

Eco-Friendly Lawn Mower

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ABSTRACT

The important function of mower is reducing the plants to a most pleased appearance or cutting down the entire unwanted plant to save the nearby plants from the lack of nutrition due to these weeds. So, the already existed conventional mowers are big in size and also using the fossil fuels to function. So, it may pollute the environment and also requires manual power. So, to reduce this type of blunders, we are getting into the robotic environment where it can work without any man power and also will not pollute the environment as it is Eco-Friendly. With the help of this bot, we can not only do the cutting/reducing the plants but also can collect the waste plants which can be given as a natural fertilizer. This Eco-Friendly Lawn Mower can have wider range, so it can rugged in search for all quite places also. In this mower, the gear wheel arrangement is given for adjusting the height of the weeds which we want cut down. This will provide us the up and down movement for the device, so wherever we want to cut/reduce the particular amount of weeds we can adjust the height of this device as much as we want with the help of this arrangement. As advancement, we can use IoT for this so that we can get some wider working range of the mower.

I. INTRODUCTION

Now days we face the issues of environmental pollution and power cut and lots of other problems. To overcome these problems, we are using renewable energy source like electricity, which is implemented in our project idea i.e. "Grass Cutter". Thanks to continuous increase within the cost of fuel and therefore the effect of emission of gases from the burnt fuel into the atmosphere, this necessitated use of abundant solar power from the sun as a source of power to drive grass cutter.

This technology commonly used for trimming the grass is by using the manually handled device. So, the

aim of our project is to develop a transportable electrically operated grass cutting device. Then this battery is connected to charger which stores the energy and hence, external supply isn't needed. Further we've used BLDC (Brushless dc) motor with gear system so as to regulate the blade speed.

Coming to the working of solar powered grass cutter, its panels mounted during a particular arrangement at an angle in such a way that it can receive radiation with high intensity easily from the sun. These solar panels converts solar power into electrical now this electricity is stored in batteries by employing a solar charger. The most function of the solar charger is to extend the present from the panels

while batteries are charging; it also disconnects the solar panels from the batteries once they are fully charged and also connects to the panels when the charging in batteries is low.

The motor is connected to the batteries through connecting wires between these two motors driver is provided. It starts and stops the working of the motor. From this motor, the Power transmits to the mechanism and this makes the blade to rotate with high speed and this makes to chop the grass. Hence, our objective is to style and develop a low-cost cleaning system which detects the presence of grass and automatically cleans the gardens.

II. ARDUINO INTEGRATION

The Arduino Uno SMD may be a version of the Arduino Uno, but uses a surface mount version of the Atmega328P rather than the through-hole version. This version was made in response to a shortage in supply of the through-hole Atmega328P. The board is predicated on the ATmega328 (datasheet). It's 14 digital input/output pins (of which 6 are often used as PWM outputs), 6 analog inputs, a 16 MHz quartz oscillator, a USB connection, an influence jack, an ICSP header, and a push button. It contains everything needed to support the microcontroller; simply connect it to a computer with a USB cable or power it with an AC-to-DC adapter or battery started. **Arduino** senses the environment by receiving inputs from add-on devices such as sensors, and can control the world around it by adjusting lights, motors, and other actuators. The use of Arduino-specific shields and the shields software libraries to interface with the real world.

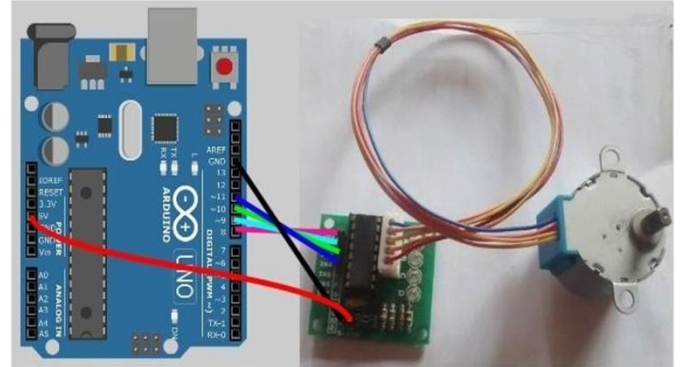
Arduino Interfacing with Stepper Motor:

Stepper motor also known as step motor or stepping motor, is a brushless DC motor that divides the full rotation angle of 360° into a number of equal steps .

