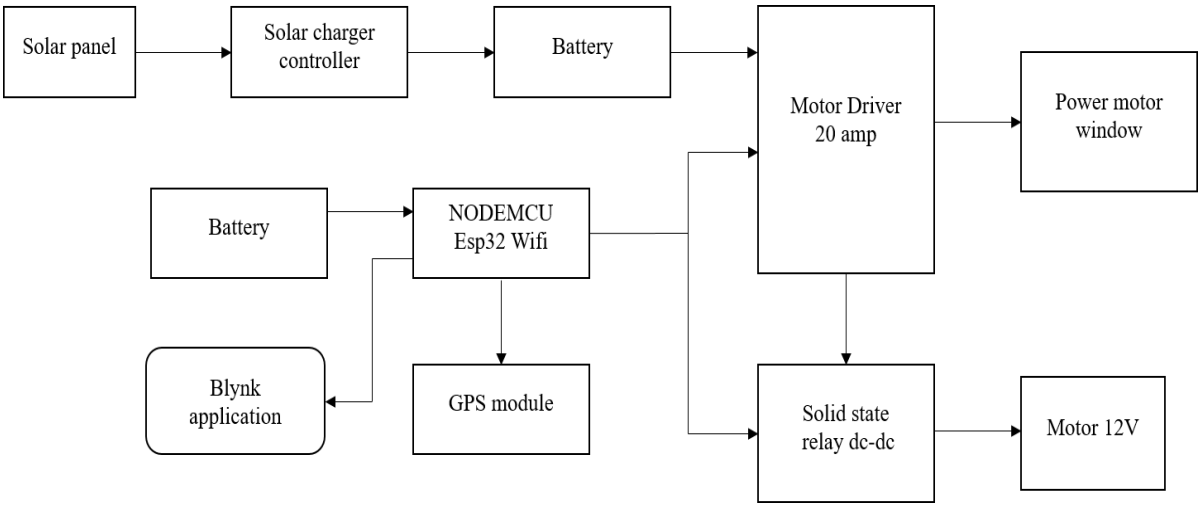

Figure 1: Block Diagram Proposed System

2.1 Modelling

The second stage is divided into two divisions, which are software and hardware. Firstly, this project was built using the Arduino Ide, Fritzing, and Blynk software. The movement of the DC motor that mows the grass and the window power motor is programmed using the Arduino IDE. The schematic and circuit diagrams of each component utilized in this project were then created using Fritzing software. Then, the machine's operations, such as turning it on and moving it, are controlled by the Blynk application. The hardware part is making electrical wiring connections on each component. The connection for hardware did not cost a lot of money to buy wires, connectors, and solders. Each component is connected carefully and neatly. Table 1 shows the software and hardware requirements.

Table 1: The software and hardware requirements.

Software	Hardware
• Arduino IDE • Fritzing Software • Blynk apps	• Solar panel 10 W,18 V • Solar charger controller • Battery SLA 12 V & 6 V • GPS module • Buzzer • Solid State Relay dc-dc • NodeMCU ESP32 • Motor driver 20 amp • Dc motor 12 V, 5000 rpm • Power Window Motor

2.2 Blynk Application

Blynk is the programmer illustrated in Figure 2 that will be utilized for this product. With the ability torun MATLAB code inside of Blynk, it is possible to undertake online analysis and processing of the data as it is being inputted. In this project, Blynk has been created to turn ON and OFF DC motors. Not only that, it can also control the movement of the power motor window and inform the location of the latitude and longitude of this machine.

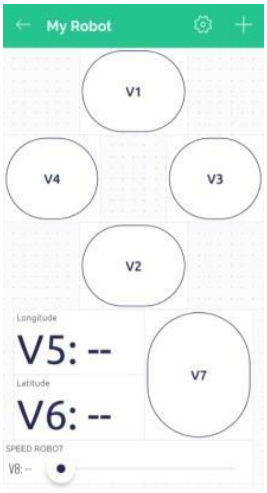

Figure 2: System Setup in Blynk Application

2.3 Schematic and Circuit Diagram

To better comprehend this project and ensure that every connection is correct to accomplish thespecified objectives, the connection of this project is created before moving on to the hardware. The duration of real estate development hardware takes more time. However, using a schematic and circuitdiagram can help shorten the process time as all component connections are referenced in the diagram,as seen in Figure 3 and Figure 4.

