

Surveillance Drone

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Abstract

In today's society, surveillance is becoming increasingly important in order to maintain a place's decorum and assure the safety and security of its inhabitants. In this case, an aerial monitoring system will be beneficial. This study explains how an unmanned aerial vehicle (drone) can be used to create an aerial surveillance system. We begin by describing the elements of our airborne surveillance system, followed by a discussion of some of the technologies we employed to construct it. Following that, we describe how we integrated those technologies into a drone and made them function in tandem to produce our intended aerial surveillance system. This system will be a practical and cost-effective replacement for present surveillance systems. It can be utilised for both peacekeeping and real-time monitoring of a location at any time of day. The goal is to create economical, rapid, and effective monitoring that may be employed broadly at the private, institutional, and governmental levels.

Keywords: Drone, unnamed aerial vehicle (UAV), python programming, Raspberry Pi, OpenCV, android app

INTRODUCTION

In recent years, there has been a significant increase in the development and sale of remote-control aerial vehicles known as quadcopters. A drone is another name for a quadcopter. These unmanned aerial vehicles have four arms and fixed pitch propellers, with two propellers spinning clockwise and the other spinning counterclockwise, letting them to fly in a specific direction. The growing desire for surveillance drones has given rise to the concept of a face recognition drone, which detects the person next to it. Mostly utilised for intelligence gathering, surveillance strike missions, enemy air defense suppression and demolition, communication relays, and combat search and rescue.

LITERATURE SURVEY

In the paper by Lutkevich and Earls, a system running on rasp berry pi is presented [1]. This system includes slow detection algorithm and fast but less accurate tracking algorithm. These two algorithms are combined to present a real time human detection and tracking quadcopter.

In the paper by Boon and Lovelace, the Raspberry Pi mounted on the system is connected to the internet via modem or LAN [2]. The user can access Raspberry Pi from any pc over the internet and thus can send the commands to control the drone.

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Vitto presented a configured system in which the drone will be able to detect the people where human reach is not possible also this drone can be used for attendance purposes by flying the drone throughout the room thus detecting and recording the faces and marking the attendance sheet without taking time [3].

In the paper by Matt Parker, the motive of this drone is to develop a technology which will help the farmers [4]. The Fryer Drone is a spraying drone

which helps the farmer to spray the pesticides all over the farm so that it reduces his work. The farmer can control this drone using an app via Wi-Fi module.

In the paper by Weiger, an approach has been made to detect cracks formed in monopole towers and also estimate its length and breadth [5]. It detects rust and categorizes it based on the colour of the rust. Using deep learning technique and Tensorflow framework, this drone achieves 90% accuracy.

In the paper by Williams, the sole motive of this drone is to aid the rescuers to carry out the human rescue process due to any calamity or hazard by detecting the motion of humans [6]. This drone helps to effectively plan out the rescue mission, increasing the survival rate of the victims to be rescued.

PROBLEM STATEMENT

Military forces all around the world strive to attain a single goal: to eliminate as many opponents as possible while sacrificing as little as possible. Defense personnel must constantly observe and assess the actions of their adversaries, putting their lives at danger. In the sweltering heat, they must survey the border for enemy interventions or other activities. The use of drones introduces new obstacles, such as complying with FAA regulations. The FAA requires all drones used for commercial, recreational, governmental, or other purposes to be registered. Security drones, on the other hand, offer a wide range of applications that are both practical and necessary. Drones can be used to look for persons who do not have permission to be in a specific location. They can also look for vandalism, weather damage, and those who have gone missing. They can keep an eye out for parking offences and even track down lost or stolen items.

PROPOSED SYSTEM

Unmanned aerial vehicles (UAVs), also known as drones, have long been used in military applications, particularly surveillance, and the spectrum of defense applications is expanding as technology advances. The main reason why defense systems like UGVs and UAVs have become so popular is that they can be operated remotely, even in the most dangerous environments, with no risk of human life being lost. There are various ways that unmanned vehicles can be utilised to assess and analyze the enemy's movements [7] It can also be used to determine where existing soldiers are and establish communication with them, as well as to pass on vital information. Because drones exist in a variety of sizes, sending one over with a strong camera attached allows you to quickly spy on the enemy's forces. However, because they are remotely controlled, there is no risk of soldiers becoming separated if they are ordered to approach difficult terrain. While there are still some obstacles to overcome before drones are widely and confidently adopted, the most significant benefit of drones is the coverage they can provide. For the first time, it gives security organizations a bird's eye view. Many of them can also record what the camera views, which is useful for verification and providing concrete evidence [8].

