AUTOMATIC SOLAR POWERED GRASSCUTTER
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ABSTRACT
Generally, present technology used for cutting the grass is done manually. This project aims to design and implement the grass cutter using Arduino UNO incorporated with solar power. In this project, Fuel Cost is reduced by using the renewable energy sources (solar) and machine has been automated. The solar powered grass cutting machine is a vehicle, powered by solar energy and is able to cut the grass automatically. The battery will be charged through solar panel. IR and Ultrasonic sensors are used to detect and avoid the unnecessary objects while operating in the fields. The solar powered grass cutting machine can be operated wirelessly through Android App via Bluetooth to a certain extent. The complete circuit for the project was designed and the results of simulation using proteus were presented.

Keywords: Solar Panel, Battery, Arduino UNO, Ultrasonic Sensors, Bluetooth.

I. INTRODUCTION
Modern architecture often leads to increase in the sense of design and innovation. Correct trimming and well furnished environment brings about sense fo utopia. Hence, it's necessary to maintain the surrounding environment inorder to establish a modernization. Maintaining optimum grass level and proper weed control is also necessary to obtain that particular outlook required. Grass cutter machines have become a very popular today. Most common machines are used for soft grass furnishing. The grass cutter is providing high speed rotation to the blade, which helps to cut the grass. Also, electric grass cutting machine are to be used in gardens, lawns and grass fields. In order to enhance the beauty of home lawns and gardens, grass cutting machines are the best available option in the industry.

Now-a-days, there are plenty of options from the simplest push along mower to the most advanced electric grass cutting machine. It is well known that the time is not so far. So, alternative sources should be used to avoid energy crisis.

Introduction of solar energy is a need of the hour. Here, we have designed a grass cutter using solar energy. Solar grass cutter has no moving parts and hence requires less maintenance. It works quite satisfactorily without any focusing device. It does not cause any environmental pollution like the fossil fuels and nuclear power.

Solar cells last a longer time and have low running costs. In this paper, we introduce the design and experimentally demonstrate that a grass cutting machine can be controlled with an android operating system, via Bluetooth which reduces human effort. Elderly uses and disabled persons can easily handled by themselves, and there is no need for gas, oil and engine to use this device.

II. METHODOLOGY
Existing System
The Grass cutter usually works on fuels. Running cost is quite higher. Conventional grass cutters are heavy machinery that requires a lot of strength and energy to operate. Time consumption is more and produces noise. It requires more human effort. Heavy weight machines lead to injury. Pollution is human made and can be viewed in our own homes as well as daily lives. Pollution is the primary concern with the conventional fuel and gas-powered grass cutter. Motor-powered push grass cutters have a loud engine, creates noise pollution and air pollution because of combustion in the engine. Along with motor-powered grass mowers, electrical lawn mowers are cannot be easily used in daily lives due to dangerous belts and motors, the need to cut grass cannot be efficiently fulfilled by the elders, younger, or disabled people and no one gets satisfied due to massive
combustion due to fuel usage. Gas-powered lawn mowers are also not efficient and it is also responsible for air pollution due to the emission of gases, and mainly the price of fuel, gases are increasing rapidly.

**Proposed System**

The purpose of our proposed project is to design a programmable automatic pattern design grass cutting robot with solar power which no longer requires time-consuming manual grass cutting, and that can be operated wirelessly using an Android App via Bluetooth from a safe distance; the cutting blade can also be adjusted to maintain the different length of the grass. The grass cutting robot system can be moved to the location in the garden remotely where the user wants to cut the grass directly. The user can press the desired button from the mobile application, and the system will start cutting grass in the required time. With the assistance of sensors positioned at the front, a barrier detection system is introduced to enhance safety measurements to prevent risks. IR obstacle sensors are used to detect obstacles, if any obstacle is found in front while traveling; it avoids the barrier by taking a right turn or stop automatically, thereby preventing the collision. Also, the main aim of this project is that which relieves the user from cutting their own grasses and reduces environmental and noise pollution. The conventional grass cutting robot has been limited to a particular remote through that, desired actions can only be performed. In this scenario, the robot will lose control if the user lost or broke the remote, leading to hazards, and the user will also waste money. To overcome this remote-control concept, controlling the grass cutting robot by using a Bluetooth Android mobile application along with Arduino is proposed using the Ultrasonic sensor, the method of identifying the obstacle in front of the robot is also proposed in which the robot and the cutter stop their motion.

