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Agriwing: Advanced UAV for Pesticides Spraying

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Abstract: *Agriculture is a critical sector that sustains the global population, but it faces significant challenges such as pest infestations, labor shortages, inefficient resource utilization, and environmental degradation. This project focuses on the design, development, and implementation of a fixed-wing drone equipped for autonomous pesticide spraying and real-time video recording. Fixed-wing drones are particularly suitable for large-scale agriculture due to their ability to cover extensive areas rapidly and efficiently. This project not only aligns with the growing demand for precision farming but also contributes to global efforts in sustainable agriculture. By leveraging the potential of fixed-wing drones, the project seeks to empower farmers with advanced technology, improve productivity, and ensure environmental stewardship, paving the way for smarter and more sustainable agricultural practices.*

Keywords: *Agriculture*

I. INTRODUCTION

Agriculture is a cornerstone of human civilization, providing the food and resources necessary to sustain the growing global population. However, modern farming faces challenges such as pest infestations, resource inefficiency, and labor shortages. Traditionally, pesticide application has relied on manual labor or ground-based machinery, both of which are time-consuming, labor-intensive, and prone to inefficiencies. The integration of drones into agriculture, particularly fixed-wing drones, has emerged as a revolutionary solution. Fixed-wing drones offer extended range, high efficiency, and the ability to cover large areas quickly, making them ideal for large-scale pesticide spraying. Additionally, their ability to stream real-time video enhances monitoring capabilities, providing valuable insights into field conditions and spraying accuracy. This project aims to design and implement a fixed-wing drone equipped for pesticide spraying and real-time video recording. By leveraging modern technologies such as autonomous navigation, GPS, and precision spraying systems, the project seeks to improve farming efficiency, reduce environmental impact, and promote sustainable agricultural practices.

II. METHODOLOGY

This methodology outlines the design, development, and implementation of a fixed-wing drone for pesticide spraying in agricultural applications. It covers system design, hardware and software components, flight operations, safety considerations, and evaluation procedures.

The fixed-wing drone is designed to efficiently spray pesticides over large agricultural fields. The system consists of the following key components: 1. Lightweight yet durable composite materials to enhance flight endurance. 2. A liquid tank, pump, and nozzle array for even pesticide distribution. 3. A High-Resolution camera used for recording the videos for precision agriculture.

The development of the fixed-wing drone involves selecting and integrating essential hardware components: 1. Use of carbon fiberfor durability and lightweight performance. 2. High-efficiency brushless motors with aerodynamically optimized propellers. 3. High-pressure pump with adjustable nozzles for variable droplet sizes. 4. Lithium-polymer (LiPo) battery pack for extended flight duration.

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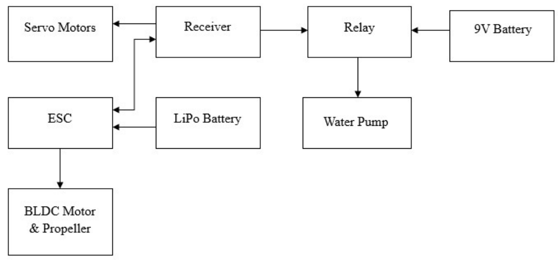

Fig 1: Block Diagram of the Fixed Wing Drone

The operational procedures for pesticide spraying involve:1. Checking battery charge and system diagnostics. Loading pesticide and calibrating spray system.2. Adjusting altitude and speed for optimal coverage.3.Autonomous or semi-autonomous flight mode selection. Continuous monitoring of spray dispersion via camera.4.Cleaning the spray system. Reviewing telemetry data for performance analysis.

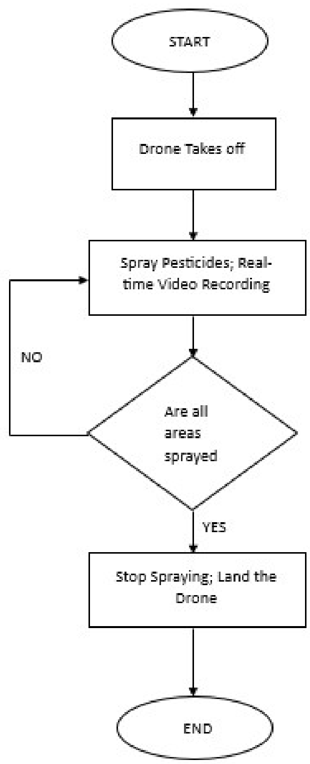

Fig 2: Flowchart for Spraying Pesticides and Video Recording

This flowchart outlines the process of the drone for spraying pesticides in agriculture, along with real-time video recording for monitoring. Here's a breakdown:

START: The process begins.

Drone Takes Off: The drone is launched into the air.

Spray Pesticides;Video Recording: The drone starts spraying pesticides over the designated agricultural area. Simultaneously, a video feed is transmitted to a monitoring station.

“Are all areas sprayed?”: This decision point checks if the entire target area has been covered with pesticide.If all areas are not sprayed, the drone continues spraying and recording video until the entire area is covered. If all areas are sprayed, the process moves to the next step.

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Stop Spraying; Land the Drone: Once the entire area is sprayed, the drone stops spraying and proceeds to land safely.
END: The process is complete.

This methodology ensures the successful design, deployment, and operation of a fixed-wing drone for pesticide spraying. The integration of precision spraying technology, autonomous control, and safety measures enhances agricultural productivity while minimizing environmental impact.

