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Self-Efficient and Sustainable Solar Powered Robotic Lawn Mower

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Abstract- *This paper proposes solar powered vision based robotic lawn mower which is an autonomous lawn mower that will allow the user to the ability to cut their grass with minimal effort. Unlike other robotic lawn mowers in the market, this design requires no perimeter wires to maintain the robot within the lawn and also with less human effort in the manual mode operation. Here we are proposing some preset pattern installed in the robot, in the automatic mode operation no human effort needed for the operation and helps to cut different patterns in the lawn very easily with less time. Through an array of sensors safety takes major consideration in the device, this robot will not only stay on the lawn, it will avoid and detect objects and humans.*

Keywords: Solar Power, Lawn Mower

I. INTRODUCTION

Mowing the lawn with a standard motor powered lawn mower is an inconvenience, and no one takes pleasure in it. Cutting grass cannot be easily accomplished by elderly, younger, or disabled people This prototype is robotic user friendly, cost efficient, safe to use, efficient to use, and environmentally friendly. It can save significantly on labor costs. Along with the various ages of users, this lawn mower can also be used by people who have disabilities and are unable to use a regular push, or riding lawn mower. The prototype is automatic and will be powered through solar panel using batteries as secondary source. The objective of the self-propelling electric lawn mower is to extend the design of currently used lawn mowers, and to improve the capabilities of standard robotic lawn mowers as well as assuring cost efficiency. This self-propelling lawn mower design is comprised of autonomous capability that is user friendly so most consumers will be able to use this device. It is safe to use, as well as efficient because it electric powered and cordless. With these objectives mentioned, the self-propelling electric robotic lawn mower is environmentally friendly.

The rest of the paper is organized as follows. Proposed design and block diagram are explained in section II. Experimental results are presented in section III. Concluding remarks are given in section IV.

II. PROPOSED DESIGN

A. Watermark embedding algorithm –

Mowing the lawn with a standard motor powered lawn mower is an inconvenience, and no one takes pleasure in it. Cutting grass cannot be easily accomplished by elderly, younger, or disabled people. Taking into account this context we first considered a remote controlled robotic lawn mower. The first expected outcome for this project is the creation of a lawn mower that will cut via remote control, and then adapt that design to create a mower to operate autonomously The primary goal was to create a reliable and efficient robotic lawn mower that is not expensive to build and performs well. The purpose of this project is to alter the already built lawn mower in such a way that minimal effort will be required to perform the task of mowing grass. This incorporates designing all of the features necessary to perform all the tasks posed for this lawn mower to accomplish. Once a final design has been created to the standards agreed on by the group, parts for the mower will then have to be obtained. The final design will incorporate communication between both hardware and software components. The two main aspects of the project needed to be accomplished was the overall safety of the machine itself and the effectiveness to efficiently cut grass. The next objective was to automate the mower so that the user is taken out of the picture, and the user's only task is setting up the device initially. Another area which was considered was an idea which could be innovative and resource saving .For this purpose we considered the use of solar energy which earlier seemed to be a difficult task .When surveyed it was realized that solar panels are easily available and can be easily accommodated into the project. Only thing that was required was an alternate source of power with availability to be recharged .Thus, emerged up a project which satisfies the renewable concept as well as easy to use.

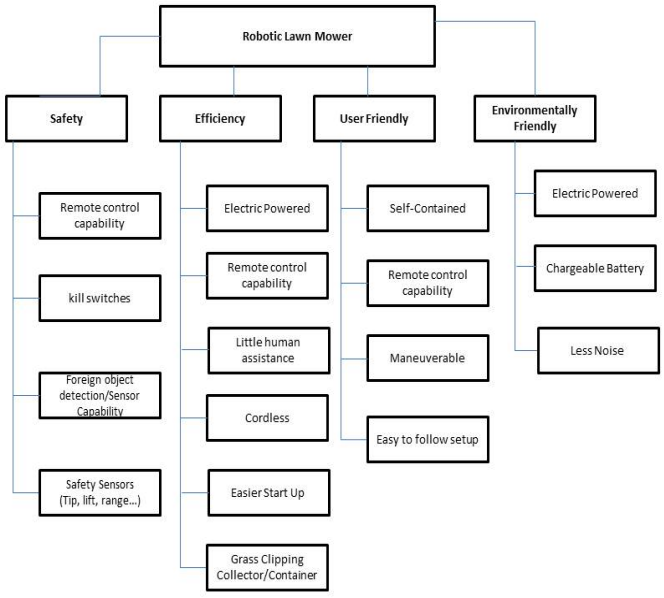


Figure 1. Research Analysis Chart

B. Block Diagram

There are different blocks are used for different function here we explain working of each block step by step.

