



INTERNATIONAL JOURNAL FOR ENGINEERING APPLICATIONS AND TECHNOLOGY

TITLE: SURVEY TO MAKE DRONE BASED PESTICIDES SPRAYING SYSTEM FOR AGRICULTURE

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Abstract

India is a land of agriculture and needs more protection and production equipment, in order to achieve huge productivity. The WHO estimated more than 1 lakh deaths each year due to pesticides and fertilizers sprayed by human being. Every year the pesticides cases are observed specially in developing countries, this pesticide affects the nervous system and respiratory system to the human. It also leads to further disorders in human body. In order to spray pesticides as well as fertilizers an UAV (Unmanned Aerial Vehicle) can be used to avoid human interference with pesticide poison. The Drone Pesticider with the vertical take-off and landing and also uses horizontal spraying with low volume of pesticides in small area. The UAV is usually operated by manual flight plan and the targeted area is sprayed using controlled nozzle. The information is fed through remote(mobile) controlling which controls the functioning of valve to prevent the loss of pesticides. The layout of the circuitry is placed on a small control board known as PCB (Printed Circuit Board). This survey paper describes the sprayer module and development of UAV. Total payload weight of Drone Pesticider is 5kg. This model is used to spray pesticides content to the agricultural fields.

Index Terms: Unmanned Aerial Vehicle (UAV), remote controlling, manual flight, PCB (Printed Circuit Board), etc.

1. INTRODUCTION

The Drone Pesticiders are best chosen because of its high stability and more lifting power. It is also cost-effective alternative to high cost standard rotor-crafts. Drone Pesticiders controlling are easier than the other aerial models of vehicle and are rapidly coming up with advanced cultivation, protection and production activities. The WHO estimated more than 1 lakh deaths each year due to pesticides and fertilizers sprayed by human being. Every year the pesticides cases are observed specially in developing countries, this pesticide affects the nervous system and respiratory system to the human body. The health effects include asthma, allergies and hormonal imbalance and problems related to reproduction, cell disruption and immature development. The Drone Pesticiders are simple to implement with very fewer moving parts which has drastically become a favourite vehicle for enthusiasts using the remote control accessing having an effective aerial platform. A large variety of the Drone Pesticiders were originally developed by hobbyists having the

knowledge of its simplicity. By adding four motors and four propellers to a lightweight frame constructed of light wood, carbon fibre, or fiberglass then connecting it to a remote control through a small control board having stabilization with gyroscopic unit and connected to the battery these vehicles are relatively simple to construct. [1]



Fig-1: Drone Pesticider with pesticide spraying system.

1.1. Aim and Objectives

Aim of this paper is to illustrate the overcome from the ill effects of pesticides on humans from spraying pesticides over large fields in short period of time compared to traditional spraying by using an automated aerial pesticide sprayer. This UAV is basically a combination of spraying mechanism on a Drone Pesticider frame. When we talk about autonomous Drone Pesticider, they are capable of balancing on their own and fly from origin to a destination path and directions. It also uses ultrasonic sensor to detect obstacles and an autonomous flight algorithm. The main aim implies the reduction in health issues that may occur when farmers spray pesticides into the field. Using a Drone Pesticider, we can prevent such health issues that occur due to pesticide spraying. Which will be possible because of the complete system being autonomous and it will go over the fields to spray the pesticides. Another aim is to make it simpler and convenient and also less time consuming for the farmers. Using this approach, we will reduce the time considerably in spraying the pesticides onto the fields. It would become much easier for the farmers as they wouldn't have to walk to fields and carry heavy containers with them.

2. PROBLEM ANALYSIS

The main problem statement for the Indian economy is its main source of income which is majorly through agriculture. Which is mainly dependent on various environmental factors like temperature, rain, climate, etc. The biological factors such as pests, diseases, insects, etc also affects its production.[3] These can be controlled by humans with the help of insecticides and pesticides which will ultimately results in increment of the productivity. Farmers have to carry containers by themselves and spray these pesticides in the field. Thus, pesticide exposure ultimately affects the human health in number of ways causing neurological and skin disorders. According to the survey made by WHO (World Health Organisation) it estimated that every year about 3 million workers are affected by poisonous pesticides.

3. SOLUTION

Drone Pesticiders having inbuilt pesticide sprayer integrated in it to spray fertilizers and pesticides in open crop fields. The main objective of this survey is to reduce the ill-effects of pesticides on humans. The UAVs are specially

designed to spray both fertilizers and pesticides on the field using the universal nozzle which is used to regulate the liquid as well as solid contents. GPS navigation is used for the location following and for auto guidance system foe UAVs.[3]

4. DRONE PESTICIDER WORKING PRINCIPLE

The Drone Pesticiders having the simple built design with four propellers with controllers (Figure 2). The embedded system acting as a flight controller acts as the main component of this vehicle. This controller controls all commands and operations given by us. The four propellers create the differential thrust and the Drone Pesticider hover to move according with the speed of propellers. The construction for the Drone Pesticider can be of two types configured as first ne is Plus (+) and the other one is Cross(x) configuration. Basically, both the models are same, but the control mechanism of these models are slightly different. The cross configuration is bit easier as compared to the plus configuration model. The total thrust produced by the rotors is 10 kg which means total mass to lifted is 5kg. Here the GPS system is used to navigate the Drone Pesticiders. Based on the GPS coordinates value, the microcontroller navigates the vehicle.

