

Solar Fed Automatic Weeding Rover for Grass Land Fields

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ABSTRACT

Weed management is one of the tedious operations in Gardening. Because of labor costs, time and tedium, manual weeding is adverse. Nowadays most of them spend their time in Gardening. The adoption of chemical weed control methods has environmental impacts. So, this project has been proposed that does not use any pesticides and also the system is small in size. This method was designed much easier, that the whole set up was controlled by using our mobile phones with the help of Bluetooth and another main advantage is that the system is powered by solar. This weeder will work by trimming the weeds in garden every day. By using mobile control, it is possible to maintain the time taken for the work carried out, etc. Thus, the Gardeners can now enjoy weed-free vegetable and flower gardens, without the monotony and frustration of weeding.

Keywords:- Weed management, Mobile phone control, Bluetooth, Trim weeds, No pesticides.

I. INTRODUCTION

Most gardeners would agree that weeding is one of the very worst parts of the gardening experience. For most of us, it seems as soon as those pesky weeds are cleared, new one's pop up and take their place. SAW (Solar Auto Weeder) is a solar-powered weeding robot for home gardens. It lives in the garden, and every day it charges itself up in the sunlight. When the battery is full, it will wander around the garden, avoiding plants and any obstacle taller than an inch (2.5cm). As it's doing this, it's looking for weeds, and if it finds them, it cuts them with a small weed trimmer mounted on the bottom of the robot. The SAW is also waterproof so you can leave it out in the garden to patrol until it runs out of energy. The SAW does have an energy port you can use if it has been overcast for an extensive period. Gardeners don't need to fear about small plants or seedlings as the SAW comes with an additional 'collar' you can place around your seedling so they are no longer on the chopping block.

The SAW was designed to run on dirt or mulch and can't be used as a lawn trimmer. Having a few pathways in the garden is not a problem as the string trimmer comes close to the ground, but doesn't actually hit it. It does caution, though, that we need to make sure our garden is fully enclosed so the robot doesn't 'wander' away. Weeding a garden is time-consuming and frustrating. As we get older, and it gets a little harder to bend over and pull the weeds out, it can become painful, too.

Weeder is a mechanical implement used to take away the unwanted plants in the garden. Gardening is reliant on human power. It is a time consuming process. Gardeners still follow the conventional methods for weeding purpose. These methods require high labour force to perform the operations. The main disadvantage of the modern equipment is its cost effectiveness because most of them are mechanized and driven by fuel. So they can hardly afford such costly equipment. Weeding operation was done mostly by the hands. The weeding performance of the hand tools are good but

mostly time consuming. These tools may have the chances of injuring the performer. The different postures of the workers have been studied on the basis of their working conditions on the garden. Gardening is not an easy task which includes different stages.

II. CHALLENGES IN WEEDING OPERATION

Mostly the weeds are removed from the field in a manual process as they are seen more as a negative factor for crop growth. The various aspects of weeding equipments consists of ergonomical considerations, it's easy working and easy handling by unskilled farmers, less damaging nature to crops, the distance between two crop rows, maximum efficiency, its important components like blades, critical design areas and the most important from all above is its cost of purchase. Every equipment which is used for weeding like animal drawn blade hoe, power weeder, single-multiple row weeders etc. are certainly possessing some inborn drawbacks which results in unnecessary time consumption, extra labour cost, more power requirement (manually as well as mechanically).

Some issues which were identified in weeding operations are:

1. Should have some arrangement to avoid mud stuck in between the teeth/blades, tyres, wheels,
2. Needs to have inbuilt adjustability to change the width of working,
3. Need of safeguarding the operator,
4. Should be manageable in design so that it can be easily built with less weight.
5. Should be made all weather-proof and durable,
6. Sold at cheapest price.

