SolarGreen Automower : Smart IoT Lawncare

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***Abstract* : In this study, we present a different approach to effective lawn care. With its clever watering system and remote control capabilities, our system provides an user-friendly way to manage your lawn grass. This is a perfect illustration of how embedded technologies can transform routine tasks. A 12-volt 7-Ampere rechargeable lead-acid battery, a 12-volt 35-watt solar panel, a solar controller, a water tank, a water pump, four 12-volt DC motors for the wheels, a motor driver, four caster wheels, and switches are all included in our device's setup. Using coding, we have developed a website that enables Android phone users to operate the lawnmower. It takes a Wi-Fi connection to run the system. Our system is designed to make lawn maintenance easy and efficient.**

Keywords:- Mobile-controlled, drenching water, wi-fi controlled, solar powered, smart lawnmower, electric lawnmower, IoT (Internet of Things).

I. INTRODUCTION

Even though it can be a laborious task, a lot of individuals still maintain their lawns with manual grass cutters. These people may need up to ten litres of gasoline to finish the job because they frequently work outside for extended periods of time in the sweltering sun. They might have to mow the grass twice a month in the rainy season and once a month in the summer. Scholars have noticed this issue and have developed a fix.

The name of their idea, " Solar Powered Semi-Automated Lawn Mower " makes advantage of a Wi-Fi link. It is intended to give consumers a safer, more economical way to manage their lawns while also saving them time and effort. The Wasif, M. study was consulted by the researchers (2014)[1] in controlling the electric motors of the project.

An ESP-32 Cam Wi-Fi module, electric motors, batteries, a motor driver, a solar panel, a water tank, and a water pump are some of the parts used in the project. The electrical, software, and mechanical are its three primary sections. Batteries, motors, and electrical components are all included in the electrical area. The motor driver and the grass cutter's motor are powered by the 12-volt, 7-amp batteries that are connected. The motor driver, which regulates the lawnmower's speed and direction, is connected to the four DC motors, or wheels.

The creation of a programme for the lawnmower's ESP-32 Cam module and the creation of a web interface for wireless transmission and control are covered in the software part. The project can be controlled using a Wi-Fi connection, and Arduino IDE is used to upload the code to the ESP-32 Cam module.

The lawn mower's case construction, wheel installation, blade installation, and caster wheel installation are all handled by the mechanical division. Although the blade is meant to cut the grass, it can also harm humans. To solve this problem, the researchers have created housing that permits the discharge of grass clippings while securely enclosing all the moving lawn mower components, particularly the speed-cutting blades. Although the lawnmower can be effortlessly rolled across the grass thanks to its wheels, it might need to be lowered when turning, particularly when there are little bumps in the field. While the water pump is used to irrigate the grass after it has been cut or to spray chemical fertilizers to keep the lawn healthy, the water tank is used to store water or chemical fertilizers.

Finally, the lead-acid battery is charged using a 35-watt 12-volt solar panel. In addition to charging the battery more quickly, the solar panel also charges the battery while you mow the lawn during the day. In conclusion, the "Solar Powered Semi-Automated Lawn Mower" project offers a creative approach to effective grass care. With its clever watering mechanisms and remote control capabilities, the system provides a convenient and eco-friendly way to take care of lawns.

II. LITERATURE REVIEW

A Survey of Robot Lawn Mowers the robotic vehicle is equipped with a blade[2], grass cutting at high RPM using

electric power supply[8], Solar powered Grass cutter Which controlled using Bluetooth, System is designed to control motion of Robot and control the speed of a cutter[6] .

III. MATERIALS AND METHODS

In the current work, solar energy powers the tool that can complete the task. A switch can be used to control the system, depending on which circuit is being used for charging the motor. The battery stores solar energy, which is subsequently used to power the motor via the switch. The motor uses the energy from the battery to run continuously.

3.1 Components

The battery is connected to the motor driver. Because it is an easy way to minimize the amount of wires used and to connect the motor's wiring to the motor driver, the researchers placed it in the middle of the lawnmower.

The project's design is based on the layout of typical electronic lawnmowers that the researchers observed, as seen in Figure 2. The Polytechnic, L. S. (2014) study was the source of the design revision [4]. Additionally, all of the important and perceptive components of the lawnmower, including the motors, motor driver, batteries, WIFI Module, and blades, are covered by the design casing that the researchers selected. In Figure 4, the circuit diagram is displayed. Following the completion of hardware installation, the following outcomes: The blades measure 150 mm in length and 2 mm in thickness. They are welded together to form pillars that will support the platform's surface when the lever arrangement is used. A lever is fixed at the base of the platform. Hence when pressure is applied on the surface of the platform it supports strongly because of the welding.

Motor

A DC motor converts electrical energy into mechanical energy by means of the interaction between current-carrying conductors and a magnetic field. A one-inch square tube made of mild steel with the exact measurements—460 mm in length, 410 mm in width, and 140 mm in height—is used to construct the main frame. With an alternator, generator, or dynamo, the opposite process—producing electrical energy from mechanical energy—is carried out. Electric motors of many kinds can function as generators and vice versa. A DC motor takes current and voltage as inputs and produces torque, or speed, as an output. Current: 0.2 amp, voltage: 12 volts.

