

Solar Powered Seed Sower Machine

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Abstract- In our country 98% of the contemporary machines use the power by burning of fossil fuels to run IC engines or external combustion engines. This evident has led to widespread air, water and noise pollution and most importantly has led to a realistic energy crisis in the near future. Now the approach of this project is to develop the machine to minimize the working cost and also to reduce the time for digging and seed sowing operation by utilizing solar energy to run the robotic machine.

In this machine solar panel is used to capture solar energy and then it is converted into electrical energy which in turn is used to charge 12V battery, which then gives the necessary power to a shunt wound DC motor. This power is then transmitted to the DC motor to drive the wheels. And to further reduction of labor dependency. Seed sowing and digging robot will move on different ground contours and performs digging, sow the seed and water the ground after closing.

Keywords- IR Sensor, Hopper, Seed Spacing, Solar Panel, Driller, Microcontroller, Bluetooth Module.

I. INTRODUCTION

Manually seed plantation method suffers from various problems. The tendency of manual work is going on reducing. The man power shortage is one of the biggest problems faced continuously to all farmers. Due to labour shortage the plantation cost should be increased. So it is not economically beneficial for all farmers.

Innovative idea of this paper is doing the processes of digging and seed sowing of crops and covering the land automatically so that human efforts will get reduce up to 90 percent.

Our system is nothing but the four tyre vehicle which is driven by geared DC motor. According to microcontroller program, after some distance or some time instant the seed should be dropped through the nozzle, which is operated by relay. Nozzle size is depends on the diameter of the seed. Same operation is repeated after some time delay. So there is no more labour work. It gives information about weather conditions for

seed plantation. Hence all the problems of conventional method are overcome by using this system.

Innovative Agricultural Robots or Agribot is a robot deployed for doing agricultural purposes. Pollution is also a big problem which is eliminated by using solar panel. The energy needed for robotic machine is less as compared with other machines like tractors or any agriculture tools; also this energy is getting from the solar energy which is found abundantly in nature.

Nowadays robotics technology plays a paramount role in all Sections like medical field, industries and various organizations. In other countries robots are used to perform different operations in the agricultural field. The main application area of robots in agriculture is at the harvesting stage and Seed Sowing Stage. Driverless robots are designed to replace human labor. The data logger through WiFi module on web server increases the effectiveness of the system so that surveillance of all actions will be maintained. The Agribot developed in this paper performs digging, seed sowing and covering seeds simultaneously and powered by solar panel with a control of Android Application. Also, every movement is monitored on web server as well as on Android Application from anywhere. The future scope for this paper is to handle seed sowing operation automatically, without disturbing the main course of the system.

II. LITERATURE SURVEY

Mahesh Pundkar, "A Seed Sowing Machine: A Review" International Journal of Engineering & Social Science ,Volume 5,Issue 2,Page 181-186,Feb 2016. ISSN: 2249-9482.

This research paper present "Agriculture Seed Sowing Equipment: A Review". The present review provides brief information about the various types of innovations done in seed sowing equipment. The basic objective of sowing operation is to put the seed and fertilizer in rows at desired depth and seed to seed spacing, cover the seeds with soil and provide proper compaction over the seed. In this multipurpose seeding machine equipment consists of cylindrical shape container in which the seeds can fill. The container is attached on the four wheeled carrier assembly. It consists of metering plate bevel gear mechanism and two holes at the bottom depending on

seed size. The working as plate will rotate in container when the bottom holes of container and meter plate hole coincide seeds will flow through pipe to soil. Here the metering plate gets rotating motion by bevel gear assembly and the bevel gears get the motion by rear wheels with the help chain and sprocket assembly[1].

Vipul Pote & Akshay Bhosale, “Review Paper on Smart Automated Multipurpose Agricultural Robot” International Engineering Research Journal, Volume 2, Issue 1, Page 71-74, 2016. ISSN: 2395-1621.

This research paper presents design modification in multipurpose sowing machine. In this they present that for sowing purpose we import the machinery which are bulk in size having more cost.

To prevent this they design multipurpose sowing machine which consists of hopper, seed metering mechanism, ground wheel, power transmission system, seed distributor, and driller. The main objective of this project is to design and fabricate a smart seed sowing robotic vehicle which can automatically sow seeds in the field based on variable pitch which is given as input by the farmers using the keypad present on the robot. It make this vehicle Solar powered so that it can be charges using the solar energy. It also incorporate the Insecticide spraying feature in the robotic vehicle which permits it to be used to spray insecticides. This machine adds the Soil moisture monitoring system which displays the soil moisture content to the farmer using the display provided on the robot [2].

