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TITLE: AUTOMATIC SOLAR GRASS CUTTER

Prachi K. Kapuskar¹, Dipali A. Derkar², Adarsh W. Meshram³, Pragati B. Mundekar⁴

¹2nd year student, EE Department, J.D.I.E.T, yavatmal, Maharashtra, India, prachikapuskar19@gmail.com

²3rd year student, EE Department, J.D.I.E.T, yavatmal, Maharashtra, India, dipaliderkar142gmail.com

³3rd year student, EE Department, J.D.I.E.T, yavatmal, Maharashtra, India, adarshmeshram45@gmail.com

⁴3rd year student, EE Department, J.D.I.E.T, yavatmal, Maharashtra, India, pragati123mundekar@gmail.com

Abstract

This paper is based on the automatic solar grass cutting machine. As the name indicates, this machine is powered by solar energy and is aided by automatic grass cutting processes by using a microcontroller. Use of microcontroller helps saving time as well as the need to invest human efforts to manually operate the machine as was required in the old and outdated ones. It also avoids obstacles and is capable of fully automated grass cutting action without the need of any human intervention. The system uses batteries which are charged by the solar panels to power the vehicle movement as well as the grass cutter motor. It is interfaced to the sensors to fulfill the purpose of object detection. The employment of solar panels helps reducing the dependence of consumers on non-renewable source of energy and in this way, the machine also helps saving electricity. The grass cutter and vehicle motors are interfaced to an 8051 family microcontroller that controls the working of all the motors and the sensors.

Index Terms: Solar panels, 8051 Microcontroller, D.C Motors, Obstacle sensors, battery, charge controller, LM 7805.

1. INTRODUCTION

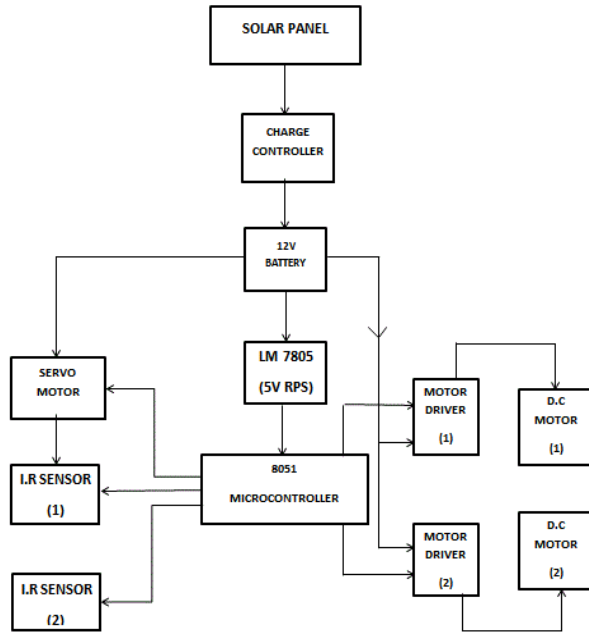
Nowadays the popularity of grass cutter machines has increased gradually. On maximum basis these machines are used for soft grass formation. Today technology goes hand in hand with environmental awareness. People are stepping towards the new ways on how to contribute to the relief of their own carbon footprints. Manmade pollution has become a regular picture in our daily lives, in fact in our own homes. Thus, we introduce a model of the automatic grass cutting machine which runs on solar energy. Our new invention is an excellent replacement for the conventional habit, which will help people and environment as well.

An automated solar grass cutter machine is completely auto controlled robotic vehicle extracting energy from sun. It is programmed such that it avoids all the obstacles and performs its task without any human aid. It employs 12V batteries to supply power for the vehicle movement motors and grass cutter motors as well.

Solar panel is used for battery charging purpose so as to avoid the need of charging it externally. The motors used for grass cutter and vehicle are interfaced to 8051 family of microcontroller that controls the operation of all the motors.