Flowchart

The method begins by verifying the drone circuit for any problems, as shown in Figure 1. For any error occurred, the error message will be displayed, else the drone would be airborne. As soon as the drone takes to the air, the Raspberry Pi powers on and the camera begins to operate. The camera begins recording video and sends it to the Python programme. After analyzation, the video is sent to the webserver of the android app [9]. Then the video is fetched by the android app and displayed on the screen.

Block Diagram

Figure 2 depicts our block diagram, which shows the camera linked to the Raspberry Pi. Both the modules are fitted on to drone. The drone is operated wirelessly by radio receiver/controller. Raspberry Pi is linked to the webserver which holds the video footage and sends it forward to the android app [10].

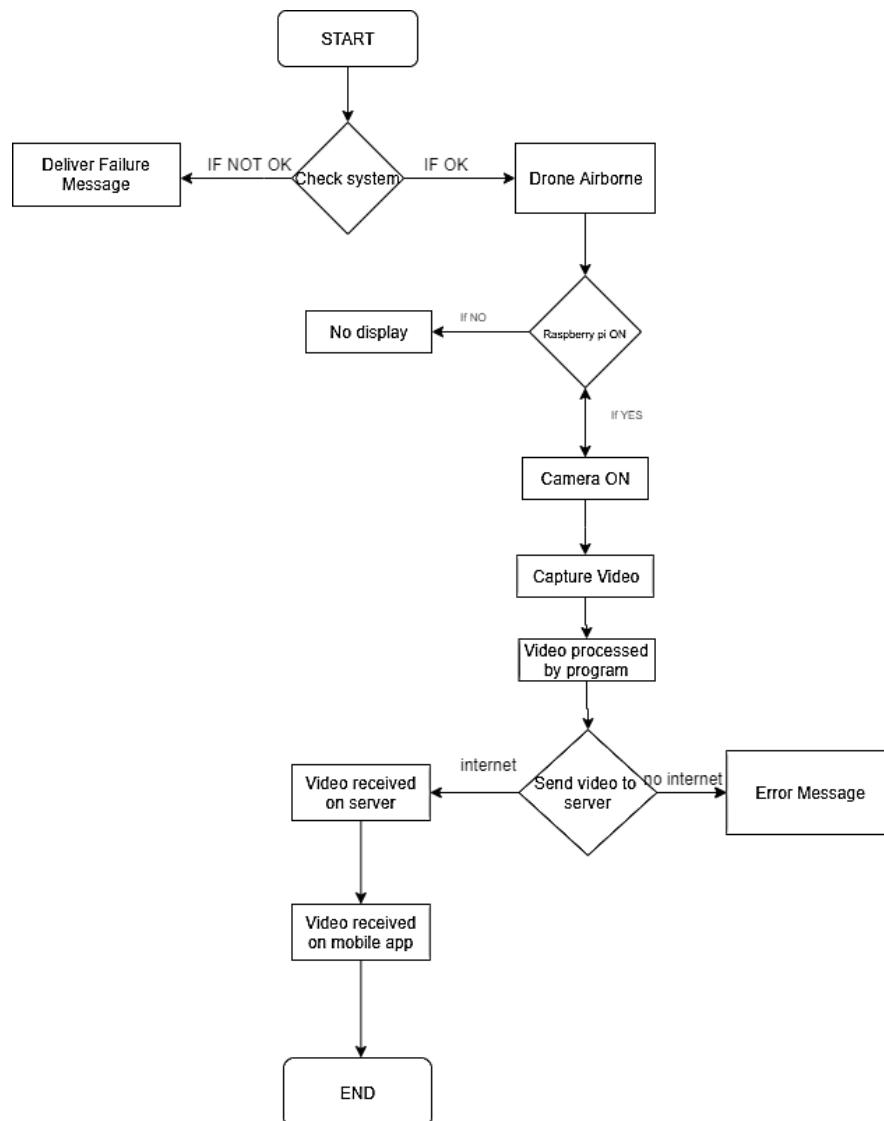


Figure 1. Flowchart for drone circuit.

