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SOLAR BASED WEED/GRASS PLUCKING ROBOT

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ABSTRACT

The concept presented here is innovative & introduced in the field of agriculture. The main function of this robot is to remove the unwanted tiny plants or grass from the main crop, this system is very useful for farmer which avoids lot of manual work. Plucking weeds manually is very painful activity and also consumes lot of time and therefore this mechanism is designed. Since it is a prototype module, basic version of grass or tiny weeds plucking mechanism is designed with spur gears.

The moving mechanism is constructed with motorized wheels, for this purpose 30RPM motors are used. The mechanism is designed to move in all directions including reverse direction. The plucking mechanism designed with spur gears is attached with another motor shaft. Two spur gears are used and are meshed with each other, when the vehicle is moving and when the gears are rolling, the grass or tiny weeds will be removed by the gear mechanism. The demo module is constructed with small spur gears, with this the basic concept can be proved and it is not a full-fledged mechanism. With the help of a remote control unit constructed with 89C2051 Microcontroller chip & RF transmitter, entire machine can be controlled. The main processing unit arranged over the moving mechanism is also constructed with same controller chip. Relay is used to energize the spur gear mechanism and H Bridge IC is used to drive the wheel drive motors. Here both motors are controlled independently by which mechanism will be moved in all directions.

KEY WORDS: Atmel 89C2051, L293D "H" BRIDGE

I.INTRODUCTION

The weed plucking robot designed here is nothing but a remote control vehicle which can be defined as a vehicle that is remotely controlled, which moves in all directions according to the command signals received from its corresponding transmitter. The main purpose of this vehicle is to serve the formers in their agriculture fields to remove the unwanted tiny weeds. Often a radio control device and RF modules operates at a high frequency will be used. A remote control

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vehicle or RCV differs from a robot in that the RCV is always controlled by a human and takes no positive action autonomously. This project work mainly focuses about controlling of a Robot or land rover using remote using RF technology. These kinds of radio-controlled vehicles/robots are quite useful for many applications. To prove the concept for one useful application here this vehicle is designed to pluck the weeds. The weed plucking mechanism is designed with spur gears. In addition these vehicles can be equipped with other agricultural tools like plough, seed planting, etc, but since it is a prototype module and to reduce the cost, here a simple robot is constructed with weed plucking mechanism for the live demonstration which moves in all directions according to the instructions passed from the transmitter i.e., a remote. The system is designed as efficient, cost effective & easy to operate and flexible for further improvements.

Conventionally, wireless controlled robots use RF circuits, which have a limited working range, limited frequency range, limited features and limited control options. While operating in real applications for specific functions, the embedded system designed with 89c2051 controller chips used here can offer 6 control options by which the vehicle moves in all directions and in addition weed plucking mechanism also can be controlled though same remote. It provides the advantages of robust control, un-limited working range depending up on the coverage area of the wireless network, no interference with other signals. In general, any simple communication system that uses microcontroller chip transmits the digital data will be in the form of 8 bit data, this data will be changed by selecting the control key that is to be activated as a input source to the controller chip, here also same phenomena is applied for transmitting the data.

