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Face Recognition on UAV: AI Drone

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Abstract:- Drones, also known as unarmed aerial vehicles in short uav who fly . They can reach the places where it's hard for any person to reach because they are small in size and can capture images. Enabling drones to perceive human beings on the floor is essential for a variety of programs, inclusive of surveillance, anti-theft, people seek, and far off monitoring. Drones can capture facial images which is used as biometric recognition. Protection citizens from crime and criminals are hard day to day by authorities and government. In order to protect citizens from criminals there is a need for some kind of technology that can save citizens from crime and keep them safe before anything happens by identifying the criminal even in crowded places. In this paper, we are going to address the cutting edge face recognition technology.

I. INTRODUCTION

As we discussed drones are also known as unarmed aerial vehicles because they can be controlled without having any pilot inside it to control it means it can be controlled autonomously. Drones can be pre-programmed to go whenever it is destined to go and don't require manual control and can take images of people at a bird's view angle. In fact, we all know that a face is the inherited feature of a person and each person has a unique geometrical face shape, size and color which distinguish it from every person in this world even when it comes to twin brothers and sisters who look alike. So, a system based on facial recognition is best to recognize anyone if the person is not willingly to cooperate with the authorities or with the biometric recognition system like fingerprint sensor or eye sensor.

Therefore it's possible to introduce a system that detects the face of a person even in a very crowded place where there are tons of faces to detect and then recognize them with the data set of the photos of criminals that are saved in the authorities database and alert them that the criminal is present there. Even in the military they use artificial intelligence to target movements of any person in the area by face detection or human detection.

Now we are going to discuss this paper in the given sections - Section 2 shows the literature review about drones and face detection algorithms. We describe the methodology on drones in Section 3. Algorithm in Section 4 and Research Challenge in Section 5. Finally, our conclusion and future works are addressed in Section 6.

II. LITERATURE REVIEW

In this section, we are going to discuss OpenCV, face detection algorithms and drone technology. Various researchers have worked in these technologies. For Better understanding for ourselves, this section is divided into two subsections: (i) UAV and its applications and (ii) Face Detection

A. UAV and its Applications

In July 1849, the primary recorded use of an unmanned aerial vehicle for battle-combating existed, there were several classifications of drones, intention and decoy, presenting ground and aerial gunnery a target that simulates an enemy aircraft or weapon, identification presenting intelligence on the battlefield, conflict supplying high-chance attack competencies, shipment distribution logistics, analysis and missile Enhancement of UAV generation increase, UAV civil and commercial agriculture, aerial photography, statistics collection.

Parts:
- Frame
- Brush-much less motor
- Propeller
- Transmitter and Receiver
- AV Transmitter
- AV Receiver
- FPV Camera.

a) Frame
There are distinctive styles of frames like tricopter, quadcopter, hexacopter, Y6 hexacopter, octocopter and X8 octocopter and many others. These frames are much less weight, sturdy, it additionally manufactures different fabric depending on its uses.

b) Brushless Motor
Growing variety of applications on brush-much less motor for industrial automotive software, home home equipment and building controls. And it has Highest performance, Small motor length, Light weight, Longer lifetime, No maintenance, No sparking, Steady operation, Variable velocity. High RPM is feasible without tons of heating. More electricity to weight ratio. Depending on the KV, analyzing the RPM might be exchanged like one thousand KV offers 1000 RPM in one volt and 2600 KV gives 2600 RPM in one volt.

c) Propeller
A type of plastic that has strong stiffness but can bend then smash if it meets something heavy it'll

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spoil, desiring to replace the prop is recently created with polycarbonate propellers.

d) Transmitter(Tx) And Receiver(Rx)
A radio transmitter (TX) is a tool that lets in the pilots to control the UAV wi-fi. The signal/commands are obtained with the aid of a radio receiver (RX) which is related to a flight controller which assists in controlling it.

e) Av Transmitter
It is an wireless audio video transmitter, by way of using the channel we will transmit the sign. We are the use of "TS832 transmitter" it has five.8G of transmitter and 48 channel, weight of 22g. 2.1.8 AV RECEIVER In this we are the use of the "RC832S receiver" for receiving the audio video sign, with the aid of using the AV to USB converter we can get the stay move in laptop, it has five.8G high sensitivity receiver, 48 channel.

f) FPV CAMERA
First-individual views (FPV), are used to watch the drone flying in first person view by mounting the display screen just close to the eyes or using virtual reality goggles. It gives a whole new experience to fly the drone in a very professional way to shoot great videos and take images that was not taken before.

