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# Design of an Internet of Things Agriculture Robot for Precision Farming Applications

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***Abstract: -*** Agriculture is the most important industry to provide the food, feed and fuel needed for our survival. So it became the main occupation for over 70 percent of the population in India. Due to its introduction, improved speed and accuracy of work and reduced labor, interest in the production of autonomous vehicles such as robots has been significantly increased in recent years in the agriculture sector. Digital farming is the application using emerging technology such as Robotics which certainly play an important role for farming processes autonomously in the field of agriculture. The design of these robots is modeled on the basis of the particular approach with specific strategy in which it is going to operate. The four-wheel prototype is designed for a multifunctional use by an Autonomous Agricultural Robot such as seeding, IoT-controlled pesticide spray. Such robots are used to minimize human interaction and guarantee high performance and resource development.

***Keywords****: IoT, Spraying, Seeding, Sprinkling and Ploughing.*

## 1. Introduction

Most of the rural population in Indian states which are named as agrarian economies rely on their livelihood on agriculture and animal farming. Various robots are built for agricultural purposes with an aim to increase the yield of the crop and to reduce the labor involved. The elementary basic functions robot will perform are ploughing, planting, and spraying the pesticides. There has been a tremendous increase in the application of agricultural machinery in precision farming.

The first automation in the field of agriculture was implemented through the tractors. The robot begins its function with soil plowing followed by seed sowing and ends the process with spraying. Basic and simple components such as Servo Motor, DC motors, Relay, Key Controller, Arduino Board, and Solenoid Valve are used for building these robots. These are designed to do the above-mentioned functions simultaneously and the mechanical design is too simple. We have to focus that the seed are planted with certain distance between them and also that the Agriculture Robot should have the row guidance when it moves in the same farm for various purposes after sowing the seed. Spiked wheels are fixed at the robot's anterior end to perform one of the operations which are ploughing, a seed container which contains a seed drop perforation is fixed at the bottom to sow seeds. For workers in the field of safety and health, pesticides are of particular significance that are potentially harmful to workers, so that a sprayer is equipped with a relay at the end of the agricultural robot, controlled by a spritz-on valve. The main aim of these agricultural robots is more than applying robotics technologies to agriculture. The process, management and control of autonomous machinery for carrying out agriculture tasks is precision autonomous

farming. The use of the network modules for communication of the Agriculture Robot with the user has a lot of options. The advanced technology which helps to connect with IOT is WiFi module.

## 2. Working of Operation

The Aurduino software is simple for beginners but fairly suitable for experience users. Start with robotics and programming, which use this software to construct small price technical instruments. designers and architects develop interactive prototypes. There are plenty of other microcontrollers available for physical computing and their platforms. Parallox Basic Stamp, Phidgets, BX-24 from Netmedia's, Handyboard from MITs, and several others provide similar features. All these devices take the messy microcontroller schedulation specifications and tie it in an easy-to-use set. Not only does Arduino simplify the microcontroller process however, it has a benefit over other systems too.

**Less Expensive:** In contrast to other microcontroller platforms, these Arduino boards are relatively cheap. The Arduino board which is less costly even the price of the modules can be built by hand also and the price of the Arduino which are pre-assembled cost cheaper than $45.

**Cross- Platform**: Depending on the IDE context may get to know how the Arduino IDE environment works, the Arduino Interface Development Environment (IDE) can be easily used for processing.

**Simple, Clear Programming Environment**: Depending on programmable IDE environment for processing, Arduino software (IDE) can be conveniently used, so that students who learn to program in this regard will learn how Aurdino works.

**Extensive Free and Open Source:** The software Arduino – IDE is available as free-ware tools for qualified developers which are available from professional programmers. C++ libraries will broaden the language and those who want to learn the technical specifics will create the jump from Arduino IDE environment to the AVR – C programming language. In the same way, if we wish, Arduino programs can be added directly by AVR – C code.