BLOCK DIAGRAM

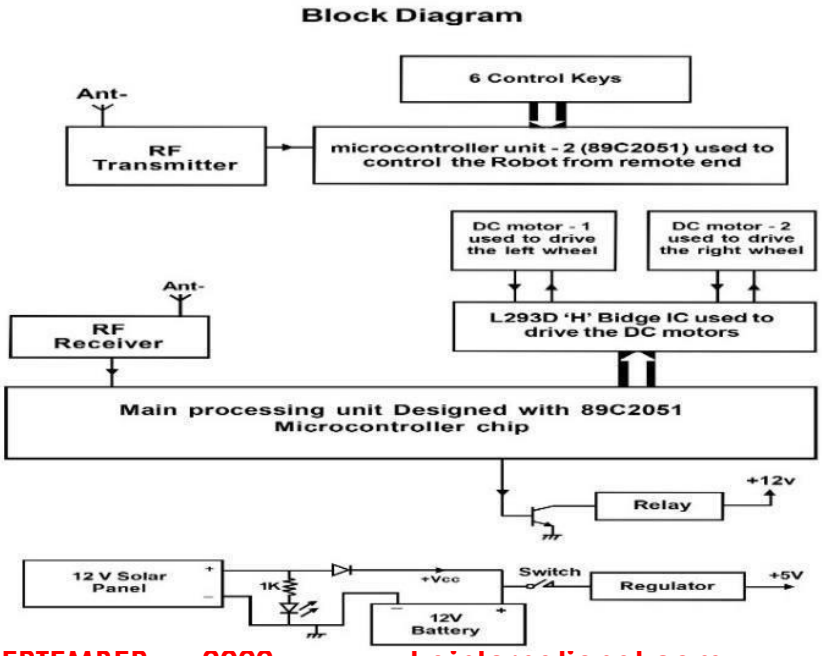

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Figure 1: Block diagram

This explains about over all function of the project work, in this regard individual blocks description as per the block and circuit diagrams will be described. The complete block diagram of the project work is shown. As per the drawings, the process starts from the solar panel, the solar panel used in this project work is rated for 0.8 Amps, means it generates a maximum power of 10 watts under the bright sun. Solar panels consisting of photo voltaic (PV) cells convert the solar energy in to electrical energy. The electrical energy produced by the solar panel is stored in the battery, and the stored energy is used to drive the weed plucking mechanism.

The most useful way of harnessing solar energy is by directly converting it into electricity by means of solar photovoltaic cells. When sunshine is incident on solar cells, they generate DC electricity without the involvement of any mechanical generators, i.e. in this system of energy conversion there is direct conversion of solar radiation into electricity. The photovoltaic effect is defined as the generation of an electromotive force as a result of the absorption of ionizing radiation. Energy conversion devices, which are used to convert sunlight to electricity by the use of the photovoltaic effect, are called solar cells.

The solar panel used in this project work is designed to deliver a maximum voltage of 18 under the bright Sun; this is known as no load voltage, when it is loaded, the voltage may fall down according to the load applied to the panel. As per the ratings specified by the panel manufacturer, when a 10watts load is connected across the panel terminals, then the voltage may fall down by less then 13V. This voltage varies according to the load applied to the panel. As the battery consumes total power when it is in discharge condition, the voltage may fall down by less then 12V, as the battery is charging slowly, the terminal voltage level boosts & charging current will be reduced gradually. As the charging current reduced, battery terminal voltage will be increased.

CIRCUIT DIAGRAM

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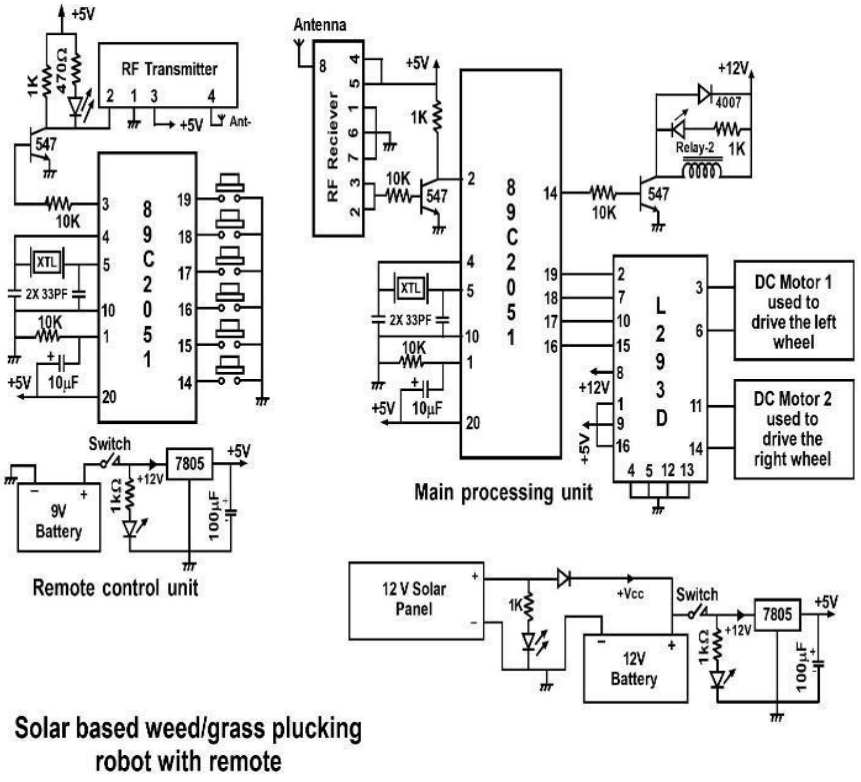

