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DRONE FOR SURVEILLANCE

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Abstract

This project focuses on the development of an autonomous surveillance drone capable of recording high-quality video footage. Equipped with advanced cameras and sensors, the drone is designed to record stable live video from the air, using computer vision and real-time communication systems to navigate and transmit clear footage. The drone automatically avoids obstacles during flight and ensures safe operation. Its ground control station facilitates mission planning and monitoring. Despite the increasing use of small camera-equipped drones for security and law enforcement purposes, current models face significant limitations such as short battery life, unstable video, difficult target tracking, poor weather conditions and regulatory restrictions. This study aims to address these issues by improving the functionality and usability of camera drones for continuous surveillance. By overcoming these challenges, the project aims to provide a more efficient and cost-effective solution for aerial surveillance that makes autonomous surveillance drones more practical and reliable for various applications.

Keywords: *Drone, Surveillance, Flight, Monitoring, Real-time.*

I. INTRODUCTION

Drones, also known as unmanned aerial vehicles (UAVs), and referred to as a Remotely Piloted Aircraft (RPA), have become increasingly prevalent in various industries and applications. One common type of drone is the quadcopter, equipped with four propellers powered by motors to generate thrust, enabling vertical takeoff and landing capabilities. This configuration, known as a Quadcopter, holds significant potential for executing tasks that are either hazardous or prohibitively expensive for humans to undertake. One prominent application of drones is in the inspection of tall structures, where they can navigate challenging environments with ease, minimizing risk to human inspectors. Additionally, drones are instrumental in humanitarian efforts, facilitating search-and-rescue missions in remote or hazardous terrain. Moreover, they serve vital roles in surveillance, whether for monitoring large events or enhancing security measures. The versatility of drones extends beyond professional use to recreational and promotional activities. At events or gatherings, professional-grade quad-copters are frequently employed to capture aerial footage for promotional purposes or surveillance. Despite their autonomous operation and lack of physical contact with the environment, the potential for collaboration among drones opens up numerous possibilities. By leveraging collaborative capabilities, a group of drones can efficiently conduct search operations over expansive areas by sharing data and coordinating efforts. For instance, in search-and-rescue missions, multiple drones can work together to locate missing individuals swiftly. Similarly, coordinated drone fleets can combine their load capacities to deliver essential supplies, such as medicine, to remote or inaccessible regions. This collaborative approach to drone operations holds immense promise for enhancing emergency response efforts and improving healthcare accessibility, particularly in remote areas.

The ability of drones to seamlessly transition between flight and ground movement further expands their utility across a spectrum of recreational and practical applications. Overall, drones represent a transformative technology with vast potential to revolutionize diverse videography to military operations and cargo transportation. industry and contribute to societal advancements.

Figure 1. Block diagram of Quad-copter

II. LITERATURE SURVEY:

Drones have become increasingly popular for surveillance purposes due to their ability to capture high-quality images and videos from unique perspectives. They have been used in various applications, including border security, disaster management, and traffic monitoring. The use of drones for surveillance has several advantages, such as cost-effectiveness, flexibility, and the ability to cover large areas quickly. However, there are also concerns regarding privacy and safety issues associated with their use. Several studies have investigated the use of drones for surveillance. In a study by Wang et al. (2018), drones were used to monitor traffic flow and detect traffic violations in urban areas. The authors proposed a deep learning-based algorithm for vehicle detection and classification, which achieved high accuracy in detecting different types of vehicles. Another study by Kim et al. (2019) focused on using drones for border security. The authors proposed a system that uses drones equipped with thermal cameras to detect human targets in border areas. The system achieved high accuracy in detecting human targets, even in low-light conditions. In a study by Al-Nuaimy et al. (2020), drones were used for disaster management purposes. The authors proposed a framework for using drones to assess the damage caused by natural disasters, such as earthquakes and floods. The framework involved capturing images and videos of the affected areas using drones and analyzing them using computer vision techniques.

A. CONCERNED PROBLEM

The integration of drone technology presents a promising avenue for mitigating various challenges associated with urban transportation. In congested urban areas, drones equipped with advanced imaging sensors can provide real-time monitoring of traffic conditions, allowing authorities to identify congestion hotspots and optimize traffic flow. Additionally, drones can assist in accident management by swiftly surveying crash sites and facilitating emergency response efforts, thus reducing the impact of road accidents on public safety and property damage.

Moreover, drones offer solutions to address road infrastructure problems by conducting aerial inspections to identify poor road conditions, lack of maintenance, and insufficient signage, enabling authorities to prioritize maintenance and repair efforts effectively. Furthermore, in areas lacking adequate public transportation options, drones can supplement existing infrastructure by providing alternative transportation services for goods delivery and emergency medical supplies, reducing reliance on private vehicles and alleviating congestion.

