

# AI Based Grass Cutting Rover Using Image Processing to Move the Obstacle

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**Abstract** – In today's technologies, automation is expanding quickly. Therefore, Automation is essential in the agriculture sector and beneficial to farmers. Grass cutters were manually operated portable instruments in former times. As a result, they used gas and petrol engines, which resulted in pollution and energy loss. Therefore, it is necessary to replace the old grass cutters with automated ones that use batteries as a power source for the system's guiding and obstacle detection. Additionally, It utilized a motor drive for the robot's wheels, a linear blade to cut the grass and using image processor for object detection, and an arm at the front of the rover to move the small obstacles which can protect the grass cutting blade and an Arduino UNO microcontroller board as the system's primary controller. A cordless electric lawn mower, which is self-powered by electricity, is another goal of the project. A Raspberry Pi microprocessor serves as the machine's brain and directs the movements of the lawnmower. It is made up of geared motors that manage the mover's speed and direction. and a high-torque motor that drives the cutting blades. The geared motors are switched on and off using a control circuit that is comprised of MOSFETS that are controlled by the raspberry pi. The mover has an onboard camera which is used by the microprocessor to detect objects and living beings and take the necessary action that being, to avoid them or stop moving. It is completely automated and renewable.

**Keywords** – Grass Cutter, Automation, IoT, Obstacle Detection Robot.

## I. INTRODUCTION

In the modern world, pollution is a major issue. The release of gases into the atmosphere is what causes pollution. Also, Due to the rising cost of fuel, it is ineffective. Hence, there are now available solar-powered lawnmowers. A solar-powered lawn mower is one that uses solar energy to propel an electric motor that then moves a blade. One green energy source is solar power that is used in many households In the event that lawnmowers with gas engines. While using a standard motorized lawnmower, cutting the grass, or mowing the lawn is a hassle that no one enjoys. Grass cutting is not a task that the elderly, young, or disabled can easily perform. Push lawn mowers and riding lawn mowers with Both noise pollution from the loud engine and local air pollution from engine combustion are produced by motors. Regular maintenance for an engine driven by a motor also includes oil changes. Electric lawn tractors can often be a hassle, even though they are environmentally beneficial. Together with motorized lawn mowers, electric lawn mowers are risky and challenging to utilize for everyone. Also, if the electric lawn mower is corded, mowing may be risky and challenging. A lawnmower with remote control functionality is the self-propelled electric remote management lawnmower. This robotic prototype is user-friendly, economical, safe, effective, and ecologically friendly.

Labor costs can be greatly reduced. Schools, colleges, and vast lawns in parks are manually maintained. The lawn was manicured and maintained uniformly by the gardener using hand scissors. Nobody enjoys moving the lawn mowers when they have a standard motor because it is difficult. Because a moving lawn mower with an engine causes local air pollution from engine combustion and noise pollution as a result of the noisy engine, elderly or younger persons may find it challenging to mow the lawn. Regular maintenance, such as changing the engine oil, is necessary for an engine driven by a consistent size motor. This is not an easy or even quite difficult task. Even if it's good for the environment, electrified solar grass is still a hassle. Like motor-powered ones, electric grass cutters are risky and challenging for everyone to use. In order to save power usage, we designed this project to be a self-operating solar lawn mower that requires the least amount of effort from the operator to cut the grass. A residential lawnmower powered by solar energy is intended to overcome a variety of concerns that conventional mowers powered by internal combustion engines do not. It will be simpler to an electric lawnmower with a solar charger. That will stop those pointless journeys for fill-ups to the petrol station. The lawn cutter can be operated by a novice gardener. Most significantly, it does away with the combustion engine mower's emissions, which have the primary responsibility for the greenhouse gas effect and environmental pollution that is thought to be contributing to the planet's growing climate change. The reason for this is

that solar energy is clean and renewable. Designs have been created in a variety of ways, each to meet a certain requirement or convenience. over time, simplifying the task of mowing grass. Manually.

A mowing machine's original design for speed, efficiency, and power has been modified by many people. The cordless electric lawn mower has been improved by the solar-powered model. The energy utilized by the earth's atmospheric system for a variety of uses comes from the sun in sustainable amounts. The lawnmower using solar power operates the same fundamental concept as other early lawnmower technologies. The only distinction is how the energy source is used. The photovoltaic panel is used to produce the electricity required to run the mower. It is anticipated that a lawn mower powered by solar energy will address several concerns that conventional lawn mowers powered by internal combustion engines and electric motors do not. The project work was extremely productive and successful. It is employed to maintain the lawn of our college's auditorium.