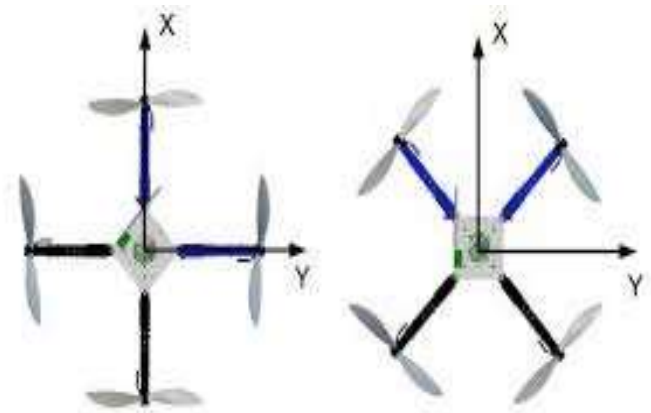


Fig-2: Drone Pesticider configuration

5. REQUIREMENT ANALYSIS

Requirement Analysis is done to analyse the expectations of a user and also required to define the processes used to build or modify an application.

5.1 HARDWARE ANALYSIS

The following hardware components used are:

5.1.1. Arduino Uno Microcontroller

An Arduino is a preassembled board which includes a microcontroller and is programmed using Arduino programming language. It refers to an open source electronic platform which uses software to program it. Arduino uses its IDE which is a development environment for its programming. Basically, this platform provides a path to build and program the electronic components. In this paper we are using Arduino Uno which is a microcontroller based on the ATmega328P. The specifications include 14 digital input and output pins out of which 6 pins can be used as PWM outputs having a USB connection, power jack, ICSP header and also a reset button. It's a complete package of everything needed to support the working of microcontroller.

5.1.2. Brushless DC Motor

A BLDC (Brushless Direct current) motor, also known as ECM (electronically commutated motor) and synchronous DC motors, are said to be synchronous motors powered by DC electricity through switching power supply which produces another electricity in the form of AC (Alternating current) to pass every phase of the motor through closed loop controller.[4] The controller provides current pulses to the winding of the motor that is needed to control the speed and torque of motor.



Fig-3: BLDC motor

5.1.3. E.S.C

E.S.C stands for electronic speed controller which is an electronic circuit controlling and regulating the speed of a BLDC motor. It can also reverse the motor and can provide dynamic braking. Full size electronic vehicles have the speed controlling system to drive the motors and also miniature electronic speed controllers used in powered radio control models.



Fig-4: E.S.C

5.1.4. WIFI Module

The WiFi module is integrated with TCP/IP protocol stack that is helpful for the microcontroller access to your Wi-Fi network. The ESP8266 module is a self-contained SOC and is capable of hosting an application or offloading networking functions using another application processor. It comes pre-programmed with firmware which means you can simply attach this up to your Arduino device and get much more about WiFi ability. With the ever-growing community, the WiFi module is extremely cost-effective component.[4]

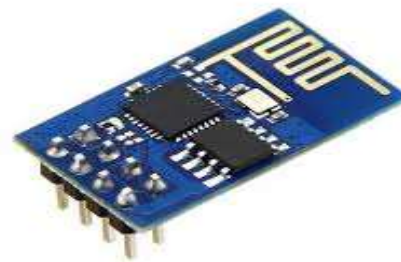


Fig-5: ESP8266 WIFI Module

5.1.5. GPS Module

The GPS module is a well performing complete GPS receiver, which provides a strong satellite search capability. The GPS module used here is NEO-6M with a built-in antenna. It is provided with power and signal indicators, in order to monitor the status of the module. The module can save the data whenever the main power gets shut down accidentally with the help of data backup battery. The 3mm mounting holes can ensure you an easy assembly of your aircraft, thus which can fly at a fixed position and can return automatically.



Fig-6: Neo 6M GPS module

5.1.6. Gyro Sensor

A Gyro sensor module is a complete 6-axis motion tracking component and the module configuration is MPU6050. It combines 3 axis gyroscope with 3 axis accelerometer and digital motion processor all combined in small package. Gyro sensor also comes with an additional feature of on-chip temperature sensor and also having I2C bus interface in order to communicate with the microcontrollers.[2] It also has other auxiliary interface to communicate with the other sensor devices like pressure sensor, magnetometer, etc. When the 3 axis of magnetometer is connected to I2C bus then it can provide a complete 9 -axis of fusion output.



