Solar Grass Cutter Using Embedded Platform An Experimental Validation

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Abstract: These days, a manually handled machine is used for cutting the grass. The most used energy sources are gasoline and electric power. These sources are not eco-friendly. To reduce pollution as well as human efforts need to develop an automated machine that utilizes renewable energy sources such as solar energy. The main idea behind this paper is to develop a solar-powered grass cutter. A 12-volt battery is incorporated into an automated machine to power the motors used for vehicle movement as well as motors used for rotating the grass trimming blades. The D.C motors are used in this automated machine. The battery is charged through a charging circuit. Particularly in this research work, we have focused on the automated machine is used for trimming the grass. The machine is made up of linear-rotary blades. These blades are functions with the support of the motors. A battery is used for power supply to the motors. A solar panel, as well as an A.C power supply circuit, are cast-off to charge the battery. Ultrasonic sensors are used to detect an obstacle in the path of an automated machine. If any deviation in the traveling path, the automated machine finds the new path to travel by using a free direction sensor. In the future, robotics will play a key role worldwide.

1. Introduction

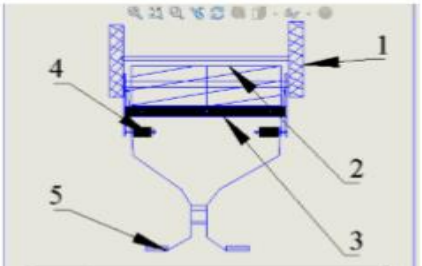
Present days the very large lawns are in colleges, public parks, botanical gardens are kept up manually. To cut the grass the gardener uses hands and scissors. But it is not in uniform as well as it is not an easy task to finish within the time limit. Most of the lawn mowers are used with electrical energy, gasoline and also need a lot of human effort. In present days the energy sources electricity and the other non-renewable sources are becoming short and in the future, they may get exhausted. So we focused on renewable resources i.e. solar energy. The solar grass cutter is a fully automated grass cutting vehicle powered by solar energy. It cuts the grass at a very high RPM.The solar grass cutting machine is a fully automated machine power-driven by solar energy. It also detects the obstacles in the path based on that changes the movement direction. It does not require any human interaction. The motors i.e vehicle and grass cutter motors are interfaced to a microcontroller. working of all motors completely controlled by the PICmicrocontroller. An ultrasonic sensor is incorporated into a microcontroller to detect the obstcles

which are in the predefined path. The sensors are working as the eyes of an automated machine. Suppose if no sensors are equipped to the machine, the vehicle goes straight and may hit the objects and the vehicle damages. For object detection, we are using two ultrasonic sensors. If the object was detected by the left sensor the vehicle moves the right side with the help of the motor driver and cuts the grass. The smart grass cutter structure is an automated yard mover element. A grasscutter is an edge that is outfitted to an automated machine that takes into account that grass cutting at a very high RPM. The background has smart practicality that permits it to cover the total territory of the yard by distinguishing corners to make use of ultrasonic sensors. The end goal is to cover the whole region by moving the machine is loaded with blades. A microcontroller-based circuit is used in this productive based framework to accomplish the task. There are two batteries are used in this machine. In these two batteries, one is used to run the DC engines and the other one is used to control the engine of the grass cutter. Solar panels are used to charge the batteries which are loaded on the top of the machine. Ultrasonic sensors are also used in this machine. The framework also makes use of a gyro sensor as a part of the request to accomplish consummate 180 degree turns keeping in mind the end goal to accomplish finish grass/cultivate scope. In this manner, this framework takes into deliberation a mechanized grass-cutting framework without the prerequisite for any human intervention.

