Droneillance – Aviation through Eagle's Eyes

Sanjana R Chavan[1], Yashaswini J[2], Dr. K. Ramesha[3]

[1]Sanjana R Chavan,Electronics and Instrumentation,Dr Ambedkar Institute of technology,BANGALORE,INDIA
[2]Yashaswini J, Electronics and Instrumentation Ambedkar Institute of technology, BANGALORE,INDIA
[3]Dr. K. Ramesha, Professor, Electronics and Instrumentation, Dr Ambedkar Institute of Technology BANGALORE, INDIA

--***--

Abstract - *In this day and age, there is a developing requirement for observation so as to keep up the dignity at a place and guarantee the wellbeing and security of its kin. An Aerial reconnaissance framework will be advantageous in such manner. This undertaking portrays how an Aerial Surveillance framework can be manufactured utilizing an automated elevated vehicle or an automaton. By outlining the highlights of the Aerial Surveillance framework consolidating and planning new advances utilizing an automaton. The undertaking framework will be a helpful and productive option in contrast to current observation frameworks. It very well may be utilized in harmony keeping exercises and furthermore ongoing checking of a spot whenever of the day. The point is to give quick and effective observation at a reasonable rate with the goal that it very well may be utilized generally at private, institutional and administrative level. Automatons can be utilized for reconnaissance for common, military purposes and for other continuous situations. Cops regularly need to watch inside a city to guarantee that lawfulness is kept up and consequently guaranteeing the security of the residents. Cataclysmic events are expanding at a disturbing rate on the planet. From time to time we hear in the report about a region influenced by quake, flood or a typhoon and so on. There is a need to inspect such a debacle-stricken region before attempted essential salvage and help measures. Military officials frequently need to watch hazardous zones so as to look for any possible danger, criminal behavior or interruption inside the outskirts of a nation that can place the lives of residents in risk. Such regions include exceptionally high danger to human life one needs to beat lethal characteristic hindrances like steep mountain slants, strong water flows, threatening and fruitless desert regions and other such territories. The Aerial Surveillance System can be utilized effectively to complete this activity with no loss of human life. The venture presents an observation checking framework dependent on recognition calculations, actualized on a UAV, to perform reconnaissance errands permitting the checking of a particular territory, wherein a few calculations have been executed to play out the undertakings of self-ruling take-off/landing, direction arranging, and observation checking. The UAV's can perform elevated level of intricacy and simultaneously they require less intercession of Humans because of their self-ruling conduct and they are light-footed in nature. The UAV is furnished with inbuilt cameras, temperature sensors, and correspondence modules so as to give full data about the reconnaissance and the UAV itself, sending this information to the ground station continuously. The advances in independent advances and microelectronics have expanded the utilization of Autonomous Unmanned Aerial Vehicles (UAVs) for basic applications alongside actualizing observation techniques that give quick reaction to changes in nature which is an incredible apparatus for the Emergency Response Team (ERT). Automaton speed of activity is quicker and with the assist it with canning keep on flying for quite a long time on end, unhindered. Accordingly, drones are a fantastic strategy for doing airborne policing An Aerial Surveillance System is fundamentally a flying machine that can be controlled distantly with abilities to communicate constant information to a control room. The task work is approved by playing out a few trips in a genuine situation, and the got outcomes show the effectiveness and the heartiness of the proposed framework, against various reconnaissance frameworks*

***Key Words*: (UAV, Aerial Surveillance, Deep Neural Network, Machine Learning, Emergency Response Team, Aerial Policing**

1. INTRODUCTION

Today, we actually seek after a similar visionary test: seeing how the eyes chip away at seeing visual tangible. Despite the fact that natural eyes are profoundly effective gadgets for looking over an enormous amount of low-level visual tangible information and conveying particular data to one's cerebrum for elevated level semantic translation and picking up situational mindfulness. In the course of the most recent couple of decades, the PC vision network has attempted to achieve comparative perceptual capacities to fake visual sensors. Considerable endeavours have been made towards comprehension static pictures of individual articles and the comparing measures in the human visual framework. This undertaking is heightened further by the requirement for understanding an enormous amount of video information, with the plan to fathom different elements inside a solitary picture as well as after some time over numerous video outlines for comprehension their spatio-fleeting relations. A huge utilization of video examination and comprehension is shrewd reconnaissance, which expects to decipher consequently human action and identify strange occasions that could represent a danger to public security and wellbeing. The present status of security is defaced by security breaks which are costly and wasteful. Criminal exercises go undetected and unnoticed in spite of the utilization of complex hardware and prepared workforce like observation helicopters and monitored officers consequently driving to loss of lives and annihilation of hardware and

