Solar Based Multiseed Sowing Machine

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Abstract: **In traditional method of agricultural works, the equipment used to perform above operations are expensive and inconvenient to handle. So, farmers need advance technologies to perform agricultural processes.**

The purpose of this work is to design and develop the robot which can perform operations like Ploughing, Seed Sowing, Water Sprinkling. This robot gets power supply from solar panel, so it does not need any external power supply. The whole system is controlled by android application using Bluetooth interfacing with PIC18F4520 which sends the signals to the robot for required mechanisms and movement of the robot. The ploughing of firm and plantation of seeds is automatically done by using dc motor. Constant distance is maintained for sowing of seed. Sprinkler is used to provide water to crop. It has rotating nozzles to sprinkle the water.

This robotic vehicle will minimize the labor cost, increase the speed and accuracy of the work. It includes multiple operations, so it is cost effective. Energy required for this machine is less as compared with tractors or other agricultural instruments like electric pumps.

Keywords: **Solar, Multiseed Sowing Machine.**

1. Introduction

In India there are 70 percentage of population chooses agriculture as a primary occupation [1] In the current generation we do not have sufficient skilled man power specifically in agricultural sector. A manual farming consumes more time & leads to more pollution. The main purpose for developing Automation in Agricultural field is decreasing labor and decreasing time required to perform the processes on crops so that human efforts will get reduce up to 90 percent. Automation is required for safety and health of workers especially when worker have to perform harmful duties.

Some of the previously developed robotics applications are Crop Seeding it involves autonomous precision seeding combines robotics with geomapping. Geomapping means map is generated which shows soil properties at every point on field. Crop Monitoring and Analysis is provided by drone companies like Precision Hawk offers farmer combined packages which include robotic hardware and analysis software. Other applications are Fertilizing and irrigation system, Crop weeding and Spraying system, Autonomous tractors, Picking and harvesting system.

Government of India has been taken major initiatives in agriculture sector are Pradhan Mantri Kisan Sanman Nidhi Yojana (PMKSNY), Transport and Marketing Assistance scheme to provide financial assistant for transport and marketing of agriculture product, Pradhan Mantri Krishi Sinchai Yojana (PMKSY). All these schemes are provided to give financial support to farmers in event of failure of any of the notified crop as a result of the notified crops as a result of natural calamities, pests and disease [3].

The system uses basic components like Solar panel, DC motor, Battery, Relay, Motor driver, Relay driver, Bluetooth Module and PIC18F4520 controller. The whole process is controlled by microcontroller. The solar panel is used to charge the battery. This battery used to power vehicle movement as well as to the motor that is used for grass cutting. The ploughing of field and plantation of seed is done by using DC motor. Distance between the two seeds are controlled and varied by using microcontroller. When the robot reaches the end of the field, we can change the direction with the help of Bluetooth command [4]. The advantage of this solar powered multi-function Agri-robot is that it does not require any fuel or petrol to work, as it works on the solar energy. The circuit model is less complex and compact due the use of PIC18F4520 controller.

2. Literature survey

The automation in the agriculture could help farmers to reduce their efforts. The vehicles are being developed for the processes for Ploughing, seed sowing, Grass cutter, Sprinkler. All of these functions have not yet performed using a single vehicle. In this the robots are developed to concentrate in an efficient manner and also it is expected to perform the operations autonomously. This idea implements the vehicle to perform the functions such as ploughing, seed sowing, grass cutting and water spraying. Energy required for this machine is less as compared with tractors and agricultural instrument pollution is also a big problem which is eliminated by using solar plate.

As there are no efficient equipment's to aid the farmers. There is a need for new techniques to be implemented. Previously the idea was formulated, design options were finalized. Few of them are described here.

In "Automated Seed Sowing Agribot using Arduino",

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Saurabh Umarkar and Anil Karwankar, discussed that the process of seed sowing is a key component of agriculture field. For many varieties of crops, high-precision planting has been developed for a wide range of seed sizes, resulting to uniform seed distribution in seed spacing along the travel path. Wi-Fi is used as receiver. Main drawback of the system is robot moves in only one direction. Whenever there is obstacle power supply is automatically turned off [5].

In "Agribot: Arduino Controlled Autonomous Multipurpose Farm Machinery Robot for Small to medium scale cultivation", M. D. I. Sujon, R. Nasir and Jayasree Baidya determined the effects of various seeding techniques and machines. The robot is performing farming using analogy of ultrasonic detection in order to change its position. The main disadvantage of this system is it does not work well on all types of soil [6].