2. Literature survey

2.1. Paper-1: Design and Fabrication of Lawn Mower

In this project, the author mainly focused on a grass cutter with helix-shaped cutting blades. Nowadays, grass cutters are functioned by using electrical energy as well as fuel. The main objective behind this design is a machine with a mower that is handy, durable, easy to control and it has a low maintenance cost. Particularly in our, we focused on agricultural needs. We developed an automated machine for agricultural field works i.e to cuts the crops in the different types of fields. There are different types of components are used to develop this simple automated machine. Those are the base frame, wheels, bearings, roller, and gear arrangements. A revolve cutting blade is fitted below the gear. The reel mover is rotated by the gear arrangements that tend to cut the crops or plants. The reel is made of several helix-shaped blades attached to a rotating shaft. The complete set up is positioned on a movable base that has wheel prearrangement. It is used to uphold and maintenance lawns in gardens, schools, colleges, etc.[1].



S.no	PARTS NAME
1.	Wheel
2.	Spiral cutter
3.	Bed knife
4.	Support roller
5.	Handle

Figure 1. Lawnmower 2-D diagram

2.2. Paper-2: Fabrication and Analysis of Lawn Mower

Revolving blades are used in grass cutter to cut the grass and garden land space at different lengths and different designs. A blade that rotates on a vertical axis is known as a cutter and a blade assembled on a horizontal axis is known as cylinder or reel cutters. There are different kinds of machines that are developed based on the requirements. For residential gardens and lawns, the compatible type is pushed by human beings. While, superior, autonomous,ride-on mowers are appropriate for large lawns. The biggest, multi-gang mowers dragged behind a tractor, are considered for large areas of grass such as golf courts metropolitan, public, community parks [2].

In 1827, the first grasscutter was developed by Edwin budding in Stroud, Gloucestershire. Primarily it is designed to cut the grass on the luxurious country parks, botanical gardens, and sports gardens. It became an alternative to the scythe. It was patented in 1830. Edwin Budding done an agreement with John Ferrabee dated 18 –May- 1830. As per the agreement between these two people the development cost paid by the Ferrabee obtained the patent letter and acquired rights to manufacture. He was sold the license to other industrialists in the manufacture of lawnmowers. The first chain-driven grass cutter is developed by Thomas Green in the year 1859. The production of lawnmowers commenced in the 1860s. By the year 1862, Farrabee's corporation was building eight models in different roller dimensions. The production was ceased in the year 1863. Until that he was built more than 5000 machines. A human-pushed grass-cutter was designed by Elwood McGuire of Richmond, Indiana in 1870. It was a very lightweight and profitable success. In the year 1899, a better-quality gyratory razor blade grasscutter was patented by John Burr. For better performance wheel alignment is altered in this machine. The Archimedean cutter was built by the Amariah Hills in the year 1871. About, 1900 the Ransomes' Automaton is the finest English instrument. It was available in two variants those are gear-driven and chain models. After world war-I, JP Engineering company situated in Leicester developed and produced popular chain-driven machines. The escalation in the fame of grassland games helped quickly the spread of the creation. Lawnmowers turn out to be a new resourceful alternate to the scythe and trained grazing creatures. In the year 1893, a steam-powered lawn mower was patented by James summer who lives in Lancashire. Petrol or kerosene was used as fuel for this machine. Afterward, several improvements, the pieces of machinery were sold by the Stott Fertilizer and Insecticide Company of Manchester. Later on, the Leyland Steam Motor Company took over the control of sales. Several industrialists go into the arena with gasoline-driven mowers afterward at the turn of the period. The roller drive lawn mower has altered very little meanwhile about 1930. In the United States, in the year 1919, Worthington assembled Gang mowers with various sets of blades. Then, Jacobsen Corporation bought this company but the name of Worthington is still cast on the structures of their gang machinery [2].

2.3. Paper-3: Modification of Solar Grass Cutting Machine

Cutting grass can't be effortlessly done through elders and youngers. Grasscutter transforming using appliance creates sound pollution owing to the loud engine. and nearby air pollution also rises due to the combustion in the engine. Nearby air pollution as well increases because of the burning in the engine. Periodic maintenance is required for these types of machines for instance changing the oil. The photovoltaic lawnmower is ecologically friendly. Motor-powered machines are additionally dangerous and can't be situated without difficulty castoff through all thus we developed the automated grasscutter handy to function using the remote control. Also, the Battery operated grass cutter remains manual. These grass cutters are using the photovoltaic panels to charge the batteries using solar energy as well as charging done through Alternate Current. To increase the cutting efficiency of the machine is having the spiral cutting blades. It can be operated in two modes those are manual mode and automatic mode. The automatic mode of operation is controlled by remote control. Boxes are attached to the grass cutter to collect the grass cut by the blades automatically [3].