property. The pace of crimes by people and dangers by fear monger bunches has been on the ascent lately. The law requirement offices have been roused to utilize video observation frameworks to screen and control these dangers. Many mechanized video observation frameworks have been created in the past to screen relinquished objects(bags), burglary, fire or smoke, brutal exercises, and so forth. Automaton frameworks have been sent by different law requirement organizations to screen hostiles, spy on unfamiliar medication cartels, lead outskirt control activities, and so on. Regular visual reconnaissance frameworks depend intensely on human administrators to screen exercises and decide the moves to be made upon the event of an occurrence, e.g., following a dubious objective starting with one camera then onto the next camera or alarming significant offices to territories of concern. This venture presents a genuine time drone observation framework to distinguish vicious people in open zones. The framework is utilized to identify people from ethereal pictures. The picture locale the directions between the assessed present are next used to distinguish the vicious people. The proposed profound organization can learn important portrayals rapidly utilizing calculations and auxiliary priors with moderately less marked models. The framework recognizes the vicious people in genuine time by preparing the automaton pictures in the cloud. This research likewise presents the airborne rough individual dataset utilized for preparing the profound organization which ideally may support analysts keen on utilizing profound learning for airborne reconnaissance. The posture assessment and vicious person's recognizable proof exhibition is contrasted and the best in class strategies. Further, the venture presents how the plan, improvement, and assessment of independent aeronautical security observation UAV are cultivated. With the utilization of Unmanned Automated Aerial observation vehicles, we can have the option to control the hoodlums by studying the security inclined domains where it isn't ok for a human to proceed to report ahead of time. A development research strategy what's more, a straightforward model is created and introduced that will be utilized to get, examine, decipher and present the discoveries. The ramifications of the examination are that it will give a premise to further turn of events, computerization and reception of UAV in aeronautical security reconnaissance and answering to specialists the data that will be utilized to raise cautions and upgrade security

2. OBJECTIVE

- The point is to give quick and proficient reconnaissance at a reasonable rate so it very well may be utilized generally at private, institutional and legislative level.
- It can be utilized in harmony keeping exercises and furthermore constant checking of a spot at whenever of the day.
- Drones can be conveyed on destinations everywhere on over the world and be worked from a single control focus.

- Security and security groups can plan far off watches and follow live the drone's direction and video criticisms on their far-off interface.
- The capacity to use constant video and profound learning procedures to automate safety efforts are now being used inside the security market.
- The capacity to identify interruptions at huge spans, in helpless climate or in night conditions are important for its armory when reacting to an occasion.
- Drone can gather a huge number of pixels of high-goal information, alongside a huge swath of metadata about a scene, while it is on the way.
- Drones can have dispatch orders transferred naturally through an organization association than the conventional episode reaction over a radio dispatch.
- An average observation drone has no issue coordinating the running rate of a security official, with ordinary speed particulars.
- Surveillance drone have a high reaction effectiveness in the doubt border scenario rates unimaginably high, as it requires no people tuned in and there is restricted potential for miscommunication

2.1   ABBREVIATIONS AND ACRONYMS

- AI -ARTIFICIAL INTELLIFENCE
- AVI- AERIAL VIOLENT INDIVIDUAL
- ANN- ARTIFICAL NEURAL NETWORK
- CCTV- CLOSED CIRCUIT TELEVISION
- CV -COMPUTER VISION
- COG -CENTRE OF GRAVITY
- DRONE -DYNAMIC REMOTELY OPERATED NAVIGATION EQUIPMENT
- DNN -DEEP NEURAL NETWORK
- DIP- DIGITAL IMAGE PROCESSING
- ESC -ELECTRONIC SPEED CONTROLLER
- FC -FLIGHT CONTROLLER
- GCS -GROUND CONTROL STATIONS
- GUI -GRAPHICAL USER INTERFACE
- GPRS- GENERAL PACKET RADIO SERVICE
- HOTAS- HANDS ON THROTTLE AND STICK
- HTTPGET- HYPERTEXT TRANSFER PROTOCOL REQUEST TECHNIQUES
- IOT -INTRERNET OF THINGS
- LCD- LIQUID CRYSTAL DISPLAY
- ML- MACHINE LEARNING
- OPEN CV- OPEN SOURCE COMPUTER VISION LIBRARY
- TCP- TRANSMISSION CONTROL PROTOCOL
- UAV- UNMANNED AERIAL VEHICLE
- UAS- UNMANNED AIRCRAFT SYSTEM
- Ue-IOE -UAV-enabled IOE

2.2   SCOPE

To plan a model that will take after the activity of Surveillance utilizing an automaton however utilizing Deep Neural Network and Computer Vision killing the traditional visual reconnaissance. The goal is to improve Surveillance and security to upgrade Individuals protection or Societal isolation. To plan a model where automaton are conveyed as law implementation organizations to screen hostiles, spy on unfamiliar medication cartels, direct fringe control activities, which is finished by ongoing reconnaissance situation. To think of a more proficient observation framework to recognize rough people in open regions with less human mediation and furthermore disposing of the individuals safe from damage's way. The proposed model uses profound organization can learn significant portrayals rapidly utilizing calculations like Scatter Net and basic priors with human stances and furthermore give Aerial Violent Individual (AVI) dataset utilized for preparing the profound learning for airborne observation which is then contrasted with the posture assessment and vicious people ID execution is contrasted and the cutting-edge procedures. Droneillance – Aviation through Eagles eye

3.   BLOCK DIAGRAM

- The major hardware modules which are needed: Drone along with camera and the Controller.
- Controller is utilized to control the trip of automation of drone and as well as the camera resolution along with video analysis which is to be sent to the RTMP Server.

