Assessment of Soil Moisturization and Farm Weeding Techniques using Agricultural Robots

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Abstract

Agriculture plays an important role in India. As an economy sector it contributes about 17% to the total GDP this agribot projects aims to reduce the work of farmers. In addition to increase the speed and accuracy of farmers work. It fulfills the basic functions of agriculture. Such as a seed sowing, fertilizer mist and arm gripper. The above feature is done using Arduino Mega 2560, moisturization sensor, temperature sensor (LM35 sensor), L293D driver, DC servo motor, Bluetooth HC05, relay, power supply and mobile app. Our project work implemented using the Bluetooth method.

Keywords: Agribot, android app, bluetooth HC05, sowing, spraying, weeding.

1. Introduction

Agriculture is the science and art of breeding plants and animals. More than 70 percent of rural households are dependent on agriculture as their main livelihood. Agribots are being gradually deployed all over the world to help the farmers and improve productivity, resulting in far more precise and smarter operations. The robot starts its work by sensing the soil moisturization content and temperature followed by seed sowing, weeding and spraying. It uses core components such as Arduino mega 2560, L293D driver, Dc servo motor, relay, soil moisturization sensor, temperature sensor (LM 35 sensor), Bluetooth HC05, power supply and mobile application.

2. Existing Method

Bluetooth Based Precision Agriculture using Agribot

Many states in India are agrarian economies and rural populations rely on agriculture and animal husbandry for their livelihood. Due rise in labor shortages interest, the production of autonomous vehicles such as robots in agriculture has risen in recent years. The proposed system [1] aims to develop autonomous agricultural robotic vehicles for multipurpose seeding and spraying of pesticides that can be regulated by IoT. The robot is housed in the farm and is powered on via is operated by Bluetooth and its functions are managed by web browser. The backbone of the system is microcontroller (Arduino uno).The microcontroller in then proposed model supports multiple field functions according to the commands received from smart phone.

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Bluetooth based agri-bot for backyard farming

In this paper [2], the concept of smart and sustainable farming practices referred to as Agribots were devised. There is a complete method from seed sowing to fertilization the whole method is numerically regulated and therefore fully automated.

Bluetooth HCO5 based Solar Powered Agribot for Irrigation and Farm Monitoring

In this paper [3], Agribot is designed that functions as a bluetooth HCO5 platform to monitor farmland remotely and also to irrigate the farmland. The Agribot developed is solar powered, consequently harvests solar energy when not irrigated.

Multipurpose Agribot

In this paper [4], a multipurpose agribot is designed for the performing functions like seeding, spraying of pesticides and water. Arduino UNO functions as the heart of the system which collects commands from the transmitter remote control.

3. Proposed Method

The designed "Agribot" will irrigate the field by receiving consumer inputs such as seed sowing, weeding, pesticide sprinkling and watering. The user inputs listed above are given through android app. This reduces the time spent by the farmer in the fields of work and to solve the health problems for the workers. The dotted red line in Fig .1. refers the power supply connection and black line in Fig .1. Refers the commands given to and from Arduino Mega 2560. Arduino Mega2560 is interfaced with power supply, soil moisture sensor, temperature sensor, relay, Bluetooth HC05, L293D driver and LCD display. By using the user credentials, the user can view the features like detecting the soil moisture and temperature value, sprayer motor, seed sowing, arm gripper and LCD display in Android App. Microcontroller, soil moisture sensor, temperature sensor, LCD display and Bluetooth module works under 5v power supply. Servo motor, L293D driver, arm gripper, relay and seed sower works under 12v power supply. Using Bluetooth HC05 technology, communication is established between the user and agribot. After knowing the soil moisture value, if the detected value is less than the value fed in the microcontroller, we can perform spraying function or if the detected value is greater than the value fed in the microcontroller, there is no need to perform spraying operation. By using L293D driver, servo motor moves the wheels in left, right, forward, backward direction. After this, seed sowing function takes place. Seed is sowed at regular intervals. If we press arm gripper feature, weeds can be cleared. LCD display will display the soil moisture and temperature value.
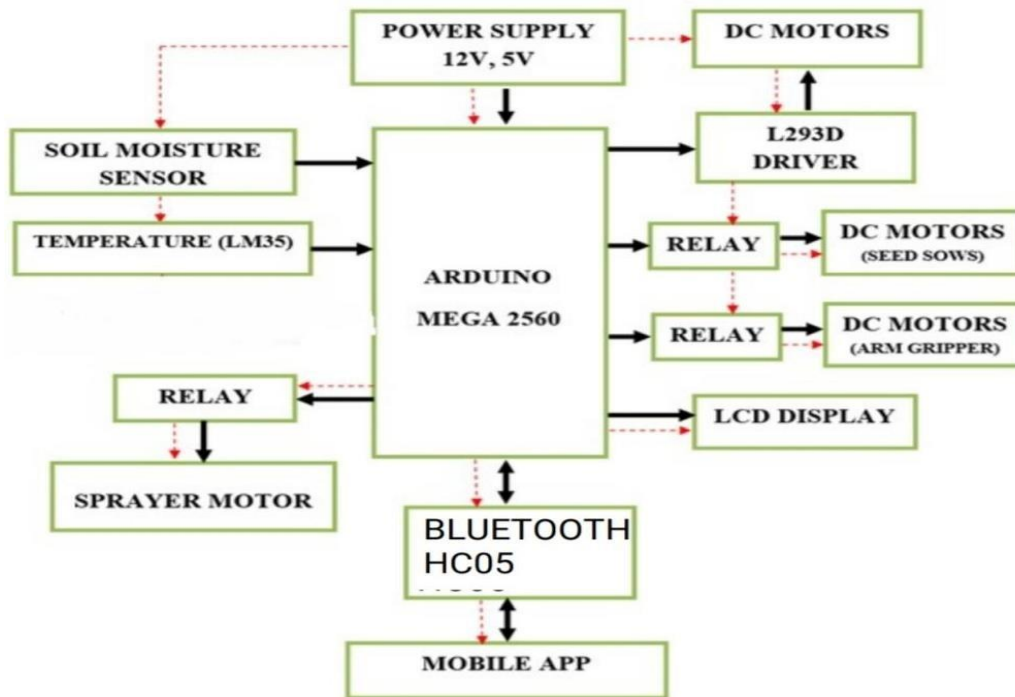
Figure 1 Block Diagram of Agribot

