

# IoT Based Precision Agriculture using Agribot

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## Abstract

More than 60 percent of the population in the India, agriculture as the primary sector occupation. In recent years, due increase in labor shortage interest has grown for the development of the autonomous vehicles like robots in the agriculture. An robot called agribot have been designed for agricultural purposes. It is designed to minimize the labor of farmers in addition to increasing the speed and accuracy of the work. It performs the elementary functions involved in farming i.e. spraying of pesticide, sowing of seeds, and so on. Spraying pesticides especially important for the workers in the area of potentially harmful for the safety and health of the workers. This is especially important for the workers in the area of potentially harmful for the safety and health of the workers. The Proposed system aims at designing multipurpose autonomous agricultural robotic vehicle which can be controlled through IoT for seeding and spraying of pesticides. These robots are used to reduce human intervention, ensuring high yield and efficient utilization of resources.

**Keywords- IoT, Agribot, Sprayer, Pesticides**

## I. INTRODUCTION

Most of states in india are agrarian economies and rural populations depend on agriculture and animal husbandry for their livelihood. Aimed at increasing the crop yield and reducing the labor involved, various kinds of agricultural robots have been proposed and developed. This robot can performs basic elementary functions like ploughing, planting and spray the pesticides. The application of agricultural machinery in precision agriculture has experienced an increase in investment. The robot starts its function by ploughing of soil followed by sowing of seeds and ends the process by spraying of pesticides. It uses basic components like DC motors, servo motor, relay, solenoid valve and Arduino as the main controller. The mechanical design of the robot is also simple. It is programmed to carry out the above functions simultaneously. To perform the function of ploughing it is equipped with spiked wheels which are fixed in the anterior end of the robot, to sow seeds it has a container with seeds and its bottom contains a perforation to drop the seed and finally the posterior end of the robot has a sprayer equipped with solenoid valve which is controlled by a relay. Precision autonomous farming is the operation, guidance, and control of autonomous machines to carry out agricultural tasks. It motivates agricultural robotics. The goal of agricultural robotics is more than just the application of robotics technologies to agriculture.

## II. METHODOLOGY

The robot is placed in the farm and is switched on through IoT and its direction controlled by web browser. This starts the rotation of spiked wheels and thus starts ploughing which is done simultaneously as the robot moves forward. As the spiked wheels are in the front, a container is used for holding the seeds. A hole is drilled in the bottom of this container and that is covered with a small sheet. This sheet acts as a flip-flop and caters to the dropping of seeds at periodic intervals. The control of the flip-flop can be done using servo motor. The final step is spraying of pesticides which can be done with the help of solenoid valve and is periodically sprayed whenever the relay switch is closed.

The system focused on the design, development and the fabrication of the multipurpose agricultural robot with pesticide spraying system in addition to ploughing and seeding. The multipurpose agricultural Robot is used to control the three functions like ploughing the soil, seed sowing, and pesticide/water spraying and controlled through Wi-Fi module with low budget. The block diagram of the system is shown in Figure 1.

