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Multipurpose Agriculture E-Vehicle Using Robotics and Automation

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ABSTRACT: The usage of multirotor helicopters in the agricultural system is increasing rapidly. In the present generation Automation is used in every industrial system but not much in agriculture. Till now most of the farmers are applying fertilizers and pesticides manually in their fields especially in developing countries. This causes many health issues to them because of the chemicals they are using. In near future Unmanned Ariel Vehicles (UAVs) are used in the agricultural field for monitoring, analyzing the field, disease detection, detection of the faulty area, identifying the suitable pesticide and applying the pesticide in the affected area. Present spraying systems in quadcopters are manually controlled or semi-autonomous. This approach is on the designing of agricultural robot for various tasks. Certainly robots are playing an important role in the field of agriculture for farming process autonomously. In agriculture, the opportunity for robot is enhancing the productivity and the robots are appearing in the field in large number. The proposed system focuses on implementing all the farming process especially in the field of ploughing and seeding by using microcontroller, HC-05 and H06 Bluetooth models, various sensors etc,. The robot detects the planning area by using sensors and seeds need to be planted in the corresponding field using gripper arrangement of the robot. In a continuation, the rest of remaining process could be done automatically. In recent years the development of the autonomous vehicles in the agriculture has experienced more interest. This robot will help the farmers in doing the farming process more accurate.

KEYWORDS: Unmanned Ariel Vehicles (UAVs); Pesticide spraying; Agricultural spraying UAV

I.INTRODUCTION

Due to the rapid growth in the population and industrialization, there is a tremendous decrease in the farming land. The World Bank says that they will need to produce 50% more food by 2050 to keep up the demand. To meet this challenge regular forming methods, have to be changed. So, there is a need to adopt new technical innovations and implement them in the agricultural sector. With the advances in the agriculture field we will be able to know about the farms such as soil PH, water saturation, weeds, disease, crop health, and yield can be estimated. From this information, we can know where to irrigate and where to apply herbicide. Most of the formers in the developing countries like India will have small cultivating areas. They can't afford and adopt new technologies in farming their lands. Hence, they are continuing the old methods of cultivation. It consumes more time and manual power which leads to tiredness and brings many health issues as they directly expose to the fertilizers and pesticides that they are applying to their lands. World Health Organisation survey says that there were more than 3 million cases of pesticide poisoning cases each year. Controlling of the robot mainly require some means of communication. One of the communication means is the wireless Bluetooth connectivity. HC-05 and HC-06 are the Bluetooth modules that are used to control the robot using Smartphone. The Bluetooth application is user friendly and data exchanging between robot and smartphones is done systematically. The developed robot is focused on agricultural purposes like ploughing, sowing and mud leveling. The robot can operate in any weather conditions. This robot is designed as a base for developing systems to enable the automation of farming process such as the spraying of pesticides, picking of fruit and the caring for diseased plants



