

Agribot - Multipurpose Agricultural Robot

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Abstract: More than 60% of the workforce in India is directly or indirectly involved in agriculture. Interest in creating autonomous vehicles like robots in agriculture has risen in response to the present labour shortage. As a result, a robot called an agribot has been developed to assist farmers in their work, making it faster and easier. The goal of the suggested system is to build a Bluetooth-controlled, autonomous, multipurpose agricultural robotic vehicle capable of pumping water and planting seeds, among other tasks, in a variety of soil types. Minimizing the need for human intervention while maintaining high levels of productivity and resource efficiency is achieved via the employment of these autonomous vehicles.

Keywords: Agriculture Robot vehicle, Bluetooth, ploughing, seeding, Solar panel

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1. Introduction

The economic structure of India rests on the back of its agricultural sector. When it comes to generating food, farmers are essential. In the past, people have farmed using implements such as bullock carts, tractors, tillers, and more. Labor shortages, a lack of knowledge about soil testing, increased labour expenses, wasted seed and water, and an increase in labour prices are the key challenges confronting agriculture right now. Agricultural robot research and development is driven by a desire to remedy these shortcomings. The main purpose of agricultural robots is to use robot technology to farming. The agricultural robot can plough, plant seeds, and even out the dirt all on its own. The robot is an automated machine with a wide range of applications that don't need human intervention. The robot obeys the operator's every order. Along the route of the robot, several sensors are used to detect and record conditions. The microprocessor at the heart of the robotic system directs all of its actions. Controlling the DC motors, it limits the range of motion for the wheel. A motor driving circuit supplies power to the DC motor, which controls the rate at which the wheel spins.

A primary need for manipulating the robot is a means of interaction. Bluetooth wireless connection is one of the accessible channels of conversation. The robot may be controlled from afar using a smartphone, thanks to the HC-05 and HC-06 Bluetooth modules. The Bluetooth protocol is user-friendly, and information sharing between mobile devices and robots is well-structured. The intended use of the developed robot is in agriculture, namely in the areas of mud levelling, planting, and ploughing. The robot can continue its job in any kind of weather. The agricultural robot not only employs moisture sensors, but also temperature and humidity

sensors, to assess the soil. The information gathered by the senses is displayed on an LCD screen. The robot's Bluetooth interface allows for the separation of duties.

2. Literature Review

Vishnu Prakash Karunakara et.al: Describes an initiative to create, build, and test an autonomous multifunctional vehicle that meets strict criteria for safety, efficiency, and cost-effectiveness. This self-driving vehicle navigates among the rows of crops on farmland to carry out duties that would otherwise be too time-consuming or dangerous for human workers. Although its primary function is spraying, it may be outfitted with a variety of other configurations as well, including seeding, a plug platform to access the tops of the plants for various operations (pruning, harvesting, etc.), and a trailer to carry the fruits, plants, and crop waste.

Burra Hymavathi , J Hariharan , K Manideep , D V Srikanth et.al: Describes an effort to create a vehicle capable of doing many agricultural tasks at once, including tilling, planting seeds, spraying fertiliser, and sprinkling water, all autonomously. It is solar powered, hands-free, and easy to use in dry or semi-arid regions. The need for human labour is decreased as this vehicle drives between the rows of crops to complete chores.

Chetan Patil, Vishal Deshmukh, Shailesh Deshmukh, Govind rai, Parag Bute et.al: create a robot that can do tasks like automatically ploughing, delivering seeds, and spraying pesticides. It has humidity sensors to keep an eye on the air's moisture content and a human override option for case automatic systems fail. The microcontroller is the important part of this setup since it monitors the whole operation. The robot starts by tilling the whole field, then moves on to ploughing and seed distribution.

Gowtham kumar S N, Anand G Warriar, Chirag B Shetty, Gerard Elston Shawn D'souza et.al: talks about how a single robot can do a variety of agricultural chores. It's important to look for other approaches if we want to increase productivity in the agriculture sector. The focus of this work is on a fresh method of farming that may significantly increase crop yields. This farm robot system is unique in that it can drill, pick and place, seed, pump water and nutrients, monitor the weather, and operate on a gardening, afforestation, and agricultural platform all at once. The goal of this project is to create a robot that can excavate dirt, plant seeds, roll over the area to compact the mud, and spray water using just battery and solar energy. More than 40 percent of the global workforce is involved in agriculture, and there has been a rise in interest in recent years in the use of autonomous vehicles to improve farming.

