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Agromist: Design and Development of an Aerial Pesticide Spraying Drone for Precision Agriculture

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Abstract: ***Agriculture is very important for feeding the increasing number of people, and protecting crops effectively helps increase harvests and make farming more sustainable. Using traditional methods to spray pesticides is hard work, takes a lot of time, and can harm farmers' health because of exposure to dangerous chemicals. To solve these problems, this paper introduces AgroMist, a drone that sprays pesticides from the air using a hexacopter. The system is made with a ZD850 hexacopter frame, a Cube Orange flight controller, a GPS module, brushless DC motors, electronic speed controllers, and a spraying system. The drone can be operated either by hand or automatically using Mission Planner software. It helps spread pesticide evenly and reduces waste. How it works is by using the flight controller to process signals and control the motor speed for steady flight. A pump system spreads the pesticide over the crops, and the air from the propellers helps the spray reach deeper into the plants. Test results show that the system flies steadily, moves accurately, and sprays effectively. This system makes farming safer, less tiring, and more productive. This work highlights how drone technology can help in precision agriculture.***
Keywords: Agricultural Drone, Hexacopter, UAV, Pesticide Spraying, Precision Agriculture, Cube Orange, GPS.

I. INTRODUCTION

Agriculture is one of the most important industries for economic growth and food production. With the need for more food, farmers must use better technologies to improve productivity and make farming more efficient. One big challenge is applying pesticides to crops in a way that protects them from pests and diseases. Traditional methods of spraying require manual labour, which is physically tough and puts farmers in danger from harmful chemicals. This can create serious health problems and lead to inefficient use of pesticides because they may not spread evenly. So, there is a need for modern solutions that make spraying safer and more effective. In recent years, Unmanned Aerial Vehicles (UAVs) have become popular in agriculture. Drones offer a faster and safer alternative to traditional methods by allowing automatic spraying and reducing the need for human involvement. They can cover large areas quickly and spread pesticides evenly. In this work, an agricultural drone called AgroMist is developed using a hexacopter design. The system is built to carry and spray pesticides over fields. The hexacopter design offers better stability and a larger carrying capacity compared to smaller drones. The main goal of this project is to create a reliable and efficient drone system that reduces manual work, improves the effectiveness of spraying, and increases safety in farming operations.

II. LITERATURE REVIEW

Many studies have looked into using UAVs in agriculture, especially for spraying pesticides and monitoring crops. Researchers have developed different drone designs such as quadcopters, hexacopters, and octocopters for farming uses. Multi-rotor drones are found to be highly useful because they can hover and stay stable during spraying. Adding GPS technology allows for accurate navigation and even coverage of farmland. Earlier studies also show that the airflow from drone propellers can help improve how well the pesticide reaches the plants. Using mission planning software for automation further increases efficiency and reduces human involvement. However, there are still some challenges, such as short flight times, limited carrying capacity, and high costs. The AgroMist system addresses these issues by using a well-designed hexacopter and efficiently combining components for better performance.

III. DESIGN AND SYSTEM ARCHITECTURE

The AgroMist system is built as a hexacopter drone using the ZD850 frame, which gives a strong and stable base for all the parts. The system has the following main components:

- Cube Orange Flight Controller
- Brushless DC Motors (5010–360KV)
- Electronic Speed Controllers (40A)

- LiPo Battery (6S)
- GPS Module
- Spraying System (Tank, Pump, Nozzles)

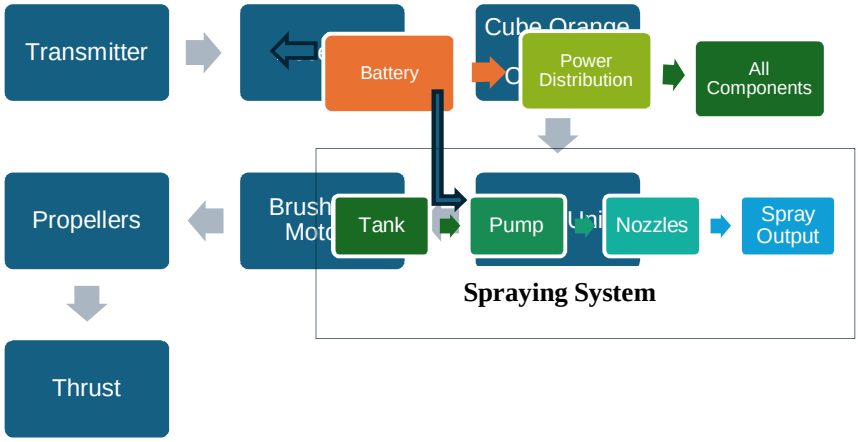

Fig. 1: Block Diagram of AgroMist Drone System

The flight controller is the main part that processes signals and controls the drone's movements.The motors and propellers create lift, while the ESCs manage the motor speed.

Table 1: Components Used in AgroMist Drone

S.No	Component	Specification	Function
1	Frame	ZD850 Hexacopter	Structural support
2	Flight Controller	Cube Orange	Control & stabilization
3	Motors	5010 360KV	Generate thrust
4	ESC	40A	Control motor speed
5	Battery	6S LiPo 22000mAh	Power supply
6	GPS Module	Crystal Ball GPS	Navigation
7	Pump	EFT 5L Pump	Spraying pesticide
8	Transmitter	T12	Manual control

The spraying system includes a tank for holding pesticide, a pump to control how much is sprayed, and nozzles for distributing it. The system ensures the pesticide is spread evenly over the field.

