



Design and Fabrication of Agricultural Smart Seeding and Spraying Robot

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ABSTRACT:

More than 60 percent of the population in India do agriculture as the primary sector occupation. At present, due to increase in shortage of labour, interest has raised for the development of the autonomous vehicles like robots in the agriculture field. A robot called "Design and Fabrication of Agricultural Smart Seeding and Spraying Robot" has been designed to minimize the labour of farmers in addition to increasing the speed and accuracy of the work. The Proposed system is designed with the multipurpose autonomous agricultural robotic vehicle which can be controlled through WIFI, for seeding and spraying water on soil is dependent on the height of the plants but not in free space, sow the seed in desired depth and provide required spacing between the seeds, detection of blockage of a seed. The project was tested on the field. The robot is successfully able to move in all the directions. And sensor position adjustment for monitoring temperature and moisture content in the soil are updated to WIFI Robot App continuously. In seed sowing unit the user is capable of measuring the volume of the seeds in all the bins and also selecting size of the seeds for sowing. The seed sowing is capable to sow the seeds to the desired depth of 4 cm for the seeds whose diameter is greater than 4mm with the spacing of 5 inches and a desired depth of 5 cm for the seeds whose diameter is less then 6mm with the spacing of 6 inches between the seeds. Pesticide spraying unit is capable of spraying pesticide only on the plant not in the free space with the maximum height of 4 feet.

KEYWORDS — *Agricultural smart and seeding, Spraying, Arduino Uno, WIFI Control.*

1. INTRODUCTION

A. SEEDING

The major occupation of the Indian rural people is agriculture and both men and women are equally involved in the process. Agriculture has been the backbone of the Indian economy and it will continue to remain so for a long time. It has to support almost 17% of world population from 2.3% of world geographical area and 4.2% of world water resources. The Seed Planter was an invention thought out in 1699. It was later built and used. He started off in law school and then later in his life studied agriculture. Jethro inherited land in Europe where he practiced his agricultural study. His seed planter successfully planted seeds in uniform although this was improved in 1782, Jethro Tull still takes credit for his extremely helpful invention. The present cropping intensity of 137% has registered an increase of only 26% since 1950-51. The net sown area is 142 Mha. The basic objective of sowing operation is to put the seed and fertilizer in rows at desired depth and spacing, cover the seeds with soil and provide proper compaction over the seed. A traditional method of seed sowing has many disadvantages. Different types of methods of seed sowing and fertilizer placement in the soil and developing a multifunctional seed sowing machine which can perform instantaneous operations. In order to save the farmers effort and his valuable time, it is important to develop the method which not only saves the time but also saves his efforts. Farmers face the problem of nonavailability of bullocks as well as tractors during the peak period of sowing. Hence, they are tempted to hire them at an increased cost. By making use of

automatic operated seed planter is that - it can be easily driven by a single person as well as it can be driven manually. Currently maximum process is done manually which is too much time consuming and require more manpower for large farm areas and the automatic machines available they having too much cost. For reducing manpower, safety and most importantly cost in working automatic seed planter following practices are adopted Simplicity of process. Reduce human efforts. Eliminate steps. Improved accuracy.

B. SPRAYING

Agriculture plays an essential position in the Indian financial system. For the rural population, agriculture is a vocation for their livelihood. All farmers use pesticides, including organic farmers. Whether from artificial or natural sources, insecticides are utilized by all farmers. The difference is organic farmers can best use insecticides from natural resources. But both synthetic and herbal insecticides have various stages of toxicity. Today solutions hugely rely upon heavy chemicals. A pesticide is a substance utilized for controlling, obviating, and ravaging pests. But when farmers spray the pest, it's far a