In our project, Grass cutter is interfaced with Mobile App provided with movement controls. Mobile is the controlling device which controls the grass cutter via Bluetooth. It can be operated in 2 modes using Mode Selection Switch.

In Automatic Mode, Grass cutter cuts the grass automatically, when obstacle is detected, it turns either right or left based on the size and shape of the obstacle detected by sensor. In Manual Mode, if it moves in a narrow path or a crooked area, it is better to turn to manual mode which can be controlled using Android App. It can be operated according to user’s wish. Buttons used for left or right and reverse controls is implemented through this app.

**Block diagram:**

![Block Diagram of Grasscutter](image)

**Figure 1:** Block Diagram of Grasscutter

Solar panel is used for the power supply which will get stored in the battery for operation when the climatic conditions affect the production of power in the solar panel. The work of charge controller is used to provide constant supply for charging the battery. Arduino controls all the functions of the machine. The Arduino get the
input from the IR sensor to intimate the user that the obstacle is detected and ultrasonic sensor is used for the measuring the distance between the machine and the obstacle detected by the IR sensor. Motor driver gets the input from the Arduino UNO for the motor operation. The motor connected to the driver is used for wheels. DC geared motor is used for both the wheels and cutter blade. When it has a heavy load, a separate gear assembly setup is required for steady movement. In semi-automatic Mode, Bluetooth module is interfaced with the Arduino UNO for connecting with android app which provides the directions that can be operated according to users need. Android app gives the options as forward, reverse, left and right movements of the machine. LCD is also given for the easier identification to the user by displaying the operating mode and the direction of the machine. So, it gives a clear view to the user about the motion of the machine.

Mode Of Operation:
In our proposed system, Grass cutter is interfaced with Mobile App provided with movement controls. Mobile is the controlling device which controls the grass cutter via Bluetooth. It can be operated in 2 modes using Mode Selection Switch.

Automatic Mode: Grass cutter cuts the grass automatically, if obstacle is detected it turns either right or left based on the size and shape of the obstacle detected by IR sensor.

Semi-automatic Mode: If it moves in a narrow path or a crooked area, it is better to turn to semi-automatic mode which can be controlled using Android App. It can be operated according to user’s need. Buttons are used for left or right and reverse control is implemented through the Bluetooth electronics app.

III. MODELING AND ANALYSIS

Simulation and Results:

Figure 2: Simulation diagram

The simulation works in two modes automatic and semi-automatic mode. In automatic mode it works based on the IR sensor output (i.e., the obstacle detected). In semi-automatic mode it works by the command given by the user through the android app which transmits the command to the user using the Bluetooth connection.

In automatic mode, the wheels and blade motor run uninterruptedly by sensing the obstacle present in front of the machine with the help of IR sensor. In simulation two separate manual switch is connected to exhibit the sensor work in the simulation. If the obstacle is detected in right, the machine moves towards the left. If the obstacle is detected in left, the machine moves towards the right. If the obstacle is detected on the both the sides, the machine stops. And further it can be operated using the android app (i.e., in semi-automatic mode).

In semi-automatic mode, it requires user command using the virtual terminal of the Bluetooth module. When the command "1, 2, 3, 4, 5" is given by user the motor goes in following movements.

- 1-forward movement
- 2-reverse movement
- 3-left movement
- 4-right movement
In forward motion, when the virtual terminal receives the command “1” from the user both the left and right motor runs in anti-clock wise direction. In reverse motion, when the command “2” is given by the user, both the left and right motor runs in clock wise direction.

When the input is “3”, the left motor runs in anti-clock wise direction and right motor runs in clock wise direction, the machine turns left. When the input is “4”, the left motor runs in clock wise and right motor runs in anti-clock wise direction, the machine turns right. When the input is “5”, the motor goes to halt position. So, both the motor wheels and the cutter blade stop.

**Simulation Results:**

![Figure 3: Automatic mode detection](image)

In automatic mode the grass cutter works based on the obstacle detected by the sensor as shown in figure 3. Here, switches are used to sense the obstacle. When left obstacle switch is in ON condition the grass cutter's left wheel motor rotates clockwise and right wheel motor rotates anti-clockwise. so, it moves towards right direction.

In simulation right button is in on state the obstacle is detected the left wheel motor rotates anti-clock wise direction and the right wheel motor rotates clockwise direction. So, the grass cutter moves towards left direction and vice-versa.