The sliding blades are used in the solar-powered grass cutters to cut the grass in different lengths. Even other sophisticated machines are available in every field. Power consumption turns out to be crucial for the forthcoming. The construction of a solar grass cutter is very simple. It is used to maintain lawns in schools, houses, public gardens, colleges, etc. as the rapid growth in technology keeps us very comfortable by the machines are doing humans jobs. The main idea behind this project is to develop and fabricate a fully automated solar powered grass cutter. The cutting mechanism is equipped with a flat blade tightly fixed to the structure behind the helix prearrangement which is designed to a connection at least one reel bar of the spiral blades during the rotation of the spiral mechanism. In this mechanism to improve the cutting speed and for effectiveness the shaft has a rotary speed of 1500rpm with a total power of 934.3 watts [3].

Based on the literature review, the solar-power lawnmower is easy to use. It has different advantages compare to other like gas-based power sources. Here mainly focused on hydrogen-based grass cutter due to high cost and complexity in the design of solar grass cutter. This machine is powered by using hydrogen instead of using petrol or gas. Because of this reason hydrogen-based cutters have become eco-friendly machines. It is an old and traditional method is not using now and many new methods are introduced. The main idea behind the self-powered design is to introduce a machine with a mower that is durable, portable, easy to operate, and low maintenance cost. One more important thing is it also focuses to develop a self-powered machine that incorporates an electrical source; a cordless electric lawnmower. A battery energized DC electric motor is used here and it is the heart of the machine. The same technique is used in our grasscutter. A keypad and display board also incorporates into the machine. At present a manually handle machine is using for grasscutting. Particularly in this project, we are introducing an automated machine for grass trimming [3].

2.4. Paper-4: Solar Based Grass Cutter

Our project titled as fabrication and modification of solar-powered automated grass cutters are accomplished and the outcomes gained are adequate. It will be less complex for human beings, who are willing to proceeds with the task for additional alternations. Here we have effectively finished the physically as well as automatically operated machine. Here a remote-operated system is developed which is safer and easy for working. The system consists of a spiral blade that gives the cutting efficacy. After cutting the collection of grass is also easily done by the automated grass cutter. This automated machine occupies less space and very light in weight. The running cost is zero because it is a solar-powered automated grass cutter. In this paper, they have organized a manually deal with a machine that is successfully to cut the grass. This machine is made up of linear blades. It does no longer affected by way of climatic conditions. The machine finds the obstacles on its path by using IR sensors which are equipped and send this information to the microcontroller is hard for the machine to find the alternate path. It gives up till the impediment is removed from the path. The primary goal behind this paper is to move the automated machine in different directions to put together a variety of designs as per the requirements. The height of the cut can be attuned by using the hyperlink mechanism. Unexperienced labor can operate this machine effortlessly. Ashish Kumar Chaudhari et.al.[4].

Here, a wireless grass cutter is introduced. The principal elements are transmitter and receiver. The transmitter uninterruptedly passes on the rays if any impediment comes in the forward-facing of the grasscutter then the emissions are mirrored in the direction of the receiver. Here the signals are received by the serial structure encoder used in a receiver. For communication purposes, the microcontroller required parallel information. So the decoder in a receiver converts the serial information into parallel form. After that, it exceeded the microcontroller. Now the external battery is needed not to cost because photovoltaic panels are using. When the machine is functioning the battery is always charged at a constant voltage. By using the power pack up batteries We can use the grass cutter at night time without any functioning, power problems due to the battery are charged in the daylight hours by the way of

photovoltaic panels on the top of the machine. The forward and backward actions of machines are possible through two DC motors. Vicky Jain et. al. [5].