The motor is rotated by applying a certain sequence of control signals. The speed of rotation can be

changed by changing the rate at which the control signals are applied.

For more information about Stepper Motor and how to use it, refer the topic Stepper Motor in the sensors and modules section.

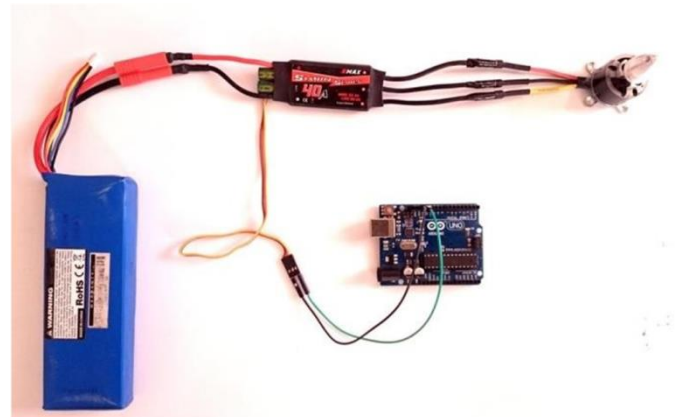


Rotating stepper motor in clockwise and counter clockwise directions alternately.

Here, we are using six wire unipolar stepper motor. Only four wires are required to control this stepper motor. The two center tap wires of the stepper motor are connected to 5V supply. ULN2003 driver is used to drive the stepper motor.

Arduino Interfacing with BLDC Motor:

Connect the motor to the output of ESC. Here, the polarity doesn't matter. If you switch any 2 of the 3 wires, the motor will rotate in opposite direction. Connect the '+' & '-' of battery to the Red (+) and Black (-) wires of ESC respectively.



From the 3pin servo cable coming out of the ESC, connect the Brown cable to the 'GND' pin on Arduino. Connect the Yellow cable to any digital pin. In our case its digital pin 12.

Arduino Interfacing with Bluetooth Module:

Bluetooth is a one of the great example for wireless connectivity. It is used in many fields. Bluetooth consumes very small amount of energy. Do you know about Smartphone controlled robot or car. Commonly one of these two wireless technologies is used in Smartphone controlled robot. One is WIFI and other is Bluetooth. And another commonly used wireless technology for controlling Robot car is RF. Which is the same remote and receiver used in drones? Here we are going to interface a Bluetooth Module (HC-05) with Arduino Uno. And describe each line of code. Then we control the built-in LED of Arduino Uno from smartphone via Bluetooth.

HC-05 is a Bluetooth module which can communicate in two ways. Which means, it is full- duplex? We can use it with most micro controllers. Because it operates Serial Port Protocol (SSP). The modules communicate with the help of USART (UniversalSynchronous/AsynchronousReceiver/Trans mit ter) at the baud rate of 9600. And it also supports other baud rate. So we can interface this module with any microcontroller which supports USART. The HC-05 can operate in two modes. One is Data mode and other is AT command mode. When the enable pin is "LOW" the HC- 05 is in Data Mode. If that pin set as "HIGH" the module is in AT command mode. Here we operate this module in Data Mode.

Technical Specifications

- Operating Voltage: 4V to 6V (Typically +5V)
- Operating Current: 30mA
- Range: <100m
- Works with Serial communication (USART) and TTL compatible
- Can be easily interfaced with Laptop or Mobile phones with Bluetooth

Step 1 : Create a sketch for Arduino Uno to Interface the HC-05.

Step 2 : Next we need to code the setup part. HC-05 uses the serial communication. So begin the

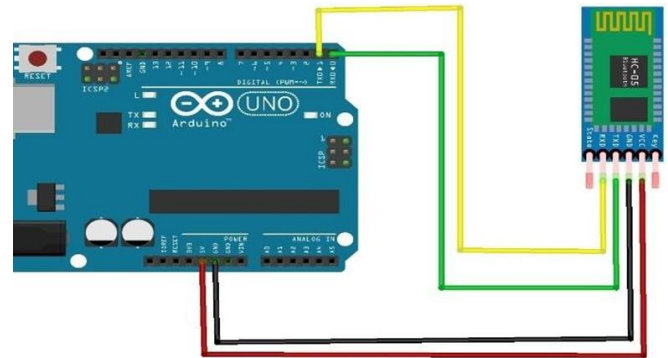
serial communication by using the function "Serial.begin()".