Table .1 Ideal Moisture levels for three major types of soils

Soil Type	No Irrigation Needed	Irrigation to be applied	Dangerously Low Soil Moisture
Fine (Clay)	80-100	60-80	Below 60
Medium (Loamy)	88-100	70-88	Below 70
Coarse (Sandy)	90-100	80-90	Below 80

The above table [1] is a general reference table which is broadly applicable for three major types of soil.

Simulation with Proteus

Start the program by clicking in Start menu on the ISIS 7 Professional icon. Designing the connections: The design of the robot's schematic diagram requires knowledge of the components needed during design. All the components can be selected from the component library and placed here. Wire pencil can be used to provide contacts between the parts. Tap Library>Select Device/Symbol or simply. Click "P" to pick the components. So the components used in this design are:

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- Arduino Mega 2560
- Bluetooth HC05
- L293D driver
- Servo motor
- LCD display
- Relay

The selected component can be seen in the design diagram on the left side window. To place the component on the sheet of design, just left click the component and place it on the sheet, to move the components, right click the component, then left click it and finally drag the component to the desired location. The component is not selected from library for power terminal and ground. At the left side of toolbar, click the "inter-sheet terminal symbol". Each component should be configured to satisfy the specifications. Choose the component (right click) and then left click to open the edit component dialog to edit the component.

Arduino Mega2560 Parameter Settings

The most important part of proteus simulation is a microcontroller configuration. To deal with any configuration fault in time for system execution, the setup must be right. To modify the microcontroller parameter, right click the microcontroller to select the component and then left click. Choose the directory where the source code was compiled and then pick the corresponding hex file.

