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Fully Automated Solar Grass Cutter Using Iot

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Abstract: *The solar lawn mower is a fully automated grass cutting robotic vehicle powered by solar energy, it also avoids obstacles. It is also capable of fully automated grass cutting without the need of any human intervention. The system uses 12v batteries to boost the bot movement motors as well as the grass cutter motor. Battery is charged by solar panel . The cutter and its motors are interfaced to an Arduino Nano that controls the working of all the motors. Ultrasonic sensor is used for object detection. The SoC moves the bot in the forward direction in case no obstacle is detected. On obstacle detection; the ultrasonic sensor monitors it and the SoC thus stops the grass cutter motor to avoid any damage to the object/human/animal whatever it is. In order to know the battery charged and how much power is generated through the solar panel voltage divider circuits are used with the microcontroller and the data is passed to blynk app using Wifi Module. We can also control the robot using blynk app or also it can be set on Auto Mode. The L293D9 bi-motor controller/driver is used.*

Keywords: *batteries, solar, iot, voltage divider, blynk, motor, self-charging*

I. Introduction

The lawn rover is an aid in the mundane task of grass cutting and tending to lawns. Due to green movement in the present situation the industries with major campus areas are changing the percentage of greenery in the campuses and increased greenery causes increased effort and money to tend to. In such cases the lawn rover proves to be a god sent. Due to increased availability of system on chips, the lawn rover can be automated very easily and also the reduced size and cost of Dc motors causes the system to be independent of fossil fuels to be able to tap into renewable energies. Due to Ultrasonic sensors and light dependent resistors in a compact packaging cause the vehicle to be more aware of its surroundings. Due to the presence of Arduino in the system causes and increase in the module that can be added.

Traditional design of lawn movers had motored powered engines which required regular maintenance such as engine oil and greasing. They created a lot of noise and air pollution. In the cold and harsh environment, the fuel powered motors tend to freeze and do not start. These problems are solved by using electric motors. They are also much greener because they use solar panel. The mover uses battery chorded system causes a range as a limitation and damage to the chords.

II. Problem Definition

- Classical grass cutters with heavy engines create noise pollution and local air pollution due to the combustion in the engine.
- Fuel powered engines require time to time maintenance such as changing the engine oils etc.
- If the electric grass cutter is cord type, to use it could prove to be problematic and dangerous.
- Solar ways grass cutters are environment friendly.
- This device will charge from sun using solar panels.
- Moving the grass cutters with a standard motor is inconvenient, and no one takes pleasure in it.

III. Components

3.1 Arduino Nano

We used Ardiuno Nano in this vehicle in order to increase the efficiency of the bot and also account for future modification. The major advantage of Ardiuno Nano is its capability to perform in such a small form factor. Also the programming language used for Ardiuno is C, which is a very popular high level language.
Technical Specification:

- Microcontroller – Atmega328

- Operating voltage – 5V
- Flash memory – 32kb
- Clock speed – 16MHz
- Analog IN pins – 8
- PCB Size – 18x45mm
- PCB weight – 7grams

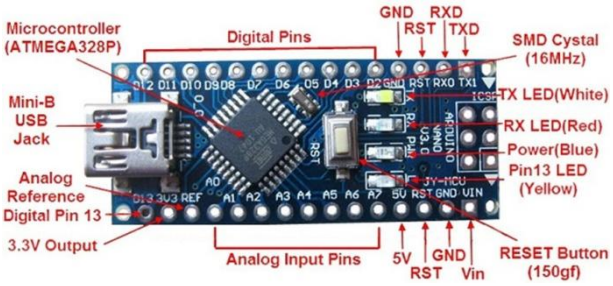

Figure-1

3.2 L293D Motor Driver

This typical motor driver or motor driver IC which allows two DC motors to be driven in either direction. L293D is a 16 pin IC which can control asset of two DC motors simultaneously in any direction. It means that you can control two Dc motors in a single L293D IC. Technical specification:

- Operating Voltage – 5V
- Operating current – 3 amps
- Output current – 1.2 amps
- Dimensions – 44x37 mm