Figure 2: Circuit diagram

Weed plucking mechanism

The weed plucking mechanism is divided in to two similar sections and each section contains 2 spur gears. Both mechanisms are designed to drive through 2 DC motors and are arranged at left and right sides of the moving mechanism at front side. Each mechanism is constructed with 2 spur gears and both are equal to each other in dimensions and having similar teeth's. One spur gear is directly coupled to the motor shaft and the motor used here operates at 12V DC. This motor is rated for 30 RPM such that gears will be revolved at normal speed. The other spur gear is meshed with motorized spur gear by which both gears will be rotated in clockwise. The idea of choosing this mechanism is to pluck the grass or weeds those encountered with this mechanism. Means as the vehicle is moving in the field, the tiny weeds existed on its way and are under the mechanism will be removed. Since it is a prototype module, the basic concept will be proven practically. It is not a real working system.

L293D "H" Bridge

The motor driver package L293D is interfaced with microcontroller chip through IN1 to IN4 of H Bridge (L293D). Both the enable pins (EN1 and EN2) of

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motor driver L293D is combined together and fed to controller to access the command signals. Depending up on the command signals issued by the controller chip, the enable pins are activated to control all the four internal drivers of L293D respectively to drive two geared DC motors. Hear H Bridge is required, because the controller output is not sufficient to drive the DC motors, so current drivers are required for motor rotation.

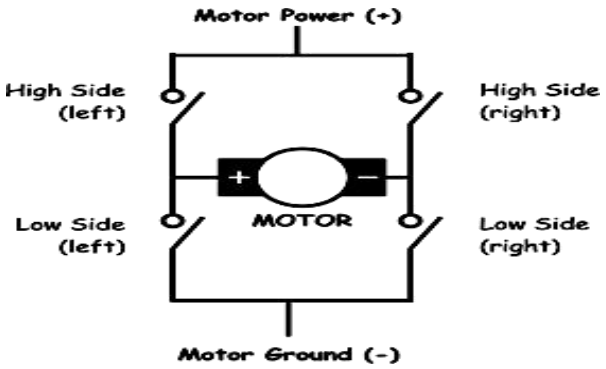

Figure 3: H-bridge connected to dc motor

The L293D is a quad, high current, half-H driver designed to provide bi-directional drive currents of up to 600mA at voltages from 4.5V to 36V. It makes it easier to drive the DC motors. The L293D consists of four drivers. Pins IN1 through IN4 and OUT1 through OUT4 are input and output pins, respectively, of driver 1 through driver 4. Drivers 1 and 2, and drivers 3 and 4 are enabled by enable pin 1 (EN1) and pin 9 (EN2), respectively. When enable input EN1 (Pin1) is high, drivers 1 and 2 are enabled and the outputs corresponding to their inputs are active. Similarly, enable input EN2 (Pin9) enables drivers 3 and 4.

Function of 89C2051 Controller

To prove the concept, here we required two embedded systems constructed with AT89C2051 microcontroller chips. At both ends of the communication system, RF transmitter and RF receivers are used and are interfaced with the controller chips for sending and receiving the data. The controller used here is a low power, higher performance CMOS 8-bit microcomputer with 2K bytes of flash programmable and erasable read only memory (PEROM). Its high-density, non-volatile memory compatible with standard MCS-51 instruction set makes it a powerful controller that provides highly flexible and cost effective solution to control applications. This is a 20pin IC.

Micro controllers are "embedded" inside some other device so that they can control the features or actions of the product. Another name for a micro controller, therefore, is "embedded controller". Micro controllers are dedicated to one task and run one specific program. The program is stored in ROM (read-only memory) and generally does not change. Micro controllers are often low-power devices. A battery-operated Micro controller might consume 50 milli watts. A micro controller has a dedicated input device and often (but not always) has a small

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LED or LCD display for output. A micro controller also takes input from the device it is controlling and controls the device by sending signals to different components in the device.

The microcontroller used in the project work belongs to ATMEL family and it is the sequence product of its mother processor known as 89C51. The following is the general and functional description about atmel series microcontrollers.

