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Face Recognition Drone

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***Abstract*—Paper presents a brief idea about advancements in drones using Raspberry PI. A camera is attached with drone which helps PI to capture images and then PI can process it further to recognize person. The drone can be controlled from server room. The video can be seen live in the server room and simultaneously stored in the server. The main aim of the project is to recognize the face of person using drone camera and load all information about that person sitting in the server room. It is useful for biometric attendance, for military operations at remote areas and for surveillance purpose. Prototype is designed with high-tech specifications where it is made more stable and noise reduction feature is added. Depending upon the criteria more feature can be added.**

Keywords—surveillance drone, face recognize, less noise, Machine Learning, GPS, Computer Vision;

I. INTRODUCTION

EMERGING technologies have increased the demand of products having more features. Nowadays combination of various techniques is the most essential criteria. Increasing demand of drones used for surveillance has given rise to the idea of face recognition drone where the drone recognizes the person next to it. The most challenging part in computer vision is Face detection and addition of this part to small drones.
Proper utilization of power to get a better flight time was an essential part of designing.

Growth of population has raised the problem of security where surveillance is an effective measure. In recent study [1] it has been observed drones with autonomous flying capability having Raspberry Pi incorporated to it helps us to capture a live transmission of video that is coming through the drone. It provides a comparison of the drone in various flight mode with variationA transmitter working on 915MHz is used. In this prototype computer vision acts as an additional part which helps to recognize the people and with GPS in the drone tells the exact location where the prototype is flying. Failsafe mechanism has been added after seeing the drawbacks.

In a recent survey by Anuj Puri [2] gave us the information about various type of UAV working in the field of surveillance. It gives us a comparison about various aerial vehicle available for surveillance with respect to the weight carrying capacity of each vehicle. The paper summarizes the fact that how UAV can be used as a key factor in civil areas. It also combines the work of different universities in this field and tells us about the upcoming challenges which we have tried to overcome.

Real time face detection [3] with the help of Raspberry pi and MATLAB gave us a brief idea where description of Harr classifier made by viola jones was used. GPIO pins were used to connect led. By turning on the led they tried to show the different positions in our face. They have used Harr Classifier, Eigen Face and Geometric Transformation. Comparison of methods like Principal Component Analysis (PCA), Local Binary Path (LBP), Linear Displacement Analysis (LDA) is shown. Basic use of image processing is in the field of gaming and image processing.

Drones are the new big thing which will create change. They can be used for different purposes like mine detection [4].
With the help of thermal camera, GPS and metal sensors attached to the drone gives exact locations of landmines. The coordinates of the position were the mine are located was transmitted by the use of GSM Module in the range of EGSM 900 Hz. For the processing of algorithm and interfacing they have used Arduino Uno.

Mobile application [5] with the capability of face detection are available which can be used for criminal detection. They have used Open CV and android to develop the mobile application. Face tracking is done by implementing optical flow algorithm with two feature extraction method. The algorithm provides an advantage in shape, orientation, and can reduce the level of false positive resulted by AdaBoost cascade. There are many researches applied in the computer vision field handled real-time face detection and tracking. Optical Flow and Viola-Jones algorithms are widely used in real time systems.

Detection of object [6] with the help of artificial neural network has come out to be another useful way, where GPU are used to process algorithms. To reduce the time consumption highly configured graphic cards which can process large number of data in a small interval of time. Comparison of the processing capability of CPU and GPU is shown. Searching in Image space and Efficient Histogram equalization are the algorithms used in execution. Multiple image from drone was captured to create a database of sub system processing. Implementation of AI for object detection with the use of Neural network. It helps the system to get a knowledge about the requested object. Digital neurons never

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get tired as compared to the biological neurons which helps the system to maintain the quality of processing constant.