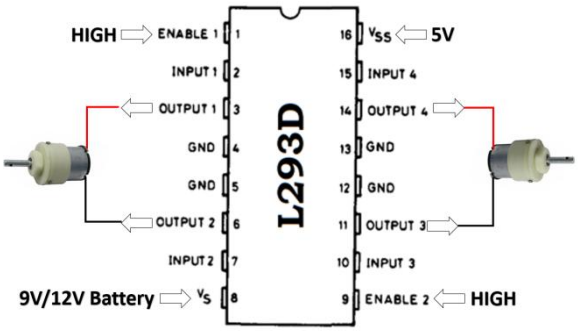

Figure-2

3.3 DC Series Motor

The speed controller works on the fundamental by varying the average voltage sent to the motor. It could do this by simply adjusting the voltage sent to the motor, but this an inefficient method. A better way is to switch the motor supply on and off very quickly. If the switching is fast enough, the motor functioning does not get affected, it only notices the average effect.

Figure-3

3.4 Node MCU

Node MCU is an open source IoT platform. It consists of firmware which runs on the ESP8266 Wi-Fi SoC from Espress if Systems, and hardware which is based on the ESP-12 module. This term "Node MCU" by refers to the firmware rather than the development kits. The firmware uses the Lua scripting language. It is based on the eLua project, and built on the Espress if Non-OS SDK for ESP8266. It uses various open source projects, such as lua-cjson and SPIFFS. Technical Specification:

- Developer – ESP8266 Opensource Community
- Type – Single board Microcontroller
- Operating system – XTOS
- CPU – ESP8266
- Memory – 128kBytes
- Storage - 4Mbytes
- Power – USB

Figure – 4

IV. Design

4.1 Circuit Design

Power is being drawn from the panel through the diode(D1). A zener diode (D2) is placed at the input terminal to suppress the excess voltage. Capacitor C1 is used to eradicate any unwanted noise/spikes. The voltage divider circuit comprising of (R1 and R2) is used to sense the solar panel voltage. The output from the voltage divider will be delivered to Arduino analog pin A0.

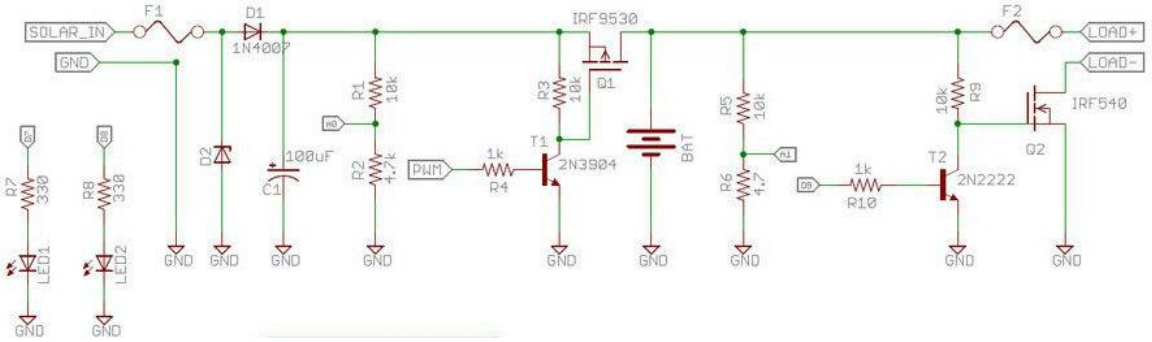

Figure – 5

The power from the solar panel can't go directly to battery until the MOSFET (Q1) is on. The switching action of MOSFET is done by a PWM signal from Arduino pin-6.Transistor T1 along with resistance R4 is used for driving the MOSFET (Q1).The resistor R3 is used as a pull up resistor for gate pulse. When the MOSFET is On, as power goes to the battery, charging process starts.

The other voltage divider circuit (R5 and R6) is used for sensing the battery voltage. The output of voltage divider is delivered to the Arduino analog pin A1.