![Figure 4: Forward Movement](image)

When the user gives the command through the virtual terminal, as’1’ as shown in figure 4 both the motor wheels run in clock wise direction. So, the grass cutter moves in forward direction. The motion of grass cutter is in reverse movement because the command of user in virtual terminal is “2”. So, the both the wheel motors rotate in anti-clock wise direction. And the grass cutter moves in reverse movement. The user command is “3” the left wheel motor rotates anti clock wise direction and the right wheel motor rotates clockwise direction. So, the grass cutter moves towards left direction. The user’s command is “4” which make the grass cutter to move in right movement. This is due to the clockwise rotation of left wheel motor and anti-clockwise rotation of right
wheel motor so, it moves towards right direction. When the users command is “5”. All the motors which are implemented in the simulation stops functioning, so, the grass cutter goes to halt.

Hardware and app development:

![Hardware Image](image1)

**Figure 5: Hardware**

Solar panel is the main source given to grass cutting machine as shown in figure 5. Power is stored in battery and can be used as a backup in the critical time (i.e., at some conditions where panel cannot supply power). Charge controller is in between the panel and battery for providing constant supply. Arduino controls all the operations performed on the machine. Both sensors are interfaced with Arduino to know the details of the obstacle detected and distance between them. IR sensor is connected to A2 pin of Arduino UNO act as an input and detects the presence or absence of obstacle in front of the machine and intimates the user about object detection. The ultrasonic sensor is given to the Arduino UNO at A3 and A4 pins acts as input used to find the distance between object and machine.

Motor driver L298D takes care of motor operation. There are 4 wheels in the machine, two on left side and two on right side. The wheels on both side is connected in parallel to perform the same operation which is convenient for turning of the machine. The wheels and cutter blades are operated by DC geared motor. High efficiency is achieved through higher rpm offered by motor. The input and output pins of the motor driver L298D is connected to 10,11,12,13 pins of the Arduino UNO. Motor driver L298D is used to control the DC geared motor for operating the wheels of the machine. Using the motor driver, the left and right motion can be controlled. The separate motor which is connected to cutting blade is controlled using the TIP driver 122 is connected to the A0 pin of the Arduino UNO.

In semi-automatic mode, Bluetooth module is interfaced with the Arduino UNO by connecting RXD pin of Bluetooth to 1st pin of Arduino UNO and TXD pin of Bluetooth to 0th pin of Arduino UNO. Now connection is established between machine and mobile. Users can give commands to machine through android app for operating in the direction according to their need. Android app gives the options as forward, reverse, left and right movement. LCD (16*2) is provided for displaying the operating mode and the direction of the machine. The pins 4,6,11,12,13,14 of LCD is connected to the 4, 5, 6, 7, 8, and 9 of Arduino UNO. The display is operated in 4-bit mode. These are the pins of Arduino UNO to LCD (4-4, 11-8, 12-7, 13-8, and 14-9) for display.

**Panel Development in App:**

![Panel App Image](image2)

**Figure 6: Panel in App**
The Bluetooth electronics app is a basic android app. The Bluetooth module and the android is connected via Bluetooth for controlling the machine in semi-automatic mode. In the semi-automatic mode the user provide the command to the machine using the panel in the android app. The controlling mechanism of the machine is possible through the buttons. Buttons can control the direction of the grass cutter machine and the blade can also be operated using the blade ON OFF button in the panel as shown in the figure 6.

IV. RESULTS AND DISCUSSION

The proposed grass cutter is designed with sensors in order to move according to the obstacle detected in front of the machine in the automatic mode. And in another mode of operation (semi-automatic mode) the machine based on the commands given by the user in the Bluetooth electronics app. Proteous software is used for the simulation purpose the

V. CONCLUSION

A solar powered grass cutter has been developed for the use of residences and establishments that have lawns where tractor driven mowers could not be used. The machine's capacity is adequate for its purpose. The machine has proved to be a possible replacement for the gasoline powered grass cutter. Due to the power demand, we choose renewable energy. So there is no running cost. Our project entitled Automatic Solar Powered Grass Cutter will be easier for the people who are going to use this project for further modifications. It is more suitable for the common man as it is having many advantages like no fuel cost and no pollution. It has also got the facility of charging the battery while the grass cutter is in motion and can be used in night time also. Therefore, the machine will remain intact for many years. Here our designed model of automatic powered grass cutter can be an economic alternative and also user friendly. which will provide live streaming and can be used for controlling the grass cutter from faraway places.

VI. REFERENCES