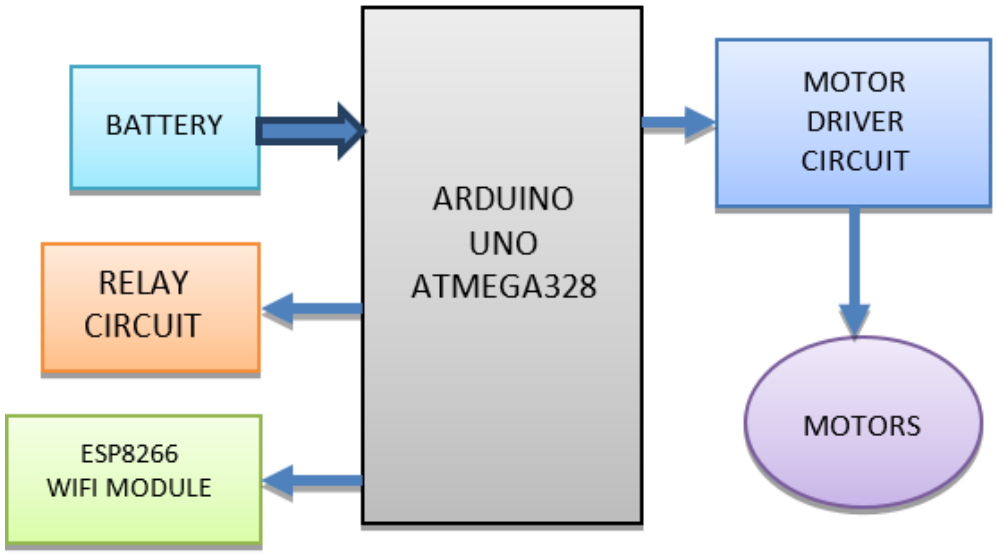


**Fig-1: Block diagram of Agriculture Robot**

**Extensible Hardware and Open Source**: The designs for IDE are available with (CCL) Creative Commercial License, so designer's experience may create their individual way of the section creation, expanding and enhancing it. Not only experienced users but also inexperienced users can create a breadboard module to learn how it works.