II. SYSTEM ARCHITECTURE

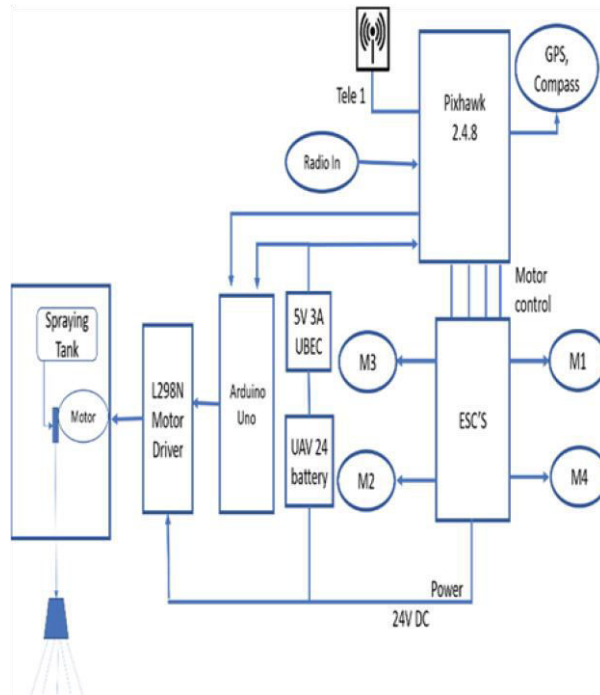


Figure.1. System architecture for Pesticide Sprayer

III. HARDWARE STRUCTURE

Hardware system consists of several components. The figure shows the entire architecture of the spraying drone. The On-board system consists of an aluminium metal frame, 360 (kv) motors, four 14x4.7 propellers, a Pixhawk Controller board, a GPS compass module, four 45A ESCs, power module, a 24 volts 3300mAh 6S 35C Lipo pack battery, Radio controller, Telemetry, Arduino Uno, L298n motor drive and spraying mechanism. Pixhawk 2.4.8 architecture is shown in Fig. 2. It has 6 auxiliary and 8 main output ports. The ESCs for the motors 1-4 are connected to the 1-4 terminals of the main output. The radio controller is connected to the RCIN terminal. The 24 volts Lipo battery is connected ESCs through power module. The produced 5 volts constant DC from the power module energizes the controller board.

Spraying system design

For spraying pesticide, a ten-channel radio is connected to the Pixhawk controller board. In that, one channel is connected to the Arduino Uno. If that channel pin is operated, the PWM signals will be produced by the controller board and then be given to Arduino Uno. Then the Arduino Uno generates the required pulses to the motor driver module. This motor driver module operates the DC motor and sprays the pesticide according to the pulses given by the Arduino Uno.



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Figure.2. Pixhawk 2.4.8 architecture

Mission planner software

Mission Planner is an open-source software for control Plane, Copter, and Rover. Mission Planner can be used as a configuration utility or as a dynamic control supplement for an autonomous vehicle. This software provides access to the google maps on PC or mobile this will help to plan and save load autonomous mission in UAV and it also helps to monitor the UAV by telemetry. Record of telemetry logs helps to view and analyses the vehicle performance.

IV. LITERATURE SURVEY

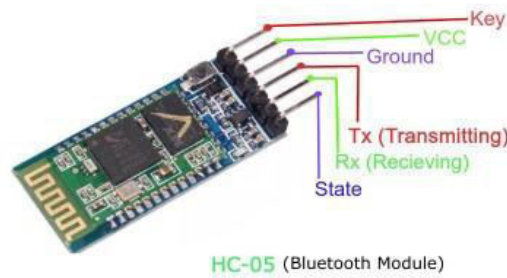
The development of our agricultural robot and the idea used to implement them, started with the study of various papers. Vehicle with safe, reliable and economic operation. This autonomous vehicle goes through the crop lines of Agricultural land and performs duties that are tiresome and/or unsafe to the farmers. First, it's been prepared for spraying, but other configurations are also designed, such as: a seeding, plug system to reach the most notable area of the plants to execute different tasks (pruning, harvesting, etc.), and a truck to move the fruits, crops and crop waste products. The wheels of this robot are designed so that it can travel easily in soft and wet soil. An automatic robot for agricultural purposes. As one of the styles of development on automation and cleverness of agricultural equipment in the 21st century, all types of agricultural robots have been explored and developed to apply lots of agricultural development in many countries. This bot carries out primary functions like picking, harvesting, weeding, pruning, planting, grafting. They developed a robot to perform various activities in farm like cutting and picking. Image processing is used to identify grass in the field and also the height of the crop. A container is used to place the cut grass and harvested crops. Pesticide spraying is also equipped in the robot.

Improvement in agriculture techniques like automatic planting of seed products on ploughed land by using automatic robot. A robotic vehicle having four tires and steered by DC motors was developed. The seed planting device is fixed on the automobile to seed the seed products in even manner. The device will cultivate the plantation by considering particular rows and specific column at predetermined distance depending on different seed products. The obstacle recognition is considered and sensed by an infrared sensor. The complete assemblage is driven by a 12V rechargeable battery pack. The battery pack can be recharged by using solar power which is also attached to robot. This robot can perform bed preparation, seed mapping, seed placement and reseeded operations.



