

Renewable Energy based Land Ploughing Tractor with Wireless Control

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Abstract

The paper aims on the development of renewable energy resources is an alternate for fossil fuels. The tractor use DC motor instead of combustion engine which act as a hybrid vehicle by using power from solar panel and EB supply. The system is used for land plougher operation and soil moisture sensing and controller controls the movements of the tractor by wireless controls. Additionally the soil moisture level in the land is sensed and displayed.

Keywords: Fossil Fuel, Solar Panel, Lead Acid Battery, Soil Moisture Sensor

I. INTRODUCTION

In India nearly about 70% of people occupations depending upon agriculture system, but compared to other field globalization of agriculture system is less. In current scenario, the agriculture activities are done by a combustion engine based tractor which needs fossil fuel for operation. Availability of fossil fuel is decreasing day by day and also cost goes on increasing. So we need to move towards renewable source. Fossil fuel it produces harmful effect to environment and also results in fuel cost.

Renewable energy based system are now being employed in all automobile system. The conventional tractor design is replaced by providing solar panel and a high capacity battery equipment for delivering power to the tractor.

This paper presents advancement in agriculture vehicle system by replacing the combustion engine based system by electric motors for the purpose of obtaining pollution free and efficient operation.

It increases agriculture productivity and also sense the soil moisture content in the land. By using wireless control tractor land ploughing operation performed will increased precision and high efficiency.

II. OBJECTIVE

The main objective is to develop a renewable energy based land ploughing tractor in agriculture sector.

- To obtain optimum control of vehicle
- To eliminate the environment pollution done by combustion engine.
- To increase agricultural precise operation by providing automation technologies.
- To increase the efficiency and the solar power is used & power output can be increased.
- Usage of solar can be utilized for battery changing as robot works in field, rays of sun can be used for solar generation.

III. METHODOLOGY

Our aims to develop an agricultural vehicle to perform the land ploughing operation. The block diagram of our project is shown in fig 1. The methodologies used for this tractor is as follows:

- The frame of the wheel is connected to the DC motors through hub.
- Controller is the heart of the module which give the control signal to all the component connected in the vehicle.
- The action of module is controlled by the wireless remote (Bluetooth technology).

- The whole system is powered by solar panel which is combined with a lead acid battery.
- The soil moisture content in the land is also sensed and displayed through the remote.

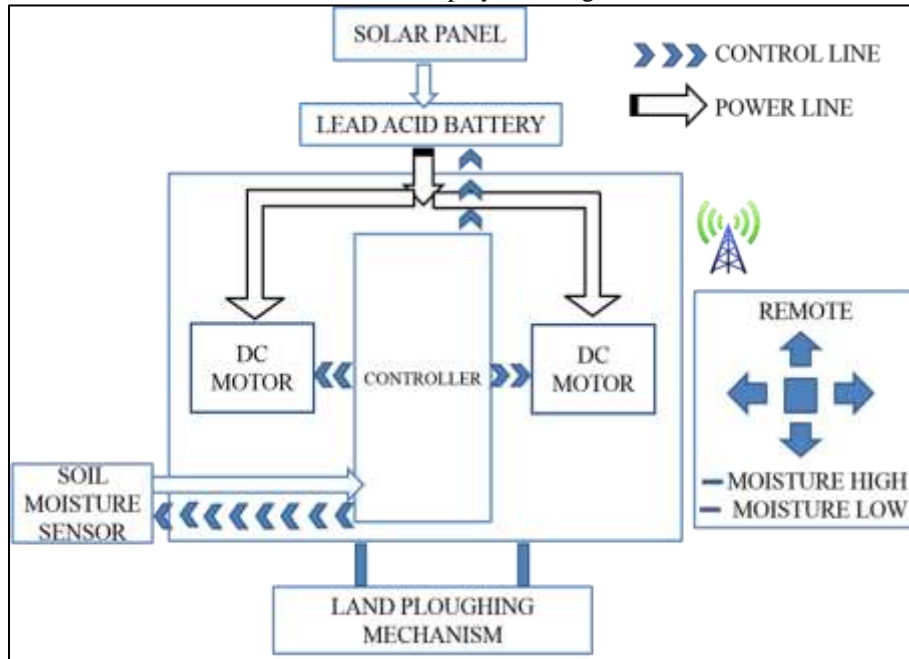


Fig. 1: Block Diagram of Renewable Energy Based Land Ploughing Tractor with Wireless Control Module

IV. MOTOR DRIVER MODULE

Motor Driver module is used to control the direction and speed of the DC motor. The input signal (5V) is received from the battery. When the controller receives the control input from the wireless remote it sends the control signal to the driver.