Furthermore, the environmental impact of urban traffic, including air and noise pollution, can be mitigated through the use of drones for traffic management. By optimizing traffic flow and reducing congestion, drones help minimize vehicle emissions and noise levels, thereby improving air quality and enhancing the quality of life for residents in urban areas. Overall, the integration of drone technology into urban transportation systems holds significant potential for enhancing efficiency, safety, and environmental sustainability.

B. EXISTING SOLUTION AND PROBLEM WITH EXISTING SOLUTION

Implementing effective traffic monitoring solutions involves integrating advanced sensor technology, data analytics, and IoT devices. This allows real-time data collection, analysis, and predictive capabilities to optimize traffic flow and enhance road safety. Mobile apps and public awareness campaigns empower drivers, contributing to overall transportation efficiency.

While traffic monitoring solutions offer substantial benefits for managing transportation systems, they are not without their challenges. One significant issue is the high cost associated with implementing and maintaining advanced technologies like sensors, cameras, and data analytics software. This financial burden can pose obstacles for cash-strapped municipalities or regions looking to improve their traffic monitoring capabilities. Additionally, ensuring the accuracy and reliability of data collected by these systems remains a persistent challenge, impacting the effectiveness of traffic analysis and decision-making. Privacy concerns also loom large, as the use of high-resolution cameras and data analytics software raises questions about the collection and use of personal information, necessitating careful consideration of privacy regulations and ethical practices. Moreover, the integration of IoT devices and cloud computing introduces cybersecurity risks, including data breaches and hacking attempts, which can undermine the integrity and security of traffic monitoring systems. Technical complexity, maintenance requirements, data overload, and interoperability issues further compound the challenges faced in implementing and managing traffic monitoring solutions. Addressing these obstacles requires a holistic approach that considers not only technical and financial factors but also regulatory compliance, privacy protection, and cybersecurity measures to ensure the successful deployment and sustainable operation of traffic monitoring systems.

C. PROPOSED SOLUTION

Employing drones equipped with cameras offers numerous advantages in traffic monitoring that are not achievable at street level. A single drone can capture footage of congestion, accidents, or road issues over a wide area, aiding traffic authorities in their management efforts. Multiple drones can extend coverage, providing diverse viewpoints from above simultaneously.

Furthermore, drones have the capability to track and count vehicles, generating valuable data for optimizing traffic signal scheduling and planning new infrastructure projects. Equipped with heat scanner

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cameras, drones can swiftly detect accidents, enabling prompt emergency responses and potentially saving lives. Moreover, drones can safely divert drivers away from crash sites, minimizing further disruptions.

In addition to aiding traffic management, drone footage can assist law enforcement in enforcing road regulations by capturing instances of illegal parking or reckless driving. Moreover, advanced drone technologies may identify signs of traffic violations or vehicles transporting hazardous materials, facilitating further investigation.

In summary, drones serve as versatile tools in traffic monitoring, offering enhanced capabilities for data collection, emergency response, and law enforcement, ultimately contributing to safer and more efficient transportation systems.

D. HARDWARE IMPLEMENTATION

A drone's hardware components collectively form the crucial elements necessary for its operation. The frame, often crafted from lightweight and durable materials like carbon fiber, provides the structural integrity and mounting points for other components.

1) Q450 Frame: This F450 / Q450 Quadcopter Frame is made from 35% of Glass Fiber which makes it tough and durable. They have arms of ultra-durable Polyamide-Nylon which are the stronger molded arms having a very good thickness so no more arm breakage at the motor mounts on a hard landing.

2) Propellers: Propellers are attached to the motors and generate the thrust required for flight. UAV drones can have multiple propellers that can rotate in different directions to enable vertical takeoff and landing.

3) Flight Controller: Naza-M Lite for multi-motors is an autopilot system designed for serious multi-rotor enthusiasts providing excellent self-leveling and altitude holding, which completely takes the stress out of flying RC multirotors for both professional and hobby applications.

4) Sensors: Sensors like accelerometers, gyroscopes, and barometers are used to provide feedback to the flight controller about the drone's orientation, altitude, and movement. Accelerometers measure the drone's acceleration and tilt, gyroscopes measure the rotation of the drone, and barometers measure the drone's altitude.

5) Electronic Speed Controllers (ESC): It comes with a multi- integrated special program fast throttle response, and surpasses all kinds of open-source software.

