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Agriculture drone for fertilizer spraying

[1] **Ms.Diksha G Tadke,** [2]**Dr. Anuradha S Deshpande**, [3]**Ms.Twinkle Ransingh**, [4]**Ms. Akansha Dhaygude**

[1]Student, Department of ENTC Engineering JSPM'S Imperial College of Engineering, Wagholi , Pune,
[2] Associate Professor, Department of ENTC Engineering JSPM'S Imperial College of Engineering, Wagholi , Pune,
[3]Student, Department of ENTC Engineering JSPM'S Imperial College of Engineering, Wagholi , Pune,
[4] Electronics and Telecommunication Department, JSPM'S Imperial College of Engineering, Wagholi , Pune,

Abstract : Agriculture is an important source of income in India. The yield of agriculture depends on factors like soil quality, rain water, seeds, weather and also on fertilizers and pesticides. The direct contact with fertilizer and pesticides can cause the health issues to persons manually handling it. The proposed system is developed to avoid the direct manual contact with fertilizer and pesticides and to spray pesticides and fertilizer all corners of the farm equally and efficiently. This Paper proposes the use of drones in smart agriculture and the idea can revolutionize agricultural. This Paper explore the use of drones in agriculture, highlighting their benefits, challenges, and future prospects. Additionally, it explores the technical aspects of drone technology, including their components, operation, data collection, and analysis.

Keywords—Flight controller, BLDC motors, ESC wires, RF transmitter, Spray.

I. INTRODUCTION

Agriculture in India accounts for over 60% of the population. It serves as the backbone of the Indian economy. It is very important to improve the productivity and efficiency of agriculture by providing the farmer with a safe harvest. Various operations such as pesticide spraying and fertilizer spraying are very important in farming. While spraying pesticides has become mandatory, it is also proving to be a harmful process for farmers. According to a WHO (World Health Organization) survey, around 3 million workers are affected by pesticide poisoning every year, causing 18,000 deaths. Avoiding pesticides completely is also not possible, as the desired result must be achieved. Therefore, the use of drones in such cases offers the best solutions to these types of problems, as well as the required productivity and product efficiency.

Fig 1. Crop spraying system

During last few years the technological advancements have shaped the evolution of drone-mounted sprayers. These advancements include improvements in drone design, flight control systems, battery technology, payload capacity, and navigation capabilities. Drones are becoming more efficient, reliable, and capable of carrying larger pesticide payloads. To ensure accurate and efficient pesticide application, drones integrated advanced navigation and sensor technologies.

In this work a drone as displayed in figure 1; for spraying the pesticides which can spray pesticide over a large area in short interval compared to traditional spraying techniques. This model can be used for spraying pesticides equally and efficiently to each and every crop, it also overcomes the harmful effect of pesticides on humans as the humans are not involved in the spraying process.

II. LITERATURE REVIEW

There are some designs of fertilizer spraying drones observed in literature. The author in [2] presented a comprehensive description of an agricultural drone designed specifically for the precision application of spraying fertilizers and pesticides. The drone combines the capabilities of remote sensing, GPS navigation, and payload delivery systems to enable efficient and targeted spraying, reducing wastage of fertilizer and environmental impact while enhancing crop yields. The drone was built with a lightweight and sturdy frame to ensure durability during flights. It utilized advanced sensor systems, including high-resolution cameras, multispectral or hyperspectral sensors, and weather monitoring instruments such as temperature and humidity sensor [3].This advanced system combined the capabilities of a drone with automated spraying mechanisms and intelligent control systems. The quad copter in [4] was equipped with a specially designed spraying mechanism that can disperse pesticides or fertilizers in a controlled manner. The system was typically operated remotely by a trained operator who monitors the flight and controls the spraying process. The advancements in [5] included improvement in drone design, flight control systems, battery technology, payload capacity, and navigation capabilities. To ensure accurate and efficient pesticide application, drones were integrated with advanced navigation and sensor technologies. The development of a spraying system for a drone involved integrating various technologies to create a reliable and efficient solution for aerial spraying applications. The goal was to provide a precise and versatile tool that can enhance productivity and reduce costs in industries such as agriculture or environmental management. This enabled accurate and efficient spraying operations while avoiding unnecessary overlap or missed areas [6]. The drones equipped with spraying systems have proven to be highly efficient and cost-effective for pesticide and fertilizer applications. By using GPS and onboard sensors, drones can navigate fields autonomously, ensuring accurate and uniform coverage. [7]