Adaboost algorithms and Harr-like features [7] are used in real time face detection were calculation speed is reduced. Harr features of any size can be calculated in very small amount of later on processed with the help of Adaboost algorithms. Some the best result in the field of face detection are [8][9][10][11].The detector window size is 40x40 pixels. They collect a face dataset of 5175 face images and a non-face dataset of 10000 samples.There are over 170 approaches to face detection. All of them can be classified into four categories: Knowledge-based methods, feature invariant methods, Template matching methods, and Appearance-based methods [12].

The paper deals with a drone which has its location being directed by GPS givingits exact location. The most important aspect of this paper deals with the detection of unidentified human faces. A database of images will be stored in our system. Small size drones creating less noise are made with Raspberry Pi attached to it which is using Open CV and Harr features for detection. The proposed face detection system has various step (1) Face detection of the individual (2) Feature extraction and representation of face (3) The extracted feature are classified using support vector machine which will be compared with the database using K-nearest neighbor based classification technique. A remote access to our raspberry Pi is established through VNC server client which helps us to remotely access the terminal of raspberry Pi.

II. System design

This section clearly outlines the construction and information of each part of the quad in a brief manner.

A. Structure of Quad

Fundamental structure of quad comprises of object having 4 axes, at the center we have main processes going on. The small sized frame helps the drone to attain stability were a separate space for battery is available which helps us to manage components. The head consists of a small opening for camera. Each arm of the frame has a perfect space for motors and propellers. In our prototype we have used 2300kv Motors which are good enough to fly at a very fast rate but cannot lift loads since there is not much thrust produced by this motors. Small propellers are used to reduce the noise produced by the drone. Frame is provided with four stands at all stands so to get a grip while landing. This Glass Fiber Mini FPV Quadcopter Frame is characterized by its lightweight, small size, long time of endurance and easy refit. And, it is specially designed for the small drones and also perfectly suitable for the senior player to professional DIY. -Moreover, the thickness of Glass Fiber fuselage is 1.5mm and the thickness of machine arm is 3.0mm, which can guarantee the flying ability of the Quadcopter and effectively reduce the shake; the fuselage is integrated by the aluminum alloy pillar to guarantee its intensity. Specificationis Material used to make the frame is Fiberglass. The length of Wheelbase is 250mm. The weight of the complete frame is 170g, due to its light weight it moves quickly in air.

Fig. 1: Structure of the Drone

B. ArduPilot APM 2.8 Flight Controller Board

ArduPilot APM is a professional quality IMU autopilot which is based on the platform of Arduino Mega. It is a mixture of varied sensors and modules similar to the pressureModule, GPS Module and memory It is a full autopilot capable of various task such as autonomous stabilization, way-point based navigation and two-way based telemetry with Xbee wireless module. It can support 8 RC channel with 4 serial Ports which are useful to attach different type of receiver and sensors. ArduPilot APM 8 is shown below:

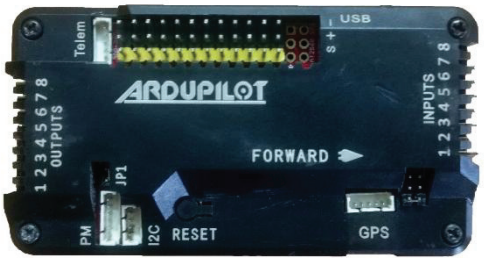

Fig. 2: ArduPilot APM 2.8 Flight Controller Board
No wires attached to it

C. Lipo Battery

The Lithium polymer battery is a rechargeable battery which uses the lithium ion technology the indication of 3S tells the no of cells present inside the battery is highly volatile and is to be kept under observation while charging. Using these batteries more than a limit destroys the capacity of battery. it gives a flight of an average 15 minutes. They heat up very fast and come in various types. The battery which we are using is LIPO 3S in future prospective we can have a 6S in use.

D. Radio Controller

Fly sky fsi6X is the most impressive and advanced receiver transmitter pair available which allows you to get a 10 channel axis and helps us to tune different things in a particular flight controller. It works in the bandwidth of 2.4 GHz. The AFHDS 2A (Automatic Frequency Hopping Digital System Second Generation) developed and proprietary by FLYSKY is specially developed for all radio management models. It provides very less interference between other devices and it also consumes less power with highly reliable receiver.