The major Software modules are: RTMP server, Digital Image Processing and Local Database where RTMP serves as an open source protocol for video streaming which is processed by the Image processing using filtering techniques, feature detection technique and color correction which is pre-processing techniques and the pre-processed image is sent to grouping where techniques like corner detection and frame splitting is done and the preprocessed grouped

Data is dumped to main program where the program runs and checks for the information which is stored in the local database from which is displayed in any android display by displaying suitable message
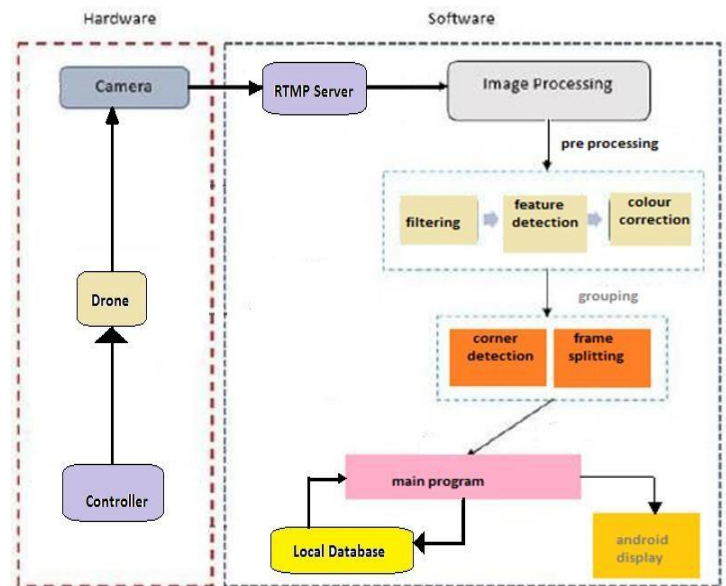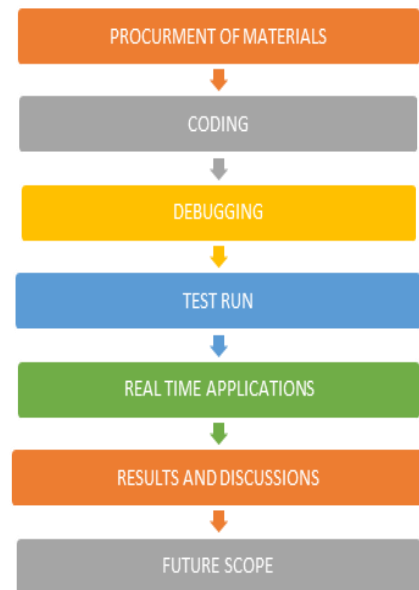

Figure 1: Block diagram of Drone Surveillance

4.   METHODOLOGY

4.1   ARCHITECTURAL DIAGRAM

Figure 2: Architectural Diagram showing the flow of data for Real Time Object Detection on Drones

The above figure depicts the architectural diagram showing the drone surveillance working on Real Time Scenario. Drone is made to wander around the suspected perimeter and it its movement, flight, camera and other metrics are controlled by the Controller here the video streaming is the main design metric and this is sent through the open source protocol to the local Base Station.

Real Time Data is sent through the UDP port through the RTMP Server which is located at base ground station where Main program is dumped with Deep Neural Network with Python OpenCV and other the library are used to collect and processed the data and this data is examined with the data stored in the local database which is placed in the ground station when the data processed doesn't complement with the data stored then a message alert or an alerting alarm to is to be displayed in an Android Display Device.

4.1.1   CONSTRUCTION

Figure displays Drone which is being controlled by a controller is connected to at one end and the other end is placed with the display of LCD or any other android device.

4.1.2   SETTING OF PRE-SET LEVELS:

• When the led glows green, it indicates that the drone is started and the user can start streaming the video.
• When the led glows red, it indicates that the drone is shut and now the user cannot access the video stream.
• When the led glows blue, it indicates that the drone is capturing and accessing the video stream by processing it to the ground control station.

4.1.3   SIMULATION OF CIRCUIT:

• To test corrections of the circuitry with various logics and algorithms were implemented using system software simulation.
• This data is computed along the continuous video streaming with the help of Deep Neural Network by implementing clustering, similarity detection and classification methods.