IV. SOFTWARE CONFIGURATION

Mission Planner software is used to set up and control the AgroMist drone. The Cube Orange flight controller is programmed with ArduCopter firmware, allowing the drone to operate as a multirotor. The software is used to adjust sensors like the accelerometer, compass, and radio system to ensure the drone flies smoothly. GPS-based navigation is used for automatic drone operation. Mission Planner also keeps track of important details in real-time, such as battery level, altitude, and position. Safety features like Return-to-Launch (RTL) are set up to make sure the system works reliably.

V. EXPERIMENTAL RESULTS AND DISCUSSION

The AgroMist drone was tested in different conditions to check how well it works.The drone showed stable takeoff, hovering, and landing. The hexacopter design offered good balance and control even when carrying a load. The flight controller kept the drone stable.

Table 2: Performance Specifications

Parameter	Value
Frame Type	Hexacopter
Payload Capacity	~5 Liters
Flight Time	10–15 minutes
Battery	6S LiPo
Control Mode	Manual + Autonomous
Navigation	GPS Based

Table 3: Flight Time vs Payload

Payload (Liters)	Flight Time (Minutes)
0	15
2	13
4	11
5	10

The spraying system spread pesticides evenly. The pump worked well, and the nozzles gave consistent coverage. The airflow from the propellers helped the pesticide reach the crops better. It was seen that adding more weight made the flight time shorter and affected stability. However, the system performed well within the best payload range. Overall, the results confirm that the AgroMist system is reliable and effective for spraying pesticides in farming.

Fig2: Hexacopter drone with Spray system

VI. CONCLUSION

The AgroMist drone system offers a smart and effective way to spray pesticides in farming. It makes farming easier by reducing the need for manual work, makes the process safer for people, and helps spread the pesticides more evenly and efficiently. By combining good hardware and software, the system keeps the drone flying smoothly, guides it accurately, and ensures the pesticide is spread uniformly. This system has successfully achieved the goals of boosting farm output and lowering the amount of chemicals used. Looking ahead, there are plans to improve the system with AI for watching crops closely, using better sensors, and upgrading the battery to make it work even better.

VII. ACKNOWLEDGMENT

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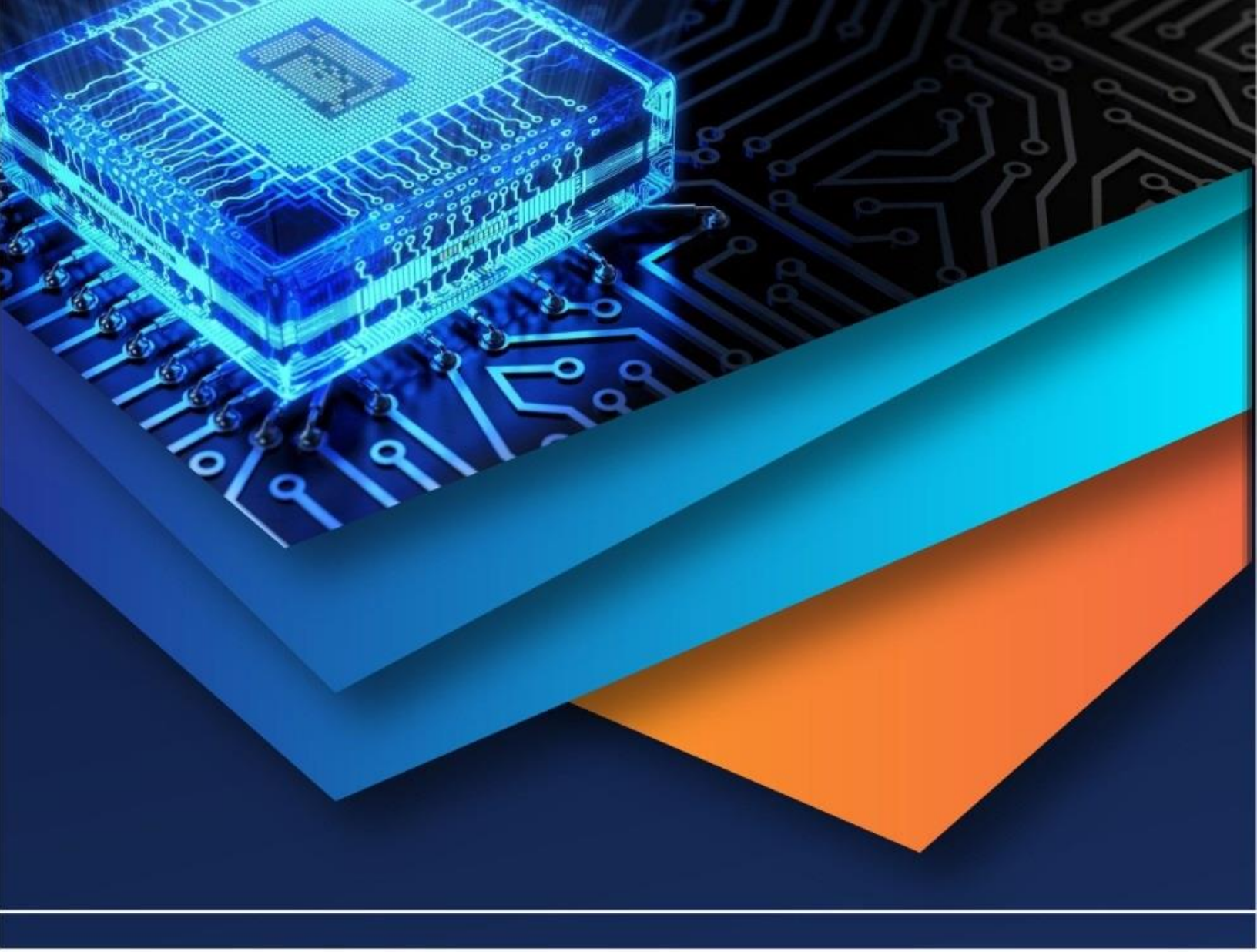

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