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IoT Controlled Grass Cutter with Solar Panel

Nivya K M¹, Mr. Vinod Kumar M S²

¹Student, ² Assistant Professor, Department of Mechanical Engineering, VTU Center for PG studies, Mysuru

Abstract- In these days we have gone through many up gradation in normal and routine technologies. There is a rapid growth in technology like AI, ML, CLOUD, IOT etc. Grass cutters are normally used everywhere to cut or shape grass, these grass cutters are controlled manually. To add a technology to it, “Automated Grass Cutters” came into picture where using ultrasonic sensors or IR sensors, the grass cutting mechanism is done automatically with considering the obstacle distance which is provided by ultrasonic or IR sensors. With these parameters into consideration to power up the grass cutters, solar panels came to add on an advantage where by using solar energy the grass cutters were powered up. This was a major contribution to the society which is economic and environmental friendly. The grass cutters which uses fuel can be ruled out so as to save fuel and also provide an eco-friendly machine by these automated grass cutter. Since ultrasonic sensors or IR sensors could also consider any obstacle in its path, this is the major disadvantage to the whole idea or concept. To overcome this, we use the concept of IOT, where whole mechanism is controlled by the mobile device which communicates through internet to the device. The whole machine motion can be controlled and the machine can be powered up by the solar panel.

Key words: Node MCU, IoT, Sola Panel, Cloud.

I. INTRODUCTION

The world’s first lawn mower was invented and described by Edwin Budding in the year 1830. Earlier the grass field used to be cut manually and later the farmers started the usage of hand scissors to cut the grass uniformly which also reduced half of their work. But it was very difficult to condition with uniform size and maintenance. Electric powered grass cutters are also present which were widely used and well known due to its accurate results and uniformity but after a few challenges or ongoing time, it was proved to be risky and unsafe. Being dependent on manpower during summer days is not a better idea. Thus renewable power source is an alternate option to be environmental friendly. This model was basically designed to cut grass in sports grounds and a few gardens. But those days, the machines caused pollution as they emit toxic gases. Fuels or coals were the only source of energy to run the machine. As the technology improves day by day, the traditional type of grass cutters are replaced by automatic and efficient smart grass cutters. In these days, pollution has become a major problem as the emitted gases fuses with air and the model also cause noise while cutting grass. Hence we design a robotic grass cutter which also reduces the power consumption. Power consumption is the most essential factor for our future. This is available in reduced cost.

After testing with the renewable sources of energy like wind and solar energy, solar turned to best option which is easily available and stored. This model design consists of Node MCU microcontroller, relay which is an electromagnetic switching device, blades which chops the growth of plants or helps in land clearing or land levelling. This helps to cut at a uniform lengths and gives it a fine look. The model is associated with a battery rated 12V and a DC motor.

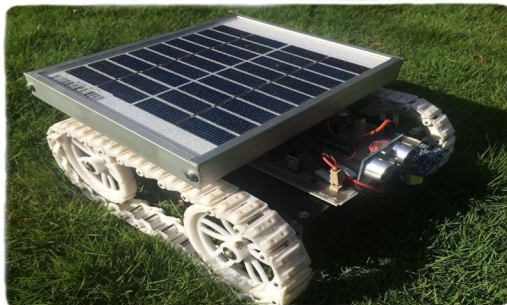


Figure 1: Solar grass cutter

Charging of battery is done externally by using solar panels. The stainless steel blades gives accurate cutting with uniform sped across the land. The height of the plant to be cut is set by the machine above ground level very effectively. This machine is very cost effective, simple and useful from small to medium farm holders.

The product is charged by sun with the use of solar panels. This device is completely automatic and manpower is not required. The sensors used here will help the device to detect the obstacle and avoids noise pollution. A remote can be permitted control with the speed and the direction while moving in lawns. Even the unskilled operator can operate this device very easily as it is simple. We can achieve the program of cutting height of lawn between 30 to 90mm. Thus, this automated robotic vehicle for grass cutting does not require any periodic maintenance for changing oil.

Among all the robots, the automated robot lawn mowers are

Considered to be the second largest domestic robot by end of year 2000.

