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HUMAN DETECTION AND NOTIFICATION USING UAV FOR SURVEILLANCE

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ABSTRACT

Several studies have reported that drone plays a very important part in the life of modern human beings in the twenty-first century. Drones provide their efficient use in case of situational awareness by the surveillance process in the disaster places. The size and weight play a vital role in traveling narrow down places in a short amount of time, this, expands the drone application in the field of military, transport and so on. This model implements the flight of a quadcopter along with the application of detecting a human using image processing. The basic principle is to autonomously detect a human and notify it to the user, for which the code is written on raspberry pi using python. Raspberry Pi along with the camera is integrated on the Drone. The vehicle would capture the live images from the camera connected to raspberry pi and may send the notification to the user.

This system provides the surveillance process for the defined perimeters by fixing via points and the quadcopter will follow the target through points that are predefined. Global Positioning System (GPS) is provided in the vehicle to locate the exact position of the Unmanned Aerial Vehicle (UAV). So in this paper, an attempt is being made to highlight the use of drones in the surveillance applications.

Keywords: Mission planner, Raspberry Pi, Twilio, Unmanned Aerial Vehicles (UAVs).

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1. INTRODUCTION

Unmanned Aerial Vehicles(UAV) are popularly known as a drone, they are basically flying robots. An Unmanned Aircraft System(UAS) incorporates a UAV, controller at the ground station or base station, and communication system. In addition to those they also carry different types of payload depending on the type of application. Drones are generally classified into two types, first type semi-autonomous aircraft that is drone is been controlled by the human from the base station. The second type is fully-autonomous aircraft these are the type of drone in which there is no live controller from the base station, as all the activities needed to be performed by the drone are already fed into the brain of the drone. The size of the drone plays a very huge impact on its application. Small in size and less in weight, makes it easily portable. During any natural disaster, drones can easily travel to the narrow down places where human travel is difficult and time-consuming. Drones are used in various applications like military purpose example seek and rescue, surveillance, relay and firefighting. Monitory purposes like weather monitoring, wildlife monitoring and traffic monitoring, forest monitoring. Apart from this, it's also used in places like agriculture, drone journalism, movies, photography, transport and healthcare.

The main objective of this project is to perform surveillance over a particular area with help of a drone and collect the picture using a raspberry pi camera. These pictures are further processed [1] in the raspberry pi to detect the presence of a human in a particular area. With the processed information a notification message is been sent to the user using Twilio in Raspberry Pi.

2. HARDWARE SET-UP

Figure 1 QAV 450 frame

QAV 450 frame acts as the base to carry all the payload like camera, battery and remaining electronics parts. This frame is selected because it improves stability and weighs around 320 grams. For better visual guidance the drone's arms are been coloured in red and white colour.

Figure 2 Pixhawk flight controller

Pixhawk 2.4.8 flight controller acts as the brain of the drone. The processor within the controller is 32-bit ARM Cortex M4 used for RTOS (Real-Time Operating System) application. It has 8 RC channels of 4 serial ports to perform telemetry and GPS operations.

Figure 3 Raspberry Pi and camera module

Raspberry Pi 4B is the processor used for performing all the logical operations. Raspberry pi camera of 5MP is interfaced with the raspberry pi via a ribbon cable. The raspbian software is being installed on the 8Gb RAM. To perform feature extraction and object detection a python code is been fed in it.

Figure 4 Brushless motor and ESC

A 222/13T –DC brushless motor of 1000Kv RPM/V (Revolution Per Minute per Volt) is used for energizing the drone. Simon K 30 A is the ESC –Electronic Speed Controller is used for managing the speed of the motor. It operates with a 16Khz operating frequency.

Figure 5 Transmitter and receiver

Fs-i6 is the transmitter used to operate the drone from the base station and Fs-i6a is the receiver mounted on the drone. Both transmitter and receiver operate from radiofrequency 2.40 GHz to 2.48GHz. Both works on the principle of the GFSK (Gaussian Frequency Shift Keying) coding technique.

3. WORKING

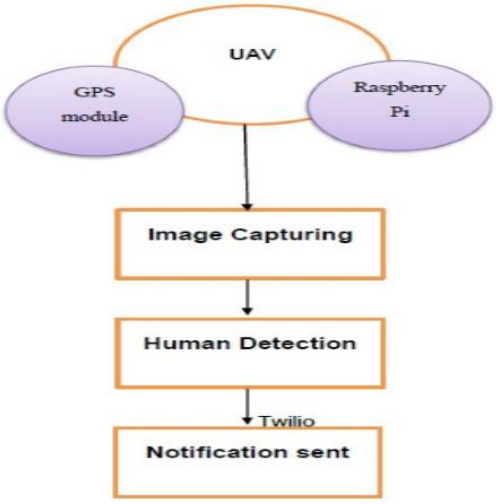

Figure 6 Flow Diagram

Figure 6 shows the flow diagram of the project. Initially, QAV 450 frame acts as a base. The 4 arms of the drone are assembled with the motor, vibrator and propeller. For the power supply, the Lipo battery of 1200 mAh is mounted on the base frame. ESC is connected between the battery and motor, to control the speed of the motor. The drone has an in-built GPS (Global Position System), but due to electro-magnetic influence, there is a slight fluctuation. To avoid this an external GPS module Neo M8N is mounted on the drone. The battery, external GPS module, receiver, raspberry pi is configured in their particular position as shown in Fig 3.2. Further, the drone is being calibrated as shown in Fig 3.4 (calibration ie., accelerometer calibration and transmitter radio calibration). After the drone calibration and configuration. The autonomous square-path for the drone is been given using a mission planner via some fixed points [2]. Then the drone traverses the targeted path and the raspberry pi camera mounted on the drone as shown in Fig 3.3, captures the still images at a regular interval of time. The collected images are next processed in the raspberry pi.