III. METHODOLOGY

Gardening is both time consuming and labour intensive. At the same time, it uses chemical pesticides for eradicating weeds. The proposed automatic weeding robot wanders the garden every day. It ensures weed-free garden without using chemicals. This robot uses rotating trimmer driven by DC motor to eliminate weeds.

The sensor activates the robot's weed trimmer. The proposed project does not need any fuel as it is powered by solar energy. The robot can be controlled by using mobile phones. Simply place the plant collar around seedlings to inform that his plant is wanted. This SAW (Solar Auto Weeder) will reduce the man power and ensures chemical-free gardening.

A. Hardware Design:

The power collected from the solar panel is charged to the battery via the battery charging circuit. The Arduino gets supply from the battery. The SAW wanders the garden and it trims the weed regularly. If there is any obstacle the IR sensor sends signal to the Arduino. Then the motors connected with Arduino runs and changes the path. The figure 1.1 shows the main block diagram of the proposed system.

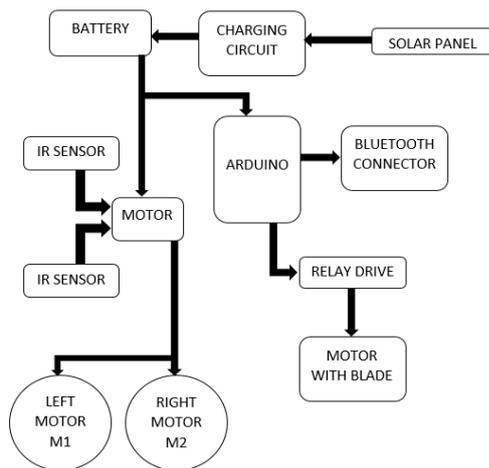


Fig1.1. Main block diagram of the proposed system

This project requires many electronic components. Following is the list of the components and also their technical specifications.

1. Power supply
2. Relays
3. Infra-red sensor
4. DC motor
5. Solar panel
6. Bluetooth module
7. L293D Motor driver
8. Arduino UNO

1.Power Supply

Available power source is an AC supply of 230V. Since our electronic circuits require only very minimal voltage and current we use step down power transformer. Step down transformer is designed in a way that the input is 230V and output of 12V. Besides the electronic circuits operate in DC whereas available output of transformer is AC of 12V. So, the rectifier circuit is used to convert AC to DC. Rectifier circuit consists of 4 diodes formed in bridge fashion so as to convert incoming AC to DC.

2. Bluetooth Module

There are three main parts to this project., a Bluetooth transceiver, an Android Smartphone and an Arduino. The Android app is designed to transmits serial data to the Arduino Bluetooth module when a button is pressed on the app. The Arduino Bluetooth module at the other end receives the data and transmits it to the Arduino through the TX pin of the Bluetooth module (connected to RX pin of Arduino).

The code uploaded to the Arduino checks the received data and compares it with previous data. If the received data is (zero)0, the LED turns OFF. The LED turns ON when the received data is 1. Now, open the serial monitor and watch the received data while connecting. This circuit is easy and small. There are only 4 connections to be made between the Arduino and Bluetooth module.

3.Dc Motor

The SAW uses 3 DC motors, one motor connected with the blade trims the weeds and the other 2 motors connected with Arduino is for changing the direction of the SAW according to the signal received from the respective IR sensors.

4.Infra-Red Sensor

In this type of remote control, as its name explains no cable or wire exits between the remote control. This wireless remote control system can be implemented using one of the following methods

- Using Radio Frequency.
- Using ultra Sonic Sound Waves.
- Using Infra-Red Light Waves

Of the above three methods the most common method is infrared method which we shall study in this section.

The LED used in the remote control system produces a special IR light beams. IR beams are special form of light which has a wavelength of the visible light. This makes the transmitted signal invisible to the naked human eye, but an IR photodiode or Photo transistor can sense this signal. The IR light Wave length is 7X10⁻⁷.

IR Led

The LED or Light Emitting Diode is an electronic device which gives off or emits light when current is passed thru it.