Module 1: ATMEGA 328

It is the brain of the whole system .It control motor drivers. The high-performance Atmel 8-bit AVR RISC-based microcontroller combines 32KB ISP flash memory with read-while-write capabilities, 1KB EEPROM, 2KB SRAM, 23 general purpose I/O lines, 32 general purpose working registers.

Module 2: Motor drivers

L293dne are used as motor drivers. They are bidirectional control motors.Two set of motors drivers are used .One set driving the front two wheels while the other set driving the rear two. They are basically half-h drivers.

Module 3: Solar panel

Solar panel is the main driving source i.e. it is the primary source for the device .Solar panel used is of 12 volts and 310 amperes. They charge the lead acid battery. Solar panel consists of many solar cells. They use photovoltaic concept for charging.

Module 4: Battery

Lead acid battery is used. Battery used is of 12 volts and 1.2 mAH. They act as secondary power source and are used in the absence of solar energy. They charge through solar panel

Module 5: Motor

A total of four motors are used. Each motor is attached to one wheel. Motors used are of 100rpm .Dc motors are used. They provide torque more than speed.

Module 6: IR sensors

An array of sensors is arranged for the safety .IR sensors are used to detect the obstacles in the field. Two set of IR sensors are used one on left side while the other on right side. The whole project is automated and does not require any human effort.

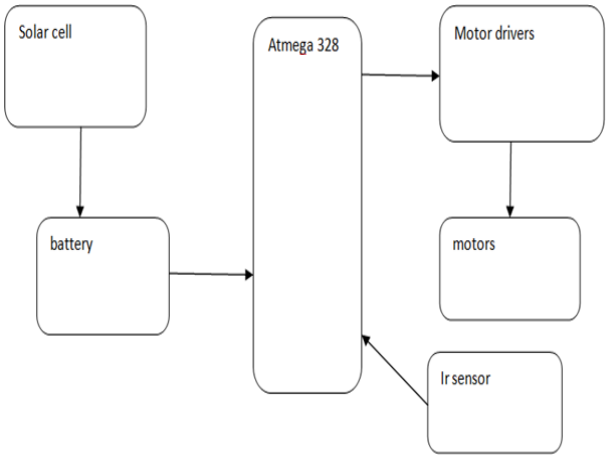


Figure 2. Block Diagram

C. Circuit Diagram and Working

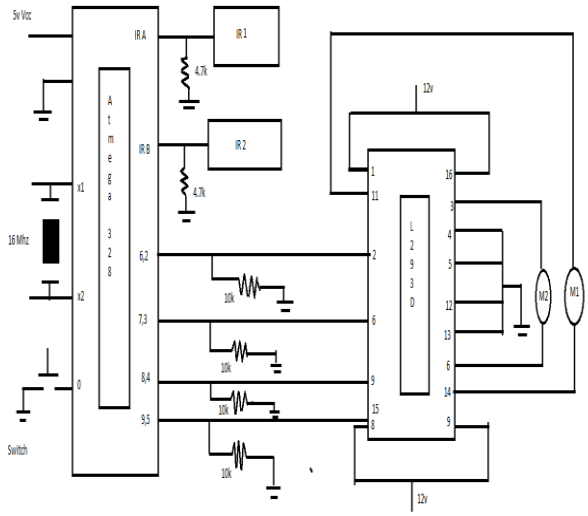


Figure 3. Circuit Diagram

In the robotic lawn mower different components are used for different functions. We explain the working of the project step by step.

The first step is to provide energy for the robot. Here we use a solar panel connected to a lead acid rechargeable battery. The solar panels provides solar energy to the battery. There are small solar cell on solar panels which take photons. Photons are what make up the light we see. Light is an electromagnetic wave that is transmitted in tiny pulses of energy. These tiny pulses of energy are referred to as photons. A solar cell is a PV cell designed a pn-junction to convert sunlight to electricity. The simplest cells consist of a circular silicon wafer with sandwiched in the middle, a metallic bottom contact (e.g. aluminum) and a transparent top contact (either a transparent conducting oxide or a grid-like metal structure).

We have used a 12v 310 mA solar panel in our project. There are 24 solar cells on the solar panel, each contributing to 0.5v each. We could attach a battery charge controller with the solar panel before connecting to battery but as the lead acid rechargeable battery used is rated 12v 1.2Ah, it won't be over charged due to the small output of solar panel. The battery as mentioned before is lead acid rechargeable battery. It is the main power source of the robot. If we keep the robot directly in sunlight, the battery will be charged in five hours. The power is then given to the IC Atmega 328 via voltage regulator lm7805. It has 3 pins, one is input, second is ground n third is output which gives 5v. 5v is given to the circuit.