Open CV is a library used for computer vision tasks like object detection, face detection etc. Open CV has a built-in method to detect the object with a pre-trained HOG (Histogram of Oriented Gradients) person detector. The input image is being converted into a gray level and then normalized. Sobel algorithm is used for gradient calculation by the horizontal and vertical gradient of each pixel. Each detection window is divided into 8*8 pixels, for each pixel's histogram of the gradient is calculated. SVM classifier is used for the classification of data given by HOG by comparing it with a higher dimension space function. The HOG completely acts as a feature extractor. SVM classifies as "human present" in the picture or "human not present" in the picture. If we get the output as human found in the picture a notification is been sent to the user as" Human found". If we get the output as human is absent in the image, a notification is being sent to the user as "Human not found". The notification from the raspberry pi on the drone to the user's phone on the ground is been convey through the Twilio. With help of this information, various actions can be taken in the surveillance mission.

Figure 7 Configuration of the drone

Figure 8 Integration of raspberry pi and camera

Figure 9 Drone Calibration

4. RESULTS

The drone travels over the square path as given by a fixed location on the mission planner by the user. The captured images from the drone are shown in Figures 10 and 11. Raspberry Pi which is integrated on the drone detects the presence or absence of human in a particular area. The presence of human is indicated with the green rectangular box as shown in Figure 14 and the absence of human is indicated without the green rectangular box as shown in Figure 11. Twilio will send the notification to the user if any human is found or not as shown in Figures 12 and 15 respectively.

Figure 10 Input Data

Figure 11 Human not detected

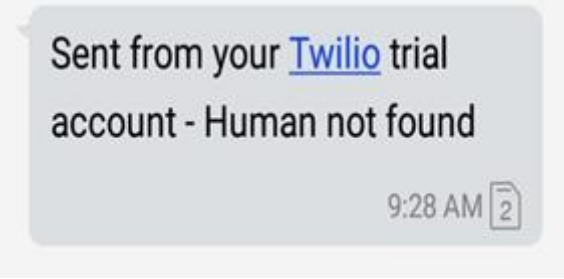

Figure 12 Notification showing that human not found

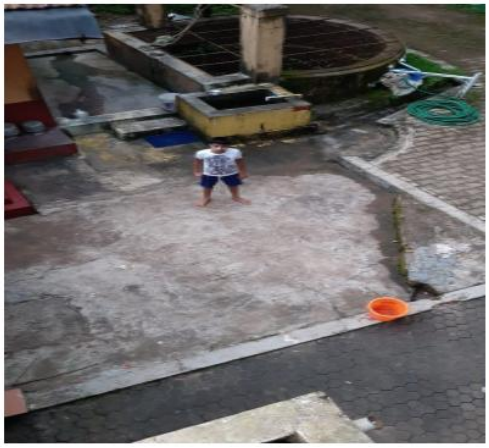

Figure 13 Input Data

Figure 14 Detecting human

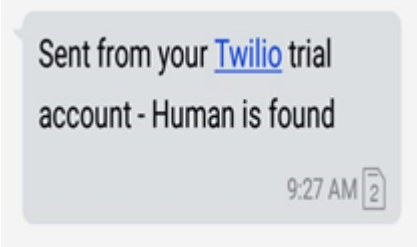

Figure 15 Notification showing that human is found

5. CONCLUSION

The drone has assembled and uploaded with the firmware ardupilot 3.2.1 on to pixhawk 2.4.8. Pixhawk is calibrated and it is integrated to drone along with raspberry pi. The targeted drone path is given with the help of a mission planner. Then the drone traverses the targeted path and a raspberry pi camera is used to capture images. Further, these images are processed using HOG+SVM and classifies it as either "human" or "no human", with the help of this information Twilio is used to send notification to the user via mobile indicating whether a human is found or not found in the targeted region.

REFERENCES

[1] Y. Said, M. Atri, and R. Tourki, "Human detection based on integral histograms of oriented gradients and svm," in 2011 International Conference on Communications, Computing and Control Applications (CCCA), 2011, pp. 1–5.

[2] M. Alwateer, S. W. Loke, and N. Fernando, "Enabling drone services: Drone crowdsourcing and drone scripting," IEEE access, vol. 7, pp. 110035–110049, 2019.

[3] N. Fernando, S. W. Loke, W. Rahayu, "Honeybee: A programming framework for mobile crowd computing", *Proc. Int. Conf. Mobile Ubiquitous Syst. Comput. Netw. Services*, pp. 224-236, 2012.

[4] L. Shan, R. Miura, T. Kagawa, F. Ono, H. Li and F. Kojima, "Machine Learning-Based Field Data Analysis and Modeling for Drone Communications," in IEEE Access, vol. 7, pp. 79127-79135, 2019, doi: 10.1109/ACCESS.2019.2922544.

[5] D. Tezza and M. Andujar, "The State-of-the-Art of Human–Drone Interaction: A Survey," in IEEE Access, vol. 7, pp. 167438-167454, 2019, doi: 10.1109/ACCESS.2019.2953900.