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Sensor Based AGROBOT for Sowing Seeds

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Abstract - *Agrobot is a robot designed for agricultural purposes. It is designed to minimize the labor of farmers in addition to increasing the speed and accuracy of the work. In this paper, we have presented a system-of-systems approach to design and development of a mobile robotic platform for agricultural applications. This agricultural robot is used in precision agriculture. This proposed sensor based robot is used for sowing seeds. It can navigate on any agricultural land and sow seeds effectively. There are several other sensors on board. The infrared sensor and ultrasonic sensor is used to detect the obstacles and for proper navigation of the robot. The moisture sensor detects measures the humidity in the soil and moisture is maintained by pumping the water from the water tank. The temperature sensor checks for the temperature. The primary task of this robot is to sow seeds at regular intervals. The dimensions of proposed robot are 33 X 41 X 20 as L X B X H respectively.*

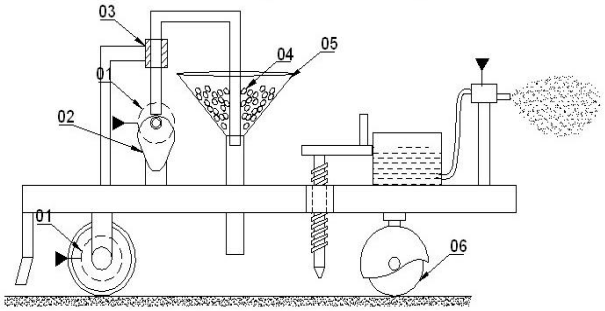
Key Words: **Soil Moisture Sensor, Temperature Sensor, IR Sensor, Ultrasonic Sensor, Sensor based Agricultural Robot.**

1.INTRODUCTION

Agriculture in India constitutes more than 60% of the occupation. It serves to be the backbone of Indian economy. It is very important to improve the efficiency and productivity of agriculture by simultaneously providing safe cultivation of the farmers. The first development of robotics in agriculture can be dated as early as 1920s, with research to incorporate automatic vehicle guidance into agriculture beginning to take shape. Other developments over the years included the harvesting of oranges using a robot both in France and the US. An agricultural robot is a robot deployed for agricultural purposes. The main area of application of robots in agriculture today is mostly at the harvesting stage. Emerging applications of robots in agriculture include weed control, cloud seeding, harvesting and soil analysis. Robots like these have many benefits for the agricultural industry, including a higher quality of fresh produce, lower production costs and a decreased need for manual labor. [10]They can also be used to automate manual tasks, such as weed or bracken spraying , where the use of tractors and other manned vehicles is too dangerous for the operators.

For any mobile device, the ability to navigate in its environment is important. Avoiding dangerous situations such as collisions and unsafe conditions. [9]Robot navigation means the robot's ability to determine its own position in its frame of reference and then to plan a path towards some goal location. Path planning is effectively an extension of localisation, in that it requires the determination of the robot's current position and a position of a goal location.

This paper is based on developing a robotic vehicle used in agriculture for sowing seeds. This project is an automatic seed sowing robot which involves the usage of sensors to detect the obstacles and helps in proper navigation of the robot. This cost effective robotic vehicle can improve productivity, safety in agricultural applications and meet the demand for labour.



S.NO	PART NAME	S.NO	PART NAME	S.NO	PART NAME
01	*dc motors*	04	*seeds*		
02	*cam*	05	*hopper*		
03	*guide*	06	*rotating wheels*	▶	TO CONTROL UNIT

Fig -1: Frabication of seed sowing robot.

2.DESCRIPTION OF PROPOSED SYSTEM COMPONENTS

This proposed robot is an automatic robot that works which can be monitored using a webpage and runs with the help of motors.

2.1 Arduino UNO

Arduino UNO is a microcontroller board based on the ATmega328P. It has 14 digital input/output pins, 6 analog inputs, 16MHz quartz crystal, a USB connection, a power jack, an ICSP header and a rest button. It contains everything needed to support the microcontroller; simply connect it to a computer with a USB cable or power it with a AC-to-DC adapter or battery to get started. You can tinker with your UNO without worrying too much about doing

something wrong, worst case scenario you can replace the chip for a few dollars and start over again.

The Arduino UNO can be powered via the USB connection or with an external power supply. The power source is selected automatically. The board can operate on an external supply of 6 to 20 volts. If supplied with less than 7V, however the recommended range is 7 to 12 volts.