## II. LITERATURE REVIEW

Due to its internet connection, this lawnmower has the unusual property of being able to be operated from any location in the world. Our cell phones, which are a popular device kept in everyone's pockets, can control it in fact. All this device's programming, including the wheel's slides, is done using the ARDUINO IDE software [1]. A gadget called a SERVO MOTOR is being introduced for the up and down movement of lawn knives. To locate the handicap and give the arm the proper commands, an Infrared and ultrasonic sensor is used. We will eventually discuss the energy consumed by this device. We used a 12V Batteries in addition to terrain friendly solar panels that will be useful on bright days [2]. The mower is intended to be self-contained, portable, strong, and easy to maintain. Moreover, a self-propelled cordless electric lawnmower with an electric supply is planned. The mind of the gadget is a Microprocessor (Raspberry pi) that controls the garden mower motions. It contains geared automobiles that manipulate the rate and path of the mover and a high torque motor that drives the slicing blades [3]. The 12v batteries are used to improve the bot motion automobile. automobile the battery level is pushed upward using solar panels [4]. The PIC Microcontroller, which manages the operation of every vehicle, is interfaced with the cutter and its vehicles. In this paper the point of interest is on the layout of a charging machine for batteries with the assist of sun panels. This technique uses it on a robot vehicle [5]. DC engine variable motion is created utilizing the rack and attach gear arrangement. And therefore, lawn incisive engine intermittent control method will be completed through like a man request [6, 7]. This application is connected to Bluetooth mechanical process principles. This work is being done in order to set up a grass cutting technique that will be advantageous and quick to implement regardless of the weather. The full reservation for this setup was made via a smart phone [8 - 10]. Most members of the ruling elite now participate gardening. The implementation of synthetic grass control strategies has significant effects. Therefore, it has been planned that this project uses few pesticides and has limited capacity for more bureaucracy. This design was made much more easily, with the requirement that everything start using our mobile phones via Bluetooth. Another major advantage is that cosmic stimulation of bureaucracy. This weeder will continuously fence the weeds inside the flowers. By utilizing traveling control, it is attainable to assert moment of truth captured for whole completed activity [17]. In the past, manual grass cutters were employed portable electronics. As a result, there was pollution. and energy was lost when they utilized gasoline and gas engines. So, it is necessary to swap out the old lawnmowers. where the system will function for battery-powered steering and obstacle detection power supply through automated operations [18]. Moreover, Arduino UNO was used. A microcontroller board serves as the device's primary controller. mowing the grass, a NODE MCU, an object-based ultrasonic sensor, a linear blade for the Wi-Fi connection, and a motor drive for the machine. Everything is automatic and based on a renewable energy initiative [20].

## III. COMPONENTS USED

The "AI Based Grass Cutting Rover" has the following components to meet the full functional requirements of the machine.

- Mild Steel
- DC gear motors
- Node MCU Microcontroller
- Power Supply
- Jumper Wires
- Motor Drive
- Bluetooth Module HC 05
- Battery
- Relay
- Wheel

### *Mild Steel*

It is a regularly used metals in the world and a cheapest and most effectively steel used. It ensures great welding ability and hard highly uniform casing. It is the best steel for gas- hardened parts [11].

### *DC Gear Motors*

D.C. Motors are devices that transform direct current energy into mechanical energy. It was developed on the premise that a current-carrying conductor subjected to a magnetic field experiences a mechanical force. The Fleming left hand rule defines the force's direction [12, 13].

### *Node MCU Microcontroller*

With the open-source NodeMCU firmware, there exist designs for prototype boards. The name "NodeMCU" is created by fusing the words "Node" and "MCU" (micro-controller unit). The term "NodeMCU" strictly speaking only relates to the firmware and not the auxiliary kits. Also, open source are the firmware and prototyping board designs [14].

### *Power Source*

A power source is another name for an electrical power source. power source units are objects or systems that deliver electrical or other forms of energy to a single or a collection of output loads. The phrase is most frequently used to describe electrical energy sources, less frequently to describe mechanical ones, and infrequently to describe other types of energy sources [15, 16].

### *Jumper Wires*

To link electric circuits on faraway printed circuit boards, a jumper wire is utilized as an electrical connector. It is possible to short-circuit and jump to the electrical circuit by connecting a jumper wire to it. Now that the circuit is connected to the jumper wire, it is feasible to control the power, halt circuit activity, and operate a circuit that is incompatible with standard wiring [19]. When a printed circuit board needs a specification change or a design change, a jumper wire can be connected or disconnected to reinforce a damaged part, partially stop an undesirable function, and alter the circuit configuration of a superfluous output part.