B. Face Detection

In 1960, Woodrow Wilson Bledsoe discovered the concept of face recognition. Face detection is a very fascinating concept but it can be very late in daily use or we can say when it arrived in mobile phones to unlock the mobile phones for security and protection and used as a biometric recognition system. But before facial recognition of a person its need to first detect the human face. It is early used in home security protection and in military uses before it reaches the normal citizens.

III. METHODOLOGY

A. System Architecture

The diagram of the drone is given in Figure 1. So, first we will initialize the drone to reach the desired coordinate or place we want the drone to reach or we can control it manually to take it to the desired place where we want it to take it. Drone after that will take images of the scene and send it to the concerned authorities where they run the algorithm for face detection and face recognition.

Here we use an arduino module which is attached to the digicam which sends the data in the form of video and images to the control center. The quad copter is the most balanced uav which can fly at one place without deflecting so it's the most suitable type of drone to track the facial features like eyes, mouth ,nose to conclude that its a face or person not a animal or anything else.

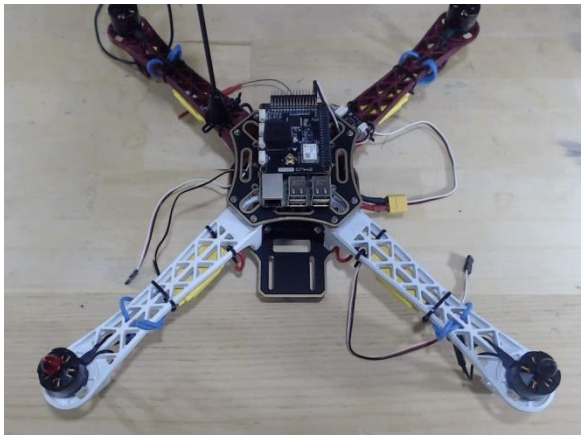

Fig. 1: A Quad-copter used for the proposed project

Using a drone is the most effective way to recognize a face from a certain distance. We use the arduino model because its lightweight and canclute many images at a time using the Haar cascade classifier to detect human face and LBPH algorithm that recognize human faces with the trained dataset.

Here, the figure 2 represents how the system will work.

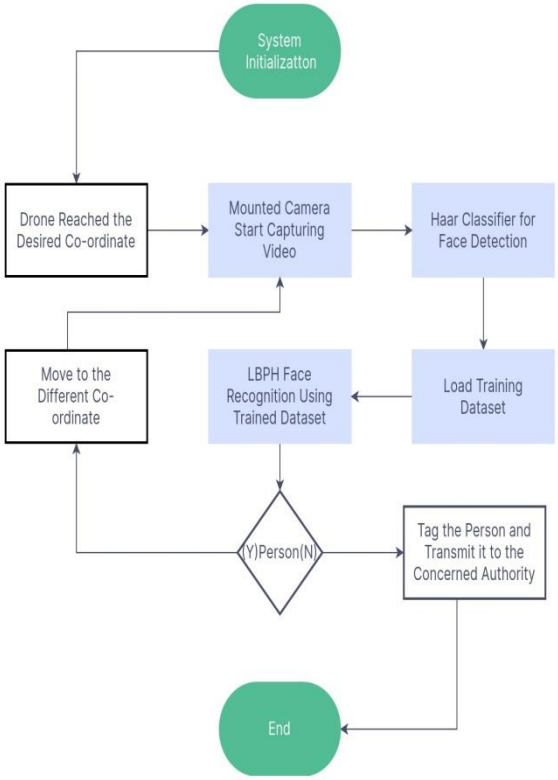

Fig. 2: System Block Representation

B. Software version

In machine learning we require a large amount of dataset to train the algorithm to work effectively and efficiently and give good results. Here we require images of 4 people that are given in Table 1. We can further increase the number of images in the proposed dataset to recognize more faces as well as to train the facial recognition algorithm.