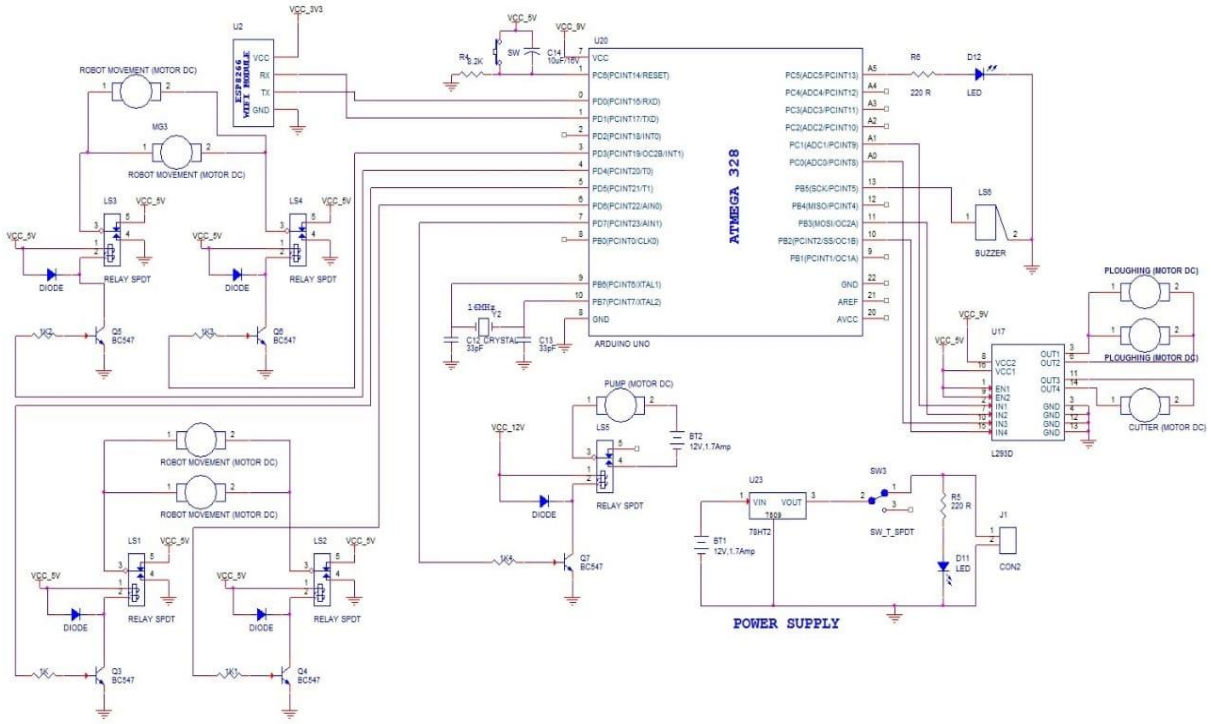


**Fig-2: Wiring diagram of agriculture Robot**

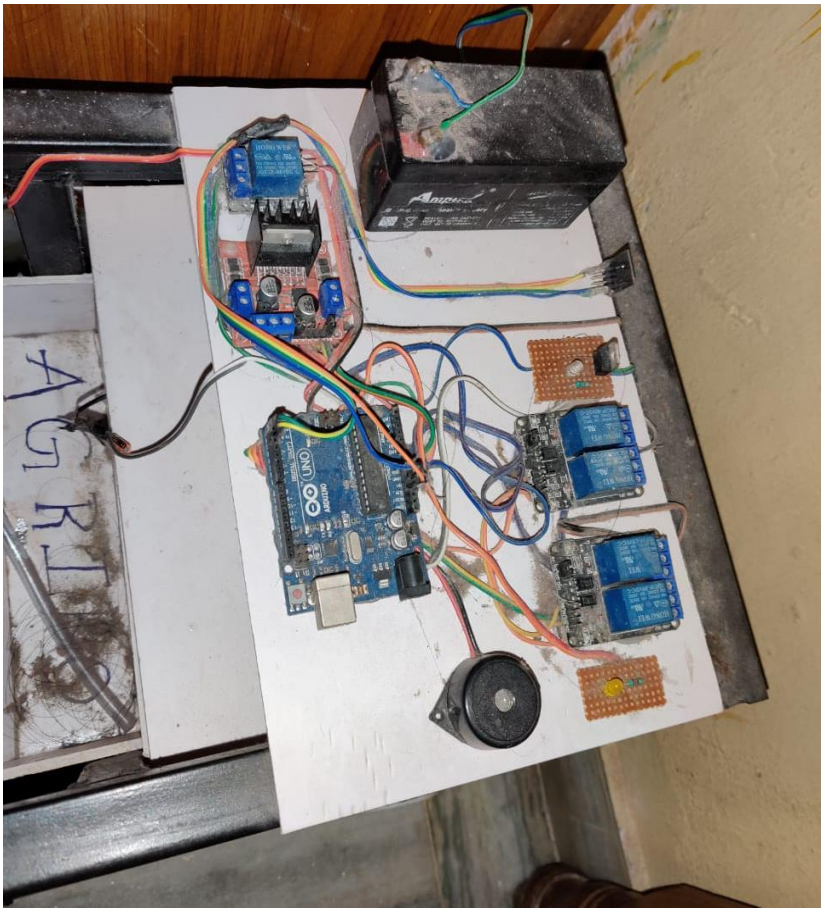

**Fig-3: Hardware circuit diagram of Agrbot**

**Proposed Model:**

**Hardware Components:**

| Sl. No. | Hardware Part | Quantity | Rating |
|---|---|---|---|
| **1** | ARDUINO UNO | 1 | ATMEGA-382 |
| **2** | DC Motors | 4 | 3Kg – 60RPM |
| **3** | DC Motors | 2 | 3Kg – 10RPM |
| **4** | DC Motors | 1 | 1Kg – 300RPM |
| **5** | Submersible Motor | 1 | |
| **6** | Relay Driver Module | 1 | 5V |
| **7** | Wi-Fi Module | 1 | ESP8266 |
| **8** | Battery | 1 | 12V |
| **9** | Motor Drivers | 1 | L293D |

**Individual Hardware Components Purpose:**

**L293D**: It is a Motor Driver IC with 16-pin, which works on the principle of H- Bridge. H-Bridge is an installation that uses both clockwise and anti- clockwise motors. This IC can run two DC motors in either direction simultaneously ad can be operated independently in the direction of these two motors.

**AtMEGA-328**: This is an Arduino UNO microcontroller. The main features consist of:

- Serial Communications supports.
- Serial Peripheral Interface Protocol supports.
- Uses a 16MHz crystal oscillator for frequency spectrum generation ranging (2-to-40) MHz.

**ESP8266:** This Wi-Fi module has an integrated TCP/IP protocol stack, which is pre-programmed to give any microcontroller access to the required Wi-Fi network.. This module is powerfully integrated into on-board processing and storage with sensors and other applications, minimum up-front development and minimum runtime loading. The high-level of integration on the chip makes it possible to occupy a limited area for external circuits like the front-end modules to occupy minimum occupancy of PCBs.