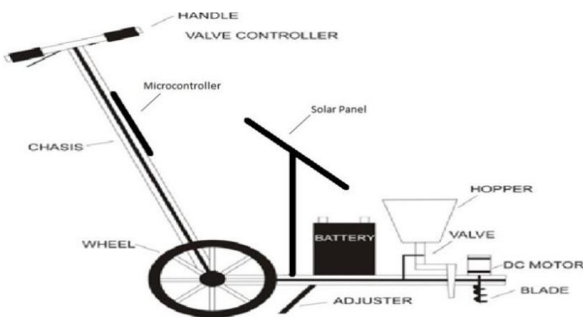


Fig.1: Oldest Model of Seed Sower Machine

A.Mohalkar, “Automatic Seed Sowing Machine using Solar Panel” International Journal of Innovations in Engineering Research & Technology, Page 61-64, 2017. ISSN: 2394-3696.

This research paper presents information about modern globalization; many technologies are to update a new development based on automation which works very rigidly, high effectively and within short time period. The basic objective of this project is is to saw the seed in row at the required depth and maintain the distance between two seeds. Solar panel is used to capture solar energy and then it is converted into electrical energy. This energy is used to charge 12V battery which is utilized by DC motors. We enter the distance between two seeds trough keypad. LCD is used to display the battery level. By using this innovative project of seed sowing machine we can save more time required for sowing process and it also reduces laborer cost. This machine controls the seed depth and proper utilization of seeds to reduce the wastage of seeds [3].

This paper is organized into four sections. Section I gives the introduction and literature survey of systems developed so far. Section II depicts theory related with seed sowing and the advantages of agribot and disadvantages of traditional sowing methods. Section III and IV delivers circuit designing, hardware components and working principle. Section V and IV delivers the experimental results and conclusion.

III. THEORY OF SEED SOWING

In seed sowing there is the basic operations needed to get better outcomes from agriculture field. Manual sowing should not give adequate spacing between row to row. Hence, it is a necessary for appropriate seed drill for sowing. Indian farmer perform agriculture mostly with manual operation. Thus this project deals with design and fabrication of a smart Automated Robotic vehicle for Indian farmers.

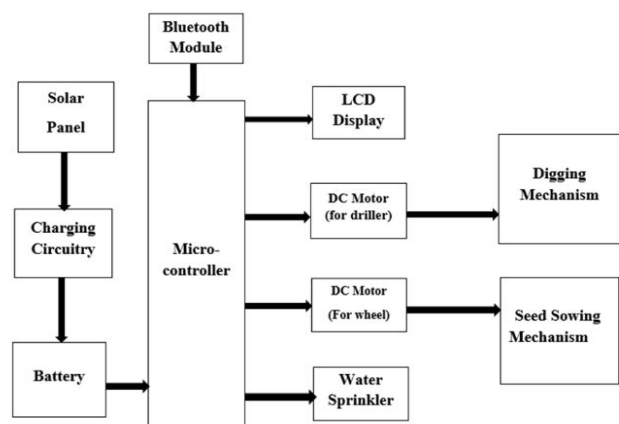


Fig.2: Block Diagram of Seed Sower Machine

A solar panel is a device that collects and converts solar energy into electricity or heat or mechanical work. Solar energy is first used to charge a storage battery. An electric battery is a device consisting of one or more electrochemical cells that convert stored chemical energy into electrical energy. The solar energy stored in the battery is utilized to operate DC motor. A DC motor is a device that converts direct current (electrical energy) into mechanical energy. By using the bevel gear and Chain drive with sprockets power is transferred to the wheels for their movement. LPC2148 Microcontroller is used to automatically control the machine. Bluetooth module are fitted to the machine for automatic turning operation and to sense the obstacle in the moving path.

IV. CIRCUIT DESIGN AND HARDWARE

The block diagram of Agrirobot consists of Arduino Nano which is controller for the whole assembly as shown in Fig. 1 and solar Panel is attached with the lead-acid battery for storing energy and further it is given to power supply circuitry which is providing 3.3V to Arm microcontroller and +12V supply for driving DC motors using 1293. Optical Compass Sensor HMC5883L is used for Compassing and ultrasonic sensor HCSR04 is used for Obstacle detection. Servomotor is used for Seed Sowing and Bluetooth module HC05 is connected with Microcontroller and wirelessly with Android Smartphone to controlling the whole assembly. The hardware of agrirobot is mounted on Chassis which is 28cm long and 22.5cm wide. All the hardware components and their features are explained below:

A. Microcontroller

In our project we are using ARM7 microcontroller. The LPC2148 microcontrollers are based on a 32-bit ARM7 TDMI-S CPU with real-time emulation and embedded trace support, which combine microcontroller with embedded high-speed flash memory ranging from 32 kb to 512 kb. Due to their tiny size and low power consumption, LPC2148 are ideal for applications where robust communication needed.