very harmful procedure for them, they want to be very cautious like sporting proper clothes, gloves, masks, etc. Our purpose is to increment the crop yield prevent human dangers due to poisonous chemicals. In conventional strategies, operated by hand low and high quantity hydraulic sprayer and electricity operated hydraulic sprayer with lengthy growth, lengthy lances or spray gun are used to hold fluid at different goals. In this approach, the time and labor required are extra. It is hard to spray the pesticide uniformly and effectively all through the tree with the aid of the conventional technique of spraying. The Hand operated sprayer's tank weighs 15-17 Kg. Farmers carry this for hours. Which may lead to Shoulder injuries, body pain, or Spinal Injuries. Long-term exposure to pesticides can motive loss of reminiscence, tension, temper adjustments, and hassle concentrating. Tractor-operated sprayers are tough for adaption with the aid of the farmer because of present cropping styles, to be had subject size, area situation during the wet season. To overcome those hassle necessities for better adaptability. We introduce a remotely controlled 4 wheeled pesticide sprayers so that it will spray the insecticides and pesticide sprayers so that it will spray the insecticides and pesticides on the crops with a more expeditious speed and with minimal effort. Tractor-operated sprayers are tough for adaption with the aid of the farmer because of present cropping styles, to be had subject size, area situation during the wet season.

2. LITERATURE REVIEW

Literature review was carried out throughout whole project to gain knowledge and skills needed to make this project.

[1] Discusses on the look, design and model of the autonomous agriculture robot. The main motive is to decrease the labor force and provide efficient way for it. It implements the use of Microcontroller and WIFI Module technology and helps in digging the soil, seeding, leveling the soil and then water spraying over the soil. [2] has termed the indigenous agriculture robot as "Agribot". India is a major agriculture boosted economic country and so such machines are necessary for the farmers to work faster in the fields. The model consists of a PSoC controller to operate the components of the motor and it performs the functions like ploughing the soil, seedling and covering the soil over. [3] "Application of Intelligent Control in Spraying Pesticide Simulation System" in their paper proposed that, On the basis of configuration embedded software studies, Smart control simulation model is proposed for the spraying of pesticides. In system design, the wireless network of information collection is formed by a Variety of terminals that link to the upper device via a dedicated NC network. We make full use of modular system design methods in terminal design for information collection.

[4] "Autonomous Pesticide Spraying Robot for use in a Greenhouse" That an engineering solution includes spraying potentially toxic chemicals in the confined space of a hot and steamy glasshouse to the current human health hazards. This is done by designing and building an independent mobile robot that can be used in commercial greenhouses for Tools to control insects and prevent disease. specified dosages.

[5] "Development and Automation of Robot with Spraying Mechanism for Agricultural Applications" proposed a scientific alternative to the current human health hazards including the application of potentially toxic substances in the enclosed environment. This is accomplished by designing and building an autonomous mobile robot.

[6] Proposed in their paper "Autonomous Pesticide Spraying Robot for use in a Greenhouse" That an engineering solution includes spraying potentially toxic chemicals in the confined space of a hot and steamy glasshouse to the current human health hazards. This is done by designing and building an independent mobile robot that can be used in commercial greenhouses for Tools to control insects and prevent disease. specified dosages. The results showed that the robot was able to meet the physical standards set by the National Greenhouse Horticulture Centre, so that it could work in its greenhouses.

3. COMPONENTS

I. WIFI MODULE (HC-05)

HC-05 module is an easy to use WIFI SPP (Serial Port Protocol) module, designed for transparent wireless serial connection setup Serial port WIFI module is fully qualified WIFI V2.0+EDR (Enhanced Data Rate) 3Mbps Modulation with complete 2.4GHz radio transceiver and baseband. It uses CSR Bluecore 04-External single chip WIFI system with CMOS technology.



Fig. WIFI module

II. MOTOR DRIVER

L298 is an integrated monolithic circuit in a 15 - lead Multi watt and PowerSO20 packages. It is a high voltage, high current dual full-bridge driver designed to accept standard TTL logic levels and drive inductive loads such as relays, solenoids, DC and stepping motors. Two enable inputs are provided to enable or disable the device independently of the input signals. An additional supply input is provided so that the logic works at a lower voltage. It is a high voltage, high current dual full-bridge driver designed to accept standard TTL logic levels and drive.