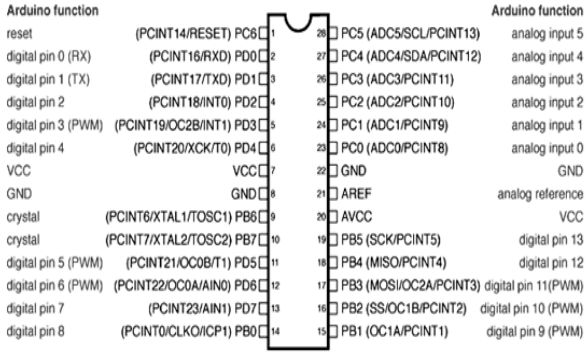


Fig -2: ARDUINO UNO to ATMEGA328 pin mapping.

2.2 Input and Output

Each of the 14 digital pins on the Uno can be used as an input or output, using pinMode(), digitalWrite() and digitalRead() functions. They operate at 5 volts. Each pin can provide or receive a maximum of 40Ma and has an internal pull-up resistor of 20-50 kOhms. The ATmega328P microcontroller provides UART TTL(5V) serial communication which can be done using digital pin 0 and digital pin 1. An ATmega16U2 on the board channels this serial communication over USB and appears as a virtual com port to software on the computer.

2.3 WiFi Module

The ESP8266 is capable of either hosting an application or offloading all Wi-Fi networking functions from another application processor. This module has a powerful enough on-board processing and storage capability that allows it to be integrated with the sensors and other application specific devices through its GPIs with minimal development up-front and minimal loading during runtime.

2.4 Ultrasonic Sensor

Ultrasonic ranging module HC- SR04 provides 2cm–40m. The ranging accuracy can reach to 3mm. The modules includes ultrasonic transmitter, receiver and control circuit. Ultrasonic transmitter emitted an ultrasonic wave in one direction, and started timing when it launched. Ultrasonic spread in the air, and would return immediately when it encountered obstacles on the way. At last, the ultrasonic receiver would stop timing when it received the reflected wave. As Ultrasonic spread velocity is 340m/s in the air.

2.5 Temperature Sensor

The LM35 series are precision integrated-circuit temperature devices with an output voltage linearly-propotional to the Centigrade temperature. The LM35 device has an advantage over linear temperature sensors calibrated in Kelvin, as the user is not required to subtract a large constant voltage from the output to obtain convenient Centigrade scaling. The LM35 device does not require any external calibration or trimming to provide typical accuracies.

2.6 Soil Moisture Sensor

This sensor measures the volumetric content of water inside the soil and gives us the moisture level as output. The sensor is equipped with both analog and digital output, so it can be used in both analog and digital mode. The soil moisture sensor consists of two probs which are used to measure the volumetric content of water. The two probs allow the current to pass through the soil and then it gets the resistance value to measure the moisture value.

2.7 Infrared Sensor

An infrared sensor ia an electronic instrument that is used to sense certain characteristics of its surroundings. It does this by either emitting or detecting infrared radiation. Infrared sensors are also capable of measuring the heat being emitted by an object and detecting motion. Infrared waves are not visible to the human eye. In the electromagnetic spectrum, infrared radiation can be found between the visible and microwave regions. The infrared waves typically have wavelengths between 0.75 and 1000μm.

3.RELATED WORK

Agriculture is the occupation of many people in developing countries. Thereby having robots as such and bringing in many developments helps the farmers to complete all the work in an efficient and easy way.

Nandagopal Srinivasan [3] proposed a mechanism where the seeds are dropped into the soil as the robot moves forward. The seeds are stored in the seed box that has a tapered structure which allows the seeds to flow easily through the pipe attached and in turn to the funnel.

Neha S.Naik [4] examined a ground based sensing approach where it is interpreted as row and column distance. Experiments are done on the wet soil and distances covered by the robot are compared with predefined optimal distances. The robot is also able to detect the field end by detecting the compound of the field.

K.R.Aravind [5] proposed a Crop Monitoring Robot for Green House where the robot has been designed and simulated using an open source software known as V-REP. Programming for navigation is done in Lua scripting tool which is embedded along with the V-REP software.

[6,10] The ultrasonic sensor and Digital Compass Sensor are used with the help of Wi-Fi interface operated on Android Application to manoeuvre robot in the field. This brings down labour dependency.

Lars Grimstad [7] developed a seed sowing robot which is lightweight so that it can operate during wet periods without damaging the soil structure. This is done by constructing the frame so that it flexes, which reduces complexity and makes the frame cheap to build, but at the same time guarantees that all the wheels are in contact with the ground.

The robot is designed independently to drive through the row crops in a field according to the design concept of open agriculture. The offset and heading angle of the robot platform are detected in real time to guide the platform on the basis of recognition of a crop row using machine vision [8].

4.PROPOSED METHODOLOGY

Seed sowing technique in agriculture is a very tedious task. Our aim is mainly to build this robot which can reduce the human labour and make things easy. This automatic robot is used to sow the seeds one at a time at regular intervals to be more precise precision agriculture is our ultimate goal.