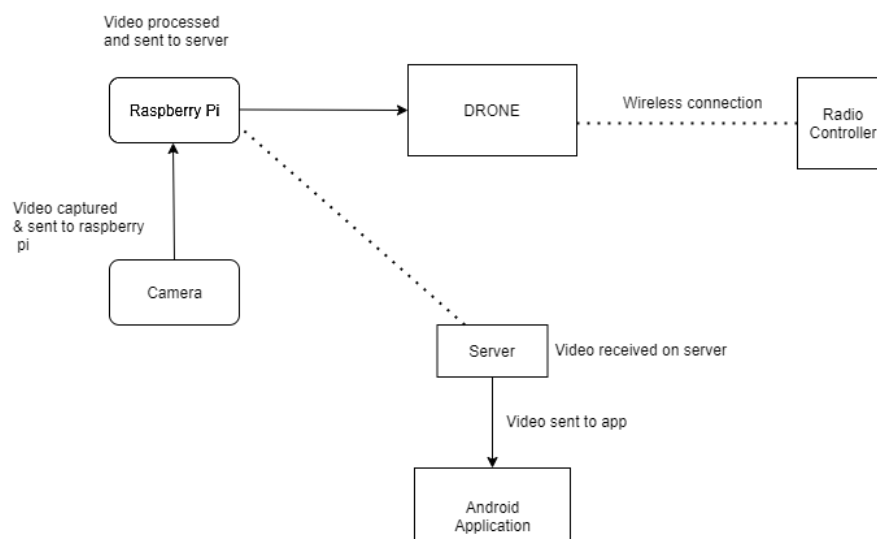


Figure 2. Block diagram for Raspberry Pi.

DETAILS OF HARDWARE AND SOFTWARE

We have provided a brief overview of the basic drone components and details below:

Hardware Specification

1. *Brushless DC motor*: The DC motor provides the thrust needed for the drone to be afloat in air.
2. *Propellers*: Propellers create lift for the drone by spinning and creating an airflow which results in pressure difference between top and bottom surface of the propeller thus lifting the drone upwards.
3. *Power distribution board (PDB)*: PDB distributes power to the components at the voltages they require.
4. *Flight controller*: We will use a KK2.1 flight controller. Using the data provided by the ESC sensor connected in the circuit, it calculates the speed at which each motor will spin to maintain the thrust. It is also responsible for the receiving and sending of the data to radio receiver.
5. *Electronic Speed Controller (ESC)*: It is a device which interprets signals from the flight controller and translates those signals into phased electrical pulses to determine the speed of the brushless motor.
6. *Radio receiver*: It is an electronic device that uses radio signals to transmit commands wirelessly via a set of radio frequency over to the trans-receiver which is present on board connected to the drone.
7. *LIPO Battery*: It is the power source of the drone.
8. *Frame*: The frame is the main structure of the drone which houses all the components.
9. *Camera*: For recording the video and feeding it to Raspberry Pi.

Software Specification

Python: For developing a software which will detect the images from the video transmitted by the drone. It will detect each frame as an image from the video and analyze it for the identification of humans and its count.

Following are the required libraries:

- *OpenCV*: A strong library used for machine learning.
- *Imutils*: To Image Processing.
- *NumPy*: Used for Scientific Computing. A NumPy array is used to store the image.
- *Argparse*: Used to give input in command line.

Android Studio: We will use Android Studio for developing an app which will be used for transmitting the video from the drone to the android mobile phone. It will live stream the video directly to the mobile for surveillance.

IMPLEMENTATION PLAN

The Raspberry Pi 3 would be installed in the drone, as seen in Figure 3. It would be airborne with the help of propellers powered by brushless DC motors. We will use RC transmitter to control the drone. The LIPO battery will provide power to the entire system.

Drone

All the sensors required for the drone will be connected to the Raspberry Pi. Raspberry Pi will calibrate the sensors and help to maintain the position of the drone. A camera will be connected at the bottom of the Drone for capturing the video of the surroundings.