From literature review it was observed that the initial and maintenance cost of drones was high due to which it is unaffordable for most of the farmers also a skilled person was required to operate the drone. Additionally, the heavy weight of the drone led to instability of drone. The flight controller used required a complex configurations and programming for efficient working of drone. This work proposed a drone for agree culture use which tries to overcome the drawbacks of the designs implemented in literature

III. BLOCK DIAGRAM AND DESCRIPTION

The block diagram of an agriculture drone for fertilizer spraying is as shown in figure 2.

The main components are described below:

- *DJI Naza*

The DJI Naza is a flight control system that provides stabilization and navigation capabilities to the drone. It includes sensors such as accelerometers, gyroscopes, and a barometer.

- *Communication module*

The communication module is responsible for transmitting and receiving data between the drone and the ground station

- *Fertilizer Spraying System*

The fertilizer spraying system includes a tank for holding the liquid fertilizer, a pump for pressurizing the liquid and the nozzles for spraying the fertilizer on the crops.

- *Battery System*

Battery system provides power to the drone. It typically includes a lithium polymer battery and a battery management system to monitor and control the batteries.

- *Propulsion System*

The propulsion system includes motors and propellers that provide lift and thrust to the overall drone.

The block diagram of an agriculture drone for fertilizer spraying using DJI Naza flight controller as shown in figure 2, shows the integration of various components that work together to provide a precise and efficient solution for precision farming.

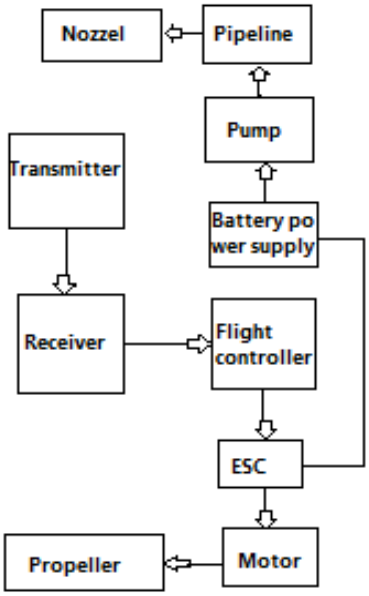

Fig 2 Block Diagram of drone

Quadcopters make use of 4 Motors as presented in figure 3. Two of these motor spin clockwise while the other two spin counterclockwise. Motors on the same axis spin in the same direction, as illustrated here.

Hovering conditions for the drone are as follows:

- When, mg(weight) < F xss=removed> F(thrust) the quad will ascend.
- When, mg(weight) = F(thrust) the quad will hover.
- When, mg(weight) > F(thrust) the quad will ascend.

The developed quadcopter shown in figure 4 has four sets of moments

1) Roll

2) Pitch

3) Throttle

4) Yaw.

Fig 3 Quadcopter moments

IV. RESULT

Drones equipped with spraying equipment that can precisely apply fertilizers, pesticides to crops was successfully implemented as shown in figure 4, 5 and 6. The testing of the drone was done successfully. The initial cost and maintenance cost is reduced as the better flight controller is used which does not require frequent maintenance.

The proposed system does not require any professional training for operating the drone as it is easy to handle and convenient to use for farming. The weight is reduced as the light weight flight controller and battery is used. Also the design of flight controller is less complex. This allows farmers to apply the correct amount of inputs exactly where they are needed, reducing the amount of chemicals used and minimizing waste.

Fig 4 spraying system

Fig 5 Quadcopter drone

Fig 6 Drone spraying fertilizer

V. CONCLUSION:

The proposed drone can be used for effectively the pesticides or fertilizers effectively. The proposed drone has many advantages such as less cost, simple flight controller design which makes the drone easy to handle. With these advantages the drone can be used to spray the pesticides and fertilizer evenly to the crop. which will lead to proper growth of crops and increase the agricultural yield. However, there are still some challenges to be addressed, such as regulatory issues, limited battery life. Nonetheless, the potential benefits of using agriculture drones for fertilizer spraying make them a promising technology for the future of farming.

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