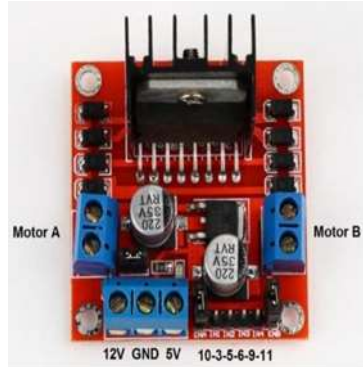


Fig. Motor Driver

III. DC MOTOR

A direct current in a set of windings creates a magnetic field. This field produces a force which turns the armature. This force is called torque. This torque will cause the armature to turn until its magnetic field is aligned with the external field. Once aligned the direction of the current in the windings on the armature reverses, thereby reversing the polarity of the rotor's electromagnetic field. Once aligned the direction of the current in the windings on the armature reverses, thereby reversing the polarity of the rotor's electromagnetic field. A torque is once again exerted on the rotor, and it continues spinning. The change in direction of current is facilitated by the split ring commutator. The main purpose of the commutator is to overturn the direction of the electric current in the armature. This force is called torque. This torque will cause the armature to turn until its magnetic field is aligned with the external field. Once aligned the direction of the current in the windings on the armature reverses, thereby reversing the polarity of the rotor's electromagnetic field.



Fig. Dc motor with gear box

IV. Node MCU ESP8226

NodeMCU ESP8266 was a microcontroller in the form of an electronic board with an ESP8266 chip with the ability to run microcontroller functions and a Wi-Fi internet connection. The NodeMCU has several I/O pins, so this microcontroller became famous for monitoring and controlling applications in IoT systems. NodeMCU can be programmed with the Arduino compiler, named Arduino IDE Software. NodeMCU was a USB port for easy programmed Internet of Things (IoT) is a network of objects connected by the internet and communicates independently without human intervention.

TABLE I. SPECIFICATIONS OF NODEMCU ESP8266*

No.	Specification	NodeMCU
1	Microcontroller	ESP8266
2	Board Size	57 mm x 30 mm
3	Input Voltage	3.3 – 5 volts
4	GPIO	13 pins
5	PWM channel	10 channels
6	Flash memory	4 MB
7	10-bit ADC pin	1 pin
8	Clock Speed	40/26/24 MHz
9	Wi-Fi	IEEE 802.11 b/g/n
10	Frequency	2.4 GHz – 2.5 GHz
11	USB Port	Micro USB
12	Card Reader	Unavailable
13	USB to Serial Converter	CH340G

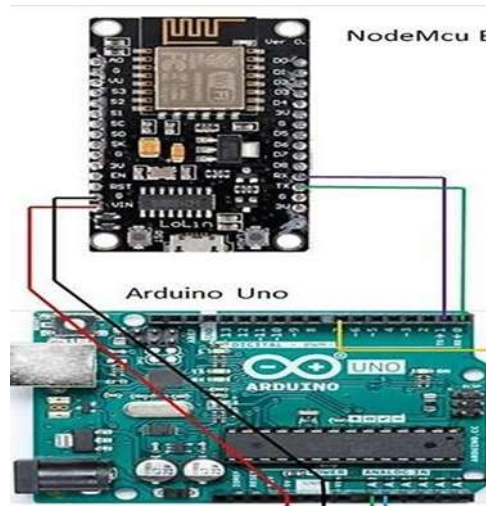


Fig. Node MCU

V. Lead Acid Battery

The lead-acid battery is a type of rechargeable battery that is commonly used in various applications such as automobiles, uninterruptible power supplies (UPS), and backup power systems. It has a nominal voltage of 12V and a capacity of 1.2Ah, which refers to the amount of charge it can store and deliver. The lead-acid battery uses lead plates and sulfuric acid electrolyte to generate electricity through a chemical reaction. It is a relatively low-cost and reliable technology, but has limitations in terms of energy density, weight, and maintenance requirements. Nevertheless, the lead-acid battery remains a popular choice for many applications due to its durability and affordability.



Fig. Battery

VI. WIFI control robot App

Blynk was a new platform that allowed you to rapidly build an interface for controlled and monitored hardware projects from iOS and Android. The Blynk application controls and monitors remotely, provided the microcontroller must be connected to the internet network with a stable connection.



4. METHODOLOGY

Precision agriculture and smart farming involves the integration of modern technologies (like the Internet of Things and Machine Learning) into agriculture practices. It upgrades traditional agricultural practices to accelerate processes, increase efficiency, production and quality of produce.

