A Project Report on

Smart UAV Framework for Multi Assistance

Submitted in fulfillment of the requirements for the award
of the degree of

Bachelor of Engineering

in

Information Technology

by

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Approval Sheet

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CERTIFICATE

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Declaration

We declare that this written submission represents our ideas in our own words and where others' ideas or words have been included, We have adequately cited and referenced the original sources. We also declare that We have adhered to all principles of academic honesty and integrity and have not misrepresented or fabricated or falsified any idea/data/fact/source in our submission. We understand that any violation of the above will be cause for disciplinary action by the Institute and can also evoke penal action from the sources which have thus not been properly cited or from whom proper permission has not been taken when needed.

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Date: 13/05/2021

Abstract

Unmanned aerial vehicles, which are also familiar as drones, play an important role in military and National emergency. Our motive in this project is to present the real time possibilities of using UAV's in rescue operations. UAV's can be practically used to transport goods on demand, provide medical support in urban areas, save people stuck during floods, analyse the scale of damages, monitor large performance inspection activities, human gatherings, ORS, deliver food and other necessary material, supply automated external defibrillators, support rescue operations and for emergency transport activities.

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List of Abbreviations

UAV: Unmanned Aerial Vehicle
GPS: Global Positioning System
AI: Artificial Intelligence
IoT: Internet of Thing

Chapter 1

Introduction

Artificial intelligence and drones is pair made in technology. Pairing technology of the machine learning with AI along with the art of UAV drones allow ground-level operators an overview of entire area. Since a long time drones play key diagnostic roles in a very form of sectors — including defence, natural disaster relief, agriculture [10], security and construction. With their capability to extend potency and enhanced safety, drones became one of the important tools for everybody from fighters to farmers. As we all know these days the unmanned aerial vehicles (UAVs) have become a popular technology with the ability to upgrade the commercial production industries and also the property right outside of the military. Public departments such as, police department, public safety and transportation management and public healthcare are beginning to use UAVs to convey prompt warnings regarding the catastrophe and improve the performance of rescue and resumption operations when a telecommunication infrastructure in an exceeding area is broken or otherwise not available .Natural disasters have been increased at an distressing rate in the world. Every now and then we hear in the news about a locality full of catastrophe, tsunami or a hurricane etc. There is a necessity to look at such a catastrophe stricken areas before tasking the required rescue and help operations.

Smart UAVs are so popular, in fact, that the method of getting medical attention in remote regions in India should be improved to extend wellness management accessible. The healthcare system should try and aim to supply the simplest and quick necessary medical help to all any one far and near the country while enhancing for time and cost efficiency. However, India's current healthcare and wellness system is disorganized and lacks the accessibility of medical services in various parts of country. AI in healthcare is used for complex algorithms and software to emulate human cognition with analysis of medical data.

The primary thought of AI applications related to health is to analyze relationship between treatment techniques and patient health. Drones used as a security camera for monitoring outside activities like violence of rules or theft and protest to acknowledge the people or mon- itor their activities. Even for street surveillance [9], concerned authorities are using drones to transmit messages and spread awareness about the lockdown measures that the government has under-taken, particularly in areas that lacks open communication channels for health insights and information. Drones equipped with loudspeakers are conventional to make public announce- ments to stay back indoors, take all the necessary precautions, maintain social-distancing and wear a mask when stepping outside from home. Doctors

and hospitals need medical supplies and laboratory testing quite often, and drones are the fastest and safest ways to deliver medica- tion supplies and transport required samples from hospitals to laboratories. The use of drones for medical reasons brings about numerous ad-vantages, such as instant help, less time for trav- elling to the destination of patient, re-duction of complications within the injured due to a brief time to attend for rescue, support and enhancement of basic functioning of medical necessity and their emergency teams, and therefore the room to succeed in places which are otherwise inaccessible for basic means of medical support.

AI drones used in construction companies can scan and cover a larger the area of buildings within some minutes, than any human would have required to complete. In defence and military areas drones have become suitable to develop for the unmanned tools to attack or bombard on the enemies during the conflicts. Military officers often should petrol areas so as to go looking for any potential threat ,illegal activity or any intrusion within the borders of the city that may put the lives of the civilians in threat. Such areas involve very high risk to human life. The Aerial Surveillance System is used feasibly to induce this job shunned any loss of human life also the rate at which the operation will be done will definitely going to be quicker with help of the drones. Until recently, though, drones were only ready to display what their cameras captured. Now, because of computer science software, they'll perceive their surroundings, which enables them to map location, track objects and provide analytical feedback in real-time.

Chapter 2

Literature Review

• 2.1 Dr. Usha Rani. Nelakuditi, M. Manoj Vihari , M. Purna Teja [1] proposed an architecture stating IoT based Unmanned Aerial Vehicle system for Agriculture applications. As we know the pesticides and fertilizers are helpful to retain the bloom of the crops and avert the suffering caused by contagion that live on these crops. Using Unmanned Aerial Vehicles (UAV) for spraying ,one can spray pesti-cides all over the crops and can cover larger area in very limited time also man-aging the use of chemicals and water at the same time. A sprayer mechanism was enabled to the drone .With this mechanism one can easily spray and prevent the crop from getting damaged with very less efforts.