Like Diode LED passes current in one direction and blocks the current in the reverse direction. The LED typically requires forward operating voltage about 2v. When the LED is forward biased, part of the energy generated in the PN section is emitted as light. When the LED is used as a remote control transmitter, here the battery is the main source of current.

IR Communication

Many of today's consumer electronic devices are equipped with small hand-held remote controls. These remotes are nothing more than small wireless keypads which, when a button on the remote is pressed, send a coded signal to a receiver unit inside the VCR. The signal may be ultrasonic, radio frequency, or IR light. IR remotes are very popular because of their limited range (line-of-sight only) which reduces interference with other remote controlled devices (e.g. your neighbor's TV set). Since this project involves duplication of IR control signals, we'll limit our discussion to remotes of this type.

IR remotes generate a stream of IR light pulses which is amplitude modulated to produce the encoded signal. The VCR contains circuitry which will detect and demodulate this signal to recover the original signal specifying the command to be performed (e.g. PLAY or POWER ON). The specific of how the signals are encoded varies from manufacturer to manufacturer, and sometimes from model to model. This variation is the reason why (with few exceptions) the remote from your VCR doesn't work with your TV and vice versa. Fortunately for us, the computer doesn't need to be able to "understand" the IR signals in order to be able to learn and reproduce them, so the variations in encoding schemes won't affect us.

5.Relays

Relays are electrically controlled switches. Normally in relays, a coil pulls in an armature when sufficient coil current flows. Numerous varieties are available including "latching" and "stepping" relays.

The stepping relays provided the cornerstone for telephone switching stations, and they're still popular in pinball machines. Relays are used for dc or ac excitation, and coil voltages ranges from 5 volts up to 110 volts are common.

The primary uses of relays are in Remote switching and high-voltage (or high-current) switching. In order to keep the electronic circuits electrically isolated from the ac power line, relays are useful to switch ac power while keeping the control signals electrically isolated. The electrical relay offers a simple on / off switching action in according to a control signal. When a current flow through the coil of wire a magnetic field is produced.This field pulls a movable arm, the armature, which forces the contacts to open or close; normally there are two sets of contacts with one being opened and the other being closed by the action.This may be an electric heater in a temperature control system.A notable property of relays is that the circuit powering the coil is totally separate from the circuit switched on by the relay. Due to this property, relays

are used where a safe low-voltage circuit controls a high-voltage circuit.

6. Arduino UNO

It is a microcontroller board based on ATmega328. It consists of 14 digital input/output pins (in which 6 pins can be used as PWM outputs), 6 analog input pins, a 16 MHz ceramic resonator, a USB connection, an ICSP(in-circuit serial programming) header, a power jack and a reset button. It has everything needed to support the microcontroller. It is connected to a computer with a USB cable or power it with a AC-to-DC adapter or battery to get started. It differs from all pre-existing boards in that it does not use the FTDI USB-to-serial driver chip. Unlike, it features the Atmega16U2 (Atmega8U2 up to version R2) programmed as a USB-to-serial converter.

"Uno" stands for "one in Italian". The Uno and version 1.0 are the reference versions of Arduino, moving forward. The Uno is the latest model in a series of USB Arduino boards, and the reference model for the Arduino platform. The figure 1.2 shows the Arduino UNO board.



Fig 1.2. Arduino UNO

TECHNICAL SPECIFICATIONS

Microcontroller	ATmega328
Operating Voltage	5V
Input Voltage (recommended)	7-12V
Input Voltage (limits)	6-20V
Digital I/O Pins	14 (out of which 6 pins provide PWM output)
Analog Input Pins	6
DC Current per I/O Pin	40 Ma
DC Current for 3.3V Pin	50 Ma
Flash Memory	32 KB (ATmega328) out of which 0.5 KB is used by boot loader
SRAM	2 KB (ATmega328)
EEPROM	1 KB (ATmega328)
Clock Speed	16 MHz

7.L293D Motor Driver

L293D is a Motor Driver IC that allows DC motor to drive on both directions. It is a 16-pin IC which can control a set of two DC motors simultaneously in all direction. That is you can control two DC motor with a single L293D IC. L293D motor driver is shown in figure 1.3.