Fig-7: MPU-6050 Gyro Sensor

7.Ultrasonic sensor

The HC-SR04 Ultrasonic sensor is a 4 pin module, in which the names of the pin are Vcc, Trigger, Ground, Echo respectively. This sensor is used in many applications where ever measuring of distance or sensing of objects is required. This module seems like having two eyes like projection in the front which forms its transmitter and receiver.

The ultrasonic sensor works with the simple formula of Distance = Speed x Time. This transmitter transmits an ultrasonic wave, which travels in air and when objected by material gets reflected towards the sensor, this reflected waves are observed by ultrasonic receiver module.



Fig-8: HC-SR04 Ultrasonic sensor

5.2 SOFTWARE ENVIRONMENT

5.2.1. Front End

5.2.1.1. Android Studio

Android studio is the software required to build the android application which is open source integrated development environment (IDE) for android developers. It is available for all the operating system platforms for downloading like on windows, macOS and Linux based. Android studio requires either the Java or Kotlin programming language in order to build application for the android platform.

5.2.1.2. Firebase

In order to develop the quality apps, grow their users and to earn profit, Firebase is the best choice as it is a mobile and web development platform database that provides developers with a variety of tools and services.

Firebase basically a real-time database is a cloud-hosted NoSQL database that helps user to store and synchronize their data in real time. Using a single API, it provides your app the current data and synchronized updates. Realtime synchronization makes it most convenient and easy for the user to access their data from any remote location or device, it may be either web or mobile. It is also highly used to help users collaborate with one another. Realtime database is also amazing for its another benefit that it ships with web SDKs which allows user to build their apps without the need of servers. Whenever the users go offline, the real-time database use local cache from the device for storing the changes. Device when comes online again, the local data is automatically synchronized. It also provides authentication being integrated with firebase authentication to provide simple and intuitive authentication.

6. ADVANTAGES & DISADVANTAGES

6.1. ADVANTAGES

1. Drones are used in large scale farming for spraying of pesticides and fertilizers due to its remote control operation from distant.
2. Drones helps to protect framers from pesticides harm to prevent poisoning and skin diseases.
3. Drones have high efficiency which can spray in large sector area in less time.
4. Drones spray in fix area and space which helps in environmental protection.
5. It also helps in less consumption of pesticides.
6. It also reduces the cost of pesticides and fertilizers spraying.
7. Drones have wide range of applications such as remote control, low height flight, no harm to crop, etc.
8. Drones are easy to use and maintain, requires less cost for maintenance.

6.2. DISADVANTAGES

1. Most of the agricultural drone have short flight time. This may not be effective in monitoring large areas.
2. The flight range also limits the radius that can be cover during every flight time.
3. Drones with good features and designs are costly.
4. It requires basic knowledge and skills to operate the agricultural drone.
5. It is difficult to fly them in extreme conditions.

7. CONCLUSION

Agricultural drone helps farmer in easy implementation of farming. Drone helps for spraying large sector of area easily in less time. Drones reduces the risk of infection and diseases produced by pesticides. Drones can be easily be used and maintained but requires basic knowledge and skills to operate. Drones are costly but reduces other costs of farming. Drone can be controlled by Android app. Drone have wide range of applications in agricultural sector.

8. ACKNOWLEDGEMENT

We would like to express our special thanks of gratitude to our guide Prof. V. R. Shelke for guiding us and for sharing their valuable time. We are highly obliged in taking this valuable opportunity to present this survey paper in this national level paper presentation event. This has been the best opportunity to learn and present the views, and with the freedom to carry out the proposed topic. Lastly, we would like

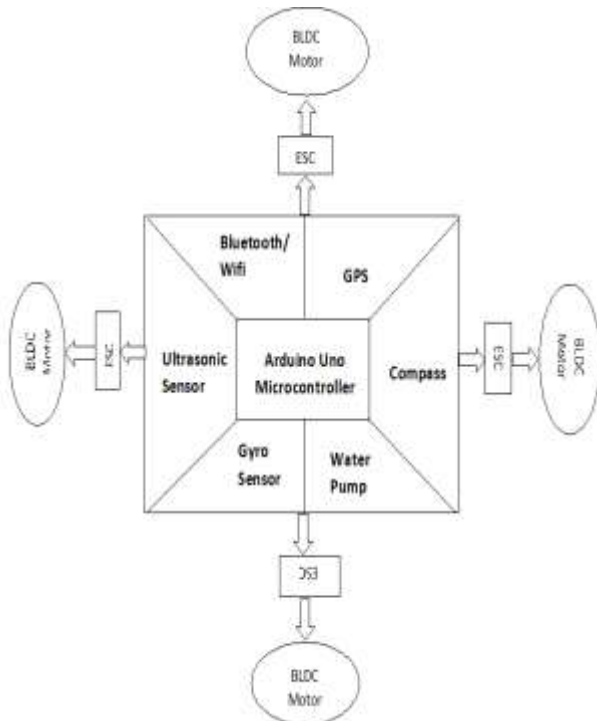


Fig-9: Block diagram of the proposed model of Drone Pesticider.

to thank all the people involved for making this paper successful by guiding us and by providing valuable suggestions.

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