To detect the obstacles, we have used IR sensors which has lm 555 IC. The 12v from the voltage regulator is connected to a push to on switch which triggers the sensors. There are two sensors: one on each side. This is because if the obstacle is on the left then it will move in right direction and if the right sensor detects the obstacle then it goes towards the left. The IR

sensors were preferred over ultrasonic sensors due to usage and cost.

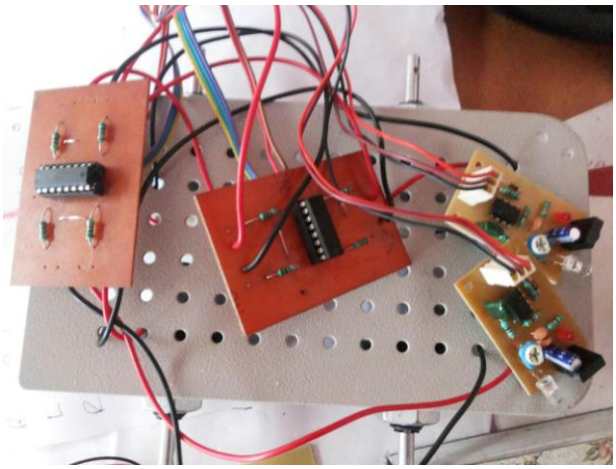
We have used 4 dc motors each for the movement of respective wheel. For cutting the grass we need more torque than speed. Hence 100rpm dc motor was selected. These were connected to the wheel hub.

To control the motor we require motor drivers. Motor driver IC L293D is used. The L293 and L293D are quadruple high-current half-H drivers. The L293D is designed to provide bidirectional drive currents of up to 600-mA at voltages from 4.5 v to 36 v. Each IC controls two dc motors. Hence two L293D IC were used. A switch is connected to drive the motors. This is because the robot should not start running as soon as the supply is given. A push to on switch does the job. To move the robot forward and backwards, we have programed our atmega 328 in such a way that if the pulse is high it moves forward if pulse is low it goes backwards.

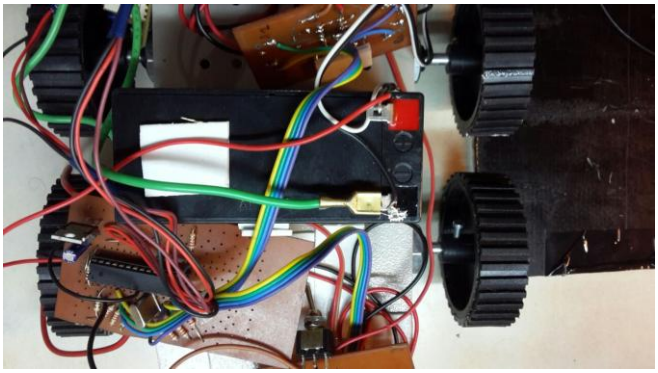
For the cutting part a separate 12v dc motor of 100rpm was used. A circular shape cutter is mounted on it .A switch is attached to the motor which is then directly connected to the power supply of lead acid battery.

III. Result and Discussions

The final robotic mower was made in three phases. The result of three phases is given as follows.



(a)



(b)

(c)

(d)

Figure 5. (a) First phase (b) Second phase (c) Pre final phase (d)Final robot

CONCLUSION

Robotics is very vast field which comes with different combinations of technology this will helps to reduce the human effort and gives maximum efficient output for the work, Nowadays lot of energy is wasted for mowing lawn in different areas of the world and also takes lots of human effort for the work. The main aim of this project is to make a solar powered automated robotic lawn mower system which will helps to mows the lawn in different design with lesser human effort. Advantages of this system are used components are of low cost so and in bulk production and adding of few more sensors doesn't makes any difference. but the disadvantage is that sometimes response of the system is too slow so in real time high end DSP processors is recommended that can process much faster. The auto controlled lawn mower provides the user with many benefits, and therefore could someday become a very profitable and marketable technology. However, most consumers are not aware of this advancement of the lawn mower. Each benefit of the previously designed lawn mowers and incorporating them into a new design of the mower that integrates a software and hardware for the use of a remote control. The safety features, reliability and cost efficiency, and the user friendliness of the mower designed will succeed the benefits of some other mowers that are present today.

Nowadays the non-renewable sources of energy are depleting and renewable sources are coming into existence such as solar energy as they are more environmental friendly.

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