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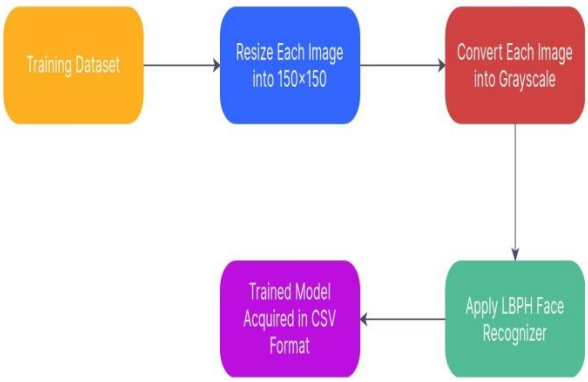

Fig. 3: Training model for face recognition using LBPH face recognition algorithm

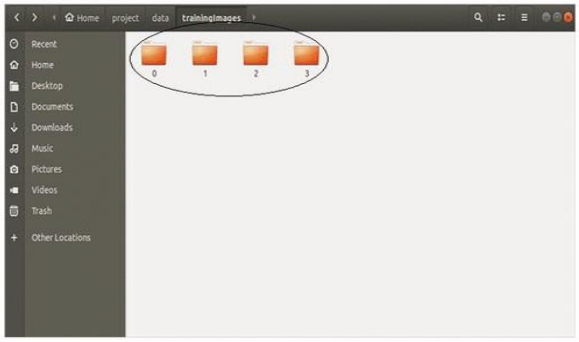

Fig. 4: Training Dataset of 4 people

At first, we train the dataset by providing the given person in the dataset with their names that the system will recognize. So, it will resize the images into the resolution of 150x150 this was done to minimize the time will we required to process the image then at second step the image will be converted into grayscale cause it will eliminate the processing speed of arduino to recognize the color in the image and it will be ease to recognize the image.Then at third step we will apply LBPH face recognition algorithm.at the last the trained data will be acquired in csv format. The training model was shown in Figure 3 and the trained dataset is shown in Figure 4.

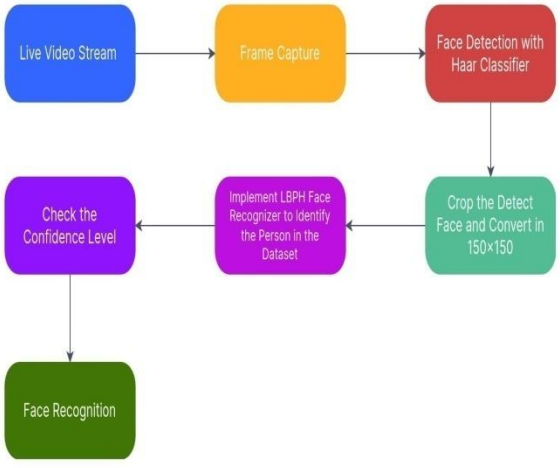

Fig. 5: Implemented Software Model

Now we will discuss the implementation of the software model when the algorithm will start working in the real world. So the first thing we will do is capture a live video stream from the digicam that is connected to the arduino, then it will start capturing the frame to minimize the processing time of the image. Then we will implement the Haar Cascade Classifier to detect the human faces after that the detected face image will be crop to the resolution of 150x150 to save the extra processing time of high resolution image. After all that the image is sent to the LBPH algorithm to recognize the person by matching its face with the person that was saved in the dataset by having the confidence level on how much the face of the person detected is matched to the person that was in the dataset. The proposed model is defined as shown in Figure 5.

IV. ALGORITHM

A. Face Detection

Face detection is done using OpenCV and Haar Cascade Classifier.here we are going to discuss the algorithm on how to recognize a face. Algorithm of face detection is given below:

- Step (1) First consider the device we are using to detect the face.
- Step (2) Then convert the taken into grayscale image or black and white format.
- Step (3) Now after all this use the Face Detection
- Algorithm to detect the face.
- Step (4) After that you can show the detected face on your laptop/pc or your mobile phone.

