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Surveillance Quadcopter

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ABSTRACT:

This paper proposes the development of an advanced surveillance drone system equipped with First-Person View (FPV) technology. FPV integration enhances the drone's surveillance capabilities by providing real-time video transmission to the operator, allowing for immersive and precise monitoring of targeted areas. The system combines state-of-the-art drone hardware with Mobile Screen and high-definition cameras, ensuring superior image quality and transmission stability. Furthermore, the drone is integrated with intelligent flight control algorithms, enabling autonomous navigation and dynamic tracking of subjects of interest. The proposed FPV surveillance drone system offers a versatile solution for various surveillance applications, including law enforcement, security, search and rescue, and environmental monitoring. Through extensive testing and validation, this system demonstrates its effectiveness in enhancing situational awareness, reducing response times, and improving overall surveillance operations. This project aims to harness these advantages by developing a Surveillance (FPV) Quadcopter that can stream live video feed to a mobile device, offering a practical and efficient solution for various applications.

Keywords: Surveillance, Collisions, First-Person View, real-time video transmission, Quadcopter, autonomous navigation , extensive testing

Introduction:

In recent years, unmanned aerial vehicles (UAVs), commonly known as drones, have seen widespread adoption in various fields such as agriculture, disaster management, surveillance, and entertainment. Among these UAVs, quadcopters have emerged as a popular choice due to their simplicity in design, stability during flight, and versatility in applications. Quadcopters, with their four rotors, can achieve vertical takeoff and landing (VTOL), hover in place, and maneuver with great precision. These characteristics make them ideal for tasks that require detailed aerial observation and real-time data collection. The ability to transmit real-time video feed from a quadcopter to a ground station or mobile device is particularly beneficial for surveillance and reconnaissance missions. This capability, known as First Person View (FPV), provides users with a direct visual perspective from the drone, enhancing situational awareness and decision-making. In situations such as search and rescue operations, security monitoring, and infrastructure inspections, having a real-time aerial view can significantly improve efficiency and effectiveness. This project aims to harness these advantages by developing a Surveillance (FPV) Quadcopter that can stream live video feed to a mobile device, offering a practical and efficient solution for various applications. Quadcopters equipped with FPV systems have revolutionized the way aerial surveillance is conducted. Traditional surveillance methods often involve manned aircraft or static cameras, which can be limited by factors such as cost, accessibility, and range of vision. In contrast, FPV quadcopters offer a flexible and dynamic approach, capable of reaching difficult terrains and providing a continuous stream of visual data. The integration of a camera and video transmission system on a quadcopter allows for real-time monitoring and quick response, making it an invaluable tool for modern surveillance needs. The development of this project also contributes to the growing body of knowledge and technology in the field of UAVs. By exploring the design, implementation, and optimization of a surveillance quadcopter, this project not only addresses immediate practical needs but also paves the way for future advancements in UAV technology. The insights gained from this project can be applied to enhance the capabilities of drones in various other applications, such as environmental monitoring, traffic management, and agricultural surveillance.

What is aim of surveillance drone?

The aim of this project is to design and build a quadcopter equipped with an onboard camera capable of transmitting real-time video feed to a mobile device via an OTG receiver, providing a stable and user-friendly platform for efficient aerial surveillance and situational awareness in various applications such as security monitoring, disaster management, and search and rescue operations. Equip the quadcopter with an onboard camera to capture high-quality real-time video footage for effective surveillance and monitoring. Implement a wireless transmission system that sends the live video feed to a mobile device via an OTG receiver, ensuring accessibility and convenience for the user. Utilize the KK 2.1.5 flight controller to maintain stable and reliable flight dynamics, allowing for precise control and maneuverability during surveillance operations. Integrate the FS-i6 Flysky transmitter to offer a responsive and intuitive control interface, enabling users to easily operate the quadcopter and perform surveillance tasks efficiently.

Why is drone surveillance necessary?

The necessity behind this project stems from the growing need for efficient, cost effective, and versatile surveillance solutions in various fields such as security, disaster management, and search and rescue operations. Traditional surveillance methods, including manned aircraft and static cameras, often face limitations in terms of cost, accessibility, and coverage. The development of a quadcopter equipped with FPV technology presents an innovative solution, offering real-time aerial views with unparalleled flexibility and maneuverability. The development of this project also contributes to the growing body of knowledge and technology in the field of UAVs.