Function of Transmitter

As micro controller designed to operate at 5V DC, using regulator a stable supply of same voltage is generated. With the help of a voltage regulator of 7805, constant supply of +5V is derived. The control circuit doesn't contain any control keys, depending up on the data available from the sensors it will be transmitted as it is continuously. This is 8-bit digital data, because the controller is known as 8-bit controller. This controller is programmed to deliver fixed data and based on this data the other controller used in the receiver decodes this data and displays through an LCD interfaced with data receiving microcontroller. The output of the micro controller is modulated at 433.92 MHz frequency produced by the RF transmitter, the data delivered from the transmitter radiates in to the air through antenna. Any digital data generated by the transmitter is transmitted as it is, and once the transmitter code is finalized, according to that data receiving controller unit has to be programmed to decode the data.

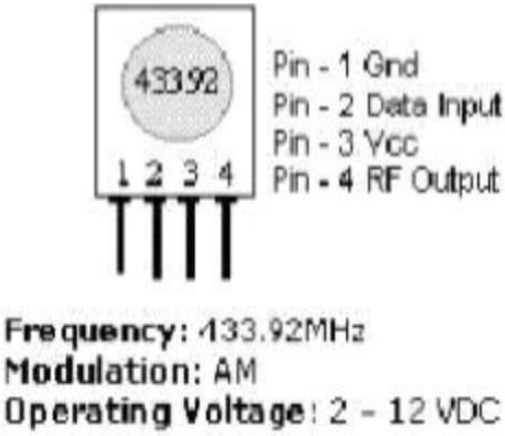

Figure 4: RF Transmitter

Pin description of Transmitter

Pin 1: Ground (-5V)
Pin 2: Input pin for data from encoder
Pin3: Supply (+5V)
Pin4: Pin for external RF antenna

RECEIVER

The data-receiving module i.e., the control unit consists of micro controller, RF receiver, H Bridge IC, DC motors, relay, etc. are interfaced with 89C2051 micro controller chip. The RF signal transmitted by the transmitter is

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detected and received by this section. This binary encoder data is sent to the decoder for decoding the original data. The receiver receives an RF signal, converts the RF signal to an IF signal, and then converts the IF signal to a base band signal, which is then provided to the base band processor. The RF receiver is coupled to the antenna and includes a low noise amplifier, one or more intermediate frequency stages, a filtering stage, and a data recovery stage. The low noise amplifier receives an inbound RF signal via the antenna and amplifies it. The RF receiver used is RWS-434. This RF receiver receives RF signal, which is in the frequency of 433.92MHz and has a sensitivity of 3µV. The RWS-434 receiver operates from 4.5 to 5.5 volts DC, and has both linear and digital outputs. The RF receiver is coupled to the antenna and includes a low noise amplifier, one or more intermediate frequency stages, a filtering stage, and a data recovery stage. The low noise amplifier receives an inbound RF signal via the antenna and amplifies it. The one or more intermediate frequency stages mix the amplified RF signal with one or more local oscillations to convert the amplified RF signal into a base band signal or an intermediate frequency (IF) signal.

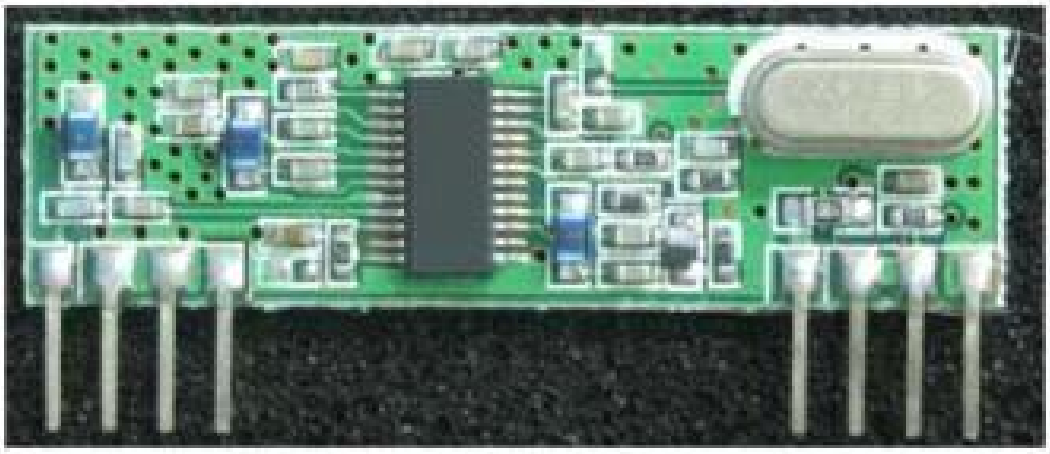

Figure 5: Pin description of Receiver

Pin description of Receiver

Pin 1: Ground (-5V)