6) Low Voltage Alarm: A low voltage alarm in the context of drones is a safety feature designed to alert the pilot or operator when the drone's battery voltage drops to a predetermined level.

7) FS-i6 2.4G 6CH PPM RC Transmitter With FS-iA6B Receiver: The FS-i6 2.4G 6CH PPM RC Transmitter is a radio control transmitter used for remote control of various devices. It operates on the

2.4GHz frequency and has 6 channels, allowing for precise control of multiple functions. The transmitter comes with the FSiA6B receiver, which receives the signals from the transmitter and translates them into actions for the 17 controlled device.

E. FLOWCHART WORKING

The workflow describes the working of the proposed system in a systematic way. In other words the workflow explains the tasks performed chronologically for the achievement of the specific mission. The workflow can be elaborated by the flowchart. The flowchart is also divided into two parts i.e. forward and backward. The forward chart describes the operation of the system from the ground to the destination and the backward chart describes the operation of the system from the destination point back to the ground station. The operation of the system in both the cases is similar with a small difference. The flowchart for the forward path of the proposed system is shown below:

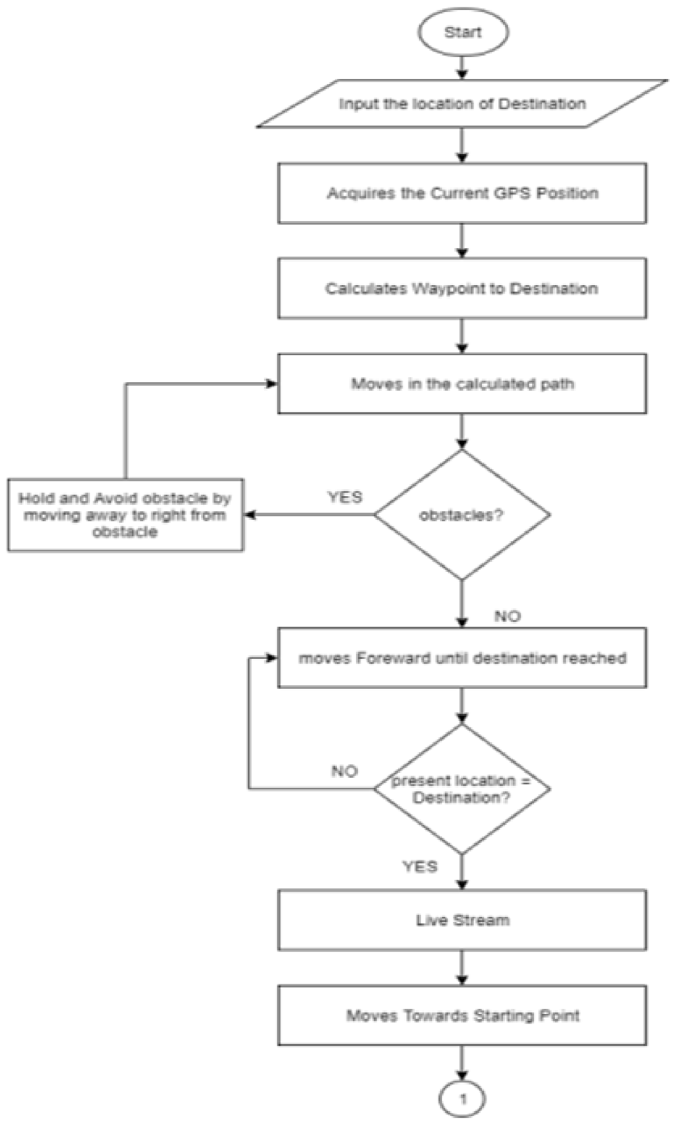

Figure 2: Flowchart of Forward Workflow

III. RESULT ANALYSIS:

The final outcome of the project is a prototype drone that flies to the desired location and live surveillance the real time video.

After much practice and research, we were able to make our drone fly autonomously and this picture was taken during our quadcopter flying.

Surveillance is the main part of our project. We have used raspberry pi for our surveillance. The pi camera takes the video and sends it to the raspberry pi for processing. Before integrating the system with the final circuit, it was first simulated using Mission Planner simulation software. The outcome of the project can be seen in the pictures below:

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Figure 3: Flying Drone

IV. CONCLUSION:

In this project a drone of autonomous nature was created. The drone uses an apm which controls most of the other hardware used in the drone. The drone also makes use of mounted raspberry pi for the live streaming part. The mission planner software is used to perform and monitor the flight of the drone. Hence, making the drone with the capability to perform the very many desired functions we begin with, we have succeeded in fulfilling our goal of completing the major project.

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