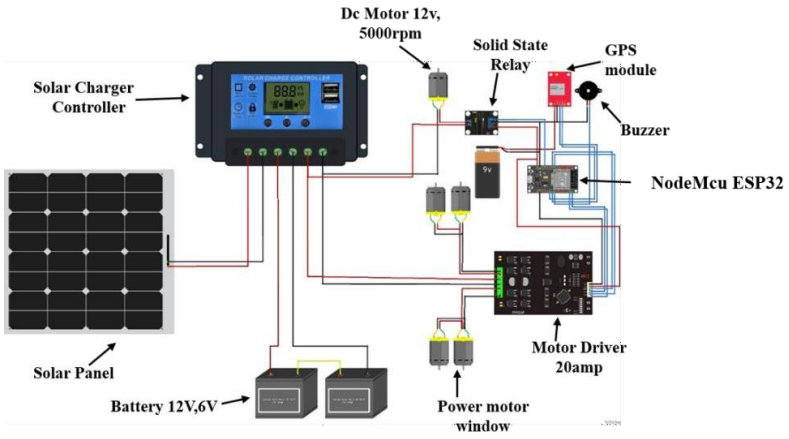

Figure 3: The Schematic Diagram of the Project

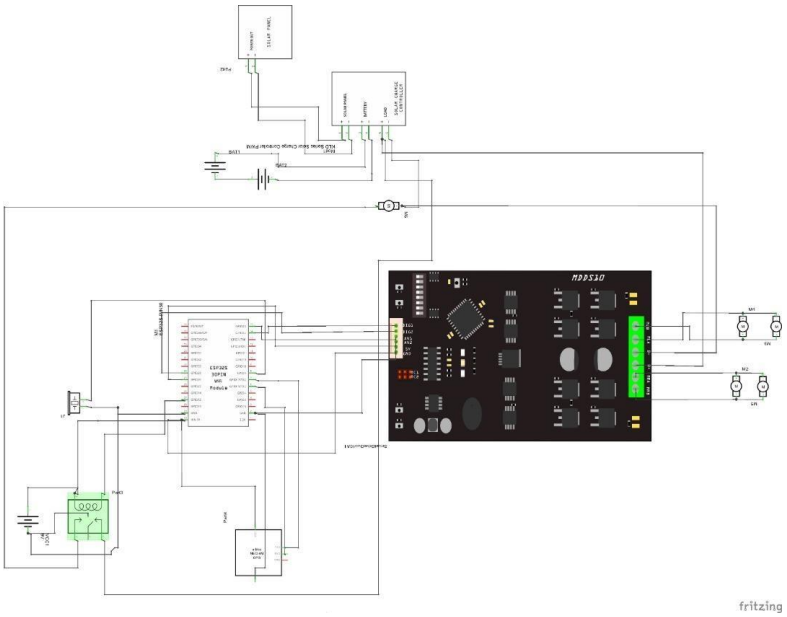

Figure 4: The Circuit Diagram of the Project

3. Results and Discussion

The functionality of this project is observed and analyzed. 3 types of tests will be done. The first test is the range grass cutter can control using Blynk and the tires can move on the grass. The test aims to evaluate the performance of the hotspot from our device connected with the NodeMcu ESP32. The second test is about the motor that can cut the grass smoothly. The test aims to evaluate the performance ofthe motor cutter grass can be cutting grass with the appropriate thickness. The last test is whether the solar panel can charge a battery and the duration time the grass cutter can be used. The test aims to evaluate the performance of the battery that can support this project.

3.1 The Blynk Control Solar Powered Golf Grass Cutter

The hardware of this project has been developed by referring to the circuit design. Figure 5 shows theoverview of the project hardware Blynk control solar-powered golf grass cutter.

Figure 5: The Overview Hardware of the Project

3.2 Movement of the machine

The Blynk app, which has four buttons, is used to wirelessly run the robot and control its movement using the motor driver. Table 2 tabulated the buttons are connected to virtual pins, allowingthe system to enable the machine to move left, right, forward, and backward. By utilizing the buttons

provided in the Blynk app, users can easily control the movement of the robot. Table 2 shows the movement of the machine.

Table 2: Results Movement of The Machine

Movement	Left Motor	Right Motor
Forward	Anticlockwise	Clockwise
Backward	Clockwise	Anticlockwise
Right	Anticlockwise	Anticlockwise
Left	Clockwise	Clockwise

A. Forward Movement

To make the machine move forward, the left motor needs to rotate in an anticlockwise direction, whilethe right motor needs to rotate in a clockwise direction. This differential movement of the motors causesthe machine to move forward direction. Figure 6 demonstrates the initiation of the forward movement of the machine.

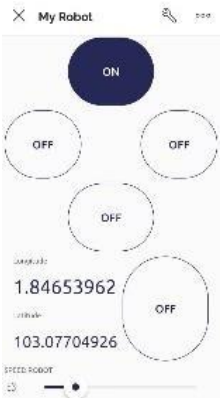

Figure 6: The Forward Movement for The Machine.

B. Backward Movement

To make the machine move backward, the right motor needs to rotate in an anticlockwise direction, while the left motor needs to rotate in a clockwise direction. This differential movement of the motors enables the machine to move backward. Figure 7 illustrates the initiation of the backward movement of the machine.

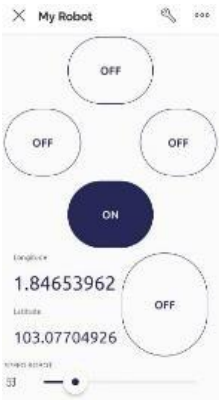

Figure 7: The Initiation of The Backward Movement for The Machine.

C. Right Movement

To make the machine turn right, both the right motor and left motor need to rotate in an anticlockwise direction. This configuration causes the wheels on both sides of the machine to move in the same direction, propelling it to turn right. Figure 8 illustrates the initiation of the right movement for the machine.