Fig. 3: FS-i6SX transmitterFS-iA6B receiver pair.

E. Raspberry Pi Camera

The most vital part of our project is the camera shown in Fig 4. It should be small in size to reduce load on drone. The PI camera is used here which is small in size with negligible weight and having high definition capturing capability. The camera is directly attached to the raspberry PI and placed at the front of the drone to get the front view. That will make the drone a FPV drone which makes the task easier to the flier. It is very simple to attach to the Raspberry PI and to get the output there is need of few lines of code.

Fig. 4: Raspberry Pi Camera

F. Raspberry Pi Module

Raspberry PI shown in Fig 5 is an electronic device that works like a CPU. It is having several USB ports, a Ethernet port and input port for micro SD card and output ports. It is having 64-bit ARM Cortex-A53 processor and with 256MB of RAM and 512 KB L2 cache. It is so efficient that no need of cooling is required even after overclocked.The raspberry pi supports Linux, Qtonpi, ARM, Mac operating systems. The operating system inside the Raspberry Pi of our prototype is Raspbian Linux. The operating system is first loaded in the micro SD card and then installed in the PI. Here the PI is used to load videos captured by camera and detect the face of person. The RAM of Raspberry PI is adequate to standalone the high definition videos decoding. Raspberry PI is able to record videos that can be used for further analysis.

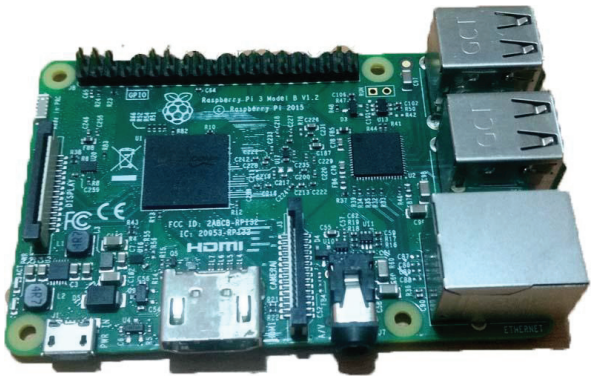

Fig. 5: Raspberry Pi Module

Python is the most efficient language used to work in Raspberry Pi. Board comprises of processor and graphics chip, CPU, GPU, Ethernet port, GPIO pins, Xbee socket, UART, power source connector. And various interfaces for other external devices. It works on the ARM11 series processor. It has a good graphic processing unit which helps the device to process the image faster. GPIO pins are input and output pins used for general purpose, they are connected to other electronic components to get the output for e.g. Temperature sensor. HDMI port is used to connect the device to screen. Ethernet port is used to connect the device to other working devices through SSH which allows to access the terminal.The Raspberry Pi is a Broadcom BCM2835 SOC (system on chip board). The model described above is Model B with single 2.0 USB connector which draws power in a range of 2.5 watts (500MA).

Using of multiple Raspberry Pi for communication is easily possible and also the board is useful to control web traffics. Raspberry Pi cannot run the X86 operating system because of its processor and takes more time to complete one calculation of the purely synthetic prime number test in comparison to Core 2 Duo E8400.

III. WORKING MEATHODOLOGY

The basic principle used for drone is to make it produce an optimum amount of thrust which will help the drone to raise and due to its light weight we are able to frequently move it from one place to another. There are some modes attached to our drone such as Horizon which is used for a stable flight and

Acro which is used to move drones at high speed. There are few fail safe mechanism attached to our system which helps us to prevent it from accidents. Fig 6 shows the location of the drone where it is located this done with the help of GPS.

Fig. 6: Map showing the exact location of Drone.