**Advantages of the Agribot**:

- Reduced man power
- The system can function independently
- A consistent depth of the drill
- Seed placement consistent
- Increased land utilization
- Increase in yield/productivity

## 3. Results and Discussion

In this section, we are discussing the investigation results of the designed Agricultural Robot. The four figures which are shown below explains the movement of the Agricultural Robot in different directions. The mode of operational directions in which we performed is Forward mode, Backward mode, Right turn mode, and Left turn mode. We can see in figure-3 that the handheld remote controller can be used to run a robot. Once we pick an option to shift the forward direction, Arduino will receive command over Wi-Fi immediately, and with the aid of DC engines, the robot starts moving in the right direction. When we select an option to push backward, the

Arduino commands immediately via Wi-Fi and the robot starts moving in the opposite direction as shown in figure - 4. If we select an option to turn right on the mobile remote control, Arduino will immediately be given command via Wi-Fi, and then the robot engines to push right along with the DC motors as shown in Figure – 5. If we choose the option to switch left on the mobile remote control, Arduino will automatically be provided command over Wi-Fi, and then the robot engines will drive left along with the DC motors as seen in figure-6.

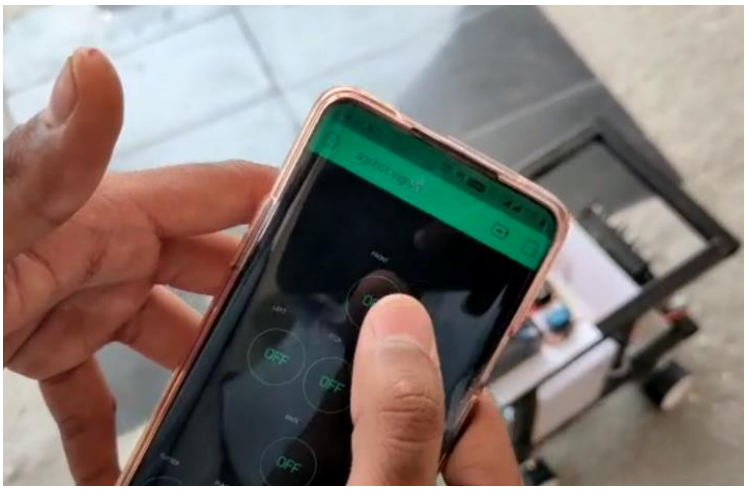

**Fig-3: Forward mode of the Agriculture Robot**

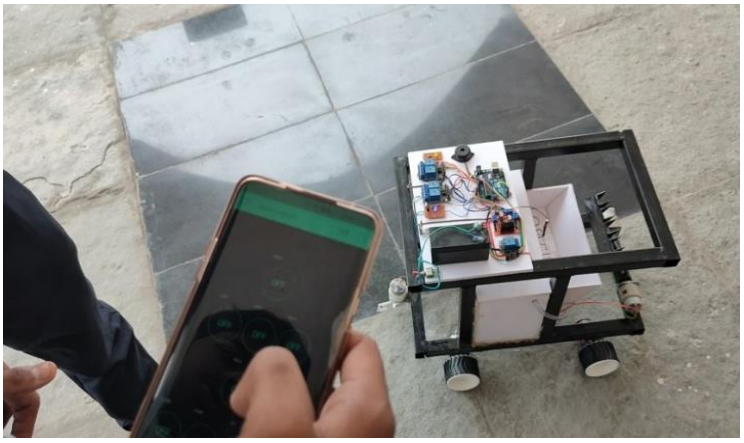

**Fig-4: Backward mode of the Agriculture Robot**

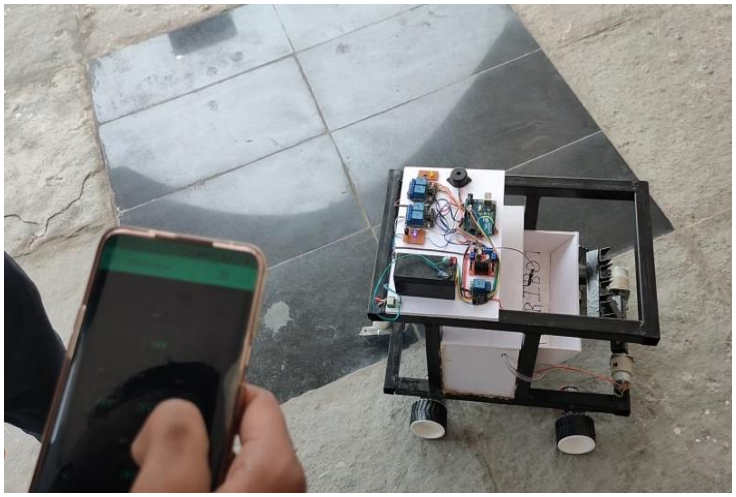

**Fig-5: Right Turn mode of the Agriculture Robot**

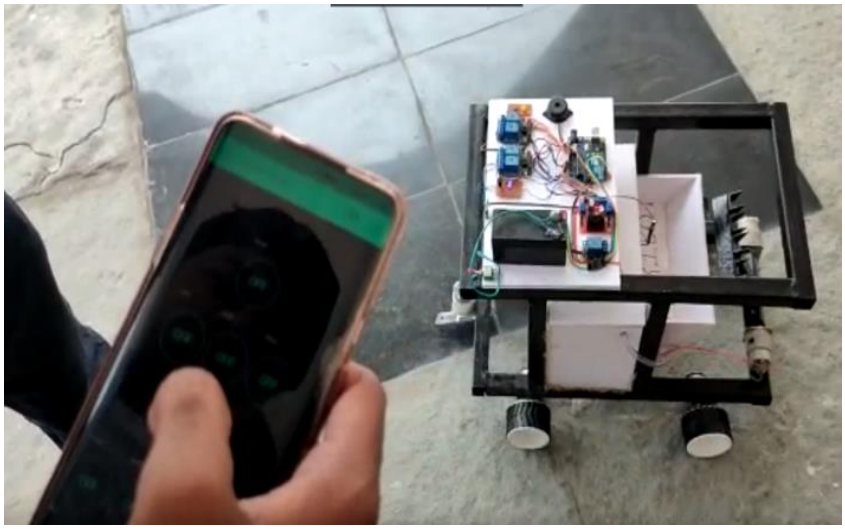

