

# Solar Based Grass Cutter Using Zigbee

Shankarappa Jogur, Venkatesh T, Tenzin Tenpa, Prof. Pradeep Vinhuti

U.G. Student, Department of Electrical and Electronics, Tontadarya College Of Engineering, Gadag, Karnataka, India

U.G. Student, Department of Electrical and Electronics, Tontadarya College Of Engineering, Gadag, Karnataka, India

U.G. Student, Department of Electrical and Electronics, Tontadarya College Of Engineering, Gadag, Karnataka, India

Assistant Professor, Department of Electrical and Electronics, Tontadarya College Of Engineering, Gadag, Karnataka, India

**ABSTRACT:** A Solar grass cutting robot uses rotating blades which cuts the grass at an even length. It is very simple in construction and is used to maintain lawns. Our robot uses Zigbee based transmitter receiver modem in order to propel itself as well as to control the main DC motor. This arrangement ensures that the manual operation is not needed. As it is using Solar energy, it does not causes pollution which is also our primary aim and it is accomplished through our work.

**KEY WORDS:** Zigbee, Lawn mover robot, Solar panels, Cutter.

## I. INTRODUCTION

Nowadays, what we see generally in market are gas powered grass cutters. Solar powered machines have not made their way to the market in large numbers yet. Due to the emission of gases to the atmosphere, they are disadvantageous and in addition to environmental hazards, they must be operated manually, a person needs to carry the machine while cutting the grass which leads to uneven cutting of the grass. Our robot reduces the burden of a person as it operates through Zigbee and ensures uniform cutting operation. As we all know that Solar is a renewable energy source, it does not deplete and it is eco friendly.

## II. BLOCK DIAGRAM

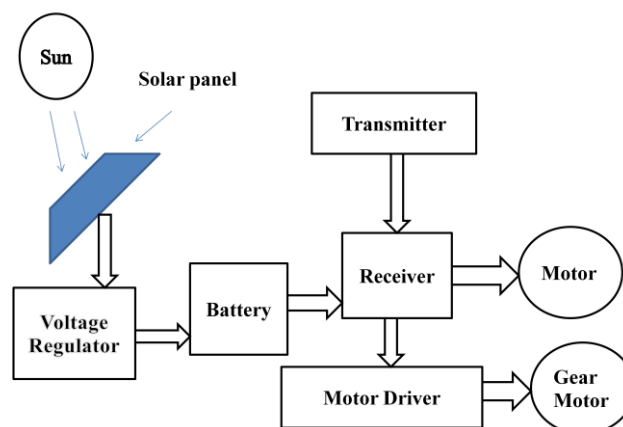


Fig1. Block Diagram

The block diagram consists of various components as shown above. The Solar panel receives energy from the Sun and based on photovoltaic effect. This energy is stored in batteries through voltage regulator. This stored energy is used to drive both the motors, main motor as well as the gear motor. The transmitter is controlled by PIC to send the signal

through Zigbee modem and the signal is received through Zigbee modem in the receiver circuit to drive the gear motor by varying its speed through program in PIC for the propulsion of the robot and proportionally it cuts the grass.

### **III. COMPONENTS REQUIRED**

#### **A. Solar Panel**

A Solar Panel is a series of structurally arranged solar cells which works on the principle of photovoltaic effect. When the Solar Panel receives photons from the Sun, there is a creation of electron of higher energy, and electric field is required to drive the electron causing the flow of electricity. Solar panel consists of p and n dope semiconductor. This yields in the formation of p-n junction causing the formation of electric field. When a photon strikes the junction, there is a transfer of light energy leading the electron to get to higher energy level to overcome the potential barrier of the junction causing the flow of electricity.



Fig2. Solar Panel

#### **B. Voltage Regulator**

Voltage regulator is generally used in order to provide constant output voltage so as to safeguard the components from over voltages.

Here, we used a LM7812 voltage regulator which gives constant positive 12V DC at the output side of it.