Gaurav Lohakar, JiwanUjwalkar, Subhash Chikankar, Rupeshkumar .D. Suryawanshi et.al: Modern agriculture must devise novel strategies for increasing productivity. One strategy is to make better use of the information technology at our disposal in the form of smarter equipment in order to cut down on energy use and direct it where it's needed most. As a result of the success of precision farming, we may upgrade to more advanced equipment. Autonomous system designs allow us to create a new generation of farming tools based on tiny, intelligent units that can do the appropriate task at the appropriate time and location.

Arunkumar S M , Erik Sentury , A Harish Kumar , Johnson A , Yuvaraju G et.al: Seed selection, field preparation, fertilising, planting, irrigation, weed eradication, and pesticide spraying are just some of the many stages involved in cultivating any given crop. We aim to supply farmers with versatile equipment that is suited for all types of seed-to-seed cultivation, and which applies all the scientific farming procedures and requirements, reducing the time and resources needed to grow crops from seed to seed. The goal of this project is to create a multifunctional agricultural vehicle that can be used for a wide range of tasks, including but not limited to ploughing, tilling, seeding, fertilising, levelling, and weeding.

3. Existing System Vs Proposed System

The lack of available farm workers, a lack of knowledge about the need of soil testing, rising labour prices, disappearing seeds, and dwindling water supplies are the most pressing problems facing modern agriculture today. All of these difficulties have inspired the proposal to use robots in farming. The main purpose of agricultural robots is to use robot technology to farming. The agricultural robot can plough, plant seeds, and even out the dirt all on its own.

The robot is an automated machine with a wide range of applications that don't need human intervention. The robot obeys the operator's every order. Along the route of the robot, several sensors are used to detect and record conditions. The microprocessor at the heart of the robotic system directs all of its actions. Controlling the DC motors, it limits the range of motion for the wheel. A motor driving circuit is responsible for powering the DC motors that turn the wheels. The autonomous sowing robot used in agriculture may be controlled from a distance using a Smartphone and Bluetooth wireless technology. A Bluetooth electronic app is used to operate the robot. It's used to control the robot's every move.

3.1 System architecture

3.1.1 Block diagram

In the block design shown in Figure 1, an Arduino microcontroller is used as the system's brain. Battery charging circuitry that gives +5 V to the Arduino board and +12 V to run DC motors with L298 motor driver modules receives electricity from a solar panel attached to the battery for storage. Bluetooth HC05 is wired to an Arduino board and wirelessly connected to an Android phone for control of the whole setup.

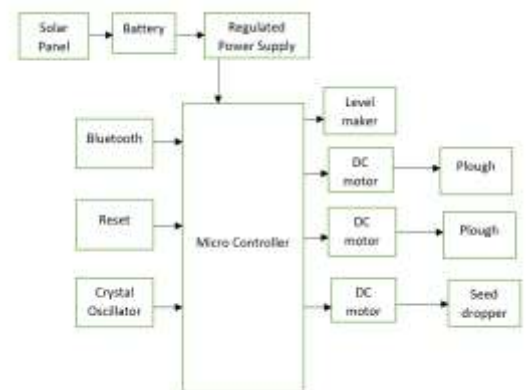


FIG 1: Block diagram of Agriculture Robot with Seed, Plough, Pesticide spray & Level

3.1.2 Components

Arduino Microcontroller (ATmega 328)

The various components are managed by the Arduino Atmega328 microcontroller shown in Figure 2. The atmega328 microcontroller used by Arduino is seen in its physical form in Figure 2. The microcontroller Atmega328 has 28 pins. There are a total of 13 digital I/O pins on the device; 5 of them are analogue inputs and 5 are pulse width modulation outputs.



**Fig-2 Arduino atmega328
SOLAR PANEL**

Photovoltaic (PV) cells, like the one seen in Fig. 3, are solar cells used by devices such as calculators and satellites. PV cells convert solar energy into electricity in a straightforward manner, as suggested by its name (photo means "light" and voltaic means "electricity"). In electronics, a module is a group of interconnected cells housed in a small enclosure (most commonly referred as solar panel). Solar panels make it possible for homeowners to become energy independent or at least reduce their carbon footprint. Using solar panels is a fantastic strategy to cut down on your energy use. The solar panels that convert sunlight into electricity employ photovoltaic (PV) cells.