4.1.4   HARDWARE IMPLEMENTATION:

• Assembling the components and setting conditions in the ground control station.
• Testing of Drone is done.
• The user controls and processing the video data which is later sent to the open source protocol the data is sent to the ground station.
• The data sent to the ground station is compared with the data stored in the computer database.
• In the server, the data is displayed along with the other details and then it would be retrieved to the concerned official.
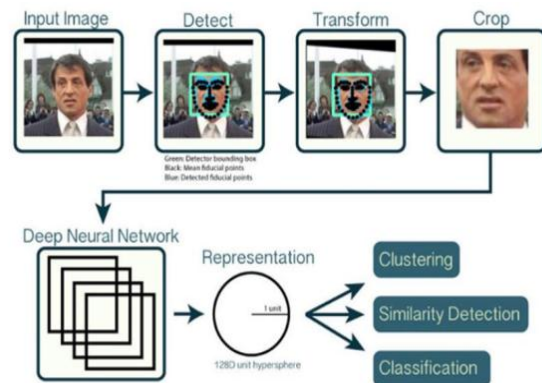
4.2   REAL TIME SCENARIO PHASE TESTING

Figure 3: Implementation of Real Time Scenario using Deep Neural Network and Python Open CV.

4.2.1   PHASE1: TESTING:

In this stage, we will test this automaton altogether to guarantee that it has wanted capacities and is good for reconnaissance. The automaton will be tried in both manual and programmed mode so as to guarantee that it will fill in as a decent, strong establishment for our venture and we can additionally include new highlights and capacities for building our ideal flying machine.

4.2.2   PHASE2: INTEGRATION:

• *Eyes in the Sky*: The fundamental point in this stage is to mount a camera on our machine to get continuous information on the ground. This information can be sound, video or an area.

We have some exhibition limitations like the camera must deliver great quality pictures. It ought to give extra alternatives like zoom in and zoom out. It must be night vision viable as the majority of the unlawful work is done in the murkiness of the night. Additionally, the camera ought to be modest so as to make our entire machine more prudent and moderate.

• *Wings of Falcon*: In this stage we intend to expand the effort of our automaton by coupling the automaton's camera to a LCD TV at the control room. The information obtained through the camera is examined by a person to recognize any criminal behavior.
• *Aerial Policing*: Here we will mount an alert framework and empower it to play prerecorded notice messages. These messages will be put away in a memory module and will be played if any criminal behavior is spotted anyplace.

5. EXPERIMENTAL ASSESMENT

5.1 FLIGHT ANALYSIS:

- The tests focused mainly on the drone's ability to fly and to maintain stability while in flight. The results showed that the drone needed much throttle to take off, and the take-off was done manually using the drone controller. It was also noted that some propellers were not rotating unless the throttle was increased. The first test that was done showed that the plane was able to rise gradually at a slow speed of approximately 10 cm/s.

- In the first test the drone, was made to fly at heights with live video streaming to check the evaluation results. This led to recalibration of the ESCs' before doing the next test.

- The "All at once" method was used to calibrate the ESCs' and resumed the tests. In all the tests that were done the weather was calm, hence the reason the plane was stable on its flight to the altitude. At 15 meters the drone was stable. The factors that affect the flight performance include the weather conditions, the controller and the overall weight of the system. The drone can fail to fly as a result of a combination of any of these factors or all of these factors.

5.2 WEIGHT AND POWER:

- The weight and the power of the drone is supplied by the propeller and due to the high-power consumption due to the various components that were using the LIPO battery, and the overall system thrust is reduced. The lift is a key factor here, drones of the same mass which has rotors the drone create more air thrust using the same power with the airflow.

- The Centre of gravity of the Drone was also a key factor in ensuring the performance of the Drone was optimal. According to the flight observation the plane's COG was okay, the components were arranged aligning them to the center of the vehicle so that the COG was at the center, and the benefit of this was that the propellers would have uniform rpms since no extra power was needed while the load was evenly distributed among the four propellers. The frame was made of plastic and hence the weight due to the frame alone was not an issue.

5.3 VIDEO STREAMING:

- The drone was made to fly high but vibration was a contributing factor in the noise that was observed because the shaking which led to some noise on the video that was observed. The quality of the identified object was not tampered with since it was still possible to identify a person on the ground even while the person or object was in motion. The video was streamed, but it can be also be used to save the footage for future reference.

5.4 GPRS AND DATA TRANSMISSION:

- Mobile network was used to send the data to the central system integration, and the data was sent using GPRS, and AT commands were used in our code to initiate the transmission, then initiate transmitting the data. The data transmission was done using the HTTP GET method where parameters were appended to the endpoint and then initiated the GET method with the real-time data.

5.5 DATABASE AND PERSISTENCE:

- The data was persisted to a database and the persistence framework used as a java framework that abstract as the database. Its serves as an interface between the database and its end users or programs, allowing users to retrieve, update, and manage how the information is organized and optimized.