III. RESULTS

The development of a fully functional fixed-wing drone system capable of automating pesticide spraying and providing real-time video recording for agricultural applications. This systemenables precise and efficient pesticide application over large agricultural fields, reducing chemical waste, labor costs, and environmental impact. The drone ensures accurate coverage and eliminating the need for manual operation. The video recording feature allows farmers to monitor operations remotely and assess field conditions instantly. Overall, the project aims to enhance productivity, promote sustainable farming practices, and improve safety by minimizing human exposure to hazardous chemicals, offering a scalable and cost-effective solution for modern agriculture.

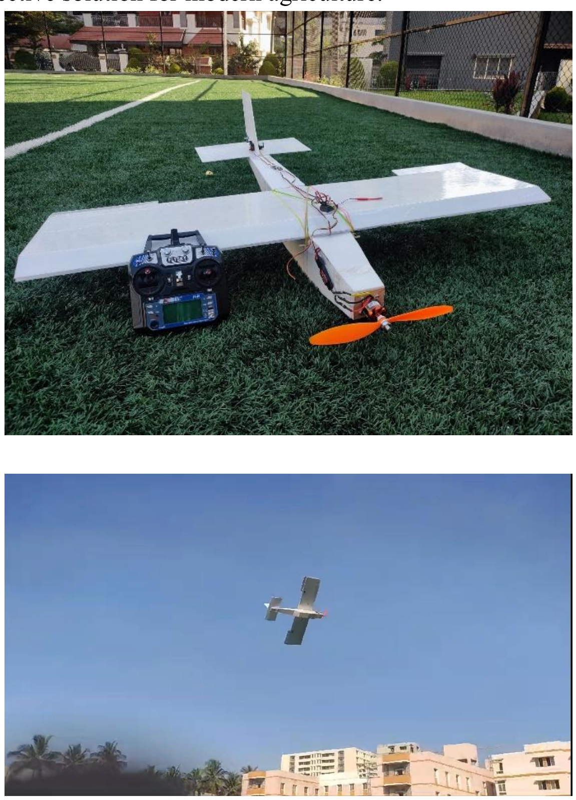

Fig 3: Outcome of the Project

IV. DISCUSSIONS

Precision Agriculture Expansion: The drone can be integrated with additional sensors such as multispectral or thermal cameras to gather detailed crop and soil data. This data can be used for precision farming, including variable rate application of fertilizers, irrigation, and other resources.

IoT and Smart Farming Ecosystems: Linking the drone to IoT-based systems can create a real-time monitoring network, allowing seamless communication with other devices like weather stations or ground sensors. This integration can optimize spraying schedules and provide predictive analytics for crop management.

Increased Payload and Multitasking: Future versions of the drone could handle larger payloads for extensive farms or be equipped to perform multiple tasks, such as seeding, crop mapping, or weed removal, making it a multi-functional tool.

Sustainability and Eco-Friendliness: The use of bio-pesticides and environmentally friendly spraying methods can be incorporated, aligning with global efforts to promote sustainable agricultural practices.

V. CONCLUSIONS AND RECOMMENDATIONS

Conclusion:

The fixed-wing drone for pesticide spraying represents a significant advancement in modern agricultural practices. By integrating precision spraying, and environmental safety measures, the drone ensures efficient pesticide application, reducing labor costs and improving overall crop health. The ability to cover vast agricultural fields with minimal human intervention enhances productivity while promoting sustainable farming techniques.

Future advancements in drone technology, such as AI-driven decision-making and enhanced battery efficiency, will further improve the effectiveness of pesticide spraying. Continued research and field testing will be essential in optimizing operational parameters and ensuring compliance with evolving agricultural regulations. The deployment of fixed-wing drones in agriculture marks a transformative step toward precision farming and ecological sustainability.

Recommendations:

Although the developed UAV is functioning as desired according to the design criteria implemented, it can be modified to be fully automated. In view of this, the following are recommended:

- The system can be fully automated with an autopilot configuration and integrated with a mobile charging station.
- A lightweight battery with high voltage and capacity is recommended for longer flight time.
- The drone frame and also the tankcan be 3D printed to aid better aerodynamics features.

REFERENCES

[1] Zhijian Xu, Lihua Zhu, Zhiqiang Wu, dept. Mechanical Engineering Nanjing University of Science and Technology Nanjing, China, “A Path Planning Method of Alleviating Spraying Deviation for Agricultural Rotorcraft”, 2022 IEEE/AIAA 41st Digital Avionics Systems Conference (DASC)

[2] Oluwasina Lawan Rominiyi, Ayodeji Olalekan Salau, Bernard Akindade Adaramola, Micheal Adegoke Ogunlade, Timileyin Oladimeji Olanibi, F.A. Akintoye, Afe Babalola University, Ado-Ekiti, Nigeria, “Development of a Precision Agricultural Based Unmanned Aerial Vehicle for Pest Control”, 2023 International Conference On Cyber Management And Engineering (CyMaEn)

[3] P.Balaji, D.Devasena, S.Kayalvizhi, N.Aarthikannan, “IoT-Empowered Precision Agricultural Multi-rotor Drones: A Revolutionary Approach for Sustainable Farming”, 2023 International Conference on Recent Advances in Science & Engineering Technology (ICRASET)

[4] Lorenzo Becce, Nicoletta Bloise, Giorgio Guglieri, “Optimal Path Planning for Autonomous Spraying UAS framework in Precision Agriculture”, 2021 International Conference on Unmanned Aircraft Systems (ICUAS) Athens, Greece