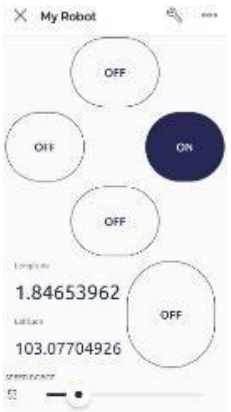

Figure 8: The Initiation of The Right Movement for The Machine.

D. Left Movement

To make the machine turn left, both the right motor and left motor need to rotate in a clockwise direction. This configuration ensures that the wheels on both sides of the machine move in the same direction, propelling it to turn left. Figure 9 illustrates the initiation of the left movement for the machine.

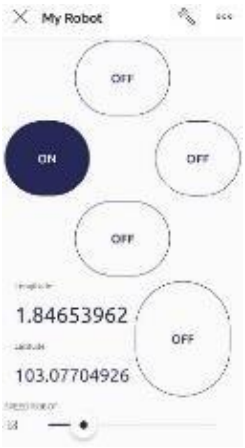

Figure 9: The Initiation of The Left Movement for The Machine.

3.3 Site Testing

Theoretically, the movement and speed of the machine can vary in different environments, as differenttesting sites may have distinct flow rates and grass characteristics. Table 3 provides data from test setsconducted with the same movement and distance. The distance was measured using a measuring tape, spanning 10 meters. However, only the most accurate data obtained during the testing process was considered. The recorded data includes information on the machine's movement, the grass cutter's ability, andthe time taken to cover the 10-meter distance.

Table 3: Data from the test

No	Site	Taman Universiti Grassfield
1	Weight robot	13 KG
2	One rotation (s)	18.3 s
3	Grass cutter ability	Can cut smoothly (0.5 cm from the ground)
4	Distance in meter	10 meters
5	10 meters forward (s)	45.4 s
6	10 meters backward (s)	48.7 s
	Movement	
7	Forward	Straight
8	Backward	Straight
9	Right	360˚ rotations

10	Left	360˚ rotations

A. The Range Grass Cutter Can Control Using Blynk.

The speed for testing is 80 to 125. From the test, the grass cutter can move 50m and cut the grass smoothly. For more than 50 meters the grass cutter cannot be controlled because the hotspot disconnected from the device and the machine will be stopped. This project can turn right and left from 0 degrees to 360 degrees.

B. The Condition of The Grass

When a machine is on for cutting the grass, the grass cuts very smoothly while moving. Before cutting the grass,the height is 3 cm from the land. After cutting the grass height is 0.5 cm from the land. The difference from height this machine cut 2.5cm. The speed of the cutter cannot be controlled using Blynk apps. The Blynk apps just switch ON the motor grass cutter only.

3.3 The Condition of Battery Testing

Two power supplies were used for this project. The first, power supply used is a rechargeable battery 3.7Vfor supply to NodeMcu ESP32. After that, the second supply used battery SLA 18V for supplying powerto PWM (power motor window) and motor grass cutter.

A. Rechargeable Battery 11.1V, 1.1Ah for Supply Power to Nodemcu ESP 32

The battery condition is fully charged. While this machine is ON condition, the battery 11.1V supplies power to NodeMcu ESP32. The durability of the battery is 25 or 30 minutes only and the battery mustbe charged again. The duration of the battery full is 20 minutes using battery charger input AC 240V. Table 4 shows the data battery test for supply power to Nodemcu of the machine.

Table 4: The Data Battery Test of The Machine.

Time (min)	0	5	10	15	20	25	30
Battery	100%	84%	67%	50%	33%	16%	16% - 0%

B. The Battery SLA 18V, 7Ah for Supply Power to PWM and Motor Grass Cutter

The battery condition for 18V before the test is fully charged. During this machine's ON condition, the battery 18V supplies power to motor DC 12V and power the window motor. The durability of the battery is 50 or 55 minutes only and the battery must be charged again using solar. Table 4 shows the data batterytest of the machine. Table 5 shows the data operation hour battery test of the machine.

Table 5: The Data Operation Hour Battery.

Time (min)	0	10	20	30	40	50	55
Battery	100%	82%	63%	45%	27%	9%	0% - 0%

4. Conclusion

In conclusion, the Blynk Controlled Solar Powered Golf Grass Cutter project has successfully achievedits objectives of designing and developing a small-scale robot prototype capable of cutting and leveling the height of grass. Additionally, the project has successfully increased the operation hours of the system through the integration of a Photovoltaic (PV) system. The design phase of the project focused on creating a compact and efficient machine that could effectively cut grass. By considering factors such as size, weight capacity, and maneuverability, the project team successfully designed a machine that meets these requirements. One of the significant achievements of the project was the integration of a Photovoltaic (PV) system to increase the operation hours of the machine. By harnessing solar energy, the system's dependency on traditional charging methods was reduced, allowing for extended operationwithout the need for constant manual charging. This innovative solution aligns with the growing trendof environmentally conscious practices and provides a reliable, efficient, and user-

friendly alternative to traditional grass-cutting methods.

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