6. ADVANTAGES AND APPLICATIONS

6.1 ADVANTAGES:

- Surveillance drones contribute to the reduction of risks for security staff.

- The Surveillance Drone prototype provides real-time access to aerial data without jeopardizing guard's safety.

- Surveillance drones automatically take off to the designated area to identify the source of the intrusion and help the security team to provide an appropriate response.

- Ease of handling Surveillance drone gives accurate data rather it's a substitute for dozens of fixed cameras and thus contributes to the reduction of material expenses.

- It also aims at creating a wide aerial viewpoint, enabling a general overview of the site, without blind spots and also capable of detecting anomalies or events at night or in low light conditions.

- Surveillance drones perform quick perimeter patrol which ensure situational follow up and improve team responsiveness by providing faster feedbacks.

- When an intervention is needed, Surveillance drones provide Operational Support by offering an aerial vantage point to the coordinators of the operation.

- The Surveillance drones are resistant to rain, sand and salt and can fly in harsh conditions of the environment and is weather resistant.

- Surveillance Drones perform autonomous operations from which they are utilized 24/7 deployments which have pyrotechnic recovery system and an ultra-performing geo-caging system for aerial safety.

- Surveillance drones are cheap and cost effective when compared to security personnel and can also operate for longer duration to do the surveillance task without any fatigue.

- Surveillance drones provide pinpoint accuracy and thus by preventing the collateral damage to civilians and infrastructures.

6.2   APPLICATIONS:

- *Humanitarian Aid and Disaster Relief:* drones have proved themselves useful during times of natural disaster and emergencies.
- *SWAT:* Special Weapons and Tactics teams, are trained to perform high-risk operations like hostage rescue using special weapons like drones
- *Maritime***:** Navigating oceans and ports requires an immense amount of expertise and labor but with increasing amounts of oceanic data and innovations in autonomy, UAV's have become the standard for maritime shipping
- *Perimeter Response*: UAVs provide a rapid response and fast eyes on to the target area with live updates control stations while active waypoint tracking can be maintained based on the target parameters, like thermal signatures.

7.   RESULT AND DISCUSSIONS

7.1   PROJECT SETUP:
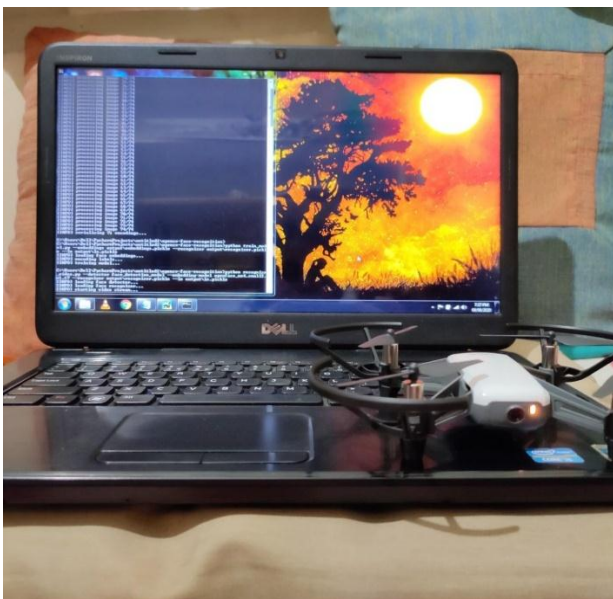
Figure 4: The Drone Surveillance Experimental Setup

The above figure represents the prototype of the Drone Surveillance which is been tested by a series of ground test and actual flight test. By conducting these test we have evaluated the performance and reliability of the project prototype and have met the expectations.

The complete and Systematic design procedure for the construction of Drone Surveillance which includes the hardware selection and software applications along with the ground and flight tests. Our results show that the proposed project prototype is efficient and effective.

It has been effectively checked and shown through genuine usage and preparing of Video Stream by drone. The proposed structure beats the cutting-edge method on the AVI information base. This structure will be instrumental in recognizing people occupied with fierce exercises in open zones or huge social events.

The proposed model the continuous Drone Surveillance System (DSS) structure that can recognize at least one people occupied with savage exercises from aeronautical pictures.

The system first uses the organization to identify people after which the proposed network is utilized to assess the posture of the people. The assessed presents are utilized to distinguish savage people.

The Drone with highlights was brought reason being, that it is an amazingly troublesome bulky assignment to manufacture our own flying machine while countless our necessities can be effectively met utilizing prepared to fly automatons which can likewise join and append new gadgets in these DIY drone units so as to fulfill our staying practical prerequisites. It is critical to note here that the TELLO Drone is an exceptionally straightforward automaton which accompanies a pre-introduced camera; henceforth it tends to be utilized for observation legitimately.