Step 3 : Next we need to code the loop part. Use a while loop and the function "Serial.available()".

Step 4 : Connect the following configuration

- Arduino Uno HC-05,
- Rx – Tx, Tx – Rx,
- 5v - +5v, GND – GND

Connection is completed. After turn on the Arduino Uno, The indicator LED in the HC-05 will start blinking continuously.

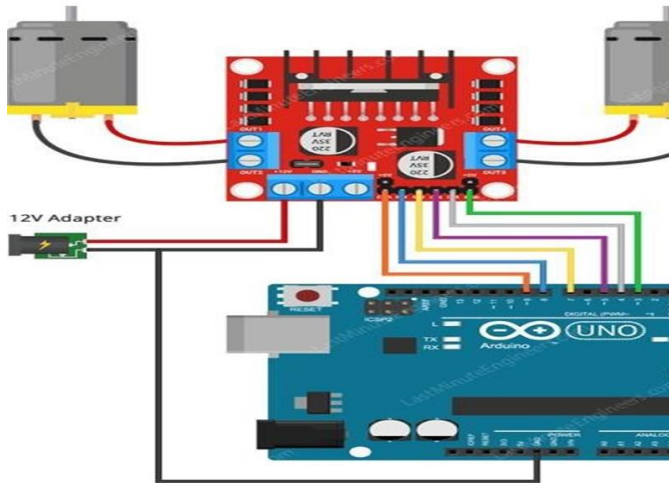


After that we need install an App in Smartphone for further process.

Arduino Interfacing with Motor Driver:

Start by connecting power supply to the motors. In our experiment we are using DC Gearbox Motors (also known as „TT“ motors) that are usually found in two-wheel-drive robots. They are rated for 3 to 12V. So, we will connect external 12V power supply to the VCC terminal. Considering internal voltage drop of L298N IC, the motors will receive 10V and will spin at slightly lower RPM. But, that's OK.

Next, we need to supply 5 Volts for the L298N's logic circuitry. We will make use of the on-board 5V regulator and derive the 5 volts from the motor power supply so, keep the 5V-EN jumper in place.



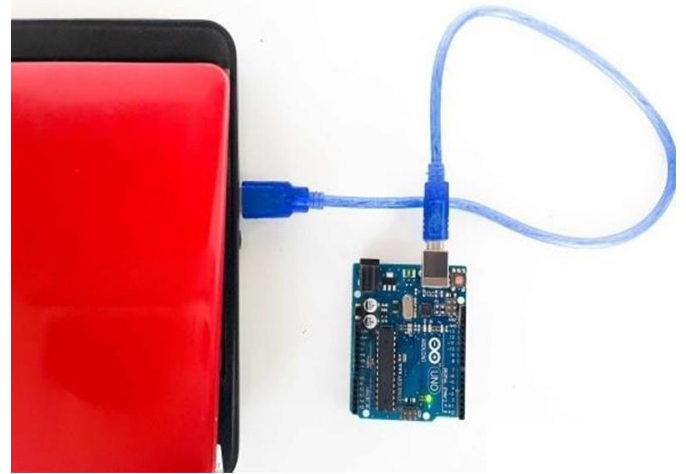
Now, the input and enable pins (ENA, IN1, IN2, IN3, IN4 and ENB) of the L298N module are connected to six Arduino digital output pins(9, 8, 7, 5, 4 and 3). Note that the Arduino output pins 9 and 3 are both PWM-enabled.

Finally, connect one motor to terminal A (OUT1 & OUT2) and the other motor to terminal B(OUT3 & OUT4). You can interchange your motor's connections; technically, there is no right or wrong way.

Arduino Interfacing with Battery:

Modern Arduino Uno boards allow the board to have more than one source of power to be connected simultaneously. An intelligent switching circuitry ensures that the highest available voltage is selected and sent to the onboard voltage regulator and eventually powers up the board.

We can power up the Arduino using power supplied from the computer via a USB cable and/or by using external power sources.



The USB port of the Arduino Uno can be connected to a desktop/laptop. If the connection is enumerated, i.e. the computer recognizes the device; the current supplied to the board is 500mA at 5V. If the connection is not enumerated, 100mA is supplied at 5V.