#### **C. Battery**

The batteries are storage devices. The stored electrical energy from the solar panel is used to drive the motors, and it also serves as the supply to receiver circuit. When the sun is not available, they can also be charged by AC supply through the provided switch. To be economically attractive, the batteries must have the following properties.

- High efficiency
- Low cost
- High reliability
- Long life



Fig3. Battery

#### **D. Transmitter**

The power to the transmitter is given through 12V battery or through AC main power supply. If the power is given from AC main supply, then it is stepped down to 12V, 1Amp AC through transformer. The supply from the transformer is given to bridge rectifier and capacitor is used to filter in order to get a regulated dc supplier which is converted to 5v through voltage regulator. The 5v is supplied to the PIC for the transmission of signal through Zigbee modem. A Zigbee modem is a communication protocol which requires minimal power and provides reliable delivery of data between devices. It is cheaper than WiFi, Bluetooth making it more economical. We used joystick in order to control the movement of the robot. The signal given from the joystick is given to PIC 16F877A which has inbuilt analog to digital converter to process the sending of the signal through Zigbee modem. After the receiver receives the sent signal, the processed signal is displayed in LCD.



Fig4. Transmitter

#### **E. Receiver**

The receiver also consists of Zigbee modem which receives the sent signal from the transmitter, and it is processed in PIC to control the motor driver circuit which in turn controls the speed of gear motors below rated rpm. The optocoupler is used to create isolation between the PIC and main motor to prevent the relay from back emf given by the DC motor. The transistor used is BD139 which acts as a switch for the operation of relay.

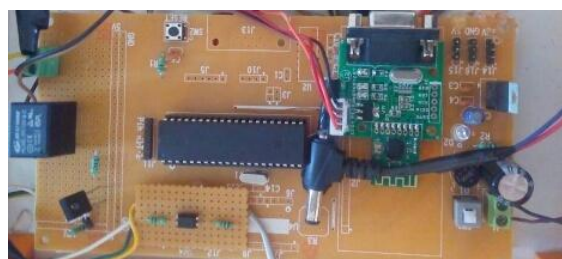


Fig5. Receiver

#### **F. Motor Driver Circuit**

L293 is a motor driver circuit which provides bi directional current up to 1Amp at voltage ranging from 4.5V to 36V. It is used to drive DC motor which has inductive loads. It acts as a current amplifier and provides higher current having 2

inbuilt H bridge driver circuits to operate 2 DC motors simultaneously both in forward and reverse direction by controlling the input logic from pin 2 and 7 and 10 and 15 rotating in both clockwise and anti clockwise direction.



Fig 6. Motor Driver

#### G. DC Motor

When the current is given to the supply, it produces magnetic field. When the current carrying conductor is placed under the magnetic field, the force is exerted on the current carrying conductor. As a result, the rotor rotates. The high rpm motor is suitable to cut the grass.



Fig 7. DC Motor

#### H. Gear Motor

Gear motor is used to enhance the torque by increasing or decreasing the speed of the motor. The motor shaft is feed into gear box that provides the torque and speed conversion through a series of internal gearing. Gear motor is controlled through motor driver by PIC for the propulsion of robot .The controlling of the speed of the motor is based upon synchronizing of motor that cuts the grass and the gear motor that is used for the movement.

### IV. ADVANTAGES, DISADVANTAGES AND APPLICATIONS

#### Advantages

- Environmental friendly
- Compact in size and portability
- Remote controlled

- Operating principle is simple
- Cutting blades can be changed as per the type of grass

**Disadvantages**

- Difficult to operate in rainy season
- Difficult to move if the surface is uneven
- High torque motors are required to propel the robot

**Applications**

- Lawns
- Fields and farms
- Playgrounds
- Gardens



Fig 8. Solar Based Grass Cutter

**V. CONCLUSION**

Our robot uses solar energy which has numerous advantages such as no fuel cost, no pollution, less wear and tear because of less number of moving components, and so it is remote controlled, thereby reducing human effort also. The initial investment will be high as we go for larger ratings of solar panel. But, due to the problem of global warming and ozone layer depletion, many of the governments in the world giving subsidies on solar components. So, we can expect the industries to produce solar components in mass production.

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