New highlights that are required for observation are added to it by utilizing different gadgets and innovations. Our Aerial Surveillance System comprises of an automaton as the essential part. This automaton is fit for self-ruling flight and supports custom mission arranging through waypoint route. The mission is based on our PC utilizing already accessible ground stations like Mission Planner and so forth. At the point when automaton is in flight, we can see all the flight information and live video transfer information in the ground control station. The PC is going about as a ground control station to screen the mission.

When the live Video Stream of data from the drone is sent to the ground control station where the classification and processing of the video is done in the laptop. The above figure represents the debugging of classification, implementation and processing of the video stream for identification of the face detection and also checks for the information in database and hence later uses face recogniser to recognise the stored information from the Database and then identifies the face when the stored information is not matching with the information sent by the video stream then it display as an unknown is detected on the Android Display.

The figures 6 and 7 represents the recognition of faces which is done in the ground control station by the official user where the information is stored in the database. The detection of faces can be done even from top view, side view, front view and other views also face can be recognized. There are no restrictions that the photo detection is done only from

front view which was an obstacle in many of the face detection programs which was resolved and implemented in our project prototype.

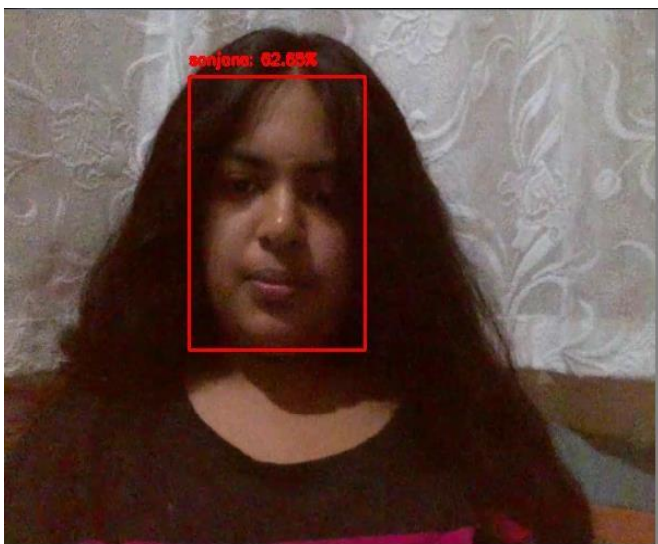**Figure 5: Processing the data from live video stream for face recognition**

Figure 6: Recognition of face stored in the database

Figure 7: Recognition of face stored in the database.

When this obstacle is removed, we even tried to encounter the face detection when there are multiple people in the frame it was efficient enough to detect the faces which is stored in the database. The grouping execution is likewise contrasted and the best in class procedure which was created to perceive the individual of enthusiasm from ethereal pictures.

The below figure represents the database of the people where it consists of the information of the people. The information includes the individual persons personnel data along with the facial features which is used for the detection purpose. The most concerned matter is that there will be no privacy problems because the database can be accessed only by the Concerned Authorities.

Figure 8: Database Storage of the Identified Persons

Table -1: DRONE REQUIREMENTS

Specification	Goals	Conditio-ns Met	Comments
Altitude	50 ft	Met	Stable enough to attempt reaching max
Weight	2kg	Met	Its lightweight
Payload	0.5 kg	Not Checked	Not required for the Project
Size	<4ft	Met	Total size is approximately in range.
Cost	<$100	Met	Total cost is in range
Imaging	Streamed Cameras	Conditio-nally	Efficient Video Streaming and processing
Weather Protection	Waterproof	Not Checked	Not required for the project
Drop Test	5 ft	Not Checked	Not required for the project
Landing Device	Impact Reducing	Conditio-nally	Impact Reduction partially accomplished
Communica-tions	Real Time Control	Met	Efficient Networking With Ground Station
Position and Orientation	GPRS and IMU	Met	Fully Operational Location Sensing and Altitude Control

8   CONCLUSION AND FUTURE SCOPE

8.1 CONCLUSION

The Drone Surveillance model was fruitful. The biographic data had the option to be electronically put away in Database and recovered with no challenges. This undertaking guarantees the protection is guaranteed as the Drone holder's character till not be uncovered to anybody as these subtleties are put away electronically however may be uncovered to the approved faculty who can get to the sequential screen.

The mix of mechanical particulars, has expanded effectiveness, lead to a more noteworthy range and perseverance of the airplane. Along these lines, the automaton reconnaissance is a more practical and eco-more amicable UAV's when contrasted with the different UAVs predetermined with perform comparable missions.

Presently the issues with the Privacy Act. UAV utilization can gather immense measures of information and data. Segment 8 of the Privacy Act permits more prominent broadness regarding the limit and serious extent of exposure between government establishments. This exposure can result in UAV information being circled to different government divisions including unfamiliar government.

A proposal is make extra powerful guideline (for the Privacy Act) that controls UAV information streams so as to forestall over the top or more noteworthy than required individual data going between governments.