The video captured will be processed by our python program in real time. The program will scan the footage for identification of humans. Now, the processed video will be sent to the server of our Android App. Now, on our Android device, the App will fetch the recording from the server, and we will get the live stream of the video with an overlay of identification of humans or other things. Figure 4 states the data working model of our proposed system.

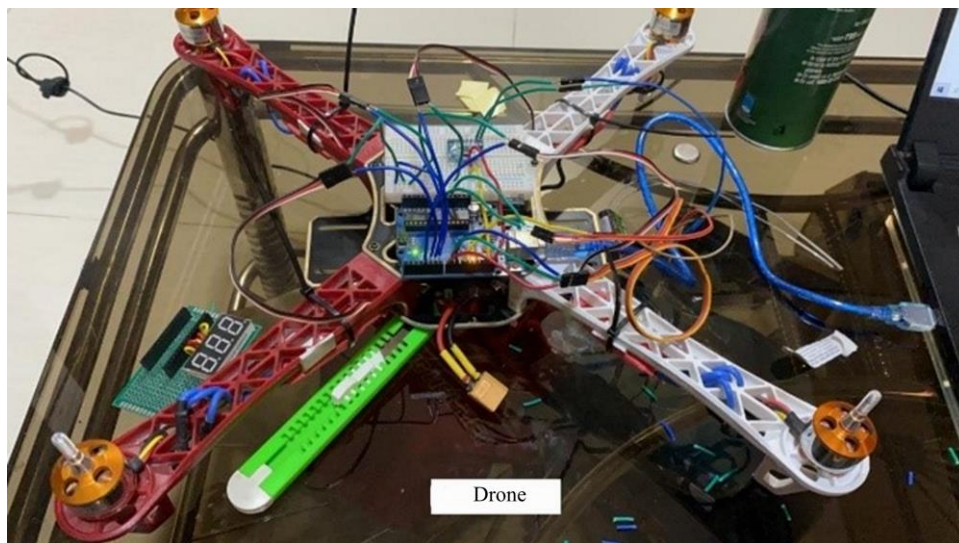


Figure 3. Assembled drone.

RESULTS

This section displays the surveillance drone results for a variety of references. Before flying autonomously with the designed controller, the AR drone is tested with various initial positions. The initial testing is completed, and the program output is depicted in Figures 4 and 5. Furthermore, the AR drone may be utilised for live video surveillance via an Android app. Figures 6–8 show how the Android app works.

Program Output

Figures 4 and 5 illustrate the Python program output for the video clip, which shows the Status, Total People, and Bounded Green Boxes.