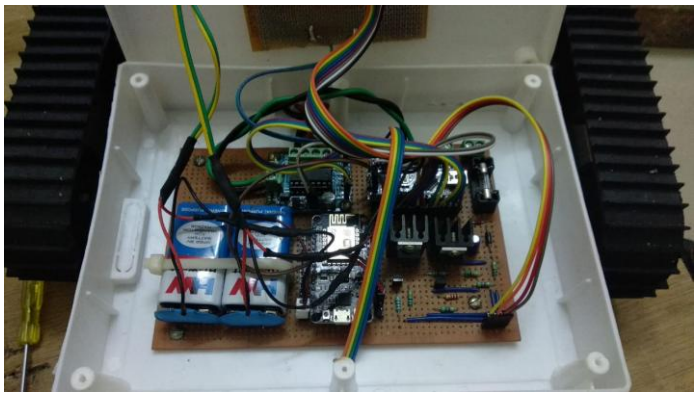

Figure – 6

The second MOSFET Q2 is required to drive the load and second transistor T2 is used for driving the MOSFET. During night load will automatically turned on by turning the MosfetQ2 on and will removed when battery voltage is low or day time.

Fuses F1 and F2 are used for over current protection. LED1(RED) and LED2(GREEN) are assign to digital pin 7 and 8 of the Arduino for indication purpose. The resistor R7 and R8 are used for controlling the current that goes to LEDs. If anybody want to use a relay device instead of MOSFET Q2 you can do so. The schematics -2 is given for relay connection.

Figure – 7

4.2 Hardware Design

The Solar controller is taking charge from solar panel and giving it to the battery. Arduino nano runs the program to calculate solar voltage and battery voltage and display's it on LCD Display. Node MCU is used to connect the Rover with the internet so that we can be able to see the battery power left in rover from anywhere around using blynk app. Because of this we can also control the robot using the blynk app controls and also can set the rover into auto mode, where the rover itself will choose a path to move according to the boundaries of the filed.

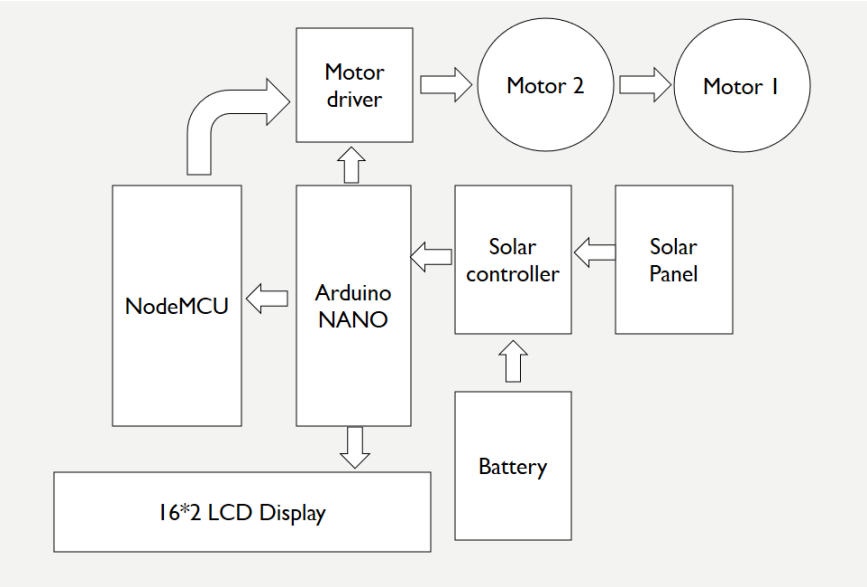

Figure - 8

V. Testing & Results

The capacity of the battery was 2000 mAh and discharging current was 1.2 amps and the output of the solar panel was 12 v and 5 watts. The discharging time was calculated by dividing the battery capacity by the discharging current. The discharging time was 2 hours approximately. Using the formula E=VIT, we calculated the charging the time which was approximately 4 and a half hour.

VI. Conclusion

The previous bot systems were studied and a suitable design was made. The schematic for the same was made on which prototyping will take place. The components have been chosen based on design requirement and based on a few other parameters. Based on data collected from research papers, we made a few changes to make our design better. A timeline was made with the knowledge of the review dates and work has proceeded according to it. In the second review we have made a prototype model of the hardware and software system with a demonstration with ultrasonic and infrared sensor. The prototype is mounted on a metal sheet chassis and the detection is done using ultrasonic sensor and the output was obtained. The green revolution has caused a burst in the lawn area and the requirement for a bot. Since grassing cutting is a mundane task requiring a lot of time; it is believed that human time should not be wasted on such tasks or a least reduced to the bare minimum. The cost effectiveness and the ease provided makes the bot to be a necessity instead of a luxury.

Acknowledgements

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