3. Block diagram description

The block diagram consists of PIC18f4520 microcontroller which is controller for the whole system as shown in Fig.1, solar panel connected to the battery for storing energy and further it is given to power supply charging circuitry which is providing +5 V for pic board and +12 V supply for driving DC motors using motor driver module. Bluetooth HC05 is connected with PIC and wirelessly with Android smartphone to controlling the whole system. In seed sowing operation machine surface. The main wheels are powered by DC motor which is regulated by a switch and movement of wheels is controlled by a remote controller.
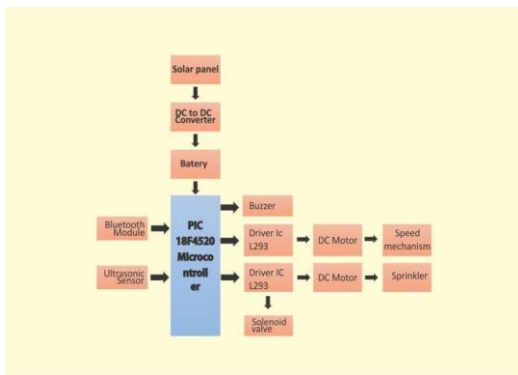
A. Components required

1) PV solar panel

The solar panels are devices that convert light into electricity. Solar panel consists of photovoltaic cells arranged in an order. Photovoltaic cell is nothing but a solar cell. Photo resembles light and voltaic is electricity. Solar cell is made by semiconductor material silicon. Solar panel is connected to DC-DC converter which charges the battery. When a light ray from the Sun is incident on the solar cell, some amount of energy is absorbed by this material. Absorbed energy is enough for the electrons to jump from one orbit to other inside the atom. The cells have one or more electric field that directs the electrons which creates current.
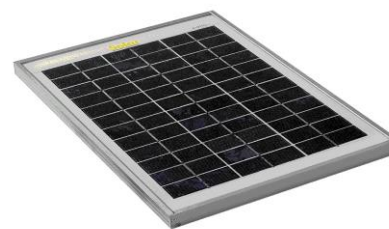

Fig. 2. PV Solar panel

Features:
Parameters:

Nominal Peak Power	5W
Maximum Power Voltage (Vmp)	18.0V
Maximum Power Current (Imp)	0.28A
Short – Circuit Current(Isc)	0.32A
Open – Circuit Voltage(Voc)	21.5V
Optimized Cell Efficiency (%)	17.2%

2) Microcontroller (PIC 18F4520)

Microcontroller is a compact integrated circuit designed to govern a specific operation in an embedded system. A typical microcontroller includes processor, memory and input/output (I/O) peripherals on a single chip. PIC microcontrollers are very popular and industrialists; this is only cause of wide availability, low cost, large user base & serial programming capability. In our project we are choosing a PIC18F4520 microcontroller because of its maximum speed, amount of RAM and sufficient number of I/O pins.
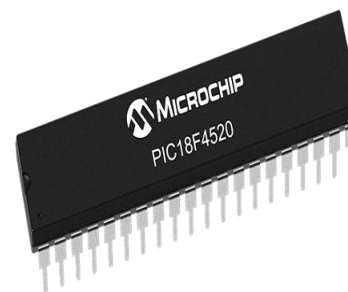

Fig. 3. PIC Microcontroller

Features:
- Operating Frequency: DC – 40 MHZ
- Program Memory (Bytes): 32768
- Program Memory (Instructions): 16384
- Data Memory (Bytes): 1536
- Data EEPROM Memory (Bytes): 256
- Interrupt Sources: 20
- I/O Ports: Ports A, B, C, D, E
- Timers: 4
- Capture/Compare/PWM Modules: 1

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- Enhanced Capture/Compare/PWM Modules: 1
- Serial Communications: MSSP, Enhanced USART
- Parallel Communications (PSP): Yes
- 10-Bit Analog-to-Digital Module: 13 Input Channels
- Resets (and Delays): POR, BOR, RESET Instruction, Stack Full, Stack Underflow (PWRT, OST), MCLR (optional), WDT
- Programmable High/Low-Voltage Detect: Yes
- Programmable Brown-out Reset: Yes
- Instruction Set: 75 Instructions, 83 with Extended Instruction Set Enabled
- Packages: 40-Pin PDIP 44-Pin QFN 44-Pin TQF

3) Ultrasonic Sensor

Fig. 4. Ultrasonic Ranging Module HC - SR04

Ultrasonic ranging module HC - SR04 provides 2cm - 400cm non-contact measurement function, the ranging accuracy can reach to 3mm. The modules includes ultrasonic transmitters, receiver and control circuit. The basic principle of work:

1) Using IO trigger for at least 10us high level signal.
2) The Module automatically sends eight 40 kHz and detect whether there is a pulse signal back.
3) IF the signal back, through high level, time of high output IO duration is the time from sending ultrasonic to returning.