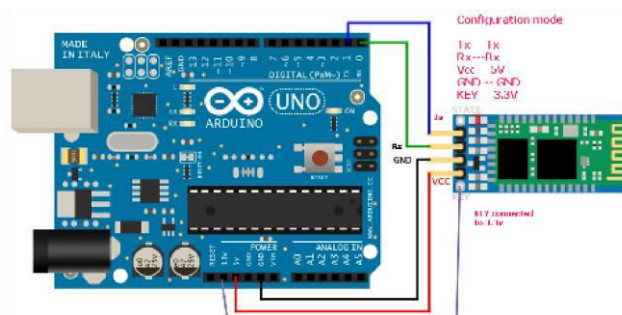
V. COMPONENTS

HC-05 Bluetooth Module



The HC-05 Bluetooth Module is a simple Bluetooth SPP (Serial Port Protocol) module that allows for the setup of a transparent wireless serial connection. The serial port Bluetooth module is fully qualified Bluetooth V2. 0+EDR (Enhanced Data Rate) with a data transfer rate of 3Mbps on a complete 2.4GHz radio transceiver and baseband.

Arduino Uno



Arduino UNO is a low-cost, flexible, and easy-touse programmable open-source microcontroller board that can be integrated into a variety of electronic projects. This board can be interfaced with other Arduino boards, Arduino shields, Raspberry Pi boards and can control relays, LEDs, servos, and motors as an output.

L293D Driver

ADIY L293D Motor Driver Module



The L293D is designed to provide bidirectional drive currents of up to 600-mA at voltages from 4.5 V to 36 V. Both devices are designed to drive inductive loads such as relays, solenoids, DC and bipolar stepping motors, as well as other high-current/high-voltage loads in positive-supply applications.

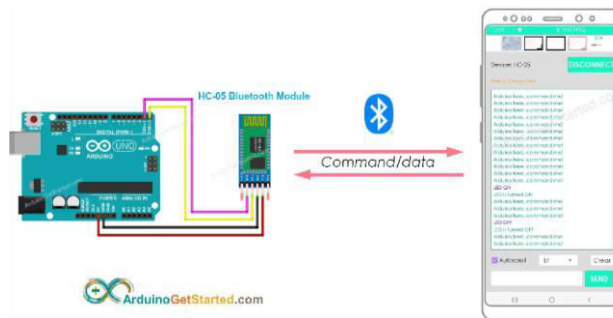


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Mobile App

Bluetooth auto connect app provides you to automatically pair with a Bluetooth device. The app works like Bluetooth Scanner for the android user which helps to search Bluetooth speakers, Bluetooth gadget, Car BT and every Bluetooth wireless technology.

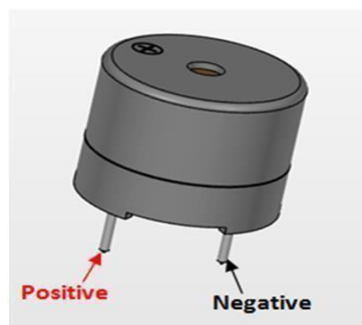


DC Water Pump



As the name implies, water pumps pump water. Whether that be in a vehicle at a business in the home or in a well, shoppers can probably find a water pump. To fit their vehicle or to help them draw water from the ground in a self-dug well to be used in pressure tanks within the location. Vehicle water pumps help regulate the flow of water through agriculture area when the seal on these go bad, the whole pump must be replaced. Located within the home or business, pressure water pumps regulate the water pressure year round controlling water flow to different areas of the location

Buzzer



The buzzer consists of an outside case with two pins to attach it to power and ground. Inside is a piezo element, which consists of a central ceramic disc surrounded by a metal (often bronze) vibration disc. When current is applied to the buzzer it causes the ceramic disk to contract or expand.



VI. WORKING OPERATION

Block Diagram

The L293D motor driver 2 circuit which controls two Dc motors. One DC motor is used for line marker and another one is used for seed dispenser. A line marker is used to mark a line along which seeds are dispensed. The marker has a single teeth and only one line is marked along the path of the robot. The depth through which the mark is done can be controlled through the Smartphone.