The motor driver gets the input from the controller it operate and generate output signal to the DC motor as shown in fig 2.

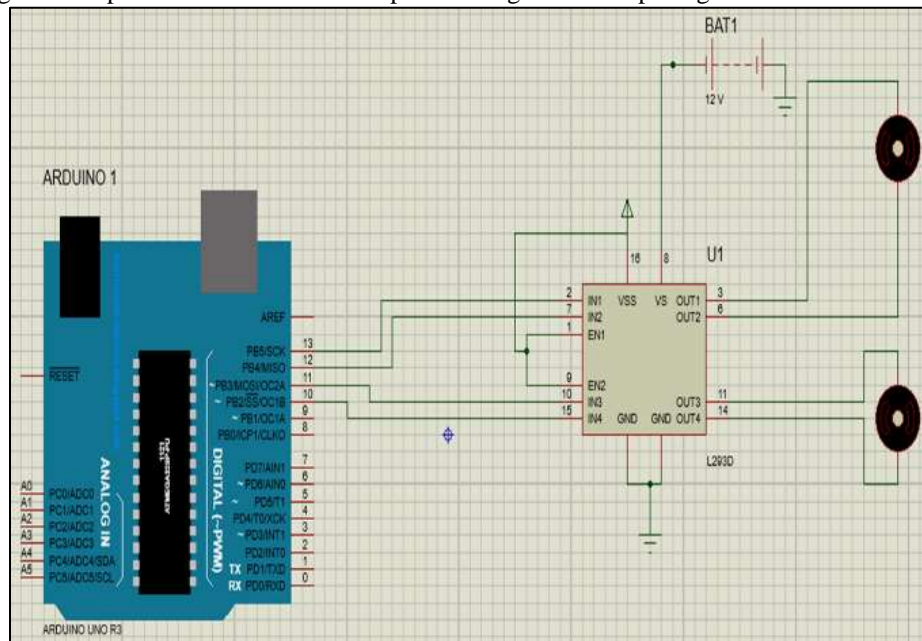


Fig. 2: Circuit Diagram of Motor Driver Control

V. SOIL MOISTURE SENSOR

The module shown in fig 3 soil moisture sensor which is used to sense the moisture content in the land and gives information to the controller and also the controller sends the control signal to the sensor. If the moisture content is high it gives indication to the farmer which can be usually seen through the remote and also if the moisture content is low it will indicate the low signal in the wireless remote usually.

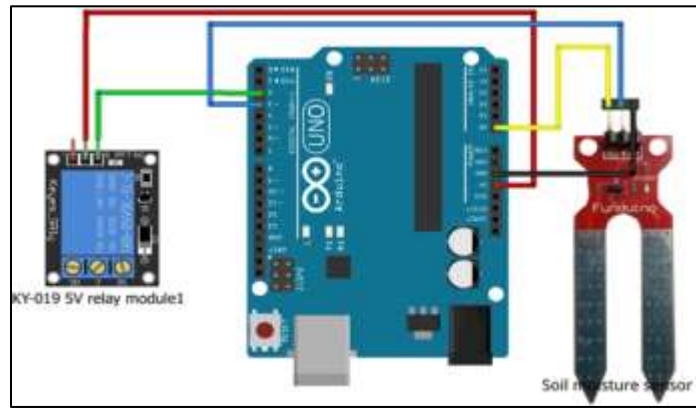


Fig. 3: Soil Moisture Sensor Module

FC 28 soil moisture sensor is a simple break out for measuring the moisture in soil and similar materials. The soil moisture sensor is straight forward to use the two large exposed pads function as probes for the sensors, together acting as a vehicle resistor thus the following table 1 shows the specifications of the soil moisture sensor.