Issues, for example, expected damages to people and gatherings from protection breaks are unavoidable and issues like group control and observing fights are killed. From these outcomes show that through reconnaissance security and protection is profoundly guaranteed. The quick reaction of the distinguishing unusual work force or any risky development at the checkpoints is quick and the reaction is hinted to the automaton holder's which can prompt control of crimes.

8.2 FUTURESCOPE:

This undertaking could likewise be improved by interfacing by utilizing supreme augmentation of IOT by making it UAV-empowered IOE. With the assistance UAV-empowered IoE (Ue-IoE), it is an answer by misusing UAVs' mobility, Ue-IoE can enormously improve the adaptability, knowledge and decent variety of IoE. The reconciliation of UAVs with IoE can uphold differing IoE applications own to the wide organization inclusion, enormous sharing information base, and universal insight. Hence, we will accomplish high productivity in each part of our day by day life.

A few missions in blocked off territories (mountains, ice streets, deserts, and so forth.), the dependability of controller is huge. Because of versatile inclusion and wise registering assets, Ue-IoE is able to help adaptable remote association and empower insightful enemy of location capacity. There is a solid interest to plan an interface for associating UAVs with the web; this association empowers the Internet to screen the UAV states. Subsequently, the keen calculations can be received to break down the observation photos and recordings with the assistance of the devoted AI calculations.

The imagine of IoE is to connect the coordination among edge and distributed computing offices is an unavoidable pattern so as to provide food for calculation concentrated IoE applications. The universalized Ue-IoE is to coordinate numerous heterogeneous ICT advances incorporation is doable by planning a significant level interface to associate the processing administrations NB-IoT, MTC, LoRa-WAN.

Utilization of advance highlights and innovation in everyday life is the confirmation for development of our innovation in least complex way IoE is making another influx of progress in all the fields at present consideration of such innovation offers degree to improve our insight with respect to new methods.

REFERENCES

[1] Kenzo NANOMI, "Prospect and Recent Research & Development for Civil Use Autonomous Unmanned Aircraft as UAV & MAV". Journal of System Design and Dynamics, Vol.1, No. 2, 2018

[2] Roberto Leyva, Victor Sanchez and ChangTsun Li, "The LV dataset: A realistic surveillance video dataset for abnormal event detection", 5th IEEE International Workshop on Biometrics and Forensics (IWBF), 2019, pp. 1-6.

[3] Duarte Duque, Henrique Santos, and Paulo Cortez, "The OBSERVER: an intelligent and automated video surveillance system", Proceedings of Internat ional Conference Image Analysis and Recognition, Springer Berlin Heidelberg, 2018, pp. 898-909.

[4] Milena F. Pinto, Aurelio G. Melo, Andre. L. M. Marcato, Cristina Urdiales, "Case-based reasoning approach applied to surveillance system using an autonomous unmanned aerial vehicle", Industrial Electronics (ISIE) 2017 IEEE 26th International Symposium on, pp.1324-1329, 2017.

[5] Apurv Saha, Akash Kumar, Aishwary Kumar Sahu, "Face Recognition Drone", Convergence in Technology (I2CT) 2018 3rd International Conference for, pp. 1-5, 2018.

[6] P.R. Sriram, Sandeep Kumar Ramani, Ram V Shrivatsav, Muthu M.Mankiandan, NithinAyyappaa, "Autonomous Drone for Defence Machinery Maintenance and Surveillance", Smart Trends in Systems Security and Sustainablity (WorldS4) 2019 ThirdWorld Conference on, pp. 288-292, 2019.

[7] Richard M. Thompson, Drones in Domestic Surveillance Operations: Fourth Amendment Implications and Legislative Responses, Congressional Research Service 7-5700, April 2017.

[8] Edwin Vattapparamban, Ismail Giivenc, Ali i. Yurekli, Kemal Akkaya and Selçuk Uluagaç, "Drones for Smart Cities: Issues in Cybersecurity Privacy and Public Safety", International Wireless Communications and Mobile Computing Conference (IWCMC), pp. 216-221, Sept. 2018.

[9] Ludovic Apvrille, Yves Roudier and Tullio Joseph Tanzi, "Autonomous Drones for Disasters Management: Safety and Security Verifications", 1st URSI Atlantic Radio Science Conference (URSI AT-RASC), pp. l-2, May 2017.

[10] Murillo Augusto da Silva Ferreira, Guilherme Cano Lopes, Esther Luna Colombini, Alexandre da Silva Simões, "A Novel Architecture for Multipurpose Reconfigurable Unmanned Aerial Vehicle (UAV): Concept Design and Prototype Manufacturing",Robotic Symposium 2018 Brazilian Symposium on Robotics (SBR) and 2018 Workshop on Robotics in Education (WRE) 2018 Latin American, pp. 443-450, 2018.

[11] S. Li and A. B. Chan, "3d human pose estimation from monocular images with deep convolutional neural network", Asian Conference on Computer Vision, pp. 332-347, 2018.