- 32-bit ARM7 microcontroller in a tiny LQFP64 package.
- 8 kB to 40 kB of on-chip static RAM and 32 kB to 512 kB of on-chip flash memory.
- 128-bit wide interface/accelerator enables high-speed 60 MHz operation.

Prototype of the solar operated automatic seed sowing machine developed has the following Performance characteristics: Working speed of the machine depends upon the DC motor and energy stored in the battery. Prototype Machine can dig the soil in three rows up to 5 inch by rotating the digging tool by the help of DC motor. Digging speed depends on the moisture content in the soil and tool tip. At the same instant from the seed dropper seed is placed in all the three rows at a distance of 4 inch. No. of seed placing at an instant can be varied by altering the size of holes in the dropper.

B. Bluetooth Module

Bluetooth to Serial Port Module HC-05 module is an easy to use Bluetooth SPP (Serial Port Protocol) module, designed for transparent wireless serial connection setup. Serial port Bluetooth module is fully qualified Bluetooth V2.0+EDR (Enhanced Data Rate) 3Mbps Modulation with complete 2.4GHz radio transceiver and baseband.

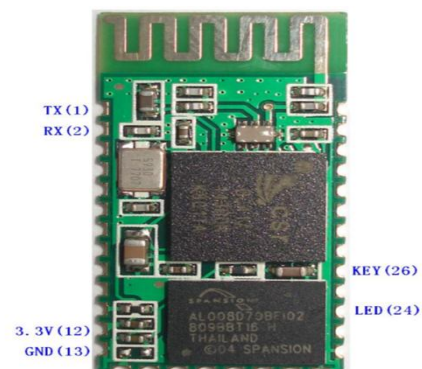


Fig.3: Bluetooth Module

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. After connect the Bluetooth module, scan for new devices from the PC and you will find the module with the device name "HC-05", after that, click to connect, if some message appears asking about "Pairing code" just put "1234" as default code.

C. DC Motor

A DC motor in simple words is a device that converts direct current (Electrical Energy) into Mechanical Energy. It's

of vital importance for the industry today and is equally important for engineers to look into the working principal of DC motor in details that has been discuss in these article. In order to understand the operating principal of DC motor we need to first look into its constructional feature.

The very basic construction of a DC motor contain a electrical current carrying armature which is connected to the supply end through commentator segments and brushes and place within the north south poles of a permanent or un electromagnet as shown in the diagram below:

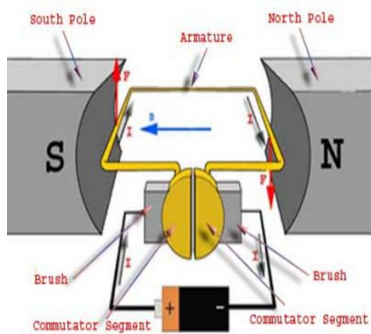


Fig.4: DC Motor

F. Solar Panel

A solar panel is a set of solar photovoltaic modules electrically connected and mounted on a supporting structure. A photovoltaic module is a packaged, connected assembly of solar cells. The solar panel can be used as a component of a larger photovoltaic system to generate and supply electricity in commercial and residential applications. Each module is rated by its DC output power under standard test conditions (STC), and typically ranges from 100 to 320 watts. The efficiency of a module determines the area of a module given the same rated output - an 8% efficient 230 watt module will have twice the area of a 16% efficient 230 watt module.



Fig.5: Solar Panel

Polycrystalline PV cells connected in a solar module. Solar modules use light energy (photons) from the sun to generate electricity through the photovoltaic effect.

The majority of modules use wafer-based crystalline silicon cells or thin-film cells based on cadmium telluride or silicon. The structural (load carrying) member of a module can either be the top layer or the back layer. Cells must also be protected from mechanical damage and moisture. Most solar modules are rigid, but semi-flexible ones are available, based on thin-film cells.

G. IR Sensor

The circuit shows that the output of IC1 555 IC, which is designed for a duty cycle of 0.8mSec, with a frequency Of 120Hz and 300 mA peak current, is used to drive the infra red LED,D1.From the connection it is clear that the diodes D1 and D2 are on the same line,just a few centimeters apart, on the breadboard.Thus diode D2 receives the infra-red output from the diode D1.The diode signal, which is given to the inverting terminal of the op-amp IC LM 358 gets amplified and its peak is detected by diode D4 and capacitor C4.The forward voltage produced by diode D4 is compensated by diode D3 with R5 and R6.According to the distance between the infra-red transmitter and receiver, a proportional DC voltage is fed to the inverting input of IC2.According to the output of the comparator the LED is turned ON and OFF and this is detected by the transistor Q1.Thus the relay is driven according to the output of Q1.