METHODOLOGY

The research methodology for this project involves a systematic approach to designing, building, and testing the Surveillance (FPV) Quadcopter. The process begins with a comprehensive literature review to understand the principles of quadcopter dynamics, FPV technology, and the functionalities of the KK 2.1.5 flight controller. Based on this knowledge, we will develop a detailed design plan, including the selection of components such as motors, ESCs, battery, and the camera. The project setup for the Surveillance (FPV) Quadcopter involved the careful assembly and integration of all essential components. Starting with the assembly of the lightweight carbon fiber frame, the 1000 KV brushless motors were securely mounted on each arm. ESCs were connected to the motors and properly wired to the KK 2.1.5 flight controller, which was mounted using vibration-dampening supports. The FPV camera and video transmitter were installed to enable real-time video feed transmission. Initial power-up included binding the transmitter (FS-i6 Flysky) and configuring flight controller settings. Final steps involved calibrating sensors and performing test flights, ensuring stable and responsive control with effective video transmission. Through detailed assembly and thorough testing, the quadcopter was successfully set up to achieve the project goals.

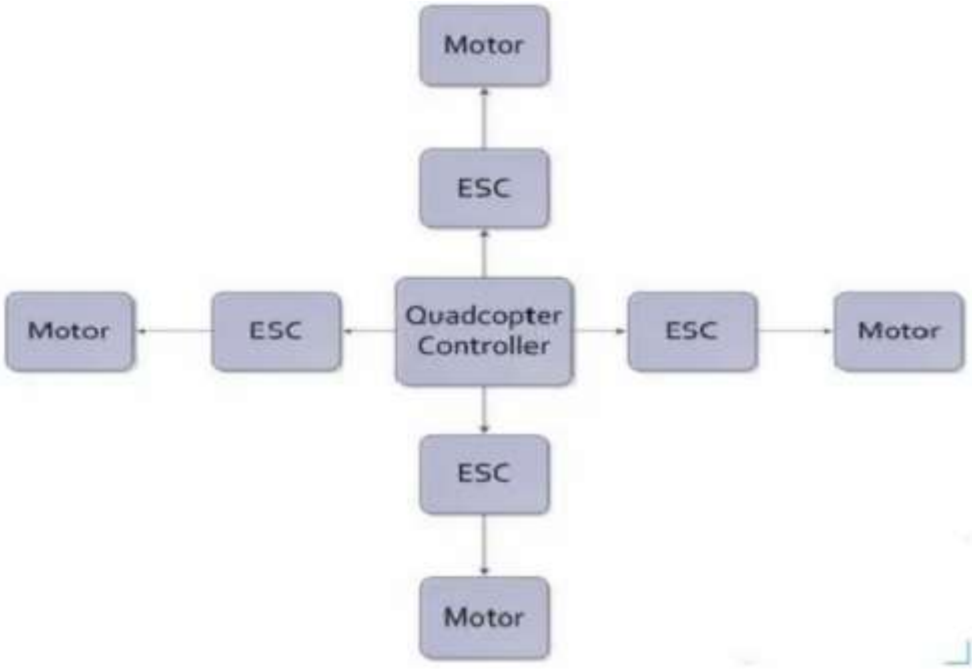

FIG NO 1: BLOCK DIAGRAM OF QUADCOPTER

The block diagram serves as a crucial visual representation of the Surveillance (FPV) Quadcopter system, illustrating the integration of various components and their interrelationships. This chapter endeavours to delve deeply into both the existing and proposed system block diagrams, elucidating the evolution and enhancements in design and functionality. The existing system block diagram portrays the traditional configuration of a quadcopter, devoid of FPV capabilities. It delineates the fundamental components requisite for flight control and navigation, including motors, electronic speed controllers (ESCs), flight controller, battery, and transmitter. Each component's function and connectivity within the system framework are meticulously outlined, offering a comprehensive overview of the basic quadcopter architecture. The block diagram of the quadcopter system provides a clear visualization of the interactions between its core components. Understanding these connections is essential for designing, building, and troubleshooting quadcopter systems. By illustrating the flow of signals and power within the system, the block diagram serves as a valuable tool for comprehending the operational principles of the quadcopter. The block diagram of the quadcopter system illustrates the interconnectedness of essential components responsible for its operation. At the core of the system lies the flight controller, serving as the brain of the quadcopter. It receives input commands from the transmitter and processes sensor data to regulate the speed of each motor through electronic speed controllers (ESCs).