Coming to second part of our drone where Raspberry Pi is attached with camera is kept at the center of Drone. VNC server client connection is used to remotely access the Raspberry Pi. Considering security as the most important issue we are have enabled a password protection to our raspberry Pi. With the help of open CV and lbph algorithm we have trained the machine were the training data is used and the test data is captured from the real time environment. We have used support vector machine for labelling of the data. We the help of remote access we are able to record the video that is being transmitted which can be further used for analysis purpose. Fig 7 shows an example of real time environment which helps us to identify the person with our available mechanism attached to our system. The data will be stored in Memory card attached to the Raspberry Pi.

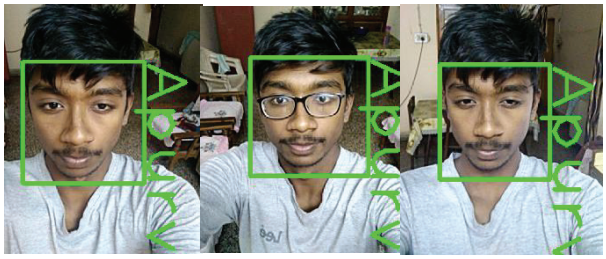

Fig. 7: Example of Recognized Data

IV. Conclusion

The prototype can be used for various purposes. It is a new version of drone where new features are added to make it automated drone. Though it is not fully automated yet but improvements are made accordingly. The face recognition application is very useful for police operation in secret missions. The drone will be able to detect the people going through the places where human reach is not possible. It can also be used for attendance purpose by just flying the drone throughout the room and it will detect and record the faces and make the attendance sheet without taking time and with zero effort. Live video transmission from the drone helps to control the prototype from the server were the video is getting recorded and stored in the database.

The project is made keeping the idea of surveillance in remote areas. It is difficult to run an operation in remote areas where an army's life is always in danger and such technology can be used for better operation in such areas. The drone if fast enough that it can cover 50 KM distance in less than an hour. It is also made with noise reduced technique and designed with very light weight materials made it suitable for surveillance operations. It will help to prevent life of soldiers. We have tried to increase the durability of the drone by soldering the connections in the most appropriate way possible. For future prospective we can use good quality Lipo batteries which will give us a better flight time for surveillance.

V. Comparision with existing work

There are few drones available in the market which work on human gestures. Implementation of Artificial Intelligence is the biggest challenge for industry. Table 1 shows the comparison of industrial drone with our given prototype.

Table 1

S no	Name	Camera	Range	Time	Cost
1	DJI Spark	1080p	2000m	15min	$519
2	Hover Camera	4K	20m	10min	$349
3	Zerotech Dobby	4K	100m	9min	$184
4	GeniusIdeaFollow	4K	100m	20min	$340
5	Our Prototype	1080p	50m	20min	$200

VI. Results

The model stated below Fig 8 is the final stage having the specific features as described. The prototype is extended version of FPV drone where the face recognizing feature is added. There is future prospect of extending the data in the server so that it can recognize large number of data. One of the important point that is to be considered is to increase effectiveness of the camera and processor on which our research is going on. Separate power distribution for Drone and Raspberry Pi is made so to avoid the drone to fall. All the parts are being setup considering the situation of fail safe. Autonomous topographies are very challenging fields where if the strong base is established then the product will be highly useful for commercial as well as industrial purpose. Prototype was designed with small size propeller to reduce the noise so

that it can be used surveillance. Our future scope is to implement machine learning in our prototype to make the drone completely autonomous so that it can identify paths.

a) *b)*

Fig. 8: (a) Front View (b) Side View Final model

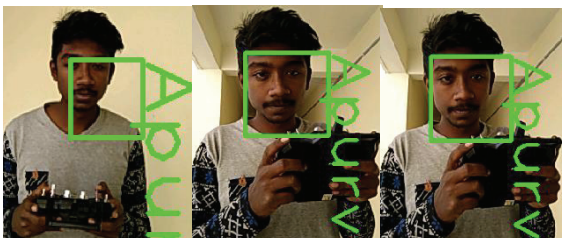

Fig. 9: Samples of Face Recognition Drone

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