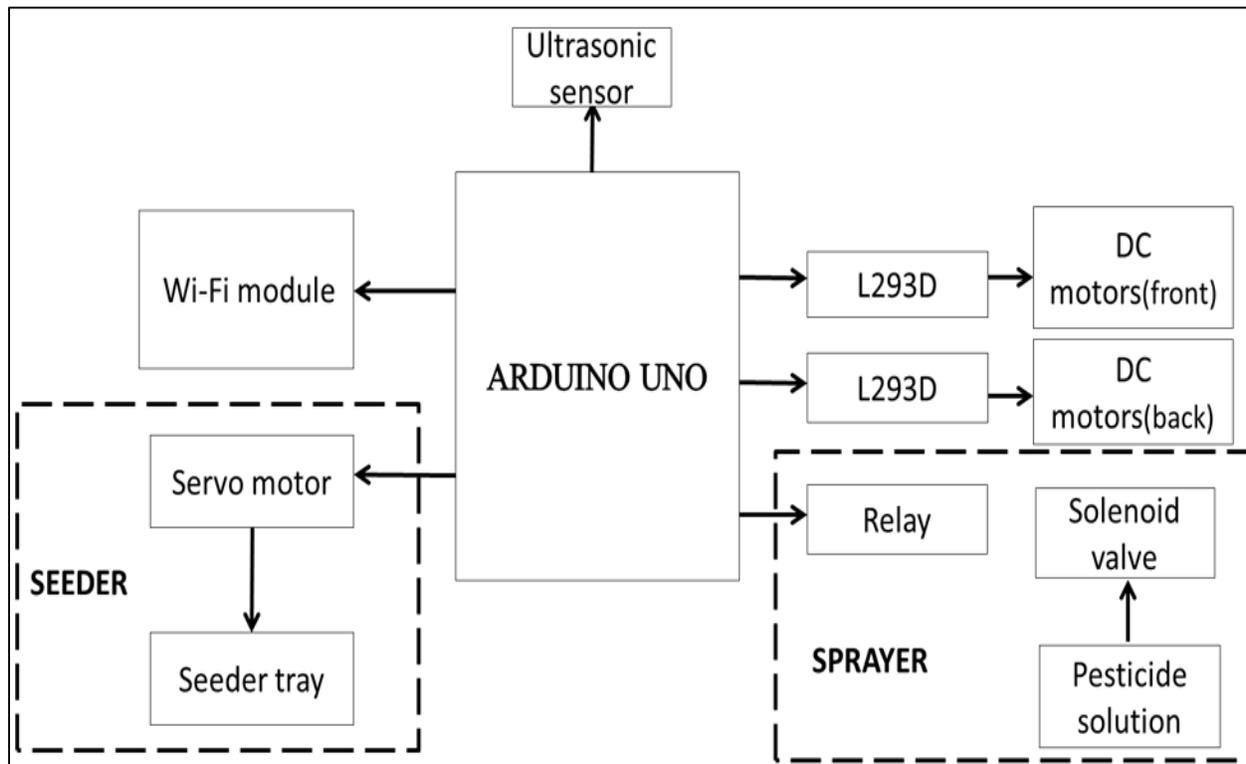


Fig. 1: Block Diagram of IOT controlled Agribot

#### A. Ploughing Function

The primary purpose of ploughing is to turn over the upper layer of the soil, bringing bottom fresh nutrients to the surface, while burying weeds and the remains of previous crops and allowing them to break down. In the prototype model shown above, a DC Motor coupled with the screw rod is used for ploughing the farm. As the screw rod rotates, the nut welded to the cultivator slides between the screws of the rod. Then the cultivator is lowered down and the soil is dug up to 1.2 inches. The direction of the cultivator can be controlled by the web browser through IoT in the smart phone.

#### B. Seed Sowing Function

Seeding is planting seeds in a soil. In this model, a box is used for Seed storage and opening is controlled by servo motor when agribot wheels are rotated. The movement of wheels of the robot causes the shaft to throw the seeds to the field.

#### C. Pesticide Spraying Function

The pesticides are used to protect crop from insects and fungus. Spraying of some pesticides causes health issues to the workers. When chemicals like rodenticides and antimicrobials come into contact with the skin of the farmers they prone skin diseases. Thus, the agribot equipped with pesticide sprayer i.e., relay controlled solenoid valve is used to spray harmful pesticide/ fertilizer.

#### D. Hardware Construction

The base frame of agribot consists of 4 wheels connected to four arms and both rear and front wheel is driven by DC motor. The seeds are sowed through drilled hole attached to the shaft. A solenoid valve equipped pump sprayer is used to spray the pesticide. Wi-Fi technology through smart phone is used to control the entire operation of robot for ploughing, seeding and pesticide spraying. The Heart of the proposed system is Microcontroller. Wi-Fi module, DC motors, relays are interfaced to the Microcontroller to provide various operations like Ploughing, seeding and pesticide spraying. The entire mechanism of the system is controlled by Bluetooth module from Android smart phone. The wireless communication of Wi-Fi technology enables the robot to move in four directions as front, back, right and left. Various commands can be used to move robot into forward, reverse, stop, left, and right. The microcontroller in the proposed model enables various functions in the field according to the commands received from smart phone.

