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Solar Based Multi-Tasking Agriculture Robot

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ABSTRACT

The main purpose of our project is to provide affordable, compact, multi-purpose robot to farmers for their agricultural use. It is a Solar based Multi-tasking Robot which performs various operations such as grass cutting, fertilizers and pesticides spraying in farms. Also it includes soil analysis in which it gives percentage of water in soil along with it, it also provides an estimated soil temperature. So as to suggest a proper amount of fertilizer that should be used to provide adequate amount of nutrients. All these operations are performed on solar energy so it does not need any external power supply that gives us a wide range to cover with the robot. As it includes multiple operations it is cost effective. It's controlling is done via a mobile application which makes it user friendly as well.

Keywords: Solar panel, Arduino Uno Board, Temperature and Soil Moisture Sensors, DC Motor.

I. INTRODUCTION

In early days cutting grass could not be easily accomplished. Moving the grass cutters which was powered with a standard motor was inconvenient. Using grass cutter that is operated on engine created noise pollution and air pollution at the same time. Even though electric solar grass cutters are environment friendly, they too can be an inconvenience.

Along with motor powered grass cutter, electric grass cutters are also hazardous and cannot be easily used by all. Solar based multi-tasking agricultural robot is a robotic vehicle powered by solar energy that is capable of cutting grass by a very high speed motor. As its name implies 'multi-tasking', so along with grass cutter it also provides fertilizer and pesticide spraying, testing soil moisture and obtaining soil temperature.

The system uses 12V batteries to power the vehicle movement as well as to the motor that is used for grass cutting. We also use a solar panel to charge the battery so that there is no need of charging the battery externally with any means of electric supply.

The grass cutter motor, vehicle motors and even a motor to which a fertilizer tank is connected are interfaced with ARDUINO UNO which controls the working of all the motors. Here two relay module are used one for operating the grass cutter and the other for the tank motor It is also interfaced to a wireless protocol called Bluetooth through which the vehicle is commanded to go forward, backward, left and right to cut the grass or to spray the, fertilizer.

The advantage of this solar based multi-tasking agricultural robot is that it does not require any fuel or petrol to work, as it works on the solar energy. The circuit model is less complex and compact due the use of Arduino UNO board. As Arduino is readily available so no need of developing any PCB board.

II. SYSTEM OVERVIEW

Figure shows the block diagram of our project. The system is designed for the modernization of agriculture. Description of different section of block diagram is given below-

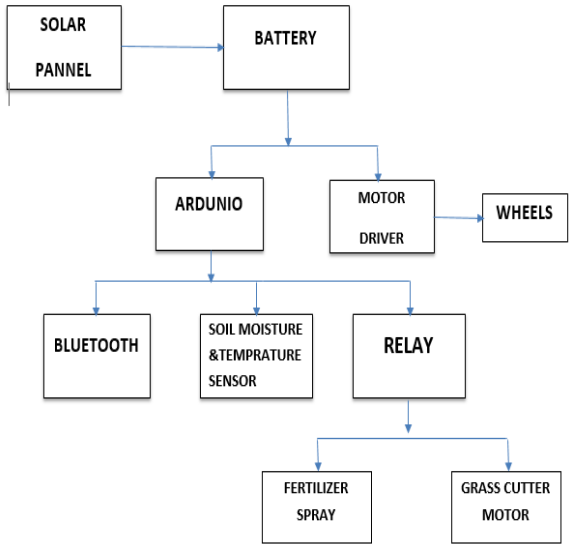

Figure 1

1. Solar Panel and Battery Section:

In this section, we are using the solar panel of 10 Watts and two 12V DC batteries. Here the solar panel is used for generating solar energy. This solar energy is then stored into the batteries. Once the energy is stored, then this energy is transferred to each and every device of the circuit.

2. Arduino Section:

Here we are using Arduino UNO Board. The reason of using Arduino UNO is that, it is the basic Arduino board which is very simple for understanding and programming. The Arduino is having the ATMEGA 328 microcontroller through which the programs are executed.

The Arduino is used for controlling the four DC motors, a Johnson motor and a motor that is used for fertilizer tank. Here the DC motors are used as the wheels of our robot, the Johnson motors is attached to a blade which is used for cutting grass and one more motor for fertilizer tank, for pumping the contents in the tank. The ON & OFF of the Johnson motor and the tank motor is controlled by the relay circuit which is also controlled by the Arduino UNO board.

The four DC motors are driven by the DC motor driver having IC called as L293d. In which the two pairs of DC motors are short circuited to each together. Where one pair of motors is out of phase with another pair of motors, so that when they are commanded for moving in left or right direction the working goes smooth.

3. Bluetooth Section:

As we know Bluetooth is a protocol. We are using here the HC-06 Bluetooth chip, for controlling the robot, which is having the range of 10 meters. It requires 5V supply for operating and is interfaced to the Arduino board through which they transmit and receive their data among each other. The Bluetooth chip is connected to the Arduino, where first they will handshake with each other and then further data is processed.

As if it transmits letter **F** then the DC motors will run in FORWARD direction, if letter **B** then it will move in backward directions. And similarly if it transmits the letters **L** & **R** then the pairs of the DC motors going out of phase will move in left & right directions.