### *Motor Drive*

This L298-based motor driver module's high-power motor driver is perfect for operating stepper motors and DC motors. It employs the well-known L298 motor driver IC and has an inbuilt 5V regulator that it can use to supply power to an external circuit. It has the capacity to control the direction and speed of two or four DC motors. For robotics and mechatronics projects, this motor driver is ideal for controlling motors with microcontrollers, switches, relays, etc. Suitable for DC and Stepper motor power used in robot arms, line-following robots, micro mice, and other applications. Pulse width modulation is used in an H-Bridge circuit to push current in either direction.

### *Bluetooth Module*

A straightforward Bluetooth SPP (Serial Port Protocol) module is the HC-05 Bluetooth Module designed for creating unobtrusive wireless serial communications. It uses serial communication for communication, which makes communicating with a controller or PC easy. Since the HC-05 Bluetooth module allows for switching between master and slave modes, it cannot be utilized for either data transmission or receiving. Offer your projects wireless connectivity that is two-way (full-duplex) with the popular HC-05 module. Two microcontrollers and any Bluetooth-enabled device, such as a phone or laptop like an Arduino, can be connected to this module. The quantity of Android apps already available considerably helps this strategy.

### *Battery*

The energy generated by solar energy is stored using batteries. The lead-acid battery in use has a 12 v; 2.5 A capacity. Lead acid cells are the most affordable secondary cell and are frequently employed in industry. As a lead acid cell is prepared for usage, two plates are submerged in diluted sulfuric acid (H<sub>2</sub>SO<sub>4</sub>), which has a specific gravity of roughly 1.28. The positive plate (anode) is constructed of lead -peroxide (PbO<sub>2</sub>), which has a chocolate brown colour, whereas the negative plate (cathode) is built of lead (Pb), which is coloured grey [21].

### *Relay*

A relay is a switch controlled via way of means of a circuit. The relay essentially sends a message that something wishes to be started. Relays are electronic components required for electric system due to the fact they require much less energy than many components to attach to. Time delay or time launch relays basically act as timers, permitting you to carry out the actions required at a selected time to your electric system. The cause of time-not on time relays is to begin or stop the currents withinside the coils and armatures which might be the transferring elements of the electric mechanism.

### *Wheel*

Castor wheel could be a sort of wheel mounted beneath a question and move that protest. Castor wheels can be seen in a wide extend of materials sizes etc. Elastic and polyurethane are the commonly utilized materials utilized to form wheels. Shopping carts office chairs toy carts healing center beds andfabric dealing with hardware are a few of the applications in

which the casters are utilized. Tough and high-capacity casters are utilized in numerous mechanical applications such as plant stage trucks carts and congregations.

#### IV. SURVEY SUMMARY

##### *Existing System*

The current lawnmower can cut underneath bushes and hedgerows but will reverse way which if it encounters any solid object, including patio furniture, a tree, or other. To get the lawn you desire, program the cutting height should range from 30 to 95 mm. Dimensions are 26 cm height, 60 cm in width, and 71 cm long. The grass cutters currently on the market are overly complicated in terms of their construction and design, and they also produce more noise and pollution. Man-made pollution is present in our daily lives, more specifically in our houses.

##### *Disadvantages*

Less accuracy, High false-positives High Cost

##### *Proposed System*

A microprocessor, an ultrasonic sensor, a DC motor, and a node MCU are all included in the grass cutting rover's architecture. The primary consideration when creating a robot with blades is safety. The success of our design as a whole depends on where we put our sensors to determine whether the robot was approaching an object detection, we used both an ultrasonic sensor and a raspberry pi. Batteries are used to power the robot's mobility, and they may be recharged. The system is connected to the internet using a Node MCU as the Wi-Fi model. For regulating the movement of the cutter, we are utilizing a geared dc motor. The cutter's motor requires a 3-12V battery with an operating voltage of around 120 rpm. For the purpose of controlling the motors, which are employed for 12 separate movement parts, a motor drive board is used. For motor control purposes, the Blink application's server must be used. Our goal is to totally automate the rover. Relay is required for the control of the battery supply. In order to prevent the lawn mower grass cutter from damage and collisions, IR sensors are employed to identify impediments.

