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Autonomous Delivery Drone

Prof. Sumit Thakre [1], Mr. Rahul Gavade [2], Ms. Sarita Shinde[3] ,Mr. Varun Gujar[4], Mr. Omkar Kamble[5]

[1]Lecturer, Electrical Engineering Department
sumit.thakre@zealeducation.com

[2,3,4,5,]Diploma Student, Electrical Engineering Department
rahulgavade180@gmail.com
saritashinde067@gmail.com
gujarvarun83@gmail.com
kambleomkar0216@gmail.com

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Abstract -
The rapid advancement of drone technology has opened new possibilities for efficient and autonomous delivery systems. This project focuses on developing an autonomous delivery drone system using the E88 Pro Max and KK2.1.5 flight controller. The goal is to design a reliable, cost-effective, and intelligent drone capable of delivering packages with minimal human intervention.

The project involves integrating GPS navigation, obstacle avoidance, and AI-based path planning to ensure precise and safe deliveries. The E88 Pro Max provides a lightweight and efficient platform, while the KK2.1.5 controller ensures stable flight dynamics and maneuverability. Key features include automated takeoff and landing, real-time tracking, and payload management.

To enhance navigation, the system utilizes waypoint-based GPS routing and a fusion approach, combining IMU, ultrasonic, and LiDAR sensors for accurate positioning and obstacle detection. The drone will be programmed using custom firmware and open-source flight control software, ensuring adaptability to various delivery scenarios.

1.INTRODUCTION

In recent years, autonomous drones have revolutionized various industries, particularly logistics and delivery services. This project focuses on developing an autonomous delivery drone using the E88 Pro Max drone and the KK2.1.5 flight controller, optimizing its navigation, payload capacity, and delivery efficiency.

The objective is to create a smart, self-sufficient drone system capable of transporting small packages with precision and reliability. By integrating GPS-based navigation, obstacle detection, and real-time monitoring, the drone will ensure safe and efficient deliveries, reducing human intervention and operational costs.

The E88 Pro Max, known for its compact design and stability, provides the ideal platform for this project, while the KK2.1.5 flight controller enhances flight control accuracy. Additional features such as waypoint programming, autonomous landing, and battery optimization will be implemented to improve overall performance.

This project has significant potential in last-mile delivery, medical supply transport, and e-commerce logistics. By leveraging autonomous technology, it aims to enhance efficiency, minimize delays, and contribute to the advancement of smart delivery systems.

2. LITERATURE REVIEW

For your literature review on autonomous delivery drones using the Drone E88 Pro Max and Drone KK2.1.5, you may want to cover the following areas:
sensor Overview of Autonomous Delivery Drones
History and evolution of delivery drones
Current applications in logistics, medical supply delivery, and e-commerce

Drone Technologies and Components
Flight control systems (comparison of E88 Pro Max and KK2.1.5)
Navigation and obstacle avoidance
Battery life and payload capacity

Autonomous Flight Algorithms
Path planning and route optimization
AI-based object detection and collision avoidance GPS and vision-based navigation

Communication and Control Systems
Remote control vs. fully autonomous operation
Use of 4G/5G and for long-range communication

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Ground control stations and real-time monitoring

Regulatory and Safety Considerations
Aviation laws and drone delivery policies in different countries
Safety measures and fail-safes for autonomous flight

Challenges and Future Trends
Scalability and cost-effectiveness of drone deliveries
Integration with smart cities and IoT
Advances in battery technology and alternative power sources

3. METHODOLOGY

3.1 CONCEPT OF AUTONOMOUS DELIVERY DRONE

An autonomous drone delivery system is when drones (small flying robots) are used to deliver packages without needing a human to control them. These drones fly on their own using special technology, like GPS, sensors, and cameras, to navigate the sky and avoid obstacles. They carry packages, fly to a destination, and drop them off, all by themselves.
The main idea is to make deliveries faster and cheaper by using drones instead of trucks or people. For example, instead of waiting for a delivery truck, a drone might fly straight to your house to drop off a small package.
However, there are challenges, like making sure the drones are safe to fly in the sky, follow rules, and can carry enough weight without running out of battery too quickly. But overall, this system could make deliveries much more efficient.
Challenges and Barriers to Implementation

Safety Concerns: Drones may cause accidents if they malfunction or collide with objects, which raises safety issues for people and property.