Precautions to be undertaken before switching on the Arduino Uno

- If the barrel connector and an AC-DC adapter are being used to power up the Arduino, make sure that the output of the adapter is between 7-12V. Although the rated input can exceed to as much as 20V, it is safe to stay within the recommended range to protect the voltage regulator from excessive heating. Also, see to it that the GND and Vin pins are not shorted.
- But if you are using the 5V and GND pins to power up the Arduino, it is imperative that the 5V input is stable and steady.
- If the Vin/5V and GND pins are being used to power up the Arduino, double-check the polarity because if the GND and 5V/Vin pins are mixed up, it can potentially damage the Arduino board.

III. METHODOLOGY

For Gear wheel Heights adjustment, the arrangement set up are in the below figure 3.1.

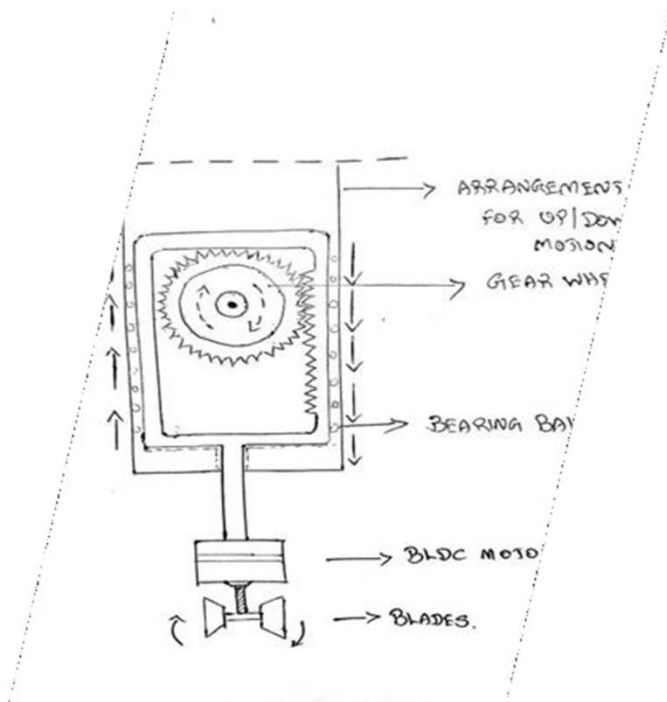


Fig 3.1 Height Adjustment set up.

A gear is a wheel with teeth around its circumference. Gears are usually found in sets of two or more, used to transmit rotation from the axis of one gear to the axis of another. The teeth of a gear on one axis mesh with the teeth of a gear on another, thus creating a relationship between the rotations of the two axes. When one axis is spun, the other will too. Two gears of different sizes will make their two axes spin at different speeds, which you'll learn about, along with different types of gears and places they're used.

Gears are a very useful type of transmission mechanism used to transmit rotation from one axis to another. As I mentioned previously, you can use gears to change the output speed of a shaft. Gears can be used to decrease or increase the speed or torque of a drive shaft. In order to drive an output shaft at a desired speed, you need to use a gear system with a specific gear ratio to output that speed.

The gear ratio of a system is the ratio between the rotational speed of the input shaft to the rotational speed of the output shaft. There are a number of ways to calculate this in a two gear system. The first is via the number of teeth (N) on each gear. To calculate the gear ratio (R), the equation is as follows:

$$R = N2/N1$$

By using this we can make the height adjustment of the Gear wheel.

IV. IMPLEMENTATION & WORKING:

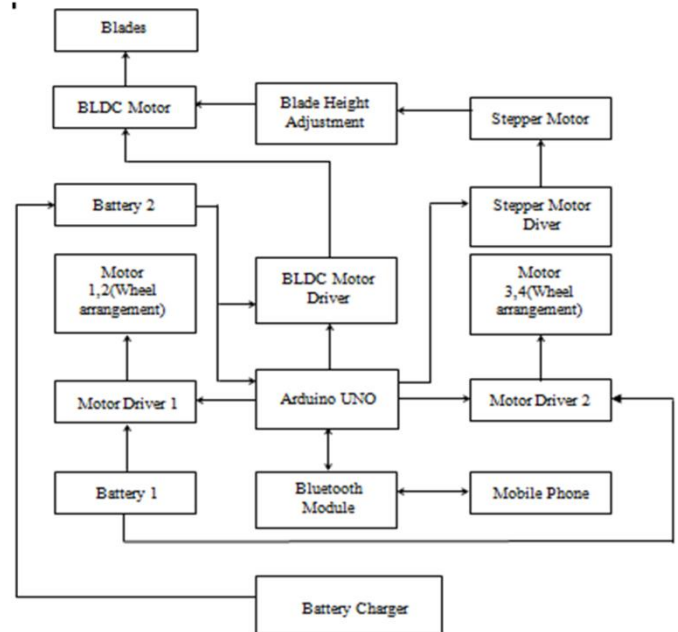


Fig 4.1 Block diagram

The main objective is to build a Lawn Mower for the cutting/reducing the unwanted plants (Weeds) in a grassland with the help of Wireless Technology (IoT). To reduce the man power and economical cost with the help of this mower.