II. LITERATURE REVIEW

This paper describes the device which is manually handled and also explains that it causes pollution during cutting. This leads to a loss of power or energy. This device can also be charged and they have used nickel-metal hydride (NiMH) which is best for low charging current and also it won't overcharge because of small output. The battery is rated 12V with 1.2Ah [1]. It is said that solar grass mowers or cutters are sophisticated and self-docking. This device works very similar to Robomow. This microcontroller is responsible to stop the device when an obstacle is detected to avoid damage to humans or animals [2]. In this paper it is explained that solar power is used to drive force and sense the obstacles during field operation. They also have reduced effort and shown their main concern about safety [3]. This device is environmental friendly as this is battery powered. This is programmed to move, light weight i.e., 15pounds. This device can be used for multipurpose like hedge trimming and grass trimming. This also replaces the fuel grass cutters with the automated battery powered grass cutters [4]. This model is basically used in agricultural lands or to cut weeds. Transmitter and a receiver are present where a transmitter transmits the information of the obstacle in the lawn to receiver and receiver accepts signal from encoder. The data should be in parallel form and hence transferred to microcontroller. [5].

III. PROPOSED SYSTEM

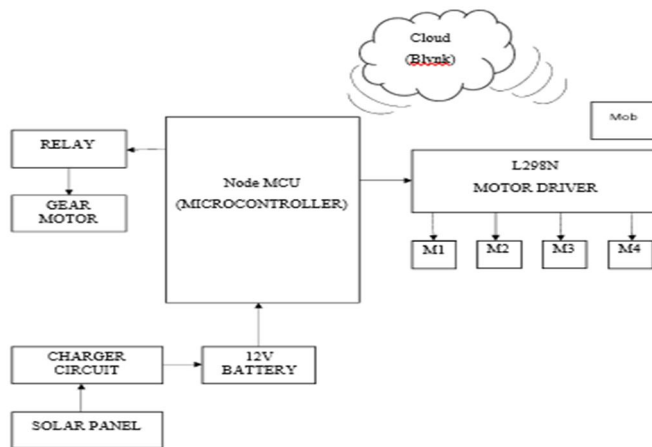


Figure 2: Block Diagram of Solar Grass Cutter

The above block diagram contains node MCU which is the microcontroller used through which communication between the circuit for required operation and communication between blynk and Google assistant is taking place. The microcontroller to perform certain set of required operation commands should to load on to it. This is done by using "Arduino IDE". Microcontroller consists of different analog and digital pins. For this pins to perform specific task program should to be loaded on to microcontroller from "arduino IDE" through interfacing cable. Now for the robotic wheel movement of grass cutter is done by using 4 DC geared motors. The gear motor are rotated both clockwise and anticlockwise with the help of L298N motor driver. The motor driver operates when certain commands is passed from microcontroller to motor driver. A relay is used for switching purpose of the blade connected to a DC geared motor based on the requirement. Solar panel is used for a low power rating which charges the 12v rechargeable battery with the help of charging circuit. Since the movement of the grass cutter is depended on the command given by the user through Google assistant. So there must be a bridging between Google assistant and the triggering app. This is done by connecting Google assistant and triggering app i.e., blynk app through another app called IFTTT. Whenever there is a command from the user using Google assistant that preloaded command triggers a web request to the blynk app so the particular or desired movement of grass cutter takes place.

IV. HARDWARE DESCRIPTION

This section gives brief description about hardware components

A. Node MCU

This is best device to quickly develop any IoT based application using minimum integrated circuits. In the field of electronics, researchers come across different types of development boards like Raspberry pi, Arduino are the common choices for developing new IOT prototyping devices. However Arduino and Raspberry do not have built in support for wireless network. Then we need to install a separate Wi-Fi module / cellular module to the board and write codes to axes the wireless module.

The unique feature of this board is that it has built in support for Wi-Fi connectivity and makes IOT application development much easier. Great Speed up for IoT application development process.