Table – 1
Specification of Soil Moisture Sensor

Operating voltage	3.3V-5V
Size	3.2cm x 1.4cm
Comparator Chip	LM393

VI. BLUETOOTH HC-05 MODULE

Bluetooth module is used to operate the tractor module by using wireless technology. The Bluetooth module is shown in fig 4. It work using in SPP (serial port protocol) with covering a distance around 70mts. Here the controller gives the control signal and (5v) supply to the module then simultaneously the module gives the command to the remote system. Then the remote is used to control the movement of the vehicle.

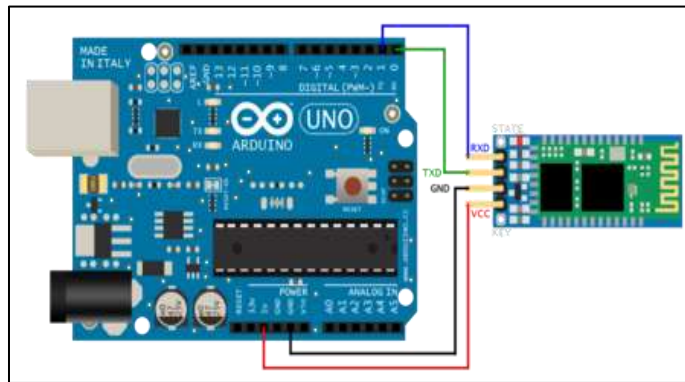


Fig. 4: Circuit Diagram of Bluetooth HC-05 Module

HC-05 module is designed for transparent wireless serial connection setup.

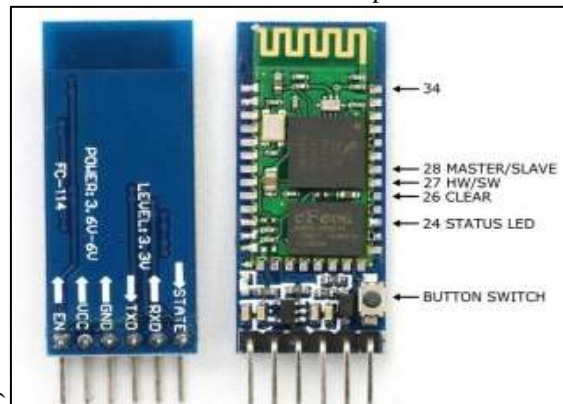


Fig. 5: Bluetooth HC-05 Module Pin Configuration

The fig 5 shows the pin description of Bluetooth module. Serial port Bluetooth module is fully qualified Bluetooth V2.0+EDR (Enhanced Data Rate) 3Mbps Modulation with complete 2.4GHz radio transceiver and baseband. It uses CSR Blue core 04- External single chip Bluetooth system with CMOS technology and with AFH (Adaptive Frequency Hopping Feature). It has the footprint as small as 12.7mmx27mm. Hope it will simplify your overall design/development cycle.

A. Specifications of Hardware Features

- Typical -80dBm sensitivity
- Up to +4dBm RF transmit power
- Low Power 1.8V Operation, 1.8 to 3.6V I/O
- PIO control
- UART interface with programmable baud rate
- With integrated antenna
- With edge connector

B. Specification of Software Features

Table – 2
Features of the Bluetooth HC-05 Module

Default Baud rate	38400
Data bit	8
Stop bit	1
Parity	No parity
Supported Baud rate	9600, 19200, 38400, 57600

In table 2 refers a software features of the Bluetooth HC-05 module.

- Auto-connect to the last device on power as default.
- Auto-pairing PINCODE:”0000” as default
- Auto-reconnect in 30 min when disconnected as a result of beyond the range of connection.
- The Schematic diagram of hardware Bluetooth HC-05 module is shown in fig 6.

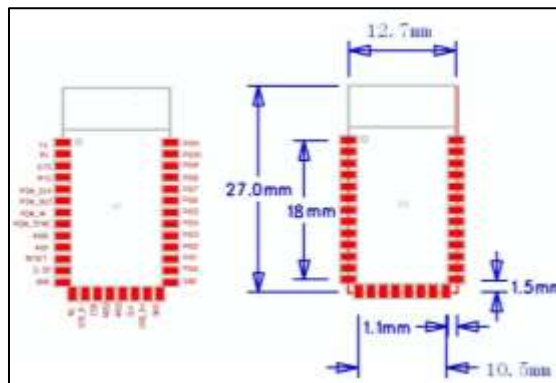


Fig. 6: Schematic Diagram of Hardware Bluetooth HC-05 Module

VII.ARDUINO UNO

The Arduino Uno is a microcontroller board based on the ATmega328 which is shown in fig 7. It has 14 digital input/output pins (of which 6 can be used as PWM outputs), 6 analog inputs, a 16 MHz ceramic resonator, a USB connection, a power jack, an ICSP header, and a reset button.



