

Solar Powered Seed Sowing and Fertilizer Spraying Robot with Wireless Control

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Abstract - Agriculture is the major sector in the world that plays a vital role in developing the economy of a nation. Agro technologies the process of implementing the recent technologies to develop the crops that are being produced. The utilization of agro technology not only helps in improving the efficiency of the crop that are being produced but also helps in developing devices that are suitable for doing mechanical works within the fields. This results in minimization of the total cost of production, saving of time and reduction in the effort involved in the process. The new technology should also be economically feasible and hence the behavior of the technology and its role in the society is an important consideration before developing a new product or process. In this work a seed sowing machine has been developed that help the farmers in harvesting the best crop with least efforts. A mechanical device that helps in sowing operation and controlled using IoT (Internet of Things) has been developed. This project is focused on an agriculture seed sowing and fertilizer spraying process using a android application. The integral construction of the robot is made simple to use. Recently in agriculture, the required manpower is not available as well as the aging farmer and increasing world population are causing a threat to the future. This project focuses on developing the m robot to minimize the working cost and increase the accuracy of seed planting.

Key Words: Microcontroller Atmega 328P, Wi-Fi Module, IoT Module, Sensors, Ultrasonic Sensor, DC motor, Solenoid valve

1. INTRODUCTION

Agriculture has been the backbone of the Indian economy and it'll still remain so for an extended time. Today the environmental influence of agricultural production is extremely much focused and therefore the demands to the industry is increasing. In the present scenario, most of the cities in India do not have sufficient skilled man power in agricultural sector and that affects the progress of developing country. Therefore, farmers have to use upgraded technology for cultivation activity. Manual method includes broadcasting the seeds and fertilizers by hand. So it's time to automate the sector to overcome these problems. Innovative idea of this project is doing the processes like verifying if the soil is suitable for cultivation, seed sowing, covering the land and spraying fertilizers automatically so that human efforts will get reduced.

The system will be utilized for sensing, monitoring, controlling and for communication purpose. Different sensors are used to detect parameters like soil moisture and obstacle detection. Depending upon the sensors output the microcontroller will take the necessary actions. The moisture sensor output will help to determine if the soil is suitable for cultivation. Once the soil is suitable, the seed sowing operation can be performed. Also, on desired time fertilizer spraying operation can be performed. The operation of robot can be controlled using an Android application.

1.1 Existing System

Agricultural robot is a robot deployed for performing agricultural activities. 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. The basic objective is to verify if the soil is suitable for cultivation, put the seed and fertilizer in rows at desired depth and spacing, cover the seeds with soil and provide proper compaction over the seed. In this method, seeds of crops namely wheat, jowar and sunflower is sown by digging the land using drill bit. But before this, the moisture content of soil is verified. The suitable moisture range for wheat, jowar and sunflower are 450-650mm, 600-900mm and 600-1000mm respectively. These three crops require a depth of 5cm for seed sowing. With the help of this implementation, seeds of these crops are dropped at uniform depth and results in uniform germination. After the crop has achieved desired growth then the fertilizers are sprayed at regular interval. The robot performs verifying the suitability of soil, seed sowing, covering seeds and spraying fertilizers and powered by solar panel with a control of android application. The innovative idea about this project is that robot is not only performing various operations related with farming but also monitoring all the actions related with the movement of robot like obstacle detection, battery voltage and compass sensor output. The proposed system is under agriculture category.

1.2 Proposed System

The Android app is configured such that it consists of two operations one is that of seed sowing and other is fertilizer spraying.

I) Seed sowing operation:

Once the seed sowing operation is selected the robot performs the first step which is checking the moisture of the soil. The controller then checks the output of ultrasonic sensor to detect if there are any obstacles in the path. If the moisture of soil is in the desirable range for the selected crop, the next operation that is the digging is performed and then seeds are dropped into the holes simultaneously as the robot moves forward. As the farm ends the seed sowing operation is completed.

II) Fertilizer Spraying operation:

In the proposed system the Android application is configured such that a remainder can be set by the farmer as to when he needs to spray the fertilizers. Now when farmer gets the remainder or even without remainder if he wants to spray fertilizers he can do so by selecting the fertilizer spraying option in the application. Then the controller will perform the operation with the help of a sprinkler.