Simulation

After the assembly and configuration of the circuit, it is now time to check whether the compiled code is virtually accurate or not. Click the PLAY button at the bottom toolbar to start the simulation. When the PLAY button is pressed, soil moisture and temperature value get displayed in LCD display and virtual terminal. When we click the STOP button on the simulation, simulation stops. By pressing the button on Android App for Bluetooth HC05(i.e., whether the robot to move in left, right, forward, backward direction or functions like seed sowing, spraying, arm gripper),accordingly the motor rotates.
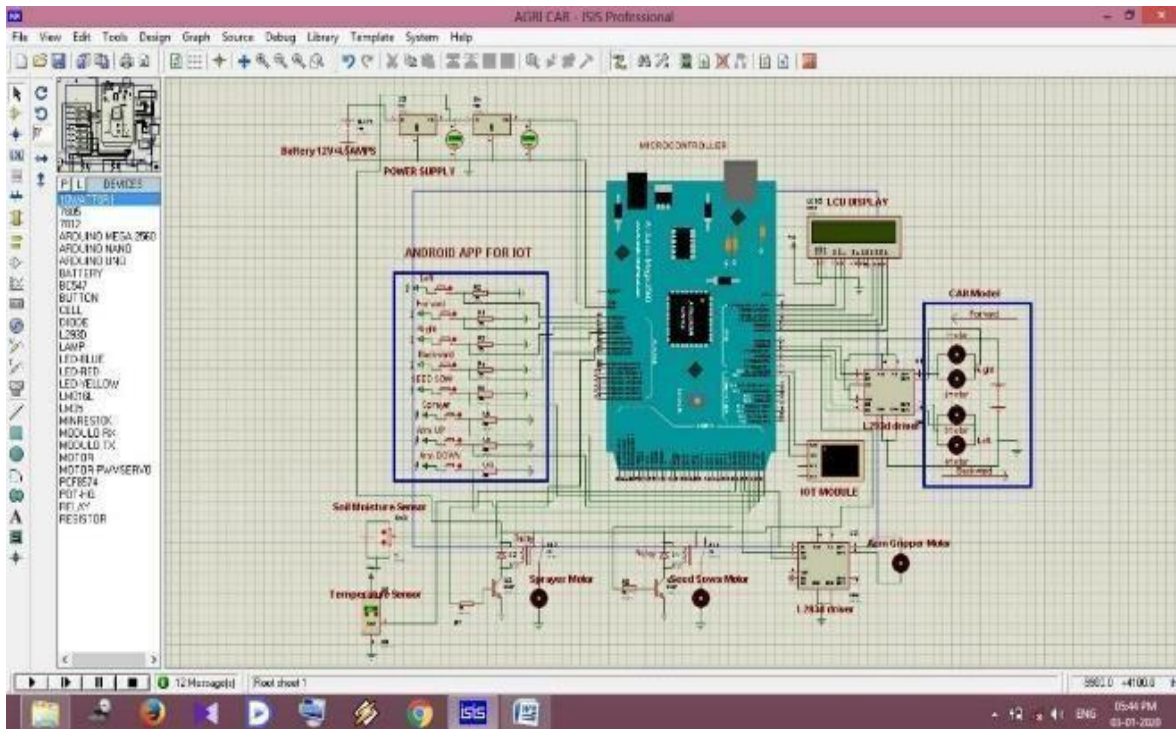
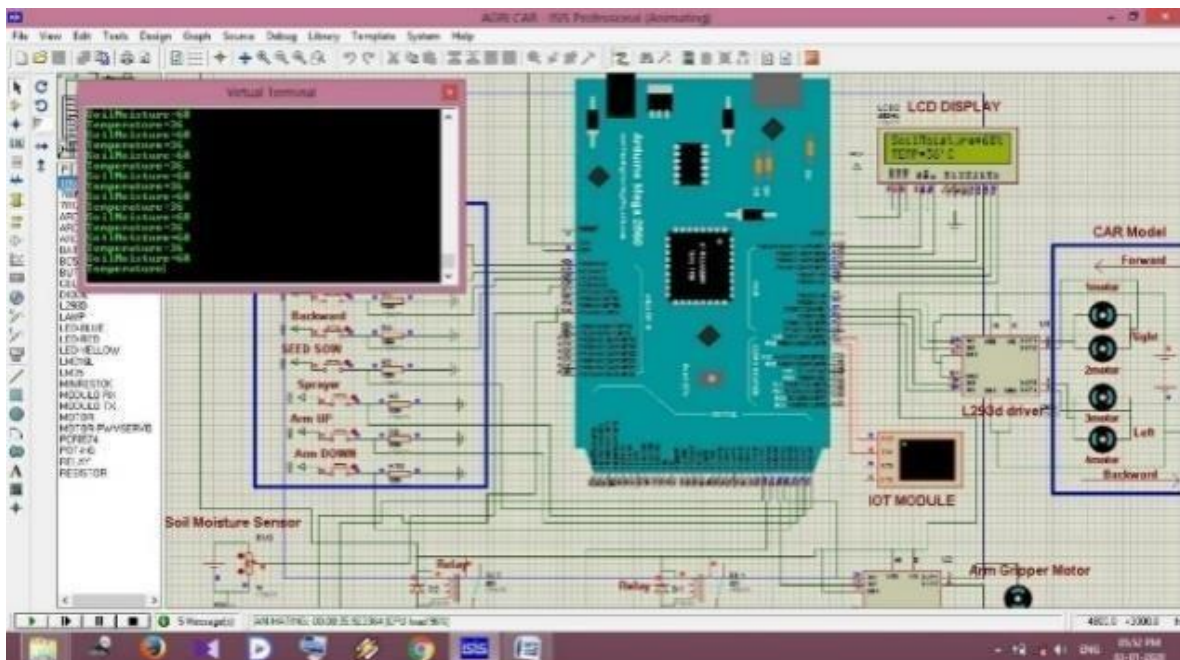**Figure 2 Simulation environment before obtaining output**

Figure 3 Simulation environment after obtaining output

4. Components Used In Agribot

Power Supply

The motors, L293D driver, relay are powered with 12v.The Arduino Mega 2560,soil moisture sensor,   temperature sensor, LCD display, Bluetooth module are powered with 5v.