Blades

The blades measure 50 mm in length and 15 mm in thickness. With a lever arrangement, they are welded into pillars that will support the platform's surface. A lever is fixed at the base of the platform. Because of the welding, the platform supports itself strongly when pressure is applied to its surface.

L298D Drive motor

A well-liked integrated circuit (IC) for managing stepper and DC motors is the L298D motor driver. At a maximum current of 2A per channel, it can drive one stepper motor or two DC motors. The L298D motor driver has built-in safety features like thermal shutdown and over current protection, and it can operate in both forward and reverse directions. It requires an external power supply to operate, typically ranging from 7V to 46V.

3.2Methodology

The design and fabrication process for solar lawn mower control via Wi-Fi will be agitated. The benefits and drawbacks of various literature workshops were linked after reading them. The benefits were taken advantage of as much as possible, and the drawbacks were kept to a minimum. For the suggested lawn knife machine, the following methodology was chosen while taking the system's results into consideration. A Smart Solar field mower's design must take into account a few factors, such as object position, large body structure, design advantages, and safety features. The solarGreen lawnmower has the potential to function independently. Its proper operation is what matters most. Effectiveness depends critically on distance travelled and the effects selected, including positions. The solargreen lawn mower is a simple design that makes use of building tools. The size determines the solar panel's overall size. The roof height's battery length varies. A distinct motor that is connected to the motor driver rotates each rotating rubber wheel. The Arduino Integrated Development Environment (IDE) was the programme utilised. The tackle was programmed using the Arduino IDE, and a website was created using the HTML programming languages to allow mobile users to control the field mower. The website displays the actual interface, which includes virtual buttons for adjusting the lawnmower's direction and a camera-capable view of the mower's front side. The virtual slider control speed is also included.The following lawnmowers were utilised: 12V/7-volt ESP-32 Cam Wi-Fi module Figure 1 illustrates the use and administration of a superior acid battery single motor driver with a maximum input voltage of 12 volts and a maximum affair of 12 volts and 5 volts, four 12-volt DC motors, a 12-volt E-Bike motor for the blade, a 35-watt solar panel, a PWM voltage regulator, a submersible water pump, two lit water tanks and a sword plate for covering the field mower and blade. The lawnmower is controlled by a programmable microcontroller called the Tensilica LX6 (ESP-32) binary-core microcontroller. Solar energy can be used to recharge the 12-volt, 7-amp battery. It is fed into the motor of the blade. The Android phone was connected using the ESP-32 Wi-Fi module. It has a WIFI connection, the SSID name and IP address should be determined for connecting to the field mower. It wasn't necessary to spend internet cargo to connect the device because without internet cargo it can be operated by using the website programmed in the Arduino IDE. This process of Wi-Fi connection in Arduino was observed in the study of Ramleet.al.(2017)(2) and Elshafee,A., & Hamed,K.A.(2012)(3). In the system design, Google SketchUp software was used to design the perspective view of the project. The design was essential to choose the accouterments to be used. In design construction, the circuit illustration was applied, covering was made and accouterments were installed in the covering. In this stage also, prototyping was considered. The ESP-32 is attached with a motor driver 5- volt output leg at the front of the lawnmower to modify it effortlessly or to know if it is performing.

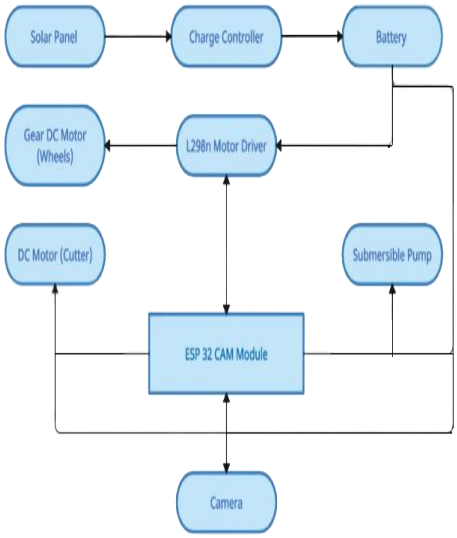

Fig 1. Block Diagram

A battery is connected to the motor driver. Because it's an easy way to connect the motor's wiring to the motor driver and because it uses the fewest amount of cables possible, the experimenters placed it in the middle of the field mower. This design is based on the common electronic field mower design that the experimenters observed, as depicted in Figure 2. The Polytechnic, L.S. (2014) study was the source of the design revision (4). Additionally, the experimenters selected this design cover because it covers all of the field mower's sensitive and essential components, including the motors, motor driver, batteries, WIFI Module, and blades. In Figure 4, the circuit illustration is displayed.