Fig. 7: Arduino UNO Module

It acts as a Heart for the module, which gives the control signal for the entire operation. The features of Arduino UNO are as following:

Table – 3
Features of Arduino UNO

Microcontroller	ATmega328
Operating Voltage	5V
Input Voltage(recommended)	7-12V
Input Voltage (limits)	6-20V
Digital I/O Pins	14
Analog Input Pins	6
DC Current per I/O Pin	40 mA
DC Current for 3.3V Pin	50 mA
Flash Memory	32 KB
SRAM	2 KB
EEPROM	1 KB
Clock Speed	16 MHz

The programs such as Motor driver control, soil moisture and Bluetooth control has be written in the Arduino and corresponding operation has been performed.

VIII. CODING & INTERFACING

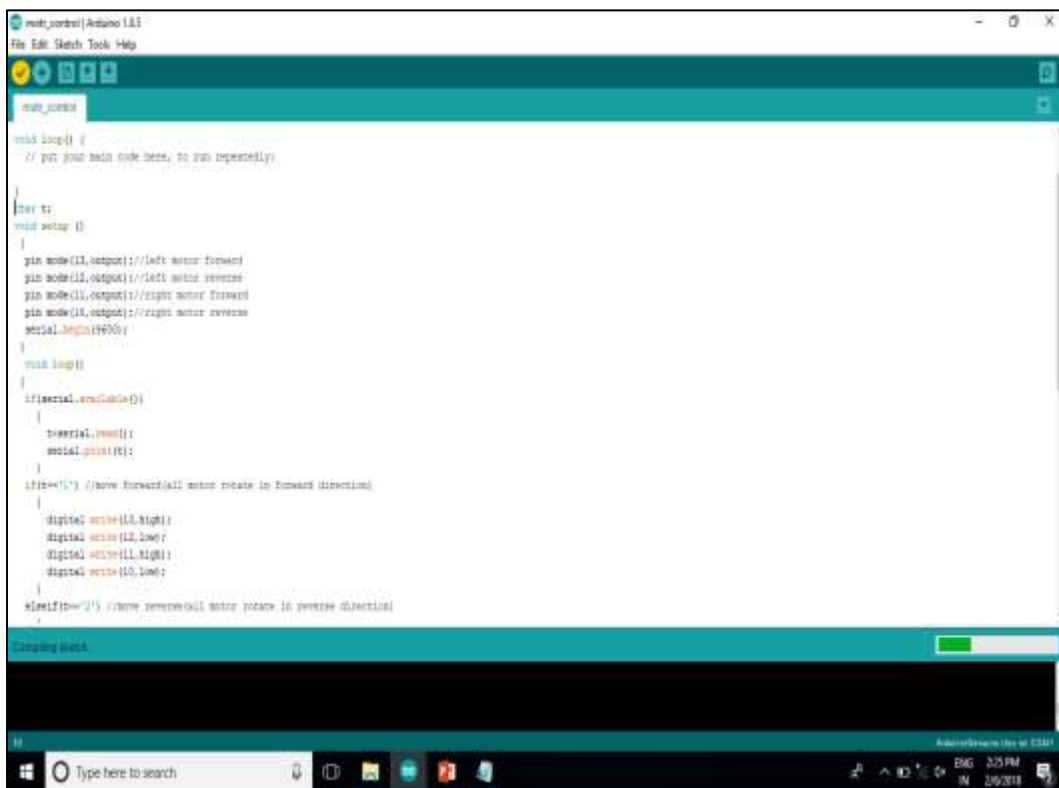


Fig. 8: Program and Coding

The program is written into the Arduino by interfacing the Arduino control with the computer. A specific software called Arduino IDE is used for writing and compiling the program is as shown in fig 8. Depending upon the program logic the movement of the vehicle.

The vehicle operation is controlled by means of Bluetooth network which is connected to an android mobile phone. By installing the Broxcode (Arduino Bluetooth control) application we can control the movement of the module. The soil moisture sensing is also displayed in mobile phone application as shown in fig 9.