#### E. Servo Motor

A Servo motor is a rotary actuator otherwise called linear actuator that allows for precise control of angular or linear position, speed. It consists of suitable to couple with a sensor module for feedback position. Servo motor is often used to in a closed loop control system. Modern day servo motors are designed and supplied around a dedicated controller module from the different manufacturer. Controllers may also be developed around microcontrollers in order to reduce the cost for large volume applications.

### F. Solenoid Valve

A Solenoid valve is an electrically operated valve. The valve is controlled by an relay through a solenoid: on account of a two-port valve the stream is turned on or off. Different solenoid valves can be set together on automatic irrigation system Solenoid valves are the most habitually utilized control components in water and industrial fluids. Their undertakings are to close off, discharge, measurements. There are various types of solenoid valve like plunger-type actuator which is utilized most much of the time, turned armature actuators and rockers actuators are likewise utilized.

### G. ESP8266-ESP 01

The ESP8266 –ESP 01 is a low-cost SoC Wi-Fi module with support full TCP/IP stack and microcontroller capability produced by expressive Systems. This small module allows microcontrollers to connect to a Wi-Fi network and make simple TCP/IP connections using Hayes-style commands. The low cost and the way that there were not very many outside segments on the module which proposed that it could in the long run be extremely cheap in volume, pulled in numerous programmers to investigate the module chip and the produce product using it.

## III. WORKING

Arduino uno is used to control various operations like ploughing, seeding and pesticide spraying. It also controls robot wheels through L293D motor driver. Controlling DC motor operations for ploughing. DC Motor used for rear wheels is connected to another L293D driver for proper movement of wheels. Similarly, for seeding and pesticide spraying functions, servo motor and solenoid valves are used respectively.



Fig. 2: A sample of field ploughed with agribot

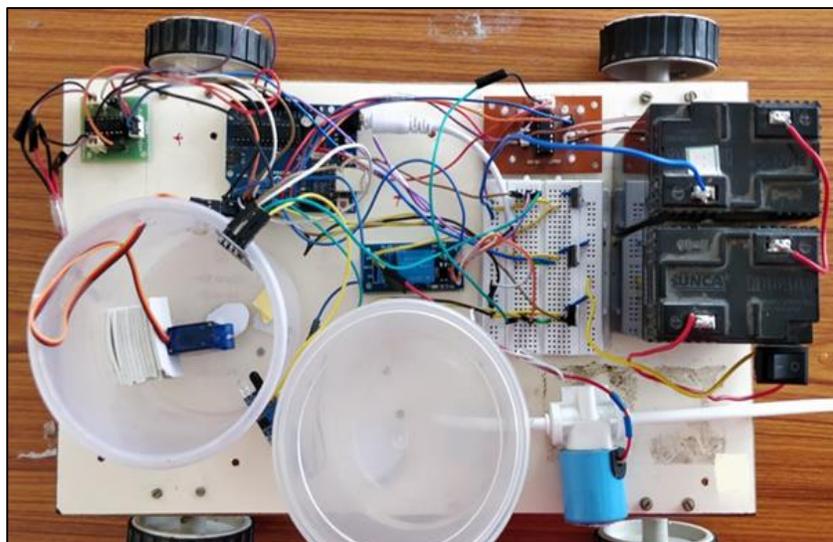


Fig. 3 : IoT controlled Agribot



Fig. 4: IoT Mobile web control

#### IV. CONCLUSIONS

In this work IoT controlled robot, named, Agribot has been designed, built and demonstrated to carry out seeding and spraying pesticides in an agriculture field. The agribot will assist the farmers in increasing crop yielded and protect them from harmful chemicals of pesticides.

#### V. SCOPE OF FUTURE WORK

Since the designed agribot is used only for sowing of seeds and spraying of pesticides controlled through internet of the thing, the following features can be added for enhancing the current project work: pH meter can be in order to determine the pH of the soil which helps to identify the suitable pesticide/fertilizer to be employed Moisture level sensor can be employed to know about the moisture content present in the soil of the farmland.

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