Fig 2. Internal Hardware Structure

Fig. 3 Project Hardware

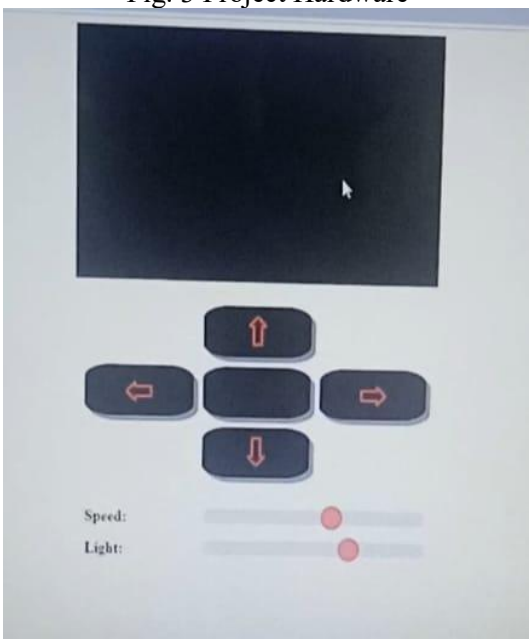

Fig 4. website interface

IV. RESULTS AND DISCUSSION

The design intends to cut lawns using renewable as source, such as solar electricity, to power a lawnmower. The DC motor features a lawn-cutting blade and is powered by a battery that is maintained in charge by a solar panel. Figure 2 also illustrates this. A frame of aluminium plates provides support for the entire structure.The system is used to cutting the grass of lawn and watering it. The solar lawn mower is usable in both during the day and night. We just use a lawnmower at night because the backup battery only lasts for two hours.

4.1. Design Analysis

4.1.1. Selection of Electric Motor
Motor Speed = 10,000 RPM,
Motor Voltage = 12 V Motor
Watts = 1266.46 W

4.1.2. Electrical (Electric) Power Equation Power = I × V
Where
V = 12,
I = 1.5
P = 1.5 × 12 = 18 W,
H.P = 0.0241

4.1.3. Solar Panel Calculation
Solar panel volt = 18 V,
Solar panel watt = 35 W
$W = V \times I$
$35 = 18 \times I = 1.87$
$I = 1870$ mA

4.1.4. Battery Calculation
BAH/CI = 7.2 ah/1600
ma =4.5 h
To find the current Power = 18 W,
Voltage = 12 V
$P = V \times I$,
$18 = 12 \times I$
$I = 18/12 = 1.5$,
Battery usage with 1.5 A

V. CONCLUSION

The primary goal of this design was to produce a lawnmower that is lighter and more portable than the large, bulky models. Because the manufactured lawnmower weighs only 15 kg, it is lightweight and simple to use. It is a noise and air pollution free solution that runs entirely silently because of its four DC gear motors and solar power. The following conclusions were made in light of the design's goals and findings:

1) Compared to do-it-yourself lawn mowers, the design offers an electric field mower that makes pulling weeds from meadows simpler, quicker, safer and more affordable.

2) The design ensures the cleanliness of the field and provides a suitable environment for scholars and preceptors to walk in. Figure 1 shows the manufactured lawnmower.

REFERENCES

[1] Wasif, M. (2014). Mower Robot Controller, (September2011). https://doi.org/10.1109/ICET.2011.6048466.

[2] Mrs. Melba D'Souza, Ms.Vaidhavi B. Naik, Ms.Rucha V Bicholkar, "*Automatic Solar Grass Cutter*", IJSTE - International Journal of Science Technology & Engineering | Volume 3 | Issue 12 | June 2017.

[3] Elshafee, A., & Hamed, K. A. (2012). Design and Implementation of a WiFi Based Home Automation System, 6(8), 1074–1080.

[4] Srishti Jain, Amar Khalore, Shashikant Patil, "*Self Efficient and Sustainable Solar Powered Robotic Lawn Mower*", Vol.2, Dec2015

[5] T. Salonidis et al., "Distributed Topology Construction of Bluetooth Personal Area Networks," Proc. IEEE Infocom 2001, IEEE Communication Society, New York, 2001.

[6] Pratik Patil, Ashwini Bhosale, Prof.Sheetal Jagtap, "*Fully Automated Solar Grass Cutter*", International journal of Science Technology and Engineering, Vol.3, Issue 9, May 2017.

[7] Ernest L. Hall , " *A Survey of Robot Lawn Mowers*", Conference Paper in Proceedings of SPIE May 2014.

[8] Srishti Jain, Amar Khalore, Shashikant Patil,"*Self Efficient and Sustainable Solar Powered Robotic Lawn Mower*", Vol.2, Dec2015.

[9] Ashish Kumar Chaudhari, Yuvraj Sahu, "*Experimental Study of Solar Power Grass Cutter Robot*", MATS University Raipur, Chhattisgarh, India.

[10] P.Amrutesh, B.Sagar, B.Venu, Mechanical engineering, MeRITS, A.P, India."*Solar Grass Cutter with Linear Blades by Using Scotch Yoke Mechanism*"