The Johnson motor and the tank motor are also commanded by Bluetooth terminal App. Once the motors are commanded they will start their respective function of cutting grass, pumping and spraying the fertilizer, pesticide or water.

4. DC Motors:

Here we are using 4 DC motors for driving the wheels having torque of 60 rpm. A Johnson motor of 1000rpm for the blade that is used for grass cutting and one more for pumping and spraying the fertilizer, pesticide or water from the tank.

5. Sensors:

One more objective of our project is to sense and display the moisture and temperature of soil. For this purpose we are using two sensors, one is LM35 temperature sensors for sensing the temperature and displaying it and the other one is for sensing and displaying the soil moisture. Here all the data is displayed on Arduino Software.

The main purpose behind using these sensors here, is to know the adequate amount of fertilizer and pesticide that should be sprayed. One more use of moisture sensor is that it checks the moisture level in soil, and using this information we can decide the amount of water to be sprayed.

III. RESULT

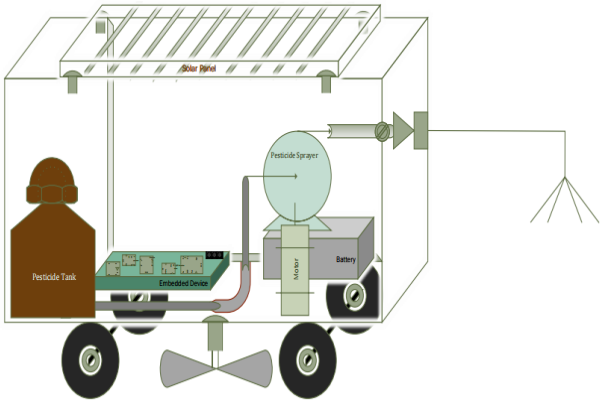

Figure 2

This is how are final model looks like as shown in figure 2. The results of are project are as follows-

1. Grass cutting.
2. Fertilizer and Pesticide Spraying.
3. Soil Analysis.

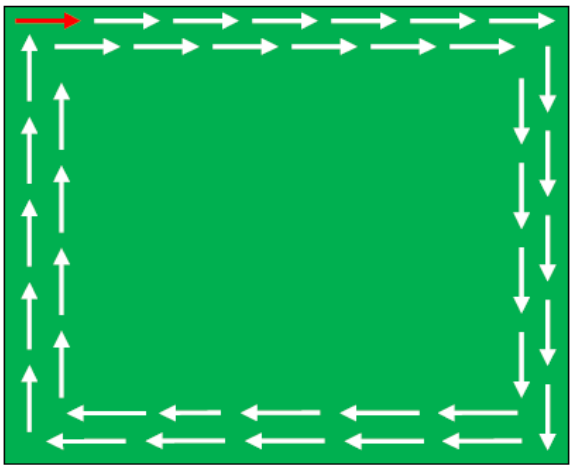

Figure 3. Grass Field Traversing Strategy

The arrows shown in figure indicates the path which is followed by our robot to perform the task that it is been commanded for. The task can be cutting grass in the field, spraying fertilizer and pesticide on crops. Here the robot is commanded using a Bluetooth Aap, to move Forward, Backward, Left and Right following the same path.

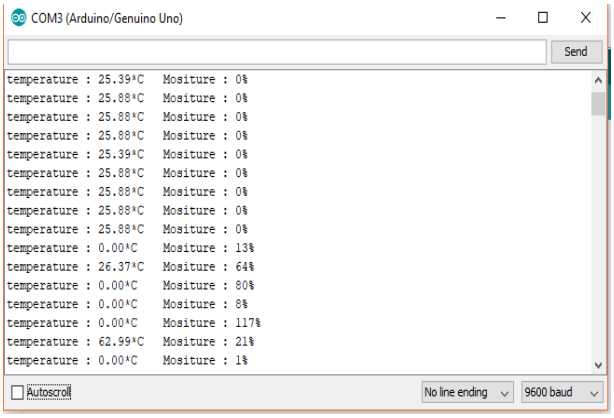

Figure 4. Window showing Temperature and moisture

The above figure shows the window of the third outcome of our system. We are using here Temperature and Moisture Sensors to dothe soil analysis. The sensors give soils temperature and moisture so as to decide the proper time and adequate type of fertilizer to be sprayed, to enrich the crops with all necessary nutrients. The advantage of using moisture sensors is that if it is detected that the moisture level of soil is very low then we can even command to spray water.

IV. CONCLUSION

Our project is entitled as'Solar Based Multi-Tasking Agricultural Robot'. The basic idea of developing this system is for the modernization of agriculture. As its name implies it is built to perform multiple tasks. The system performs four different tasks those are, cutting grass with the help of a blade, a compressor cum motor is used for spraying fertilizer and pesticides on crops, soil analysis is done by temperature and moisture sensors, which sense the temperature and moisture so as to decide a proper amount of nutrients to be sprayed using different fertilizer. All these operation are operated through Bluetooth, and this is the key function of our project which makes it stand different from all the agricultural robot available in market.

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