[12] S. Penmetsa, F. Minhuj, A. Singh and S. Omkar, "Autonomous uav for suspicious action detection using pictorial human pose estimation and classification", ELCVIA: electronic letters on computer vision and image analysis, vol. 13, no. 1, pp. 18-32, 2019.

[13] T. Pfister, K. Simonyan, J. Charles and A. Zisserman, "Deep convolutional neural networks for efficient pose estimation in gesture videos", Asian Conference on Computer Vision, pp. 538-552, 2018.

[14] Peng Wang, Bingliang Jiao, Lu Yang, Yifei Yang, Shizhou Zhang, Wei Wei, Yanning Zhang, "Vehicle Re-Identification in Aerial Imagery: Dataset and Approach", Computer Vision (ICCV) 2019 IEEE/CVF International Conference on, pp. 460-469, 2019.

[15] Bharath Raj N., Anand Subramanian, Kashyap Ravichandran, N. Venkateswaran,"Exploring Techniques to Improve Activity Recognition using Human Pose Skeletons", Computer Vision Workshops (WACVW) 2020 IEEE Winter Applications of, pp.165-172, 2020.

[16] M. S. Faughnan, B. J. Hourican, G. C. MacDonald, M. Srivastava, J. A. Wright, Y. Y.Haimes, et al., "Risk Analysis of Unmanned Aerial Vehicle Hijacking and Methods of its Detection", In 2013 IEEE Systems and Information Engineering Design Symposium (SIEDS), pp. 145-150, 2019.

[17] N. Mohamed, J. Al-Jaroodi, I. Jawhar and S. Lazarova-Molnar, "A Service-Oriented Middleware for Building Collaborative UAVs" in in Journal of Intelligent & Robotic Systems, Springer, vol. 74, no. 1–2, pp. 309-321, April 2018.

[18] E. Diamantidou et al., "Multimodal deep learning framework for enhanced accuracy of uav detection," in CVS, Springer, 2019.

[19] Bilal Taha, Abdulhadi Shoufan "Machine Learning-Based Drone Detection and Classification: State-of-the-Art in research" ReseachGate.net Publicat ion, Sep 2019.

[20] Muhammad Zohaib Anwar, Zeeshan Kaleem, Abbas Jamalipour" Machine Learning Inspired Sound-Based Amateur Drone Detection for Public Safety Applications",IEEE Journal of transport and Vehicle Technology ,Dec 2018.[21].C. Aker, S. Kalkan, "Deep nets for drone detection," Proc AVSS 2017[22]. Saqib et al., "Detecting drones using deep CNNs," Proc AVSS 2017.

[21] M. Wu et al., "Real-time drone detect using DL," MLIC, Springer 2018 Gu, J.; Su, T.; Wang, Q.; Du, X.; Guizani, M. Multiple Moving Targets Surveillance Based on a Cooperative Network for Multi-UAV. IEEE Commun. Mag. 2018, 56, 82–89, doi:10.1109/MCOM.2018.1700422. [CrossRef]

[22] Mancini, F.; Dubbini, M.; Gattelli, M.; Stecchi, F.; Fabbri, S.; Gabbianelli, G. Using Unmanned Aerial Vehicles (UAV) for High-Resolution Reconstruction of Topography: The Structure from Motion Approach on Coastal Environments. Remote Sens. 2017, 5, 6880– 6898. [CrossRef]

[23] Lyu, J.; Zeng, Y.; Zhang, R.; Lim, T.J. Placement Optimization of UAV-Mounted Mobile Base Stations. IEEE Commun. Lett. 2017, 21, 604–607. [CrossRef]

[24] [27]. Araujo, J.; Sujit, P.; Sousa, J.B. Multiple UAV area decomposition and coverage. In Proceedings of the IEEE Symposium on Computational Intelligence for Security And Defense Applications (CISDA), Singapore, 16–19 April 2018; pp. 30–37

[25] Jakob, M.; Semsch, E.; Pavlicek, D.; Pechoucek, M. Occlusion-aware multi-UAV surveillance of multiple urban areas. In Proceedings of the 6th Workshop on Agents in Traffic and Transportation (ATT 2010), Toronto, ON, Canada, 11 May 2019; pp. 59–66.

BIOGRAPHIES

	Miss Sanjana R Chavan is a recent graduate with a Bachelor's Degree from Dr Ambedkar Institute of Technology, Bangalore. She has keen interest in the field of research and development projects on Machine Learning, CNN and CV.
	Miss Yashaswini J is a recent graduate with a Bachelor's Degree from Dr Ambedkar Institute of Technology, Bangalore. She interests on working research and developmental projects based on DNN, CNN and CV.
	Professor Dr. Ramesha K has pursued his Bachelor's degree from Vijaynagar Engineering College, Bellary, Master's degree from BMS College of Engineering, Bangalore and Doctorate from JNT University, Hyderabad. He has published many papers in journals and conferences.