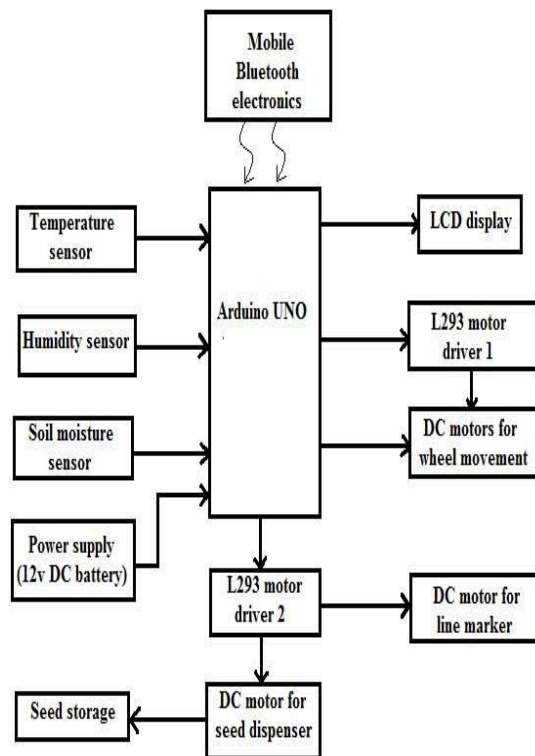


Figure.3. Block Diagram

The seed storage device is a cone like structure or a hopper in which seeds are stored for seeding purpose. The hopper has a tube extension in its lower part and this hopper tube will allow seed to flow to the lower part of the robot i.e., for seeding position. Seeds from the hopper are dispensed for seeding through a seed dispenser. The seed dispenser assembly consists of a motor and a tube with a hole through it and is attached to the shaft of the motor. The dispenser tube is horizontally aligned inside the hopper tube. As the motor rotates the hole in the tube displaces. When the axis of the hole comes in contact with the axis of the hopper tube, a seed is dispensed. As the motor continues to rotate, the axis of the hole is displaced from the axis of the hopper tube. Therefore, there is no seed dispensing. After the seeding operation, a leveler is used to close the soil and to level it.

Cad Module

Design Computer-aided design (CAD) is the use of computer systems (or workstation to aid in the creation, modification, analysis, or optimization of a design. CAD software is used to increase the productivity of the designer, improve the quality of design, improve communications through documentation, and to create a database for manufacturing. CAD output is often in the form of electronic files for print, machining, or other manufacturing operations. The term CADD (for Computer Aided Design and Drafting) is also used. Its use in designing electronic systems is known as electronic design automation (EDA). In mechanical design it is known as mechanical design automation (MDA) or computer-aided drafting (CAD), which includes the process of creating a technical drawing with the use of computer software. CAD software for mechanical design uses either vector-based graphics to depict the



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objects of traditional drafting, or may also produce raster graphics showing the overall appearance of designed objects. However, it involves more than just shapes. As in the manual drafting of technical and engineering drawings, the output of CAD must convey information, such as materials, processes, dimensions, and tolerances, according to application-specific conventions. CAD may be used to design curves and figures in two-dimensional (2D) space; or curves, surfaces, and solids in three-dimensional (3D) space. CAD is an important industrial art extensively used in many applications, including automotive, shipbuilding, and aerospace industries, industrial and architectural design, prosthetics, and many more.

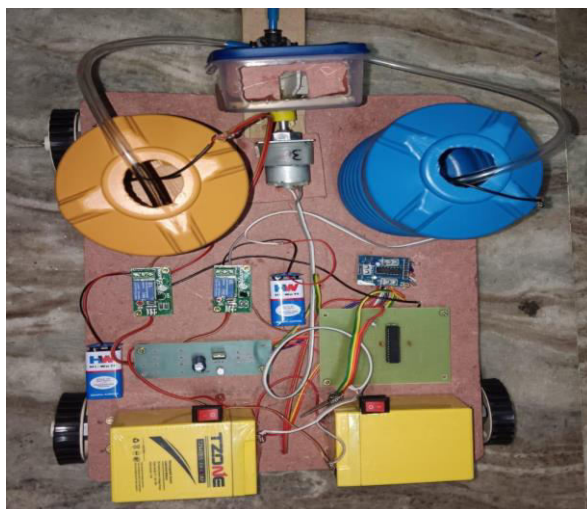


Figure.4. Hardware Model

VII. CONCLUSION

The prototype gave a fairly good rate of area coverage with a reasonably low operating cost. The system addresses the issue of dearth of agricultural labour and ensures safe agricultural practices by completely eliminating, handling of harmful chemicals, cutting crops and extensive labour by the farmer as it can be operated remotely. The proposed spraying & mower robot is suitable for small and medium scale farmers. Large scale production of the spraying unit will reduce the cost significantly giving partial thrust to Indian agriculture practices. With the proposed design of the robot in this project, the above mentioned gaps can be eliminated completely. This project integrates two of the major activities in agriculture which are Pesticide spraying and Crop Cutting (or Weed Removal). Workload on the farmers is decreased and health problems also. Successful in constructing robot which can be travelled on rough, uneven surfaces also and weighing enough load of pump and other equipment. An attempt has been made to develop an app operated agricultural robot which performs fertilizing, water sparing, seed sowing and operations. The proposed system is battery operated and controlled by WIFI device.