Fig. 9: Mobile Control Application

IX. DC MOTOR

The Gear type DC motor used for moving the tractor module and it is placed in bottom of the motor driver control. Control information were collected from the controller and it send to the driver control. When the signal reaches to the driver control it held to drive the DC motors for that particular directions.

Motor is a 12V DC Geared motor with an output shaft and 2mm rear encoder shaft. The shaft work with our ENC quadrature encoder to allow the motor to be used in a position control application.

Thus the DC motor braking is done by driver control with the help of inbuilt H-Bridge technology. The DC motor specifications are following below the table 4.

Table – 4
Specification of DC Motor

Operating Voltage	4.5 to 18V
Startup Torque	3.6 Kg
Gear Ratio	30:1
No Load Current at 12V	0.053 Amps
Stall Current	1.5 Amps
No Load Speed at 12V	200 Rpm

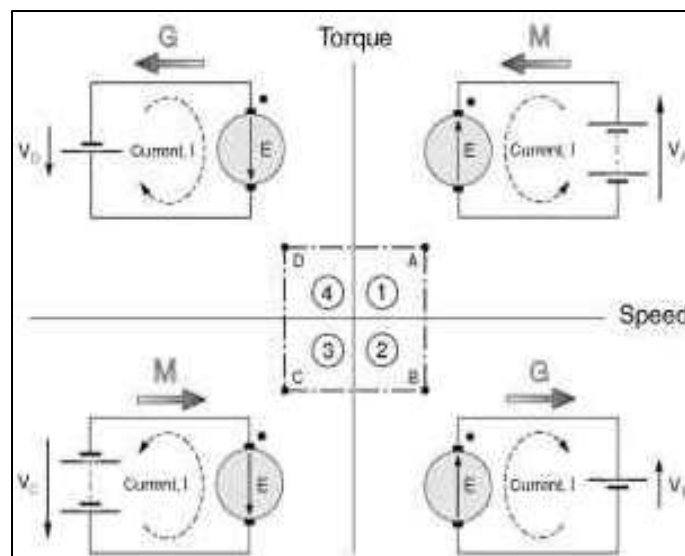


Fig. 10: Four Quadrant Operation of DC Motor

In fig 10 shown that the four quadrant operation of DC Motor under running and braking conditions.

X. SOLAR PANEL & BATTERY

Fig 10 shows the solar panel and lead acid battery. It provides the supply to the entire project the solar panel is a 100W, 12V panel having 24 series cell each cell provides 0.5V output.

The output of the solar panel is given to the lead acid battery. The lead acid battery of capacity is 12V, 6.5Ah battery.

It delivers about a maximum 6.5V amps of current to the circuit, the battery weight about 0.70kg and the manufacturing is AMPTEX.

Table – 5
Rating of Solar Panel

Rating	100 W,12V
Cell structure	36 series cells
Each cell output	0.176 V
Output current	5.78 A

In the table 5 shows the rating of the solar panel.

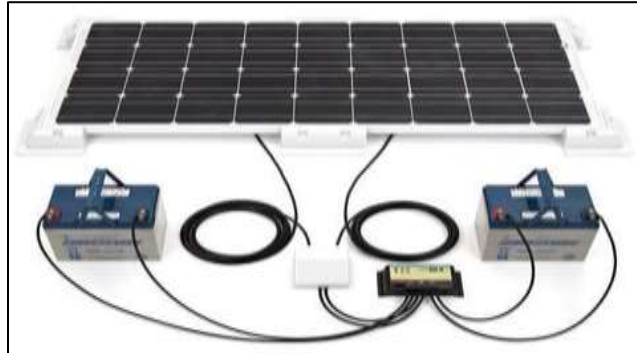


Fig. 10: Solar Panel and Battery

XI. CONCLUSION

In Agriculture, the opportunities for automation enhanced the productivity. The Electric vehicle usage is now being involved and this project pays the way such that combustion engine are going to be replaced by DC motor.

The job in agriculture such an electric vehicle can be rightly substituted. The combustion petrol vehicle is being expensive and we need some kind of source system to perform the tractor operation.

The system can be subjected to further development using advanced techniques. In this paper the implementation of tractor operated by DC motor is analysed and hardware module result is verified.

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