4.1 Controller and Sensors

The main hardware components used are the controller (ARDUINO UNO) and sensors. The soil moisture sensor is used to check the humidity of the soil. The humidity is maintained by the water tank and water is pumped using the motor. The temperature sensor is used to measure the temperature of the soil. The soil humidity and the temperature is displayed on the LCD screen.

4.2 Sensor based guidance system

The sensor based guidance system allows the robot to navigate correctly and sow the seeds as regular intervals. Here, the ultrasonic sensor is used to notify the robot the obstacles present and make it to move in a correct direction. The infrared sensor is used to drop the seeds at regular intervals and one seed at a time. Another infrared sensor is used to check us whether the seeds is present or not and when not present it notifies us. With the help of ultrasonic sensor and infrared sensor the robot navigates correctly in the proper direction. The robot and its movements are monitored in the website created.

4.3 Seed sowing mechanisms

Seed must be sown one by one at regular intervals and at a depth for proper production. Here a lead screw which is present to make a depth in the soil into which the seed is sown. The robot moves correctly with the ultrasonic sensor and the seed is sown by the infrared sensor. It helps in sowing the seeds at regular intervals. There is a container which contains the seeds when the robot starts the pulley connected to the container rotates and thus it lifts the rod and a seed is dropped through the opening in the container and the pulley continues to rotate and now it comes back to the original position and the opening gets closed. The infrared sensor also checks the presence of seeds, it notifies us when there is no seeds and the motor is switched off immediately. The robot runs only when there are seeds in the container. This is how the seed is sowed at regular intervals.

4.4 Workflow of proposed sensor based Agrobot for sowing seeds

The workflow of proposed sensor based agrobot for sowing seeds involves the following steps:

Step 1: The soil moisture sensor checks for the moisture in the soil.

Step 2: If the moisture is not as the expected levels then the water is pumped into the soil from the tank using a water pump and thus the soil regains the moisture.

Step 3: The temperature sensor checks for the temperature of the surroundings.

Step 4: All the values are displayed in the LCD screen.

Step 5: The ultrasonic sensor guides the robot by checking for any obstacles.

Step 6: The infrared sensor is used to check for the presence of seeds in the container and also is used for sowing the seeds at regular intervals.

Step 7: All the activities of this automatic robot is monitored using a webpage which is connected using the WiFi module.

Step 8: The robot stops working when the seeds are sown at regular intervals.

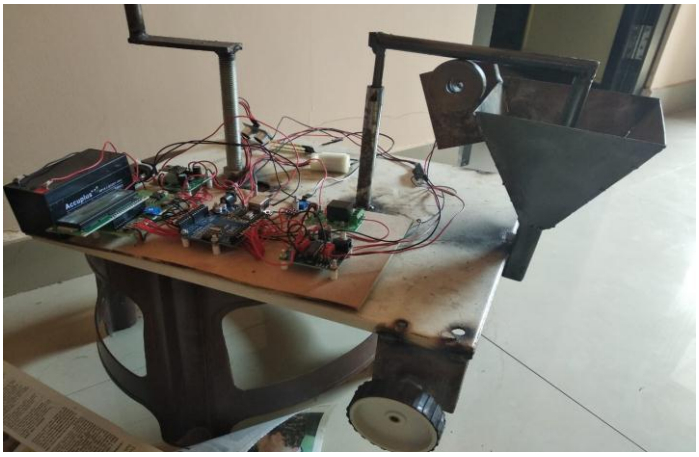


Fig -3: Sensor based autonomous seed sowing robot.

5.RESULTS

This automatic robot is used to sow the seeds at regular intervals. This is mainly aimed to make the work easier and effective. It thus helps the farmers to work effectively. This robot can work effectively at any soil. The robot moves with the help of motors that are fixed to the wheels, the motor runs with the help of batteries that are fixed. This is an automatic robot which is just monitored using the webpage. This robot is guided by the ultrasonic sensor which guides the robot through obstacles and the infrared sensor helps in sowing the seeds at regular intervals. The robot need not be controlled it is an automatic robot that is easy to use because it needs only to be monitored. It is user friendly and farmers can easily use this vehicle. This robot mainly emphasizes on sowing the seeds from a remote location without coming in contact with it directly.

6.CONCLUSION

In this paper we have proposed a sensor based agrobot for sowing seeds. The paper aimed at not only extend the advanced technologies in agriculture but also make things easier for the farmers. Sowing seeds is a very tedious task and involves a lot of man-work and time. This robot helps to sow the seeds effectively and makes things easier so that it encourages people to take up agriculture as their occupation. This robot is very user friendly and easy to handle. This paper will be economical to the farmers and also hit their target of high productivity. All the errors have been detected and corrected. Ultrasonic sensor and infrared sensor along with the lead rod mechanism is used to sow the seeds at regular intervals. Further, the vision mechanism can be used to monitor the seeds easily by using a camera.

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