It detects the obstacles coming in its path by the sensors. The robotic vehicle moves in forward direction if no obstacle is detected, and this phenomenon is brought into action by a microcontroller. As soon as it detects any obstacle, the IR sensors analyses it and the microcontroller commands the grass cutter motor to stop in order to avoid damage. The robotic vehicle remains off until it crosses the obstacle and then moves the grass cutter in forward direction again.

2. BLOCK DIAGRAM



3. WORKING

A lawn mower or a grass cutter is a machine utilizing one or more revolving blades to cut a grass surface to an even height. It is designed to operate entirely on its own.

It encompasses of a microcontroller of 8051 family, IR sensors, a motor driver to drive the D.C gear motors for robotic direction control, a motor driver to drive the high speed motor, a 12V battery which can be charged by the solar energy through a charge controller and a 5V regulated power supply for the microcontroller.

The microcontroller operates all the components at 5V supply, therefore some of the main components like the obstacle sensor, L298 motor drivers are directly connected to the microcontroller.

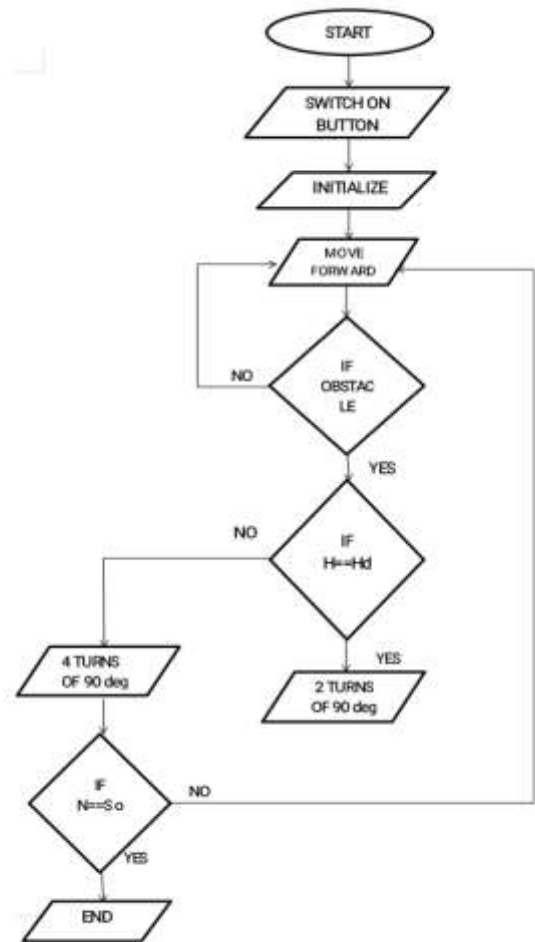
All the above components are further to interfaced to different motors required in the grass cutter machine.

The L298 motor driver drives 2 the D.C motors. The machine is built using a high speed 1000 rpm motor which is driven by the motor driver. The system has 12V, lead acid battery which can be charged from a solar panel through a charge controller and the 5V of regulated power supply is built using LM7805 regulator.

The machine utilizes the solar energy to carry out the operation. This solar energy is captured by the solar panels

where it is converted into accessible D.C power and then stored in the battery having output rated voltage of 12V through a charge controller. The battery is used to supply power to the 8051 microcontroller through a voltage regulator IC LM 7805. The microcontroller initializes its action as soon as it receives the rated power supply (i.e 5V) and endures its operations by continuously receiving signal from the obstacle and analyzing it and sending the desired commands to the motor drivers. Lastly, these motor drivers controls the switching ON and OFF of the direction motors and the grass cutter motors.