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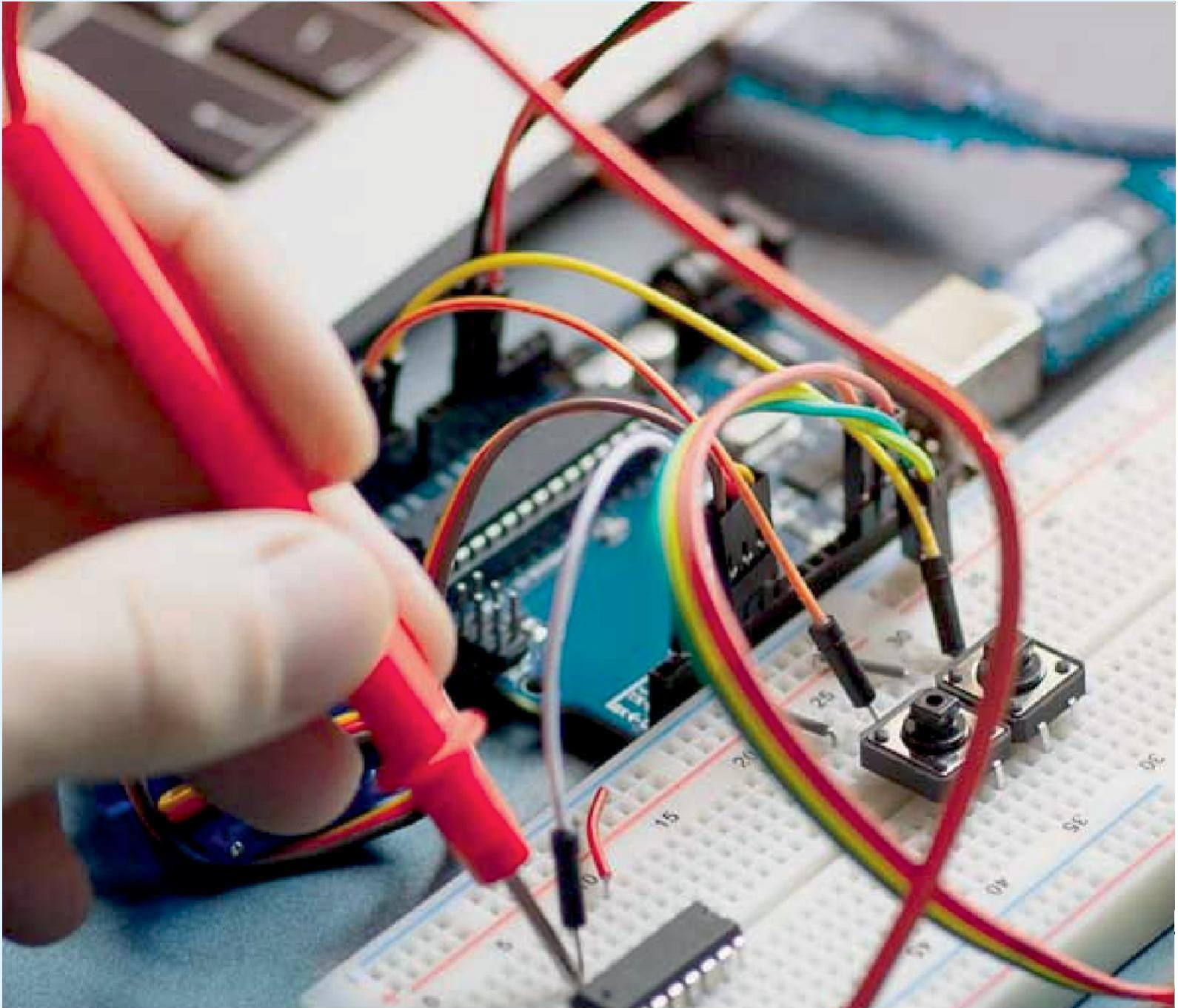
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