Test distance = (high level time×velocity of sound (340M/S) / 2

4) LM7805
Features
- Output Current up to 1A.
- Output Voltages of 5V.
- Thermal Overload Protection.
- Short Circuit Protection.
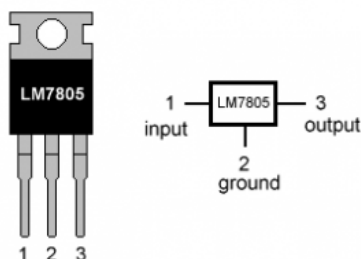- Output Transistor Safe Operating Area Protection.

Fig. 5. LM7805

Description

The MC78XX/LM78XX/MC78XXA series of three terminal positive regulators are available in theTO-220/D-PAK package and with several fixed output voltages, making them useful in a wide range of applications. Each type employs internal current limiting, thermal shut down and safe operating area protection, making it essentially indestructible. If adequate heat sinking is provided, they can deliver over 1A output current. Although designed primarily as fixed voltage regulators, these devices can be used with external components to obtain adjustable voltages and currents.

5) Battery

A rechargeable battery is a type of electrical battery which can be charged, discharged into a load, and recharged many times, as opposed to a disposable or primary battery, which is supplied fully charged and discarded after use. In our project we are using 12V-7AH lead acid rechargeable battery. By connecting a battery to the solar panel, we can store the energy generated by the solar cells and this energy can be used when required.

Fig. 6. 12V 7Ah Battery

General Features
- Absorbent Glass Mat (AGM) technology for efficient gas recombination of up to 99% and freedom from electrolyte maintenance or water adding.
- Not restricted for air transport-complies with IATA/ICAO Special Provision A67.
- UL-recognized component.
- Can be mounted in any orientation.
- Computer designed lead, calcium tin alloy grid for high power density.
- Long service life, float or cyclic applications.
- Maintenance-free operation.
- Low self-discharge.

6) DC motor

A DC motor in simple words is a device that converts electrical energy (direct current system) into mechanical energy. Here we are using three DC motors, two are used to control the position of solar panel. Geared DC motors can be defined as an extension of DC motor which already had its insight details demystified here. A geared DC Motor has a gear assembly attached to the motor. The speed of motor is counted

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in terms of rotations of the shaft per minute and is termed as RPM. The gear assembly helps in increasing the torque and reducing the speed. Using the correct combination of gears in a gear motor, its speed can be reduced to any desirable figure. This concept where gears reduce the speed of the vehicle but increase its torque is known as gear reduction. This Insight will explore all the minor and major details that make the gear head and hence the working of geared DC motor.

Fig. 7. DC motor

Specification:
- Nominal Voltage: 6V.
- Maximum Current: 115mA.
- Stall Torque: 36 g.cm
- Size: 25*15*20
- Weight: 18g
- Shaft Diameter: 2mm
- Torque: 4kg.cm

7) HC-05 Bluetooth Module

• HC-05 is a Bluetooth module which is designed for wireless communication. This module can be used in a master or slave configuration.

Fig. 8. HC-05 Bluetooth Module

Bluetooth serial modules allow all serial enabled devices to communicate with each other using Bluetooth.

It has 6 pins,

Key/EN: It is used to bring Bluetooth module in AT commands mode. If Key/EN pin is set to high, then this module will work in command mode. Otherwise by default it is in data mode. The default baud rate of HC-05 in command mode is 38400bps and 9600 in data mode.

Fig. 9. Key/EN

HC-05 module has two modes, pin description
1) Data mode: Exchange of data between devices.
2) Command mode: It uses AT commands which are used to change setting of HC-05. To send these commands to module serial (USART) port is used.
3) VCC: Connect 5 V or 3.3 V to this Pin.
4) GND: Ground Pin of module.
5) TXD: Transmit Serial data (wirelessly received data by Bluetooth module transmitted out serially on TXD pin)
6) RXD: Receive data serially (received data will be transmitted wirelessly by Bluetooth module).
7) State: It tells whether module is connected or not.

