BLUETOOTH CUM PC CONTROLLED SOLAR LAWN MOWER WITH REAL TIME MONITORING MECHANISM

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Abstract - *Solar energy is the heat and light radiations received from the Sun. It is one of the most abundant forms of non-conventional, renewable energy source found on the Earth. It is readily available, free of cost and is pollution free. Solar energy can be harnessed to be changed into electricity and power by the use of devices like solar panels which consists of photovoltaic cells. Photovoltaic cell is an electrical device which converts sun's light into electricity by the property of photoelectric effect. By the use of solar panels we can harness sunlight to generate electricity free of cost. In this project we have used solar energy in the process of grass cutting of lawns, fields etc. The lawn mower is dual controlled first by the pc and other by the Bluetooth module. The pc controlling employs the real time monitoring system by the LabView software. LabView is used for the live coverage of the lawn / fields along with the values of voltages developed in the photovoltaic cell during the course of the day. This real time monitoring system would help to efficiently utilize the solar power developed in the system. The solar lawn mower when Bluetooth controlled can be operated from anywhere within the Bluetooth signal range by the mobile phone of the owner.*

Key Words: Solar power, Lawn mower, LabVIEW, Bluetooth control, Photovoltaic cells.

1. Introduction

 The technological advancements are mostly designed to reduce to reduce the manual work and save time and labour power. The conventional grass cutting, lawn cleaning equipments are manually handled. This project is designed to reduce the labour power required in grass cutting at residences, corporates, agricultural fields etc. The project is developed to automatically operate without any human need saving labour power and time. The lawn mower is powered by the solar energy. Solar energy is one of the most abundant forms of energy present on Earth whose efficient utilization can reduce the burden of the fossil fuels. Solar energy is pollution free thus it has no negative effect on the solar system.

Photovoltaic cells or solar cells are used to convert sun's heat and light into electricity. Solar cells work on the principle of photoelectric effect. The photovoltaic cells are made of semiconductor materials like Silicion. These semiconductor materials emit electrons when hit by the solar light consisting of protons. These free electrons when captured result into electricity.

Here the solar energy is stored in the batteries and at the same time used to drive the controlling unit used that is arduino. The arduino is interfaced with the driver motors for the cutting operation. Arduino is also interfaced with the ultrasonic sensor, the Bluetooth module and the personal computer. The output of the arduino is analysed on the computer and labview is used for the real time monitoring of the photovoltaic cells and the area of the lawn covered and the path followed.

2. Block Diagram

- The block diagram below outlays the components used in the project. Arduino is the main controlling unit of the system. An ultrasonic sensor, Bluetooth module, Solar cells, Battery, Transistor, driver motor (L293D) and motors are the other components required in this lawn mower project.

- Arduino is interfaced with the computer/laptop by the RS232 or MAX232 cable for the purpose of real time monitoring in labView.

- Solar panel is connected with battery to charge the battery by the sunlight. This in turn powers the arduino. Thus arduino gets the power supply from sunlight.

- An ultrasonic sensor is used for the obstacle avoidance while the movement of lawn mower.

- The Bluetooth module is used to control the arduino based mower through the mobile phone.
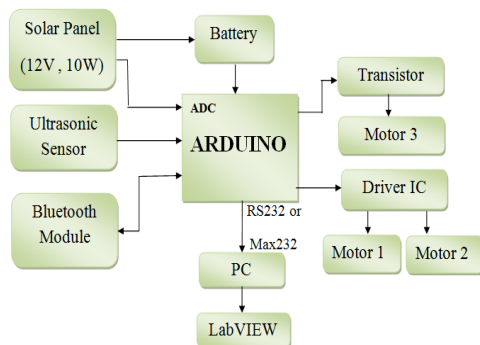
Figure 1- Block Diagram of Solar Lawn Mower.

3. Flow Chart

The flow chart below shows the steps and sequence of processes performed in the project.

The basic flow of steps are-

1) Sunlight is received on the photovoltaic cells of the solar panel. These cells emit free electrons which are turned in to solar power.

2) The solar power is stored in battery which drives the arduino.

3) The arduino gives the output which switches the transistor to give high output to the various motors attached.

4) Arduino is controlled by 2 ways-
   a) PC Control- Solar output is given to the ADC pin of Arduino. RS232/ MAX232 cables are used to connect arduino to PC with LabVIEW.
   b) Bluetooth control- Arduino is connected with the Bluetooth module which drives the unit through mobile phone.
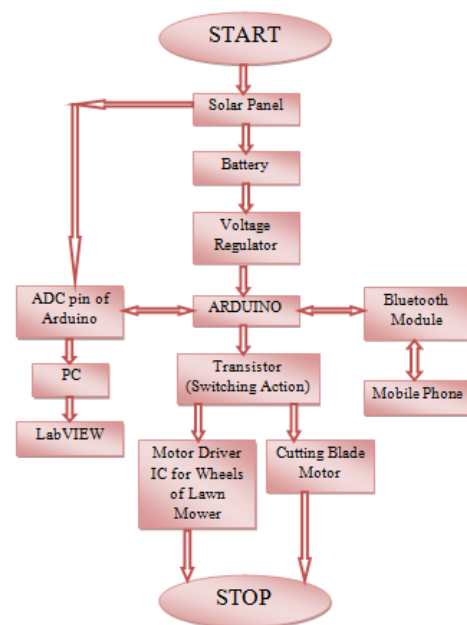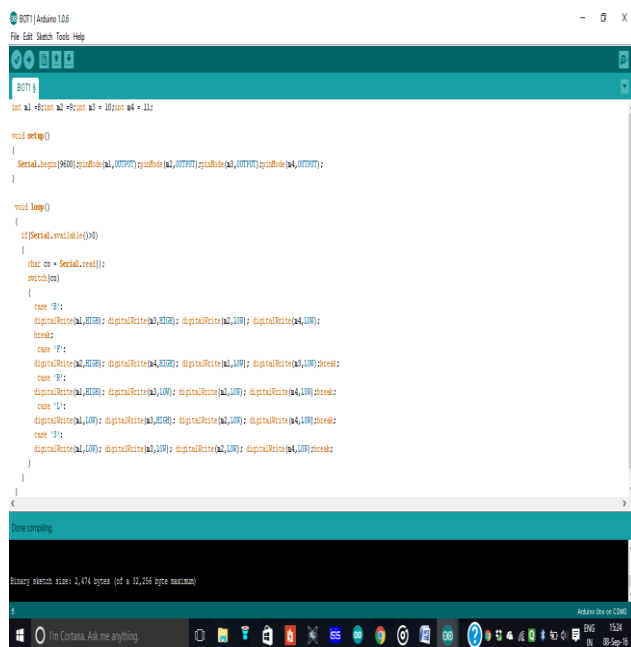