How does drone works

The Surveillance (FPV) Quadcopter operates based on the integration of various electronic components and software configurations that allow it to fly and transmit real time video. The core of the system is the flight controller, which processes inputs from the pilot and sensors to stabilize the aircraft and execute commands. The primary hardware components include four 1000 KV brushless DC motors, four 30A electronic speed controllers (ESCs), and a 2200 mAh LiPo battery. The flight controller, KK 2.1.5, is central to the quadcopter's operation, processing input from the pilot and various onboard sensors. The flight controller uses data from its integrated gyroscope and accelerometer to continuously adjust the speed of each motor via the ESCs, ensuring stable flight by balancing the forces acting on the quadcopter. The ESCs regulate the power supplied to each motor, translating the flight controller's signals into precise motor speeds. The 1000 KV motors generate the necessary thrust to lift the quadcopter and enable maneuverability by altering the speed of individual motors, thus controlling the yaw, pitch, and roll. The 2200 mAh LiPo battery supplies consistent power to the entire system, ensuring sufficient flight time and performance. The pilot uses a transmitter to send control signals to a receiver onboard the quadcopter, which the KK 2.1.5 flight controller interprets to execute the desired maneuvers. This seamless integration of components and real-time data processing allows the quadcopter to perform complex flight operations while transmitting live video feed for surveillance purposes. The KK 2.1.5 flight controller plays a pivotal role in ensuring that the quadcopter maintains stability and responds accurately to the pilot's commands. It receives input from the receiver, which captures the pilot's instructions via the transmitter, and translates these inputs into electrical signals that adjust the speed of each motor. The gyroscope and accelerometer within the flight controller continuously monitor the quadcopter's orientation and movement. If the quadcopter tilts or deviates from its intended flight path, the flight controller quickly adjusts the motor speeds to correct the orientation, maintaining a stable and level flight.

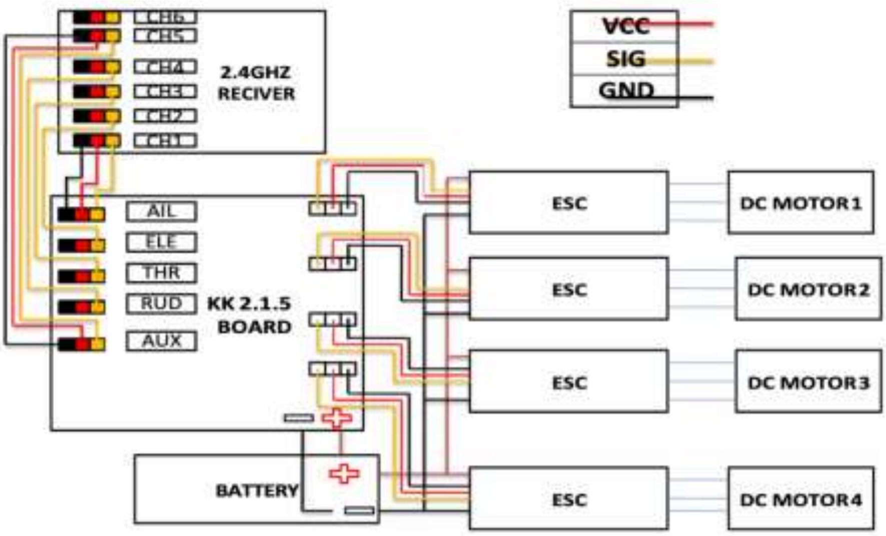

FIG NO 2: CIRCUIT DIAGRAM Hardware Requirements:

1. KK 2.1.5 Flight Controller: This board has eight motor outputs, five control inputs, an LCD display, polarity protected voltage sensor input, an ISP header, six-axis accelerometer/gyroscope, a fuse protected piezo output.
2. ESC: Four ESCs are necessary for controlling the speed and direction of each motor independently. The ESCs regulate the electrical current supplied to the motors based on commands from the flight controller.
3. Motors: Four high-quality brushless 1000 kV DC motors are essential for generating the thrust required to lift and manoeuvre the quadcopter.
4. Frame: The frame serves as the structural backbone of the quadcopter, providing a rigid and stable platform for mounting other components.
5. Battery: A high-capacity lithium polymer 2200 mAh (LiPo) battery is essential for powering the quadcopter's electronics and motors during flight.
6. Transmitter and Receiver: A radio transmitter and receiver pair are necessary for remote control of the quadcopter, allowing the operator to send commands and adjust flight parameters in real-time, receiver should be compatible with the transmitter's frequency and modulation scheme.
7. FPV Camera: An 1200 TVL FPV camera is integral for capturing live video footage of the quadcopter's surroundings and transmitting it to the ground station in real-time.
8. OTG Receiver: An OTG receiver facilitates the reception of the FPV video feed on a mobile device, allowing the operator to view the live video stream during flight.
9. Propellers: The quadcopter requires four propellers, one for each motor, to generate lift and thrust.
10. Video Transmitter: A video transmitter is required for wirelessly transmitting the FPV camera's video feed to the ground station.

OBJECTIVES

1. To observe large areas or isolated site, including sometimes poorly accessible or dangerous areas
2. Control of defined parameters and inspection of surrounding areas.
3. Real-time transmission of video enabling to detect suspicious activity.

RESULT

The Surveillance (FPV) Quadcopter performed successfully, meeting all project objectives. The quadcopter demonstrated stable flight and responsive control, thanks to the precise integration of 1000 KV brushless motors, 30A ESCs, and the KK 2.1.5 flight controller. Real-time video transmission was achieved via the FPV camera and video transmitter, providing clear footage to the pilot's mobile device. Initial test flights confirmed the system's reliability, stability, and effectiveness, showcasing its potential for various surveillance applications. The project setup and testing phase validated the design, highlighting its readiness for real-world deployment.

FIG NO:3 OUTPUT OF THE PROJECT

The project setup culminated in a series of successful test flights, demonstrating the quadcopter's capability to perform stable and controlled flights while providing real-time video transmission. The images and data collected during these experiments showcased the effectiveness of the integrated components and highlighted areas for potential further refinement and enhancement..

FUTURE SCOPE:

Enhanced Payload Capabilities: Explore opportunities to enhance the quadcopter's payload capabilities by integrating additional sensors or equipment, such as infrared cameras for night vision surveillance or environmental sensors for pollution monitoring. Autonomous Navigation: Investigate the implementation of autonomous navigation features using advanced flight control algorithms and GPS technology. This could enable the quadcopter to perform predefined missions and flight paths without direct pilot intervention. Longer Flight Endurance: Research methods to extend the quadcopter's flight endurance by optimizing power management systems, exploring alternative battery technologies, or integrating solar panels for in-flight recharging. Obstacle Detection and Avoidance: Develop algorithms and hardware solutions for obstacle detection and avoidance to enhance the quadcopter's safety and maneuverability in complex environments. This could involve the integration of proximity sensors or computer vision systems for real-time object recognition and avoidance manoeuvres.

CONCLUSION:

This project, "SURVELLIANCE (FPV) QUADCOPTER" was successfully created and tested, and a demo device was built. In conclusion, the development and testing of the Surveillance (FPV) Quadcopter have been successfully completed, resulting in a functional and reliable aerial surveillance platform. Through careful selection and integration of hardware components such as the KK 2.1.5 flight controller, 1000 KV motors, and 30A ESCs, combined with software configurations and testing procedures, we have achieved stable flight performance and real-time video transmission capabilities. The quadcopter's ability to capture high-quality footage while maneuvering through various environments demonstrates its potential for applications in surveillance, monitoring, and aerial reconnaissance. Furthermore, the successful completion of this project highlights the potential of unmanned aerial vehicles (UAVs) in various fields beyond surveillance, including search and rescue operations, environmental monitoring, agricultural management, and infrastructure inspection. As technology continues to evolve, further advancements in drone capabilities, such as increased autonomy, longer flight endurance, and improved sensor integration, will open up new avenues for innovation and application.

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