#### V. WORKING

A microprocessor, an ultrasonic sensor, a DC motor, and a node MCU are all included in the grass cutting rover's architecture. The primary consideration when creating a robot with blades is safety. The success of our design depends on where we put our sensors. To determine whether the robot was moving towards an item detection, we were solely employing an ultrasonic sensor. Batteries are used to power the robot's mobility, and they may be recharged. a Node MCU For regulating the movement of the cutter, we are utilizing a geared dc motor. The cutter's motor requires a 3-12V battery with an operating voltage of around 120 rpm. The NODE MCU board is utilized for the purpose of controlling the motors that are used for various movement components. On the internet of things, everything is based. Our goal is to totally automate the rover. Relays are required to manage the battery's power supply, which is also controlled by our smartphone. In order to prevent the lawn mower grass cutter from damage and collisions, IR sensors are employed to identify impediments.

In this project Ultrasonic sensor, l298n motor driver, servo motor relates to nodemcu microcontroller. In this robot four dc motors are used and it's connected with l298n driver module. D5, l298n module D6, D7, D8 pins are connected with nodemcu. d0, D3 pins relate to ultrasonic sensor trigger and echo pins. D2 pi connected with relay module. Relay module are used to control grass cutter motor automatically on and off. D4 pin connected with servo motor to move obstacles. Ultrasonic sensor sense obstacles and its send signal to nodemcu and its send stop signal to motor driver simultaneously servo motor move the object from out of the track.

#### VI. DESIGN

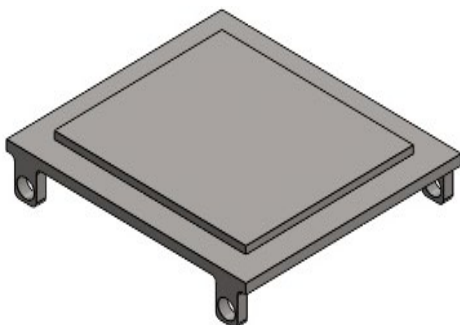


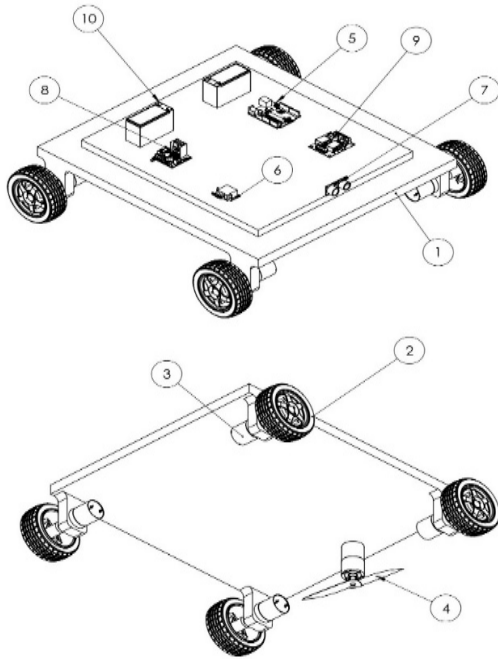
Fig 1. Base.



Fig 2. Blade.

**Table 1.** Components

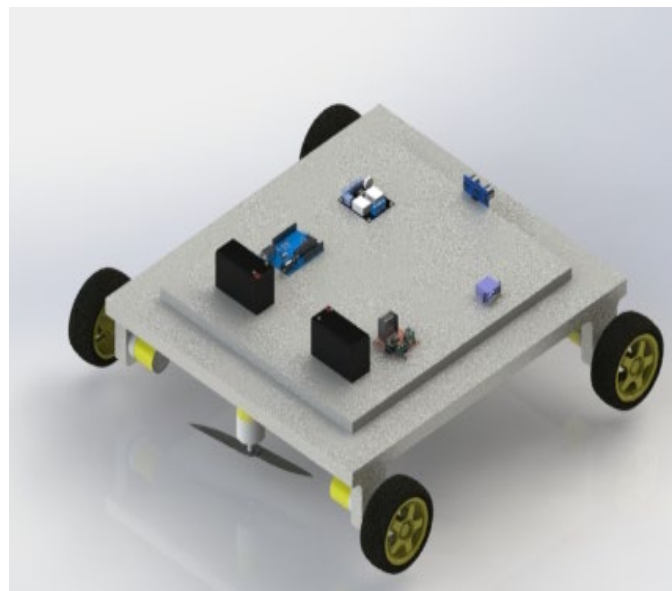
ITEM NO.	PART NAME	QTY.
1	Base	1
2	Wheel	4
3	Motor	5
4	Blade	2
5	ARDUINO	1
6	Servo Motor	1
7	Ultrasonic Sensor	1
8	Motor Controller	1
9	Relay	1
10	Battery	2