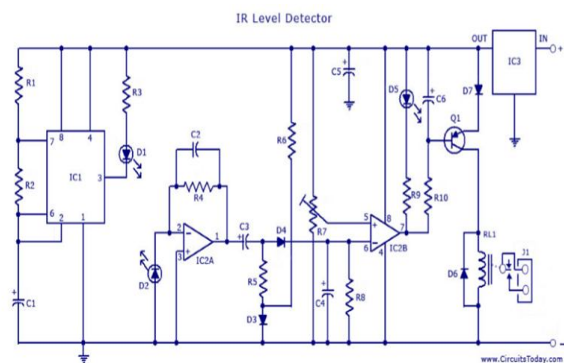


Fig.6: Circuit Diagram of IR Sensor

The comparator output is set according to the value of the pot. This circuit is mainly used for liquid level detection or proximity detection. It operates detecting the distance from the target by reflection of an infra-red beam.The biggest advantage of this circuit is that there is no physical contact with the liquid whose level is to be measured.The range is set by adjusting the pot.Range can vary, depending on infra-red transmitting and receiving LEDs used and is mostly affected

by the color of the reflecting surface. Black surfaces lower greatly the device’s sensitivity.

V. WORKING PRINCIPLE

We enter seed to seed spacing distance through keypad. After providing this distance wheel’s motors start to rotate in clockwise direction then machine will start. These motors will stop after covering the provided distance then digging motor will start.

Machine will dig the soil through mechanical assembly and stop the digging motor. At the same instant seed dropper motor starts to rotate. Seed is dropped in pit and cover the seed with soil. This process is continuously repeated till one row is completed.

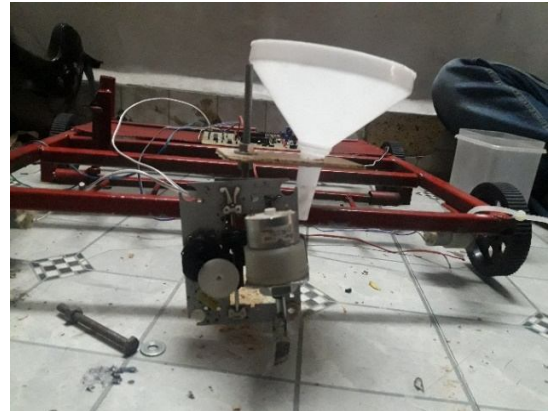


Fig.9: Hardware of Seed Sowing Module

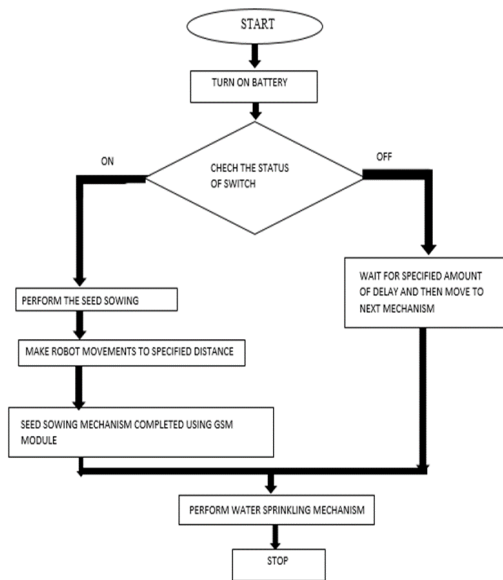


Fig.8: Design Flow of Seed Sower Machine

VI. RESULTS

The proposed system gives a compact, low power and low cost system with an efficient output. The Table III shows the placement of seeds in three different contours effectively by controlling agribot in 15m track to get the expected results.

TABLE I: RESULTS OF SEED PLACEMENT

Placement of seed by Agribot (distance between two seeds)	Farm land	Grassy Land	Hard surface
Soybean seed (expected 5-6 cm)	5.3cm	5.2cm	5cm
Jowar seed (expected 10-12 cm)	10 cm	11 cm	10.5cm
Wheat seed (expected 8-10 cm)	9cm	8 cm	8.7 cm
Pulses (expected 6-8 cm)	7.2cm	8cm	7 cm

As the Agribot is serving all the necessary requirement of farmers, it will be the great initiative and contribution to the society.

Hence the Agribot gives near about 93 % accuracy regarding placement of seeds. The graph of obstacle distances, battery and panel voltages graph with respect to time are attached in results with the help of dashboards created in Adafruit Io web server using the concept of Internet of things as shown in Fig. 9, 10 and

VII. CONCLUSION

This Automated seed sowing Agribot has considerable potential to increase productivity. The chassis handles the complete weight of solar panel, battery and the hardware mounted on Agribot which is able to perform each and every operation skillfully and successfully. Seed sowing operation results are observed with precision using different ground contours. All the data collected from agribot sends on Adafruit-IO Server and controls using Android Application successfully.

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