**Fig3.Solar panel
HC05**

The HC05 module is very user-friendly, and the Bluetooth Serial Port Protocol (SPP) module facilitates the construction of a transparent wireless serial connection. Figure 4 shows the HC-05 Bluetooth module, which can communicate with two microcontrollers like Arduino or any other device that supports Bluetooth. The whole setup is controlled by an Android smartphone and an Arduino through a Bluetooth HC05 connection. The HC-05 module's use of the SPP makes it easy to integrate with many microcontrollers.



**Fig4.HC05
Motor Driver IC L293D**

This motor module, known as a "motor driver," allows for the speed and direction of operation of two motors to be controlled at the same time. The motor driver was created using the L293D IC as its base. A 16-pin motor driver IC, the L293D is seen in Fig. 5. It provides bidirectional driving currents between 5 and 36 volts. The L293D is an integrated circuit that can run two DC motors at once using its sixteen total pins (eight on each side). There are four inputs and four outputs in addition to two enable pins for each motor.\



**Fig5.L293D motor drive
RELAY**

Referring to Fig. 6, a relay is an electrical switch. While an electromagnet is used to actually perform the switching action, other mechanisms, such as solid-state relays, are also a part of its inner workings. A relay may control a circuit with either a single high-power signal or several low-power signals. Relays were often used in early computers and telephone exchanges to execute logical functions.



Fig6.Relay

3. Prototype Results

The proposed robot will be able to sow seeds, spray pesticides, and mow the lawn all at once. Solar panels use the sun's heat to create electricity. This electric current is sent into the charging circuit. Using the maximum power point tracking (MPPT) standard, the charging circuit will provide a pulsed voltage while blocking any potential for reverse

current. The battery is charged by applying a pulsed voltage. Voltage sensors control the charging process. In addition to being able to charge the Arduino, the battery can also provide power to it. The high pass filter is connected between the power source and the Arduino, allowing for constant oscillation. The channel relay supplies electricity to all of the individual mechanisms. The robot's DC motors are powered by a motor driver. The device's signal transmission and reception are handled by a Bluetooth HC-05 and an android app. The machine holds its position until it receives commands from the app. Once the robot receives the signal, it will begin the required processes and proceed with its work. The prototype, which has numerous sections of actual output, is the work's principal accomplishment. Fig. 7 displays the final prototype of the app-operated autonomous multipurpose robot. It can mow the grass, apply pesticides, and sow seeds on any kind of farmland at the same time.

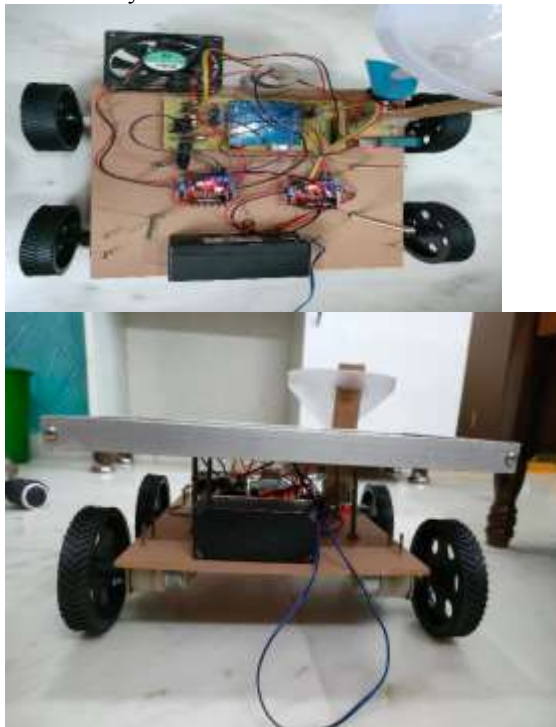


Fig7. Snapshot of the Automated Seed Sowing, Grass Cutting and Pesticide Sprayer Robot Using Bluetooth/Android App.

5. Conclusion

To help farmers with labor-intensive chores like planting seeds, mowing grass, and spraying pesticides, manufacturers have developed autonomous multifunctional agricultural robots. This task is meant to be carried out while planting two different-sized seeds. A robot's advantages include better resource management and less need for human labor. When instructions are sent to the system through bluetooth, the operator is never put in any danger since there is no physical connection between them. This solar-powered robot is a great

example of the use of eco-friendly technology. An Android app runs the operations. The agricultural industry has benefited greatly from technological advancements in seed planting, grass cutting, and pesticide spraying equipment. The use of this cutting-edge tool may help farmers save time and money.

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