Flow chart of the project

4. Working

The solar panel which consists of photovoltaic cells generates electricity / power harnessed from sun's heat and light radiation. This generated power is stored in the battery. A voltage regulator is used to maintain a constant voltage level. This voltage is used to provide supply to the arduino. The arduino's high output is given to the transistor for the switching purpose to drive the motors and driver motor ic. The transistor switches to give high output to the motor

connected with the blade of the lawn mower. Along with this motor driver ic has one pin connected with the arduino and other with the transistor. The high pulse of driver ic turns on the motors connected with the wheels of the lawn mower. The ultrasonic sensor is also interfaced with the arduino for path finding and obstacle avoidance by the lawn mower during its motion. The lawn mower is controlled through mobile phone because of the presence of Bluetooth module or by the laptop/ computer by use of RS232/ MAX232 cable. Labview is used to take represent the photovoltaic cell voltages on the screen used for voltage versus time analysis.

5. Software Coding and Interfacing

- The controlling unit is programmed in IDE – Integrated Development Enrironment in open platform language. The controlling of lawn mower through Bluetooth module and PC is programmed in arduino.

- A part of programming for the movement of Lawn mower by the keys of laptop is shown below.

The interfacing with labview utilizes the concept of serial communication of data from arduino to pc and labview.
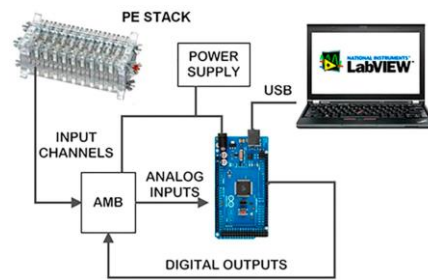

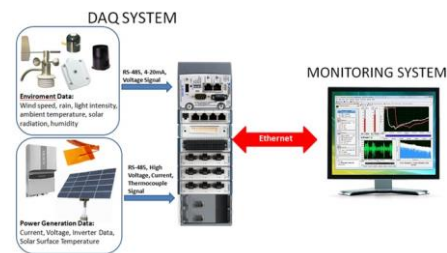Figure 2- Arduino and labview interconnection.

Figure 3 – LabVIEW monitoring of PV Cell.

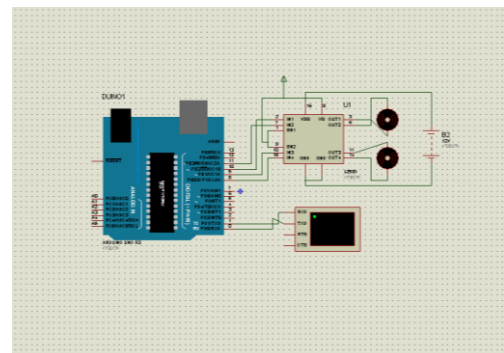- The interconnections are first developed in the software named Proteus as shown below.

Figure 4 – arduino interfacing with driving motors.

6. Advantages

1) Easy to use.
2) Small size and portable
3) Reduces manual labour.
4) Solves the problem of manual labour shortage by autonomous operation.
5) Use of solar power saves energy
6) Cost effective
7) Phone/pc controlled

7. Applications

1)   Lawn care taking in residences.
2)   For corporate offices.
3)   For cricket, football and other sports fields.
4)   For parks, playgrounds etc.

8. Results and Conclusions

The solar lawn mower project is designed to reduce the time and manual labour required for lawn clearing. The use of electronics and robotics helps by increasing the overall efficiency of the work done. The use of solar power makes this lawn mower more pollution free and cost effective. The concept of controlling the lawn mower by mobile/ pc solves the requirement of man's presence near the mowing site. The operation of movement can be governed and controlled through phone and also monitored on the computer screen through labview. The study of photovoltaic voltages is also analysed at different intervals of time throughout the day by the help of Labview.
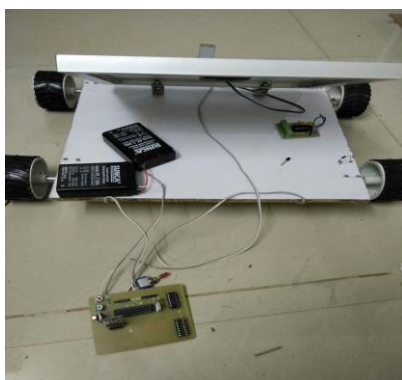

Figure 5 -Front view of the lawn mower

Figure 6 – Back view of lawn mower

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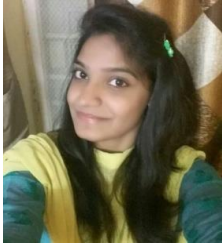
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