Here, the author defined that the photovoltaic plate is positioned above the grass cutter. It produces photovoltaic power and makes consumption of this strength for in work the grass cutter. Usage of driver circuits intended for controlling the pace of the motor as per the constraint. Photovoltaic panels, batteries, DC motor, photovoltaic mount, circuit, and razorblades these aspects are cast-off for making ready solar powered grass cutters. The latest and technologically developed regulators are placed in series that are used in the machine to prevent the battery from over-charging and over-Discharging. An LCD unit is used to shows voltage produced through photovoltaic rays training. Due to periodic stipulations if the battery is no longer charged at that time the power bank is used to charge the battery immediately. Ashish Kumar Chaudhari et.al.[6].

More power is required for numerous industrial applications and electrical appliances due to industrialization. The best alternate for electrical energy is solar energy. Different components are used for the fabrication of grasscutter those are DC motor, battery, solar panel, and solar charger. A fewer number of moving components are used to design the machine so it has very little maintenance. This grass cutter is easy to handle and gives more physical exercise to the operator.

Table 1. Components of grass cutter

S/No	Element	Qty	Observations
1	Battery-operated	1	Motor power supply
2	Solar panel	1	Battery power supply
3	IR Sensor	1	Obstacle detection
4	wheels	4	Wheels are rubberized
5	Collection bag	1	Collects the grass as moving progress
6	DC motor	3	Rotating the wheels, blades
7	Collapsible blades	2	Made up with Steel

Here the manual handle machine is prepared by the author. The external power supply, as well as the photovoltaic panel, is used to energize the battery-operated. A controllable DC motor is cast-off for altering the movement way of the machine as per the requirements. Overcharging and discharging reduces the lifetime of the battery. To avoid this the most recent watchdog is used for averting charge too much and discharging of battery that improves the lifetime of the battery. Nowadays more electrical energy is required for several industrial applications as well as for electrical gadgets due to the usage of advanced technologies. The best alternative for electricity is solar energy. For the fabrication of solar grass cutter Batteries, a DC motor, solar panner, and solar charger are used. A fewer number of moving components

are used in this machine due to that reason machine requires less maintenance. the latest solar power grasscutter can be handled by the operator easily. Pankaj Malviya et.al.[7].

In this paper, a physically functioned grass cutter with corkscrew rollerblades prepared by the author. The spiral blades will increase the effectiveness of cutting. The reel cutter is an element positioned on the grass cutter is used for adjusting the height. This grass cutter can the different types of grass uniformly. The battery can be charged at some stage in working prerequisites and it additionally has AC charging. Packing containers are positioned over the grass cutter. Containers are used to collect the cut grass and which is put outside the lawn. It is compact in design and having lightweight.Praful P. Ulheet. al. [8].

Here, the author mainly focusing on how to use solar power. An automated solar grass cutting machine with a rotating razor blade functions by using photovoltaic energy. To generate electricity, astral vitality is locked in the photovoltaic cells. Here the cells are in the form of arrays. The solar panels are positioned with an angle of 45^0 such that to captivate high-intensity light or energy commencing the sun. To start as well as stop the motor circuit's breakers are used in this particular model of design. The foremost purpose of a solar charger is amplified current throughout day time. The batteries are charging and also cut off when they are fully charged. Rotary blades and Circuit's breakers, adust height, position based on the ground clearance. T. Karthicket. al. [9]**.**

Here, a solar-powered lawnmower is technologically advanced by the author. They found and compare different results which are given in the below table.

Table 2. Comparison of Typical height of grass before and after moving of the machine

Example plot	The typical height of the grass before cutting(mm)	The typical height of grass after cutting(mm)	Predictable height of grass after cutting(mm)
Carpet Grass	70.5	56.5	50
Spare Grass	111	70	80
Stubborn Grass	234	92	100
Elephant Grass	224	90	100

The machine is automated to adjust the height of the rotary blades based on the ground clearance. Then the average height of the four different species of grasses after the machine is moving was lesser than expected. The efficiency of the machine is increased as well as very little time is required to finish the task set up by the operator. Tanimolaet. al. [10].