B. DataSet Creation

Dataset creation is the first step to create the training model for further work because creating a dataset is important to train our machine learning algorithm.In the dataset each image is given a unique id. Algorithm of dataset creation is given below:

- Step (1) Use the face detection algorithm to detect the face from the device that we are using.
- Step (2) Create the dataset of the images that are taken by the device or camera.
- Step (3) Now you can ask the user to input the name and id for each detected face taken.
- Step (4) Take at least 100 images and then save them into the dataset folder or directory.

C. Trainer

To train our algorithm we will use the labeled dataset we discussed in the previous part. We will use Open CV and python to train our algorithm. The algorithm we are using to train is LBPH face recognition algorithm. Algorithm of trainer is given below:

- Step (1) Acces all the images from the labeled dataset that we created in the previous part.
- Step (2) Extract the features of the images using the highly efficient LBPH face recognition algorithm.

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D. Recognizer

The recognizer is defined in simple language as the recognition of the detected face images with the created dataset in a real time environment. Algorithm of recognizer is given below:

- Step (1) Define the tools that are used to seize the facial image.
- Step (2) Use face detection, to come across the face from the enter feed.
- Step (3) Get access to the labeled dataset that contains all images.
- Step (4) Check the image taken is similar to the image that is saved in the dataset.
- Step (5) If yes, then the image of the person with its unique id and name is shown on the display screen.
- Step (6) If no, then it will tell the person detected is not recognized or does not match the image to the person saved in the dataset.

V. RESULT

The dataset of four people is created in the directory where each person has at least 250 images each to train the algorithm and facial recognition model. The required dataset is shown in Figure 6.

Fig. 6: Four sample images of 4 people for the training dataset

When the algorithm takes the images from the live video capture it will convert the taken live video into frames to cut down the extra processing then it will detect all the faces that the Haar Cascade algorithm is able to detect the images in the frame. Then all those detected images of faces are coveted into the resolution of 150x150 to save time of processing an extra number of pixels by compressing the image. At last all images are converted into grayscale images. Grayscale images of 4 person is shown in Figure 8.

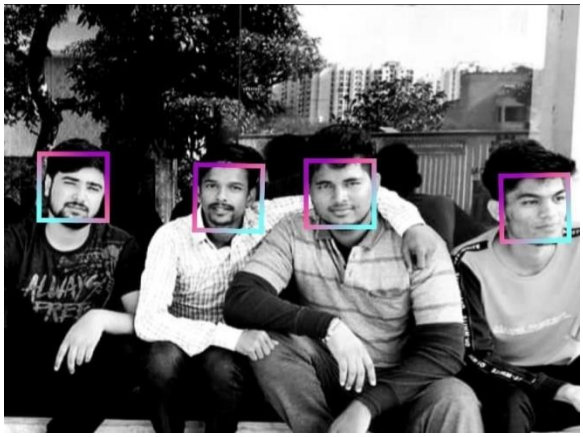

Fig. 7: Face detection using Haar cascade classifier

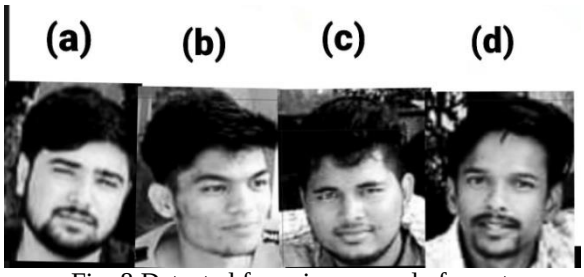

Fig. 8 Detected faces in grayscale format

Confidence level is an important factor in deciding whether the taken image is similar to the image that was in the dataset. Confidence level determines in percentage out of 100% on how much the image taken during live video capture is similar to the image that was saved in the dataset. If the Confidence level is 0 percentage it means the pesson detected is not the dataset and we detected a completely new face. Here, Haar cascade detected 4 person faces and LBPH face recognition algorithm identifies the individual in Figure 9 as Pratap because it has a confidence level of 81.45%. In Figure 8, we can see that in figure (c) has a confidence level of 81.45% with folder ID: 0 means all detected faces with their names and this directory has the image of the Pratap face in all possible scenarios to train the algorithm much better.. Similarly photo (d) from Figure 8 has a low confidence level of 4.8% ,it has so much low confidence level because some of the facial recognition features recognized by LBPH for different images are similar to it but it was so low that the confidence level is not even 10%. Here some features of some faces will match the other person's face. That is why we use confidence level to determine how much possibility that it has the same person that was in the dataset . Same thing applies to the images from (a-b) that their confidence will be low cause their the should value is low as compared to that of the trained dataset.