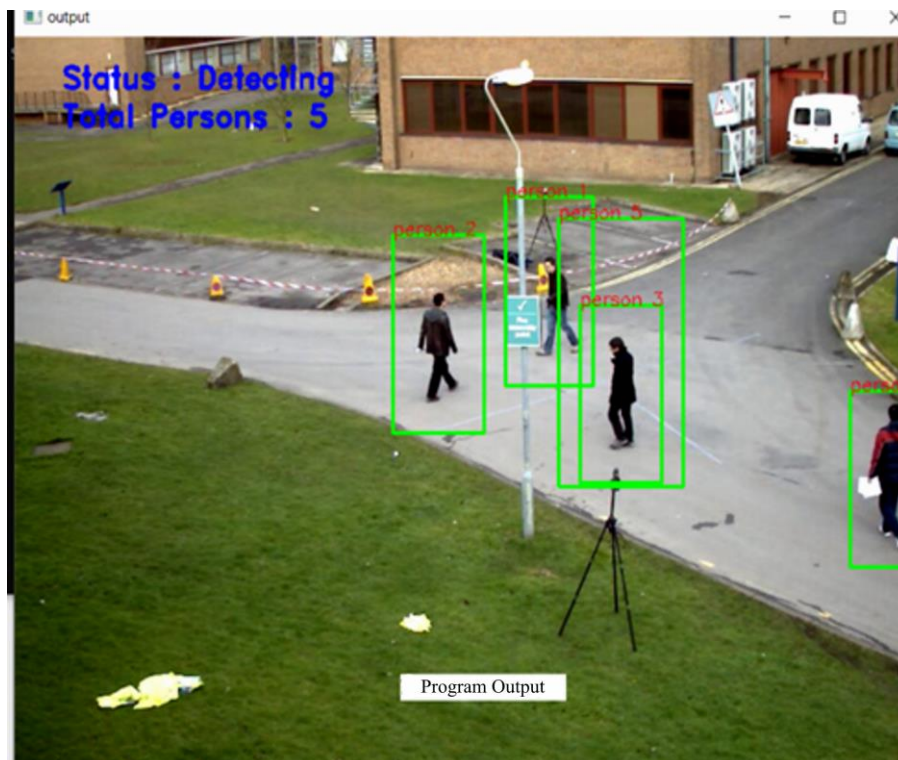


Figure 4. Human identification.

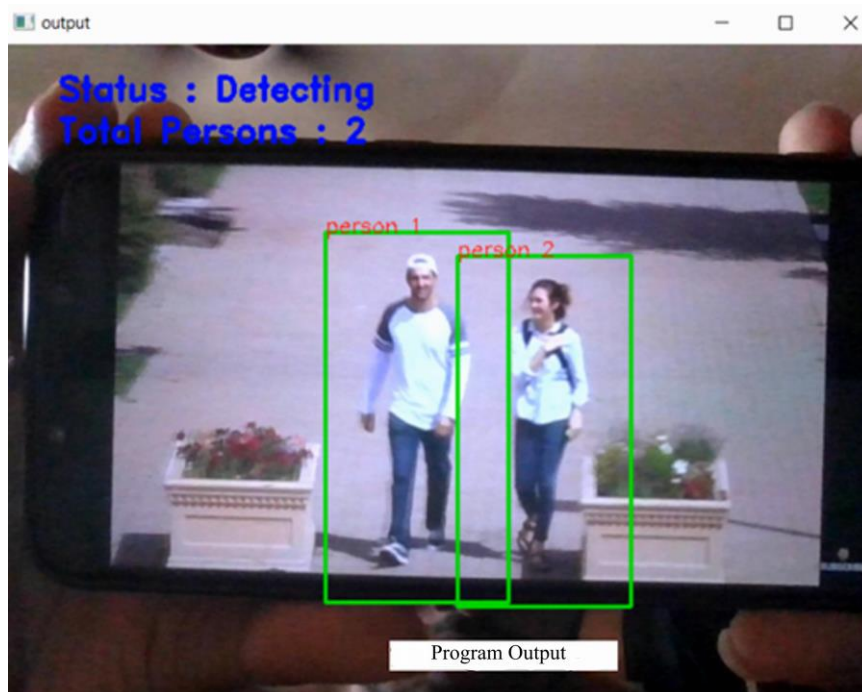


Figure 5. Human identification count.

Android App

Figures 6 and 7 show the start page of the Android app and the IP address of the local webserver, which must be input to begin live video surveillance.



Figure 6. Start page of the android app.