Particularly in this research paper, the author discussed a solar grass cutter equipped with tempered blades. This grass cutter functions both manually and automatically. The materials commonly used to construct the machine are motor, wheels, GI sheet, A1 sheet, square pipe, switch, insulating material, and

wire. There are different types of elements used are a rechargeable battery, relay, temperature sensor, DC motor, and comparator. Here the LCD unit is attached to a solar grass cutting machine. It displays the voltage generated by the solar panels. Ms. Lanka Priyanka et. al. [11].

Here, A manually operated solar-powered vision-based robotic lawnmower was developed by the author. A camera is positioned over the structure of the robot. The predetermine MATLAB program is dumped into the system. The robot moves according to the predetermined pattern with help of the MATLAB program. Robots are automated to detect the objects which are in front. Therefore it guards the tools against damage and as well it reduces the humanoid effort and risk factor. The robots are programmed to amended the grass is not the same direction for creating various designs. Dipin.Aet.al [12].

In this paper, the writer fabricates a machine for reducing human efforts and work. solar panels are grasping energy from the sun and it is stored in batteries. The robots are used the stored energy in batteries as the requirement. All these functions of the machine are scheduled permitting the recommended time by proper checking. For the safety of batteries from additional charging a precise mechanism is used which increases the lifetime of the batteries. It is also used in a minor scale for nursery. SachinPrabha et.al [13].

It uses energy from non-renewable sources so the over-all energy absorbed as of the sun extreme goes beyond our vitality usage. It is inevitable towards being an alternate green possibility to the widely held and environs harmful gas-powered lawnmower and moderates humanoid work. It is easily handled by the non-skilled persons also. It can easily control and handled within less time by using a predetermined program and simple switches. It functions based on the instructions given by the machinist. Based on the given instructions it senses the bits and pieces and changes the ways and even stops functioning. It is highly well-organized and very accurate. Therefore machines should be sheltered from destruction and moderates menace on humans. solar panels are equipped with light sensors. Thus liable upon the moving direction of the sun, the solar board will be inclined, such that the sun emits or light energy is incident generally at 90^0 to the photovoltaic panel. This is how the expedient would be uninterruptedly accomplished of catching astral vitality by the side of intervals when the power of the sunlight is a smaller amount. If the panel is cast-off for excessive watt, at that time the machine can be used through the night-time for backyard lights, room lightning, due to the fact we can accrue extra energy. And at night time still, you cling to it distant. So the battery power is used for this purpose. It is used for gardening by adding the valve in the pipe that means pouring water for plants. It can be used to transport books, files, and other kinds of stuff from one place to another place by adding a box type transporter. Grass cutting can be done more skillfully cast-off afterward altering intended for rice harvesting.

In all these existing solutions we have seen many problems like a continuous requirement of human throughout the working of the device, some devices work only with the help of remote and some existing sensors do not have any sensors to detect the objects. Some devices work with GSM modules and RF modules. Some devices have many disadvantages like fuel and electric charge requirements. By considering all the drawbacks in the existing models, we have proposed a model called SOLAR GRASS CUTTER. In this, we have overcome all drawbacks by keeping ultrasonic sensors as it detects the objects while it moves. We do not require any person's help for the whole process and it uses solar energy as an external supply to the device. As we do not use any modules the circuit becomes simple and easy to operate.

3. Proposed methodology

The source is determined commencing from solar energy using a solar panel that energizes the battery and makes use of for driving the process of the system. The microcontroller controls the entire system. A 40 kHz ultrasonic sensor, microcontrollers are used to automated the system. These are helpful for object detection. DC motors are used for wheel movement and cutting operations. An L298 driver circuit is used to achieve the compatibility of motors and the microcontrollers. Here, the output of the microcontroller enhances by using the driver circuit. The cutting action of the blade is delivered by a motor of 1000rpm. The previous technological know-how of grass slicing is hand-operated with the aid of the use of hand