Regulations: Governments have strict rules about where and when drones can fly, making it difficult for companies to use them freely for deliveries.

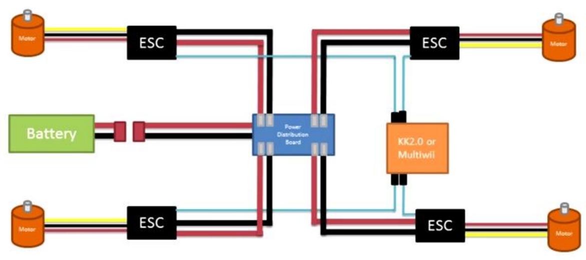
Technology Limitations: Drones need advanced technology to navigate, avoid obstacles, and operate in different weather conditions, which can still be unreliable.

Cost: Building and maintaining drones is expensive, making it a big investment for companies, especially in the early stages.

Privacy Issues: Drones equipped with cameras could invade people's privacy by capturing images or videos without their consent.

Public Acceptance: People may be skeptical or uncomfortable with drones flying over their homes, and some might worry about noise or security risks.

4. BLOCK DIAGRAM



4.1 Working of Block Diagram

The working principle of autonomous delivery drones like the Drone E88 Pro Max and Drone KK2.1.5 involves several key components to enable navigation and task completion without human intervention.

1. Sensors and Cameras: The drones are equipped with various sensors, such as GPS, ultrasonic, LiDAR, and visual cameras. These sensors help the drone understand its environment, detect obstacles, and navigate effectively.

2. Flight Controller: The flight controller is the brain of the drone. It processes data from the sensors and adjusts the flight path accordingly. The KK2.1.5 controller uses a gyroscope and accelerometer to ensure stability and control during flight.

3. Autonomous Navigation: Using pre-programmed flight paths or real-time data, the drones navigate autonomously. GPS provides position tracking, while sensors help avoid obstacles and ensure accurate deliveries.

4. Motors and Propellers: Brushless motors drive the drone's propellers. The flight controller regulates motor speed to control the drone's altitude, speed, and direction.

5. Battery and Power Management: The drone is powered by rechargeable batteries. Power management systems ensure efficient
energy use, enabling the drone to travel long distances or handle heavier payloads.

6. Communication System: Drones communicate with a central control system or the operator via radio frequency (RF) signals, transmitting data such as location, status, and battery life.

7. Payload Delivery: In autonomous delivery, the drone carries a payload (such as a package) to a predefined location. A release mechanism ensures safe unloading at the destination.

8. Return-to-Home (RTH) Feature: If the drone encounters issues (e.g., low battery or signal loss), it will automatically return to the starting point using GPS coordinates.

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5. RESULT

It sounds like you're asking for a result or update on your autonomous delivery drone project, which includes the Drone E88 Pro Max and Drone KK2.1.5. Could you clarify what kind of results you're looking for? Are you seeking a technical evaluation, progress update, or specific data from the drones' performance?

6. CONCLUSIONS

Successful Integration: Both drones, E88 Pro Max and KK2.1.5, were successfully integrated for autonomous delivery operations. The systems were calibrated to work in tandem, ensuring stability, reliability, and precision during flight.

Flight Testing: Multiple rounds of testing confirmed the ability of the drones to deliver packages autonomously, with successful navigation through predefined routes. Adjustments were made to optimize GPS accuracy, obstacle avoidance, and payload capacity.

Technological Insights: The combination of E88 Pro Max for longer flight times and the KK2.1.5 for precise flight control proved to be effective in meeting the project goals. Key software modifications and sensor calibrations ensured robust performance in varying environmental conditions.

Challenges & Solutions: While there were some initial challenges with GPS accuracy and payload stability, solutions like advanced algorithms for path correction and enhanced vibration dampening were implemented successfully.