The driving power of smart farming is IoT? – connecting AI-enabled machines and sensors on farms to make farming methods data-driven and data-enabled.

Technological advancements are now shaping every aspect of farming. From producing to harvesting, every area of crop production and management is getting far more scalable and cost-effective. Here are some technologies that are truly making a difference

With driverless tractors and new IoT enabled machines rising, tasks like seeding and planting are becoming more flexible and effortless. Initially, it was a manual process, requiring a significant amount of effort to be put in by farmers or farmhands. But with the help of machine learning and IoT sensors/devices – farmers can now resolve problems like sowing the seeds in-depth and spacing it at an appropriate distance for better plant growth, etc.

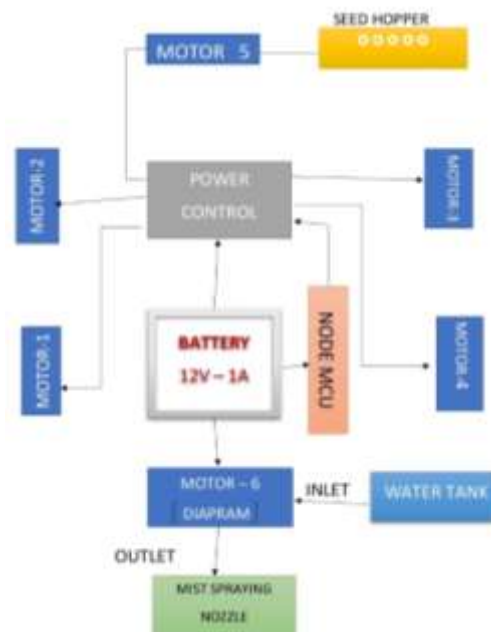


Fig. Block diagram of overall set-up

Electromechanical device which converts electrical energy into mechanical movement is the DC motor. The de motor controls the Robot shaft with the help of L293D IC. Power required to run the Motor and

Arduino is separate. The L293D IC is widely used 16-Pin IC for motor driver. The name itself suggests that it is mainly used for driving the motors. This 16pin L293D IC is capable of running two DC motors at the same time. The direction of running these two motors can be independently controlled.

Bidirectional drive currents of up to 1A at voltages ranging from 4.5 V to 36 V is possible in this IC. The L293D also has the capacity to give bidirectional drive currents of up to 600-mA at voltages of 4.5 V to 36 V. Operational temperatures for this L293D IC ranges from 0°C to 70°C.

Pattern	Input Av	Input B
Stop	LOW	LOW
Anticlockwise	LOW	HIGH
Clockwise	HIGH	LOW
Stop	HIGH	HIGH

Fig. Pattern for Direction change of DC motor

5. RESULTS



Fig. Overall set-up

After Dumping the code, the resulted circuit is the smart seeding and spraying robot. We can monitor and control the seeding and spraying where we make farming. This project aims to utilize the L298 device which inputs to the Arduino Uno microcontroller are distributed by the NodeMCU, fitted with a Wi-Fi module. The Robo control application sends and displays the data on a smartphone using the WIFI signals. The Robo Control app is connected when device is within the limit of 30meters radius. The control indicators are presented to make movement of the robot. The app design is easy to understand and readily to operate even to the Illiterates.

ADVANTAGES

- i. Reduced labour cost.
- ii. Saving time due to automation
- iii. Robots can work 24/7/365 days.



Fig. Robo controller app

6. CONCLUSION AND FUTURE SCOPE

The proposed robotic machine for Agriculture is a automated Seed sowing machine and spraying which has the ability to increase productivity and watering with low effort. It has the capability to handle the weight of the complete setup properly performing all the operations. Seed sowing patterns are observed under different conditions. All the data in Robot is collected in Android application and saved for future process. Robotics in Agriculture plays a very important role for the increase in production and economy development of the country. The scientists in agricultural research are mostly focusing on replacement of laborers completely by robots. In India very few areas are covered with robotic implementation in the future there is a lot of scope for the complete automating in farming. Many Agricultural robots designed are based on GPS but it may have signal issue and may not give accurate results. But in this proposed project WIFI module is used and hence it may give precise results.

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