gadgets like cutters, scissors, these consequences in better human work, and abundant time necessary for accomplishing the work. Also in old techniques deficiency of uniformity of the remaining grasses. The usage of engine-powered machines will increase sound and air pollution. Additionally, these machines require high maintenance. Nowadays grass cutting machines are turning into very popular. In the olden model of grasscutter, the IC engine is used, and subsequently, due to the fact of ecological influence, air contamination level growths and ic engine grass cutters are also more costly. Looking after such a traditional grass cutter is more. Headed to cling away from these disadvantages we make a strategy to construct an innovative kind of photovoltaic power and this mannequin is additionally economical. The main goal behind this project is headed for reducing the grass which functions on photovoltaic power consequently except for electrical energy and diminishes manpower. In this project, a microcontroller is used for controlling quite several operations of the grass cutter. Also, the grass cutter operates automatically and much less usage of manpower, for this reason, it does now not require a professional individual to operate.

3.1 Product (Hardware & Software) Requirements:

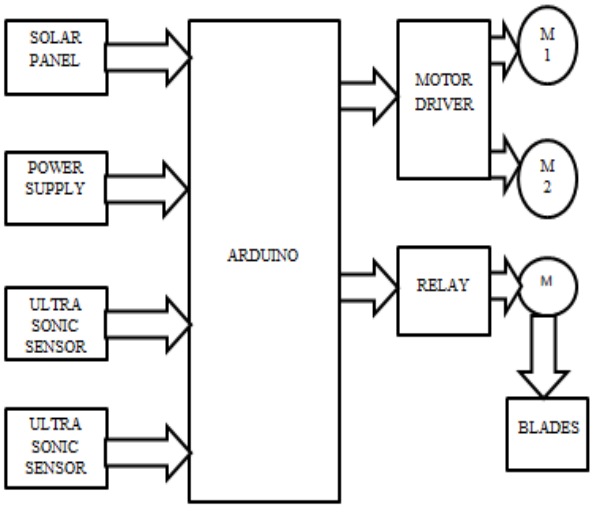


Figure 2. Block diagram of solar grass cutter

3.2 Components used:

1. Arduino Uno
2. Body of the vehicle
3. Greensward Cutting Razor blade
4. Photovoltaic Panel
5. Motor Driver IC
6. DC Motors
7. Ultrasonic Sensor
8. Robotic Body

3.3 Software used:

1. Arduino IDE

4. Implementation

The project design comprises a solar charging system, blades, microcontroller, ultrasonic sensors, and a motor driver for moving the vehicle in different directions. By interfacing these components we get a solar grass cutter. To cut the grass in all directions the first vehicle has to move in all directions, for moving the

vehicle in all directions we are using a motor driver it has four conditions, they are moving forward, moving right side, moving left side, and stop. As motor driver works on the principle of H-Bridge which is having four switches internally based on these switches our vehicle will move.

The sensors are working as the eyes of an automated machine. Suppose if no sensors are equipped to the machine, the vehicle goes straight and may hit the objects and the vehicle damages. For object detection, we are using two ultrasonic sensors. These sensors will be attached right in the forward-facing of the machine for thoroughgoing discovery. If the object was detected by the left sensor the vehicle moves the right side with the help of the motor driver and cuts the grass and if the object was detected by the right sensor it moves to the left side and cuts the grass. If the object was not detected by two sensors it moves in a forward direction cuts the grass and if the object was detected by two sensors vehicle moment stops. We are using the solar panel for giving supply to the vehicle. If we want to cut the grass in the evening or when the sunlight is absent we can use a rechargeable battery we can charge the battery when the sun is present.

Table 3. Comparisons Of Conventional Grass Cutter And Automatic Grass Cutter

Factor	**Conventional Grass Cutter**	**Automatic Grasscutter**
Pollution	Causes more pollution	Clean and pollution-free
Effect	More effort	Less effort
Maintenance required	More	Less
Remote control	Not available	Available
Noise	More	Less
Efficient	Less	More

Table 4. Comparisons Of Solar Grass Cutter And IC Engine Grass Cutter

Influence	**IC Engine Grass Cutter**	**Photovoltaic Grass Cutter**
Friction	High	Greatly reduced
Fuel	More	No
Pollution	More	No
Load carrying capacity	High	Low
Cost	High	Low
Maintenance	High	Low