**Fig-6: Left Turn mode of the Agriculture Robot**

We can see from the figures below that we can perform different operations for the designed agricultural robot by installing different type of tools. Now, let us see the operations in the figures in detail. The different modes of applications that we can perform using agriculture robots are plowing, sprinkling, and cropping by taking the help of respective tools. The figure-7 below shows that the robot performs the plowing task with the help of a farming tool.

**Fig-7: Ploughing mode of the Agriculture Robot**

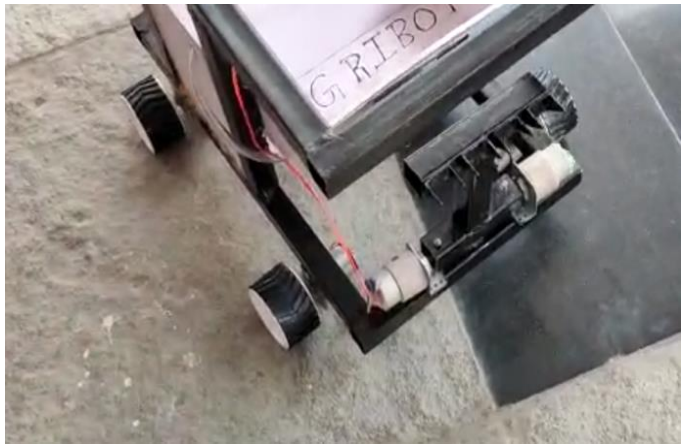

**Fig-8: Watering mode of the Agriculture Robot**

A robot is shown below figure-8 with a watering method for seeds. The tool to cut grass in the field shown in Figure-9 that is fixed to the robot.

**Fig-9: Cropping of the Agriculture Robot**

## 4. Conclusion

The robot designed is integrated into the various sub-structure models that can be used globally for redeeming and farmimg purposes by all circumstances, especially in like our country India, where farming offers main livelihoods to the Indians. The designed prototype mainly concentrates on a stand-alone robot for all forms of farming, such as control, seeding, sprinkling, and pesticide spraying, etc., The control of the robot by noticing the visualizations by using the in-built camera placed on the top of the designed prototype. The simple concept of autonomous robots can accelerate progress and can be programmed to operate in a wide variety of fields. This advanced sensor-enabled agricultural robot aware of the farmer about the moisturizing level of the field, the Ph value of the Soil, and finally reveals the required pesticide to increase the crop yield through IoT technology.

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