2. System Architecture

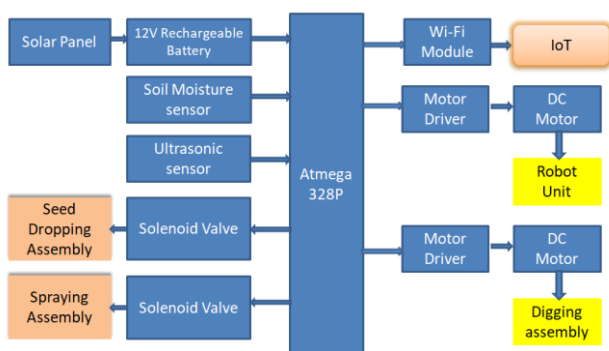


Fig -1: Block Diagram

The 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. The soil moisture sensor is used to determine whether the soil contains required moisture for the desired crops namely wheat, jowar and sunflower. An HC SR-04 ultrasonic sensor is a sensor that measures the distance to an object using ultrasonic sound waves. HC-SR04 is used to detect if any obstacle is present in the path. The soil is drilled using a drill bit based on a predefined depth. Here, for the desired crops, the depth is 5cm. Then the microcontroller sends the command to drop the seeds into the drilled hole. Hence, in this way uniformity is achieved in the drilled depth and. After the set numbers of seeds are dropped in the hole created, ATmega328 sends a command to move further and this is fed to the motor driver IC L293D. The L293D IC receives signals from the Atmega328 and transmits the relative signal to the motors. We need motor driver for running motor using microcontroller. To interface between motor and microcontroller we will use L293D motor driver IC in our circuit. Four 60 rpm motors have been used which receive supply voltage from a motor driver L293D. Since the supply voltage of the motors been used is

12V, a motor driver is essential as a microcontroller can't provide such high voltage. Now when desirable growth of plants is obtained then the fertilizers are sprayed. A reminder will be provided in the android application which will remind the user about spraying fertilizers. Then the user will just need to give the command for fertilizer spraying and in this way the fertilizer spraying operation will be carried out by robot at regular intervals. Wi-Fi Module interface will be used operated on android application to man oeuvre robot in the field. Every movement is monitored on android application from anywhere. Hence, in this way seeds will be successfully sowed in the soil and fertilizers will be properly sprayed as well as the monitoring can be done on an Android application.

2.1 Hardware Description

1. ATMEGA328P microcontroller

It is the heart of system which is connected with all the sensors and other hardware assembly required to achieve the desired work. It is used as the hardware platform. It is the heart of system, to which all other components are interfaced. It is a low voltage and an 8-bit high performance microcontroller of AVR family with low power consumption and is based on enhanced RISC architecture with 131 powerful instructions. Most of the instructions requires one machine cycle for execution. Its operating frequency is 16MHz. It is a 40 pin microcontroller and has 32 I/O lines.

2. Soil moisture sensor

Soil moisture means the content of water amount present in the soil. This can be measured using a soil moisture sensor HL-69 which consists of two conducting probes. It can measure the moisture content within the soil supported the change in resistance between the 2 conducting plates. When the sensor is inserted into the water, the resistance will decrease and obtain better conductivity between plates. Here we will be using this sensor to verify if the soil contains appropriate moisture content for the growing of crops: wheat, jowar and sunflower.

3. Ultrasonic sensor

This is a 4 pin module. It is a very popular sensor used in many applications where measuring distance or sensing objects are required. The sensor works with the straightforward formula: Distance = Speed × Time. The Ultrasonic sensor transmits an ultrasonic wave, this wave travels in air and when it gets objected by any material it gets reflected back toward the sensor this reflected wave is observed by the Ultrasonic receiver module.

4. Wi-Fi module

Wi-Fi module is a MQTT (Serial Port Protocol) module, designed for transparent wireless serial connection setup. This Module can be used in a Master or Slave configuration, making it a great solution for wireless communication. This device used for wireless communication with Wi-Fi enabled

devices (like smart phone). It communicates with microcontrollers using serial communication (USART). Here, as we will monitor the operations of robot on smart phone thus Wi-Fi is required.