When the face was detected in the frame from live video capture and also recognized then the person is tagged with the confidence level and its name that was entered by and used during dataset creation and it was shown in Figure 9. Out of the 4 person face faces we used in our data set only one is recognized because the other 3 were not the trained and labeled dataset. Figure 10 (a) and (b) are other examples of facial recognition in an image . In this case, the algorithm

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identifies Ankul with a high confidence level of 89%. Figure 11 represents the accuracy of the trained dataset that we created with appreciation to the application applied in real time. The training accuracy will increase with the increased number of dataset where each person has a large number of images from different perspectives to increase algorithm training and increase the confidence level of detected face.

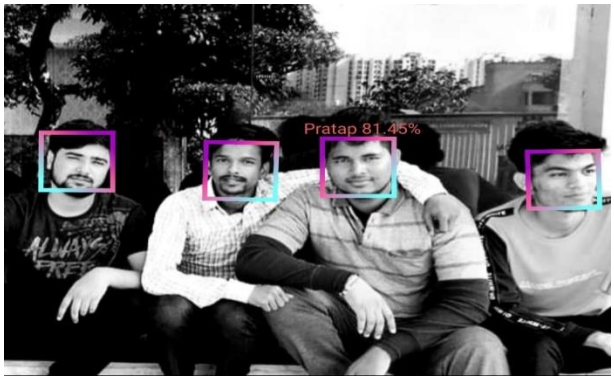

Fig. 9: Tagged person with the confidence level of 81.45%.

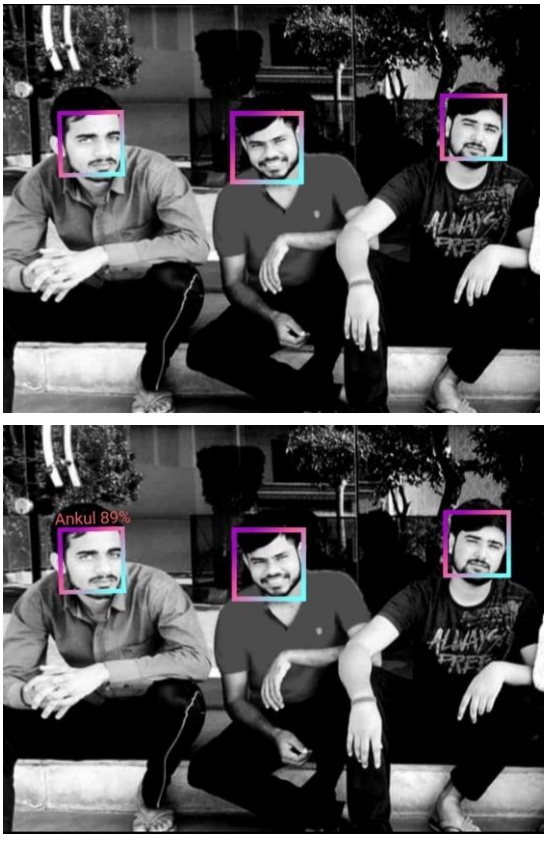

Fig. 10. (a) Face detection. (b) Tagged person with the confidence level of 89%.