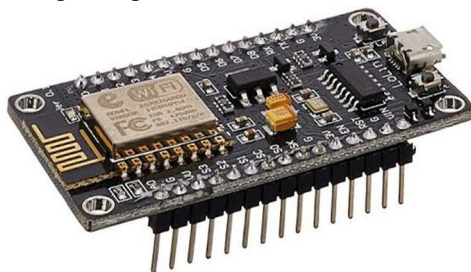


Figure 3: Node MCU

B. Gear Motor

Gear motor is a combination of a motor and a gearbox. Gearhead reduces the speed while increasing torque output. The main parameters are speed, torque and efficiency. The addition of gear box is to limit the speed of motor shafts and increases the motor's ability to output torque.



Figure 4: Gear Motor

C. L298 Motor Driver

The L298 Motor Driver is a high current, high voltage dual H-bridge driver which is designed to receive standard TTL logic levels and drive inductive loads like solenoids, relays, DC and stepper motors. This will easily control two motors up to 2A in different directions. This acts as an interface between the control circuits and the motors. To independently enable or disable the input signals, two enable inputs are provided.



Figure 5: L298N Motor Driver

D. Relay

Relay is an electromagnetic operated switch. It has an input terminals set for the control signals. With any number of contacts, this is used to break contacts or make contacts. Relay has two circuits normally closed and normally open which operates based on flow of current. When the electric current flows through the coil, it generates magnetic field.

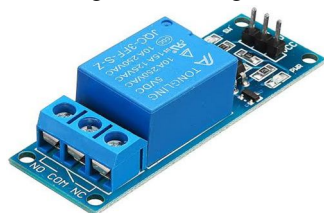


Figure 6: Relay

E. Battery

Battery converts chemical energy into electricity which used as power source. 12v battery has six single cells connected series which produces 12.6v fully charged output voltage, battery has two plates, one is positive and another one is negative. Positive plate made up of paste of lead dioxide and negative covered with sponge lead, and these batteries are rechargeable.



Figure 7: Battery 12v

F. Dc Motor

Dc motor converts the electrical energy to mechanical energy in form of rotation. DC motor consists of stator, armature, rotor and commutator and brushes. The motor start its action when an opposite polarity between the magnetic fields inside the motor.



Figure 8: DC Motor

G. Solar Panel

This is also known as the photovoltaic panel which is the assembly of multiple solar cells called photovoltaic cells. Solar source of energy is used in this device. it receives the solar energy and converts it into electrical energy. Thus this panel is used for generation of electricity and can also be used in commercial as well as residential purpose.

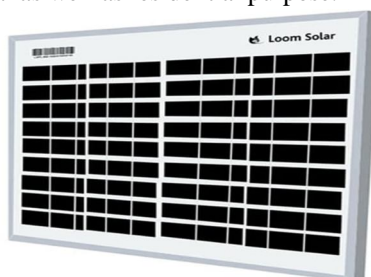


Figure 9: Solar Panel

V. SOFTWARE DESCRIPTION

This section gives brief description about software requirements

A. Arduino IDE

The Arduino Integrated Development Environment is mainly used for compiling, editing and uploading the codes into the Arduino module. There are two parts i.e., editor and compiler. Former writes the required code and later it is compiled and uploaded to the Arduino module. IDE agrees with C and C++ language.

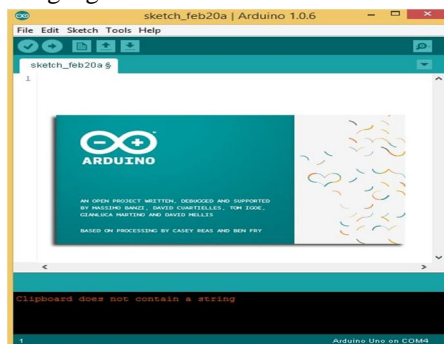


Figure 9: Arduino Software

VI. CONCLUSION

This paper presents, the most effective and reliable way of grass cutting robot was developed and achieved. The automatic grass cutting is done with the help of distance sensor i.e., IR sensor and saves the result in cloud with help of node MCU and IOT, which triggers the information to the user blynk application. This automatic grass cutting robot is most easy, reliable and ecofriendly to achieve the grass cutting operation by storing the energy in a battery with the help of solar panel.

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