5. Motor driver (L293D)

The Actuator's are those devices which actually gives the movement or to try to to a task like motor's. Within the real world there are various types of motors available which works on different voltages. So we'd like motor driver for running them through the controller. To interface between motor and microcontroller we use L293D motor driver IC in our circuit. L293D may be a 16-pin IC which may control a group of two DC motors simultaneously in any direction. It means you'll control two DC motor with one L293D IC.

5. DC Motor:

Four 60 rpm motors have been used which receive supply voltage from a motor driver L293D. Since the supply voltage of the motor been used is 12V, a motor driver is essential as a microcontroller can't provide such high voltage.

6. Solar Panel

The supply is taken from solar panel of 5 watt 12 V output so as to fulfill the power requirement for the system. 12V lead-Acid battery is used to store the energy from solar Panel. When solar panel is kept in sunlight and voltage across it is greater than battery voltage, it will start storing the solar energy in the battery.

2.2 Simulation Snapshot

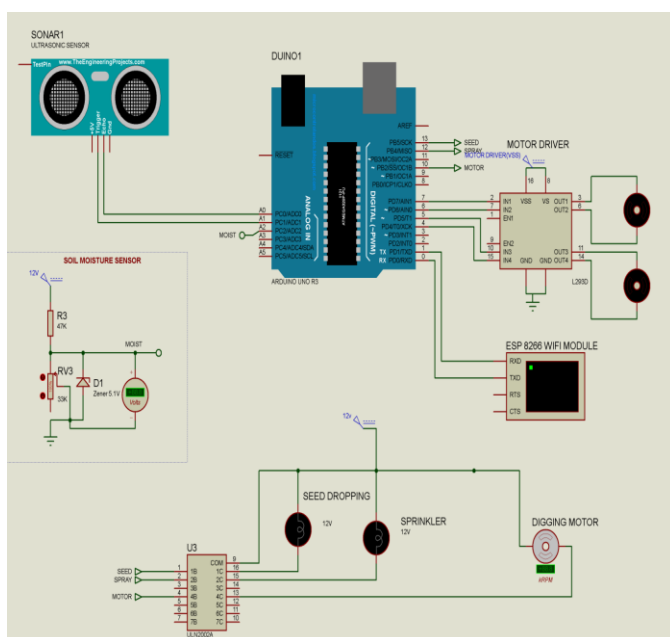


Fig -2: Proteus Simulation

3. ALGORITHM

3.1 SEED SOWING:

- 1) Step1: Start
- 2) Step2: Initialize the system on arduino microcontroller ATmega328.
- 3) Step3: DC motor will run robot forward and other motor start sowing and also simultaneously perform digging operation.
- 4) Step4: Ultrasonic sensor will detect the obstacle and make a decision to turn by the allocation of programming sequence.
- 5) Step5: covering the soil by an agribot.
- 6) Step6: DC motor will stop and servomotor will stop seed sowing.
- 7) Step7: Robot will start the operation of digging and sense moisture with the moisture sensor.
- 8) Step8: If the soil moisture level is low, the sensor sends the information to the motor at that time. Motor flows the water to the field.
- 9) Step9: If step 8 is complete, it will go to step3.

3.2 FERTILIZER SPRAYING

- 1) Step1: Start
- 2) Step2: Initialize the system on arduino microcontroller ATmega328.
- 3) Step3: DC motor will run forward and Ultrasonic sensor finds the presence of plant.
- 4) Step4: Ultrasonic sensor will detect the plant presence and make a decision to spray fertilizers on plants.
- 5) Step5: DC motor will stop and spraying operation performed.
- 6) Step6: Again motor starts and go to step 3.

4. CONCLUSION

This project plans to design fully functional automated product. In this proposed work, solar powered seed sowing and fertilizer spraying robot with wireless control will be successfully developed and implemented in real time environment. The proposed system will be developed at low power and low cost with an efficient output. Adding more accessories to the mobile robot and controlling it using an android application will also be possible. This robot with wireless control system gives an alternative way of broadcasting seeds and fertilizers by

hand. This robot will perform the seed sowing and fertilizer spraying operations and hence will save labor requirement so as labor cost, labor time and lot of energy.

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