Fig1.3. L293D motor driver

It is a Dual H-bridge Motor Driver integrated circuit (IC) is used to drive small and quiet big motors as well.

IV. WORKING

Gardening is both time consuming and labour intensive. At the same time, it uses chemical pesticides for eradicating weeds. The proposed automatic weeding robot wanders the garden every day. It ensures weed-free garden without using chemicals. This robot uses rotating trimmer driven by DC motor to eliminate weeds. The sensor activates the robot's weed trimmer. This robot can easily decipher between a growing weed and garden vegetation. It relies on simple concept that weeds are super short and plants are tall. Once it identifies ground-level weeds, it begins the trimming process. If a plant is tall enough to touch the front of weeder's frame, then an obstacle avoidance sensor is activated and the robot turns away. The hardware implementation of the proposed system is shown in figure 1.4.

Simply place the plant collar around seedlings to inform that this plant is wanted. Then once your plants grow, you can remove the collar and let the weeder continue to work around your garden. The proposed project does not need any fuel as it is powered by solar energy. The robot can be controlled by using mobile application (Arduino Bluetooth control). This SAW (Solar Auto Weeder) will reduce the man power and ensures chemical-free gardening. The working hardware implementation of the proposed system is shown in figure 1.5.



Fig.1.4. Hardware implementation
Of The Proposed System

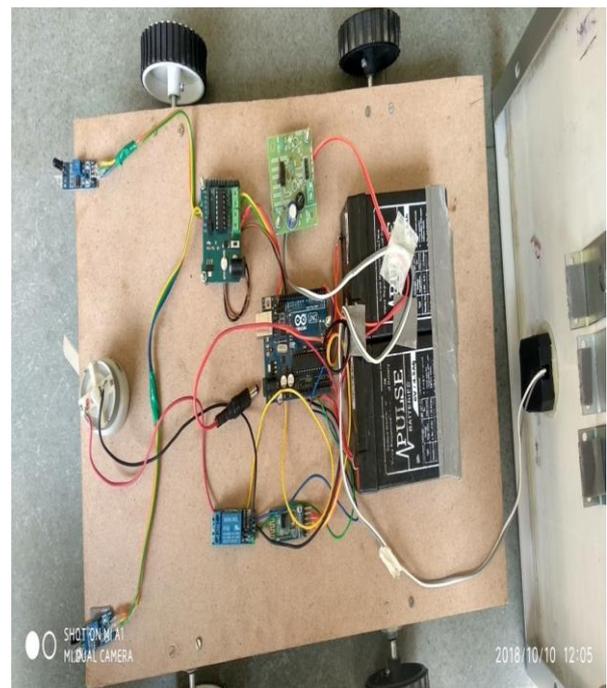


Fig.1.5. Working Hardware Implementation

IV. CONCLUSION AND FUTURE SCOPE

Conclusion

The great advantage of this proposed method is that gardeners can enjoy weed-free and chemical-free gardens. The robot is out there every day, so the weeds never have a chance to grow any taller. This project has a proper understanding of different aspects or constraints of weeders as well as different weeding techniques to reduce the efforts which were put in by gardeners in terms of money, labor, time, physical efforts for economical cultivation. Control of Blades using mobile phones and rotary blades will definitely influence the performance of the weeder. Design consideration of

equipment also has a greater impact over the performance of weeder.

Future Scope

The proposed system can be modified for future application. In advancement of weed detection process we can make use of the concept of digital image processing. At the same time, we can also use 3D data acquisition for weed removal. Further development of the technology may make it possible for a robot with similar technology to weed any field in agriculture.

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