3.1 FLOWCHART



Where,

H =height that is being checked

Hd = desired height that is set to microcontroller

So = speed of the rotating blades at no load (i.e short length grass or no grass)

N = speed of the rotating blades at a particular instance of time

Table-1: components and their ratings

Sr.No.	Components	Quantity	Ratings
1.	Solar Panel	1	3 watts
2.	8051 Microcontroller	1	5 volts (i/p)
3.	IR Sensors	2	4.5 V (15-150 cm)
4.	D.C. Motor	3	1.2A, 2.4W
5.	IC LM 7805	1	5V (o/p)
6.	Battery	1	12 V (o/p)
7.	Charge Controller	1	12 V
8.	L298 Motor Driver	2	0.6 Amp per channel

4. COMPONENT DESCRIPTION

- *SOLAR PANEL:*

The device which converts the solar energy into electrical energy is called solar panel. It charges the 12V battery which is used in the machine through a charge controller. Use of solar panel eliminates the need of external power supply through additional wires.

- *CHARGE CONTROLLER:*

A charge controller limits the rate at which electric current is added to or drawn from electric batteries. It prevents overcharging and also protects against overvoltage, which can reduce battery performance or lifespan, and may pose a safety risk. It may also controlled discharges, depending on the battery technology to protect the battery life.

- *BATTERY:*

Battery is defined as an energy storing device. It stores the solar energy received from the solar panel in the form of electrical energy and supplies required power to the respective components of the machine.

- *LM7805:*

Voltage source in a circuit may have fluctuations resulting in not providing fixed voltage outputs. A voltage regulator IC maintains the output voltage at a constant value. 7805 IC, a member of 78xx series of fixed linear voltage regulators used to maintain such fluctuations, is a popular voltage regulator integrated circuit(IC).The xx in 78xx indicates the output voltage it provides.7805 IC provides +5 volts regulated power supply with provisions to add a heat sink.

- *8051 MICROCONTROLLER:*

8051 microcontroller is an 8-bit microcontroller. It is built with 40 pins DIP, 4kb of ROM storage and 128 bytes of RAM storage, two 16-bit timers. This microcontroller in built with program and control the working of all the motors.

- *IR SENSORS:*

The IR sensors are basically the electronic devices which senses or detects the changes that occur in their surrounding and works accordingly. In our machine, these sensors detects the changes of obstacles and boundary (wall) in the grass surrounding and accordingly sends signals to the microcontroller.

- *L 298 MOTOR DRIVER:*

When the Motors are not capable of providing required amount of current for running the motors. So we use a device called motor driver which will provide sufficient current for driving the motor. It also provides the direction to motors.

- *DC MOTORS:*

D.C motor is a class of rotary electrical machines that converts direct current electrical energy into rotating mechanical energy. In automatic solar grass cutter, these motors are used for the movement of the machine as well as for rotating the blades.

5. ADVANTAGES

1. The system is quite easy to move from one place to another.
2. The operating principle of the system is very simple.
3. The system is compact in size and portable.
4. Requirement of electricity is eliminated since it uses renewable source of energy.
5. Eco-friendly.
6. Light weight.
7. Saves time and saves money.
8. The messy oil and smelly gasoline is not required because the system extract the power from the battery.

6. DISADVANTAGES

1. The manufacturing cost of the system is high as it uses the solar panel.
2. The eventual disposal of worn out batteries is problematic.

7. APPLICATIONS

1. Lawn mowers are widely used in all sports grounds.
2. The smaller types are pushed by human user and are suitable for small residential lawns and gardens.
3. It is widely used to cut small grasses and it can also be used for cutting small herbs
4. It can be used in the nurseries for soft grass formation.

8. FUTURE WORK

1. Size can be reduced to make the hardware of the machine compact.
2. Efficiency can be improved by increasing the capacity of the battery.
3. More number of sensors can be incorporated for precise results and improved automation.
4. Different operations can be performed by enhancing the programming.

9. CONCLUSION

The automatic solar grass cutter requires very less space and also it is light in weight. It uses renewable source of energy therefore the running cost is negligible. Battery charging is possible when the grass cutter is in working condition. In a country like India, where the sun light is available in abundance such a system can be installed successfully. Other than its applications in sports grounds it can also be used in the places where manual grass cutting is tedious and time consuming job.

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