In this work we are using Arduino Uno, BLDC Motor, Stepper Motor, Battery, Bluetooth Module and Driver as key components. We are integrating these entire components with Arduino like as we explained earlier. The performance of the solar panel is analyzed with the help of Arduino Uno.

We use the stepper motor instead of gear motor with the help of Gear wheel arrangement fixed on the chassis of the vehicle to adjust the height of the blades. The gear wheel part is done by 3D printing. The rotation of the motor in clockwise as well as counter clockwise direction has been obtained with the use of stepper motor.

The data analyzed Arduino unit is stored in the mobile application. The data handled by the mobile application is dynamically changed and stored in cloud.

V. RESULT AND DISCUSSION

Problems:

When we made connections we didn't check the BLDC motor's driver. We finish all our circuit and then we faced the connection and communication problem between BLDC driver and BLDC motor.

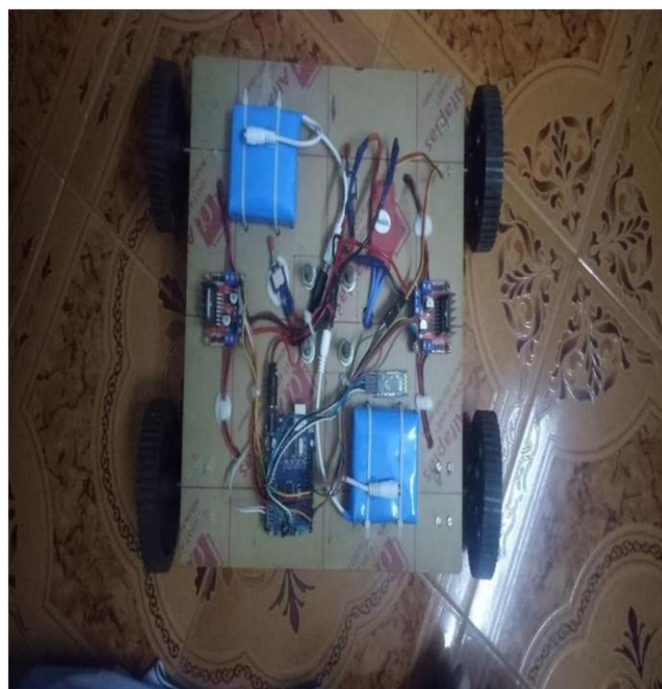
We fabricated the lawn mower with height adjustment. For cutting the grasses, initially we used gear motor for the height adjustment. We found a problem with the rotation of gear motor.

Rectification:

- Finally we identified that one capacitor is not working properly, so we replaced the component and we rectified that problem
- We use the stepper motor instead of gear motor with the help of Gear wheel arrangement fixed on the chassis of the vehicle to adjust the height of the blades. The gear wheel part is done by 3D printing. The rotation of the motor in clockwise as well as counter clockwise direction has been obtained with the use of stepper motor.

Result:

Thus the Eco-Friendly Lawn Mower was developed with height adjustment by using gear wheel mechanism and controlled by Arduino UNO without any fuel consumption.



VI. CONCLUSION

The existing conventional lawn mowers are used for cutting weeds in garden, they are designed with combustion engine (or) AC powered motor and which need human power to control the mower. And also, the conventional mowers are not having any automatic blade adjustments. For that also, it requires some man power to adjust the blade Arrangements. After a detailed study, it is concluded that there is hardly a completely controlled mower suitable for cutting the grass all over the lawn. So, this Eco-Friendly Lawn mower will provide the solution for the above mentioned. In addition to that adjusting the height of the blades automatically is a plus in this mower. The blades can be automatically adjusted by 1/1.5 cm variations. Our lawn mower may provide some wider range when it comes up with IoT.

VII. REFERENCES

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