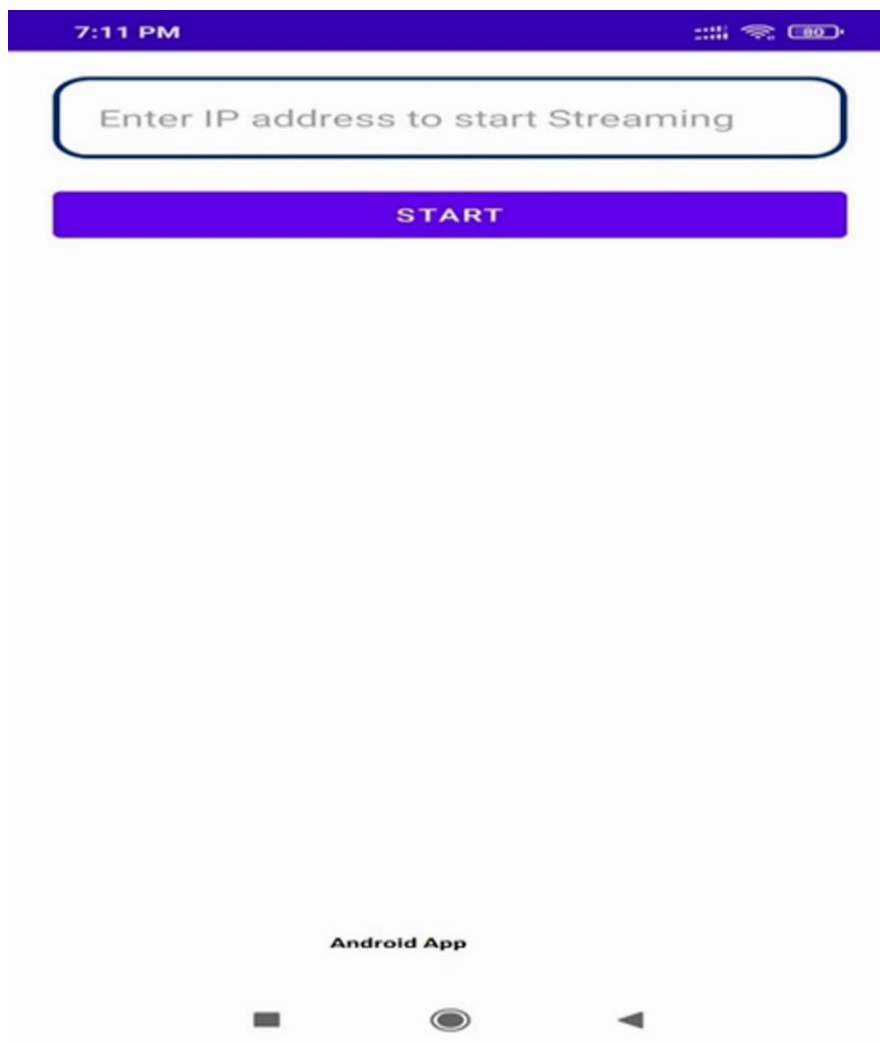


Figure 7. Main page of the android.

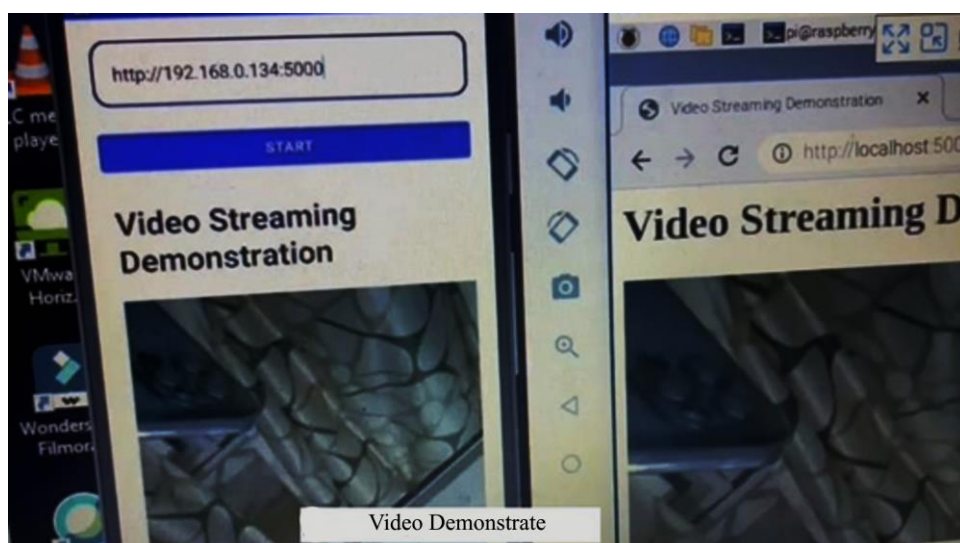


Figure 8. Working of android app.

Figure 8 demonstrates how the Android app works. The Android App displays live footage streaming from the Raspberry Pi Camera.

CONCLUSION

With the addition of a camera system, the team made great progress in creating a low-cost, lightweight unmanned aerial vehicle capable of surveillance, according to the final results. Several design iterations were accomplished in order to build a quadrotor that was best suited for the project goals, and the final prototype indicated the project's potential for success. Furthermore, the team's development on a user-friendly and simple GUI would aid the quadrotor's surveillance capability. This project resulted in the full realization of an unmanned aerial vehicle. The quadrotor exhibited its ability to fly to great heights. This project's future success would be assured by more iterations.

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