Figure 3. Solar Grass Cutter

5. Results and discussion

5.1. Serial monitoring of Arduino software

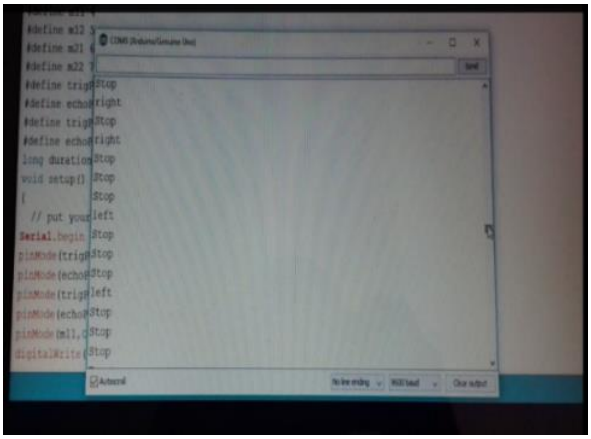


Figure 4. Serial Monitoring Of Obstacle Detection Of Solar Grass Cutter.

Initially, the program is written in the embedded C in Arduino software. After completion of the code save and run the program. If any errors are found the code should be modified. Then again execute the program and verify it. If errors were not found, next compile the program and dump the code into the Arduino board. Then notice a popup window called debugging done. After that check the results in the serial monitor as shown in the above figure.

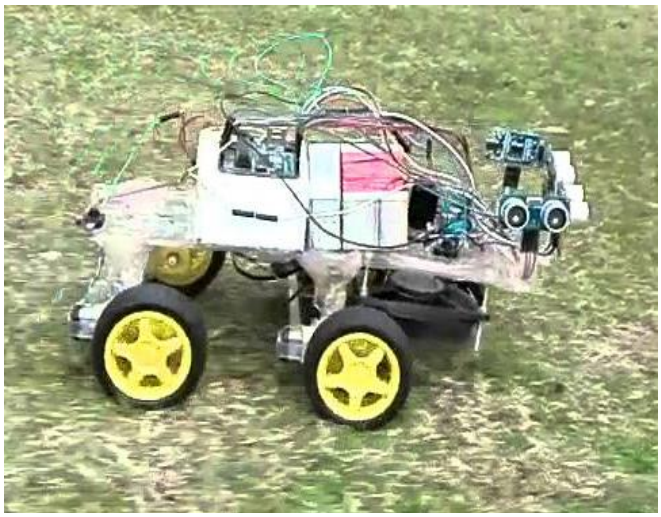


Figure 5. Working Of Automatic Grass Cutter

Here the design has a solar panel, DC motors, battery, and microcontroller. The components are incorporated into a microcontroller. The ultrasonic sensor transmits the signal to detect the objects. If any echo signal is received that information goes to the microcontroller that controls the movement of the DC motors. In the case of no object detected by the sensors the grass cutter move until it finds the object in front that shows by glowing LED light. When it finds the object changes the path based on the preferences. The cutter motor is connected to the battery and the microcontroller and it works uninterruptedly to cut the grass consistently. Meanwhile, the battery gets charges using the solar panel.

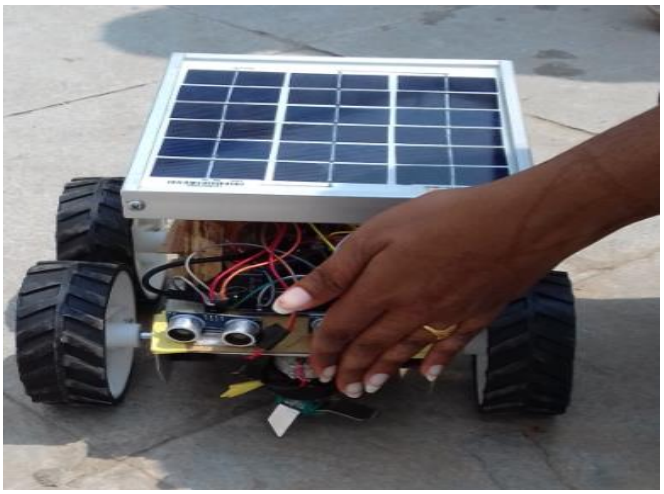


Figure 6. The Machine Is Moving On The Right Side Due To Obstacle Detection On The Left Side.