**Fig 3.** Assembly of Grass Cutter.

Shown as **Fig 1** and **Fig 2**, Base frame and Blade are the main parts of the AI Based Grass Cutter Rover. Base frame gives the structure to the grass cutter and other parts of the grass cutter which are mounted to the Base frame. Blade is the key feature of the grass cutter which is used to cut the grasses in the lawn efficiently. The blade of the grass cutter is directly attached to the motor shaft through pulley drive. Two blades on a rotary cutter typically revolve horizontally. While the blade revolves, the blade's edges are slightly bent upward to produce a constant air flow, which produces a sucking and tearing action. Assembly of the grass cutter is Shown in **Fig 3** and that the numbers are the parts of grass cutter. Shown as **Table 1**, Parts name and quantity of the part is mentioned. Therefore, based on the design and structure of grass the grass cutter that works effectively and efficiently. That the prototype of the grass cutter is shown as below.

## VII. PROTOTYPE



**Fig 4.** Prototype of Grass Cutter.

**Fig 4** shows the prototype of grass cutter.

VIII. BLOCK DIAGRAM

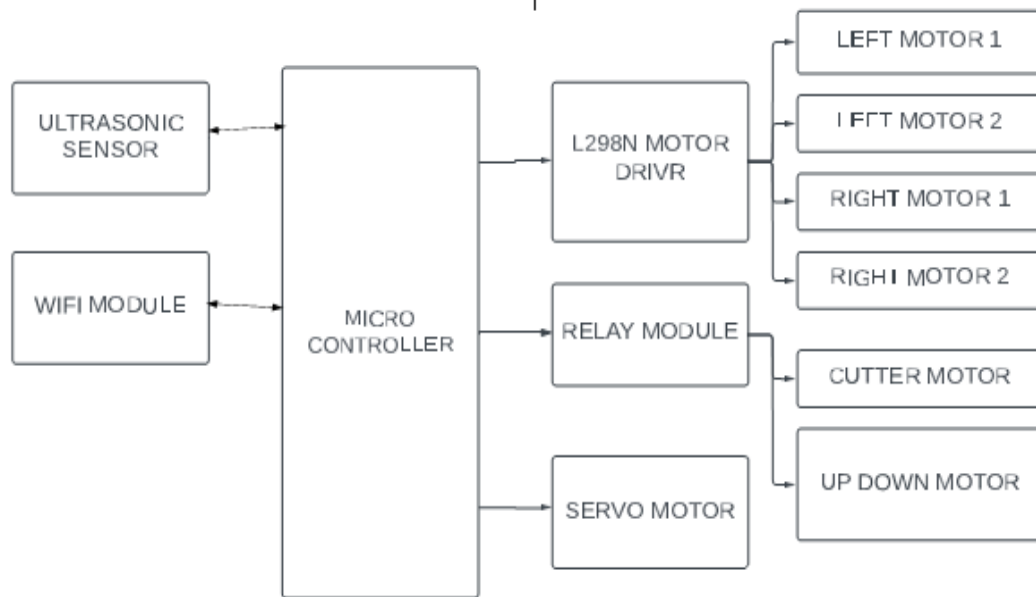


Fig 5. Block Diagram.

Fig 5 shows the block diagram.

IX. BILL OF MATERIAL

Table 2. Bill of Material

S. No	Components	Quantity	Amount
1	DC Gear Motors	4	1200
2	Node MCU	1	500
3	Battery	2	2000
4	Bluetooth Module	1	400
5	FrameWork	1	1000
6	Blade	2	200
7	IR Sensor	4	700
8	Relay	1	80
9	Wheels	4	400

Table 2 shows the bill of material.

X. CONCLUSION

The primary issue of the current technology is that a separate person is required to manage the robot. Hence, a system was built for fully automatic grass cutter powered by batteries. There are advancements in lawn cutter features as technology advances. It is an environmental maneuver as distinguished to different backyard mowers. By the study of the above paper's, we going to design a grass cutting rover which can be controlled using phone which connected through Bluetooth module and the rover can be controlled through the Arduino UNO which are Forward, Backward, Right, and Left and which may control the movement of the grass- cutting rover in all directions in the surroundings. There was an image processing to avoid the obstacles and an arm to move the small obstacles, which can avoid the grass cutting blade from damage. An excellent benefit is that it doesn't demand frequent support. It removes the human work two times as it not only cuts the lawn but likewise maybe regulated utilizing cellular phone. The rechargeable batteries are used for the grass cutting rover to work, which make it as an eco-friendly device as compared to other lawn mowers as it uses the batteries for its working.

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