HC-05 module Information:
- HC-05 has red LED which indicates connection status, whether the Bluetooth is connected or not. Before connecting to HC-05 module this red LED blinks continuously in a periodic manner. When it gets connected to any other Bluetooth device, its blinking slows down to two seconds.
- This module works on 3.3 V. We can connect 5V supply voltage as well since the module has on board 5 to 3.3 V regulator.
- As HC-05 Bluetooth module has 3.3 V level for RX/TX and microcontroller can detect 3.3 V level, so, no need to shift transmit level of HC-05 module. But we need to shift the transmit voltage level from microcontroller to RX of HC-05 module.

8) Buzzer

Fig. 10. Buzzer

Features:
- sealed: yes
- operating power: 3-6V DC / 25mA
- extremely compact, ultrathin construction
- no electrical noise
- low current consumption yet high sound pressure level

Specifications:
- tone type: single
- operating voltage: 3-6V DC
- rated voltage: 5V DC
- current consumption: 25mA
- osc. frequency: 3.2kHz
- sound level: 87dB
- connector type: PCB
- body color: gray
- weight: 0.056oz

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9) Transistor BC547

A transistor is a semiconductor device used to amplify or switch electronic signal and electrical power. It is composed of semiconductor material usually with at least three terminals for connections to an external circuit.
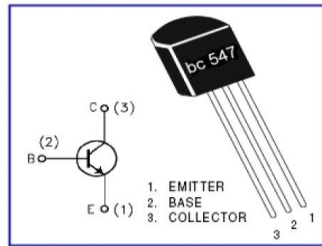

Fig. 11. Transistor BC547

10) Diode

A diode is a two terminal electronic component that conducts primarily in one direction. It has low resistance to the current in one direction and high resistance in other. The most common function of a diode is to allow an electric current to pass in one direction while blocking current in the opposite direction. This unidirectional behaviour is called rectification and it is used to convert ac to dc. Here we use 1N4007 diodes.
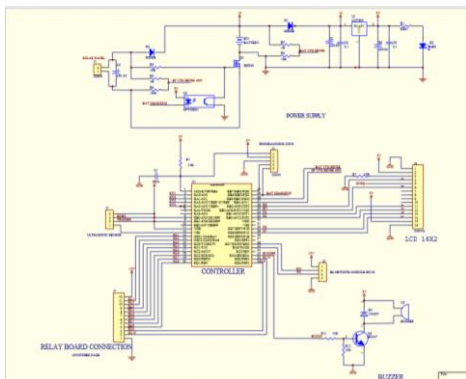

Fig. 12. 1N4007 Diode

Fig. 13. Circuit diagram of controller

4. Software Design

A. Algorithm

Algorithm of Parameter Measurement System
Step 1: Start.
Step 2: power on.

Step 3: Bluetooth ready.
Step 4: forward command received-robot move Forward.
Step 5: backward command received-robot move backward.
Step 6: left command received-robot move left.
Step 7: right command received-robot move Right.
Step 8: ploughing command received-robot Ploughing on.
Step 9: seed command received-seed motor On.
Step 10: sprinkler command received- sprinkler On.
Step 1: obstacle detected-robot stop and all Function stop.
Step 13: Stop.

MPLAB X IDE is a software program that runs on a PC (Windows®, Mac OS®, Linux®) to develop applications for Microchip microcontrollers and digital signal controllers. It is called an Integrated Development Environment (IDE), because it provides a single integrated "environment" to develop code for embedded microcontrollers.

MPLAB X Integrated Development Environment brings many changes to the PIC® microcontroller development tool chain. Unlike previous versions of the MPLAB IDE which were developed completely in-house, MPLAB X IDE is based on the open source NetBeans IDE from Oracle. Taking this path has allowed us to add many frequently requested features very quickly and easily, while also providing us with a much more extensible architecture to bring you even more new features in the future.

B. Advantages

- To reduce Farmer efforts.
- No wastage of water.
- Less time consumption.
- Row to row spacing can be adjusted.

C. Limitations

- Robot has to provide external power supply in rainy season because solar plate is used for power generation.
- This system works only initial process of planting of any crop.

D. Applications

- Agricultural field.

5. Conclusion

This robot is designed basically for the agricultural field and lawn purpose. This will help farmers for cutting unwanted grass, water sprinkler, sowing seeds, which reduce the human efforts and work is done simultaneously as per the requirement. This is the low-cost machine, which is easy to handle. By using solar energy, battery is charged and work can be done as per the

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command. It also reduces the labour cost. By the use of machineries in this field save time, increase efficiency and indirectly increase the production in farms.

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