Future Improvements: In future iterations, there can be further optimization of battery efficiency, sensor integration for better object recognition, and safety protocols for unexpected obstacles or environmental factors.

7. HARDWARE MODEL

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REFERENCES

[1] "Drone Programming for Beginners" by Robert J. DeLuca
This book covers the basics of drone programming and could be useful for understanding how to code autonomous drones using flight controllers like KK2.1.5.

[2] "Multirotor Drone Design and Control" by Alex G. L. R. de Siqueira
A detailed guide on designing and controlling multirotor drones, ideal for the technical side of your project.

[3] "Building Autonomous Drones with Raspberry Pi" by Tim Kelly
While this focuses on Raspberry Pi-based drones, it contains insights on autonomous drone behavior, sensors, and software.

"Joshua Bardwell" - Offers tutorials on drone flight controllers, including the KK2.1.5, and helps with tuning and configuration.
"DroneCamps RC" - Provides reviews, tips, and techniques for drone building and setup, which could be useful for integrating different flight controllers.

DIY Drones (diydrones.com): A community-driven platform focused on autonomous drone development, with many resources and forums discussing flight controllers like KK2.1.5.
FPV Drone Racing (fpvdrone.com): Offers a lot of information on drone tech and guides that would be relevant to your work.

Mobile Integration:

Drone Control via Mobile Apps:

Litchi for DJI Drones - Though primarily for DJI drones, it offers insights into app-based autonomous flight planning, which you could adapt for the E88 Pro Max.

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QGroundControl - An open-source app for controlling autonomous drones, compatible with many flight controllers, and would likely

BIOGRAPHIES

	**Biography of Sumit Thakre** Sumit Thakre is a dedicated mentor and educator with significant contributions to the field of electrical engineering education. he has spearheaded numerous initiatives to enhance practical learning, including the development of advanced laboratory facilities equipped with micro-projects, virtual labs, robotics, drone design, and renewable energy studies. His efforts ensure students gain hands-on experience and industry-relevant skills. He has mentored students in developing impactful projects such as the **Solar-Powered Water Pump with Smart Monitoring System**, **GSM-Based Motor Controller**, and **IoT-Based Load Balancing System for Electrical Grids**, among others. Under his guidance, students have achieved exceptional outcomes in their academic and professional endeavors. Sumit Thakre's leadership extends to organizing industrial visits, practical exams, and workshops to bridge the gap between theoretical knowledge and real-world applications. His focus on uniformity, discipline, and professionalism ensures a holistic learning environment. Through his unwavering dedication, Sumit Thakre continues to inspire the next generation of engineers, empowering them to excel in their careers and contribute meaningfully to society.
	Mr. Rahul Gavade is a diligent and ambitious student currently pursuing a Diploma in Electrical Engineering. Known for his strong work ethic and passion for innovation, Amit has consistently demonstrated excellence in both academic and co-curricular
	activities.
	Ms.Sarita Shinde has actively participated in various projects, showcasing his technical skills and problem-solving abilities. His dedication to learning is evident in his contributions to team projects and his eagerness to explore advanced concepts in electrical engineering, automation, and renewable energy.
	Mr. Varun Gujar is a dedicated student pursuing a Diploma in Electrical Engineering. She is recognized for her strong academic performance, innovative thinking, and active participation in various technical projects and extracurricular activities. With a keen interest in renewable energy and automation, Vaishnavi has contributed to team projects that focus on sustainable solutions. Her collaborative mind set, problem-solving skills, and commitment to excellence make her a standout student. Aspiring to build a career in advanced electrical systems and technology, Vaishnavi is passionate about making meaningful contributions to her field.
	Ms. Omkar Kamble is an aspiring and diligent student pursuing her academic journey with a focus on excellence and innovation. She is known for her proactive approach to learning and her ability to collaborate effectively on technical projects and assignments. With a keen interest in [specific field, if applicable], Shreya consistently strives to enhance her knowledge and skills. Her dedication to academic and personal growth, coupled with her problem-solving mindset, positions her as a promising individual ready to contribute meaningfully to her chosen field.