L293D Driver

L293D is a motor driver for managing servo motor to move in left, right, forward, backward direction. Servo motor is used for proper wheel movement.

Servo Motor

Usually, the servo motor is a mixture of the four components, namely a DC motor, a control circuit, a gear system and typically a position sensor as well as a potentiometer.

Relay

The electrochemical relay uses a appropriate sensor such as limit switch to determine the gate closure and in effect help to stop a robot from working.

LCD Display

LCD display is a flat-panel monitor or other electronically modulated optical device using the light modulating properties of liquid crystals coupled with polarizers.

Soil Moisture Sensor

Soil moisture sensor is used to determine the volumetric soil water content. Used to measure moisture loss over time due to the evaporation and uptake of plants.

Sprayer Motor

Sprayer motor is powered with 12v. High pressure water pump with threaded interface and pressure transfer. This sprayer motor can be used in agriculture lands.

Arduino Mega 2560

Arduino Mega 2560 is an Atmega2560 based microcontroller board. Compared to other boards available on the market, it comes with more memory space and I/O pins. It comes with a USB cable port for attaching and copying code from machine to board. The DC power jack is when coupled to the board used for controlling the machine. This functionality is missing in some variant of Arduino board (for example, Arduino Pro mini does not come with DC power input).
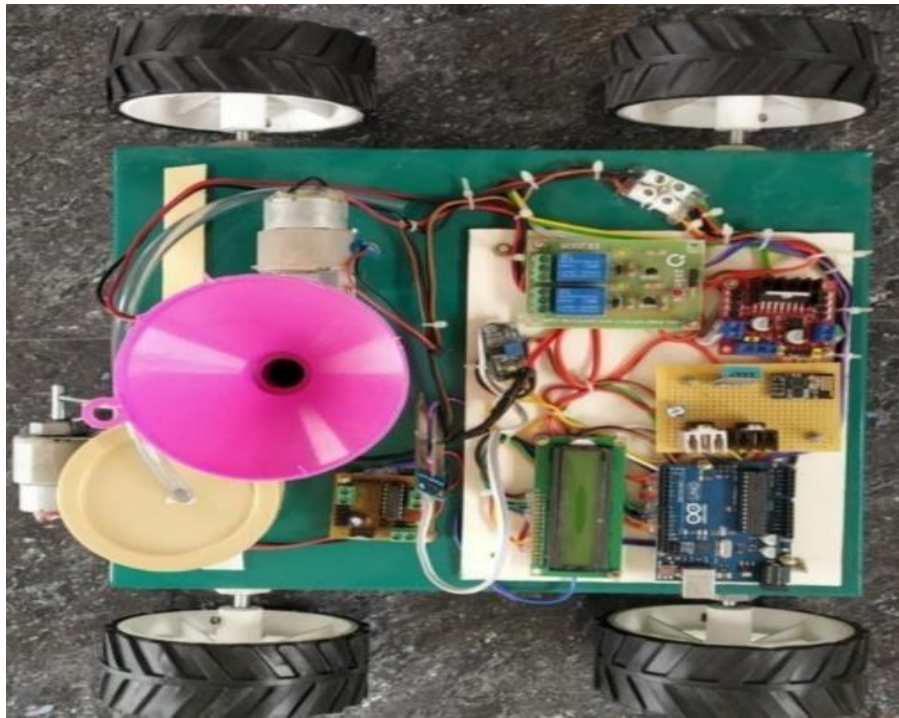
5. Results and Discussions

Figure 4 prototype model of an automatic agribot

The above showed prototype model is an automatic agribot. The agribot is also operated in manually for switch ON the specific function of the parameter. The temperature and soil moisture of the farm land will be indicating in LCD display.

6. Conclusion and Future Scope

In traditional method, the agriculturalist faced issues like lack of mechanization. Those days, the agricultural operations such as ploughing, weeding, spraying the fertilizer or water are carried out by humans using conventional tools. The proposed system is designed to ease the work of farmers and reduce the time consumption. Using BluetoothHC05 technology in our project, seed sowing, spraying of fertilizer and water, weeding processes are carried out. In the addition, we can add some features in this project like a harvesting of the crop at correct time and using image processing technique to detect and remove the infected leaves in the farmland.

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