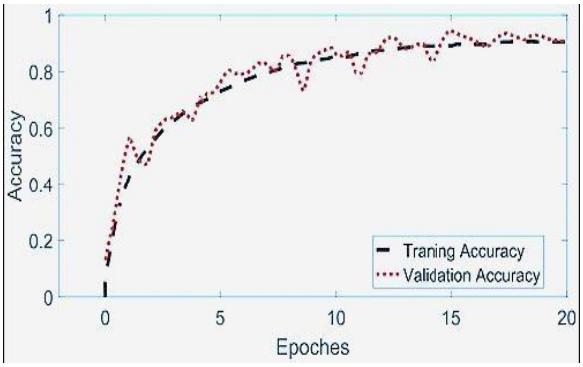

Fig. 11: Trained dataset vs validation accuracy

REFERENCES

[1.] G ¨A˘Eszczak, T. P.Breckona, and J. Hana. Real-timePeople and Vehicle Detection from UAV Imagery. InIS&T/SPIE Electronic Imaging, pages 78780B–1–13, 2011.

[2.] F. Nex and F. Remondino. UAV for 3D mapping applications: a review. Applied Geomatics, 6(1):1–15,March 2014.

[3.] G. B. Huang, M. Ramesh and T. Berg and E. Learned-Miller. Labeled Faces in the Wild: A Database for Studying Face Recognition in Unconstrained Environments. Technical Report 07-49, University of Massachusetts, Amherst, October 2007.

[4.] International Civil Aviation Organization. CIR328 N/190Unmanned Aircraft Systems (UAS), 2011.

[5.] Real time human detection in video streams FATMA SAYADI*, YAHIA SAID, MOHAMED ATRI AND RACHED TOURKI Electronics and Microelectronics Laboratory Faculty of Sciences Monastir, 5000 Tunisia, July 2012.

[6.] Drone SURF: Benchmark Dataset for Drone based Face Recognition Isha Kalra, Maneet Singh, Shruti Nagpal, Richa Singh, Mayank Vatsa, and P.B. Sujit IIIT-Delhi, India.

[7.] Design and Development of Unmanned Aerial Vehicle (Drone) for Civil Applications Dr.Pran Kanai Saha , A.M.

[8.] Reasad, Azim Bappy , MD. Asfak-Ur-Rafi MD. Saddamul Islam , Ali Sajjad, Khan Nafis Imran..

[9.] Design & implementation of an UAV (Drone) with flight data record. Tuton Mallick, Mohammed Saifuddin Munna, October 2016.

[10.] Roland Perko, Ales Leonardis, “A framework for visual context-aware object detection in still images,” Computer Vision and Image Understanding. 114, 700-711 (2010).

[11.] Navneet Dalal, “Finding people in images and videos”, Ph.D.thesis, INRIA Rhone-Alpes, (2006)

[12.] Cheng, E-J, Chou, K-P, Rajora, S, et al. Deep sparse representation classifier for facial recognition and detection system. Pattern Recogn Lett 2019; 125: 71–77.

[13.] Andrejevic, M, Selwyn, N. Facial recognition technology in schools: critical questions and concerns. Learn Media Technol 2020; 45: 115–128. [13] Kadambari, S, Prabhu, G, Mistry, D, et al. Automation of attendance system using facial recognition. In: 2019

international conference on advances in computing, communication and control (ICAC3), Mumbai, India, 20–21 December 2019. New York: IEEE.
[14.] Deeba, F, Memon, F, Dharejo, FA, et al. LBPH-based enhanced real-time face recognition. Int J Adv Comput Sci Appl 2019; 10(5): 274–280.
[15.] M. Rizon et al., "Face recognition using eigenfaces and neural networks," Am. J. Appl. Sci., vol. 2, no. 6, pp. 1872–1875, 2006.
[16.] D. Wang, A. Khosla, R. Gargeya, H. Irshad, and A. H. Beck, "Deep Learning for Identifying Metastatic Breast Cancer," pp. 1–6, 2016.
[17.] Sandvik, K.BLonde, K: The rise of the humanitarian drone: giving content to an emerging concept. Millennium, 43(1), pp. 145–164. (2014)
[18.] Krajník, T., Vonásek, V., Fišer, D. and Faigl, J, June: AR-drone as a platform for robotic research and education. In International conference on research and education in robotics (pp. 172–186).Springer, Berlin, Heidelberg. (2011)
[19.] Ira Kemelmacher-Shlizerman, Ronen Basri. 3D Face Reconstruction from a Single Image Using a Single Reference Face Shape. IEEE Transactions on Pattern Analysis and Machine Intelligence, 33(2):394–405, 2011.