Figure 6 shows an automated machine equipped with ultrasonic sensors. When the machine is moving in the forward direction if the left side of the ultrasonic sensor detects the object the vehicle turns to the right side. The switches S1, S2, S4 are opened and S3 is closed also making the relay pin low. Here S1, S2, S3, S4 are the switches that are internally present in the motor driver IC.

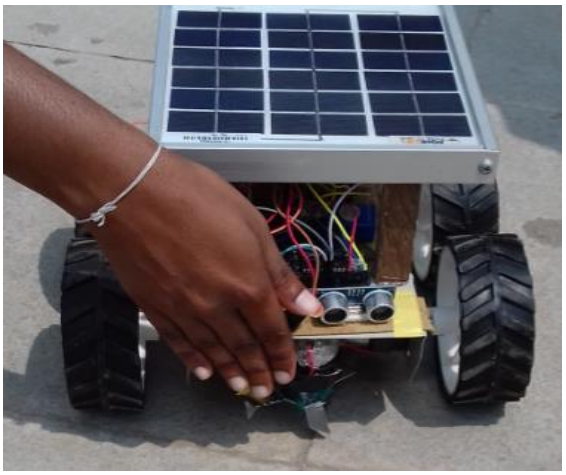


Figure 7. Obstacle Detection On The Right Side And Moving In The Left Side

Above figure 7 shows when the vehicle is moving in the forward direction, if the right side of the ultrasonic sensor detects the object the vehicle turns to the left side. The switches S1, S3, S4 are opened and S2 is closed, also making the relay pin low. Here S1, S2, S3, S4 switches are incorporated into motor driver IC.

Figure 8. No Obstacle Detection And Moving In A Forward Direction

Figure 8 explains that When the vehicle is moving if both of the ultrasonic sensors do not detect the object, the vehicle continues in the forward direction. The switches S1, S4 are closed and S2, S3 are opened, and also making the relay pin low. Here S1, S2, S3, S4 are the switches incorporates into motor driver IC.

Figure 9. Obstacle Detection On Both Side And Stop Moving

Figure 9 explains that When the vehicle is moving in the forward direction if both of the ultrasonic sensors detect the object, the vehicle stops moving. The switches S1, S2, S3, S4 are opened and also making the relay pin high. Here S1, S2, S3, S4 switches are internally equipped into the motor driver IC.

6. Conclusion & future work

6.1. Conclusion

The work done on solar grass cutterwill come across the challenge of ecologically friendly production. The low cost of maintenance and operations possible due to no cost for fuelling. The automated machine i.e solar grass cutterhas been technologically advanced for the use of houses and establishing that have grasslands where tractor driven mowers possibly will not be used. It is very simple for human beings, who practice this project work for further alterations. The automated grass cutter is light in weight and to place it occupies a very small area. As it makes use of a renewable energy sources for this reason there is a zero running price. It has the ability that can charge the battery while the machine is in workable condition. The automated machine is used to maintain the lawns are very clean and uniform in schools, playground, and public gardens.

6.2. Future Work

Video cameras can be used to acquire pictures of the object being spotted. By fixing a metal detector to the robot, it can be send to battlefields, forests, coal mines, etc...to find out the metal objects. Temperature sensors are incorporated into the machine to get the extreme temperature of dangerous zones where human beings cannot go. As a result of attaching a smoke sensor to the machine, it can get the information related concentration of smoke or gases in the respective fields.The Size of the machine can be compact. The efficiency of the machine can be modified by increases the capacity of the battery. We can also place a bin to collect the grass and we can also configure the ultrasonic sensors depending on the distance. Additionally, sensors are integrated for perfect outcomes and upgraded robotics. Enhanced programs are used to update the machine and to perform different tasks.

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