• 2.2 Mikhail Yu.Kataev, Maria M. Dadonova Qadeer[2] presented a model Ac-cording to the model the monitoring of the research processes predicting crop yields, supervising the growth stages of the plant, using unmanned aerial vehicles are feasible for farming.One of the effortless solution for this problem is to process the received data (images)from the unmanned aerial vehicle (UAV). An essential segment of image processing linked with application of the clustering method to isolate the different varieties of plants in the field, such as, weeds. The given report presents us the examples of an application of the standard K-means method for clustering images of agricultural fields.

• 2.3 Elloumi, M., Dhaou, R., Escrig, B., Idoudi, H., and Saidane, L. [3] proposed their design in 2018.In this paper contains design for monitoring the traffic on road using a UAV-based system.This UAV is capable of monitoring the traffic situation on a road, they collect and send the real time data of information about the vehicle to a traffic processing center to regulate the movement of vehicles. This paper states that the performance of their system is better than the performance of those UAV which are used for trajectory traffic monitoring system in terms of coverage and events detection rates.

• 2.4 Naser Hossein Motlagh, Miloud Bagaa, and Tarik Taleb [4] proposed a very clear and precise description about UAV-Based IoT Platform A Crowd Surveillance Use Case. This paper consists of a high-level perspective of a UAV-based integrative IoT platform for delivering the IoT assistance from greater height, in addition to the system orchestrator all together. As a visualized use case of the platform, the paper demonstrates how one can use UAVs to monitor the crowd depending upon the face recognition technology. They have designed a tested consisting of a local processing node and one MEC node.

Chapter 3

Project Design

The following figure Fig.1 shows the existing system architecture of Arduino based UAV.This system has Arduino as a core component and can be controlled through mobile GUI using Bluetooth.

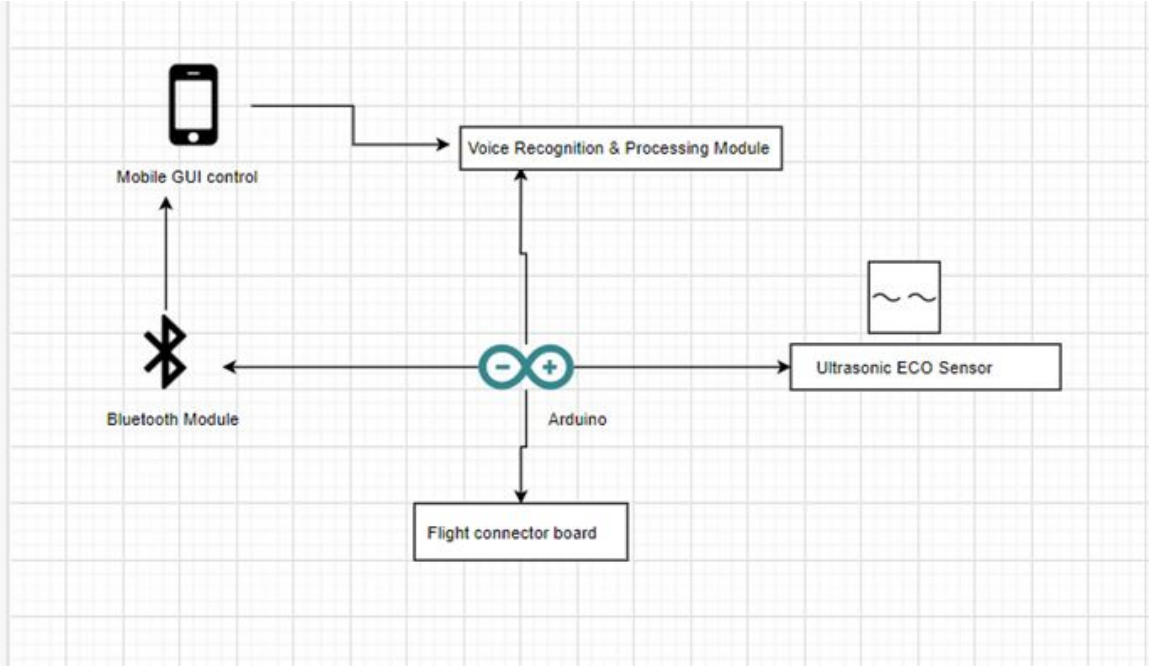

Fig 3.1 Existing System Architecture

Working :Usually the drones are controlled with the help of an RF remote, or in case of autopilot using a GPS module for automatic controlling by directing the proper path to drone. Here in this system a drone is constructed using an Arduino Uno.The main objective of this project is to collect data and 2D video information from a particular known public area. So as to get the video information, we have to designate the values of maximum length and width that the drone can travel by using Arduino programming. As the name suggests, autopilot which means the drone will be controlled by itself, and that the flight controller will handle the controlling action of the drone which consists of built-in sensors to balance the drone.

The Fig 3.2 represents the Proposed System Architecture. It is Arduino based UAV Framework.

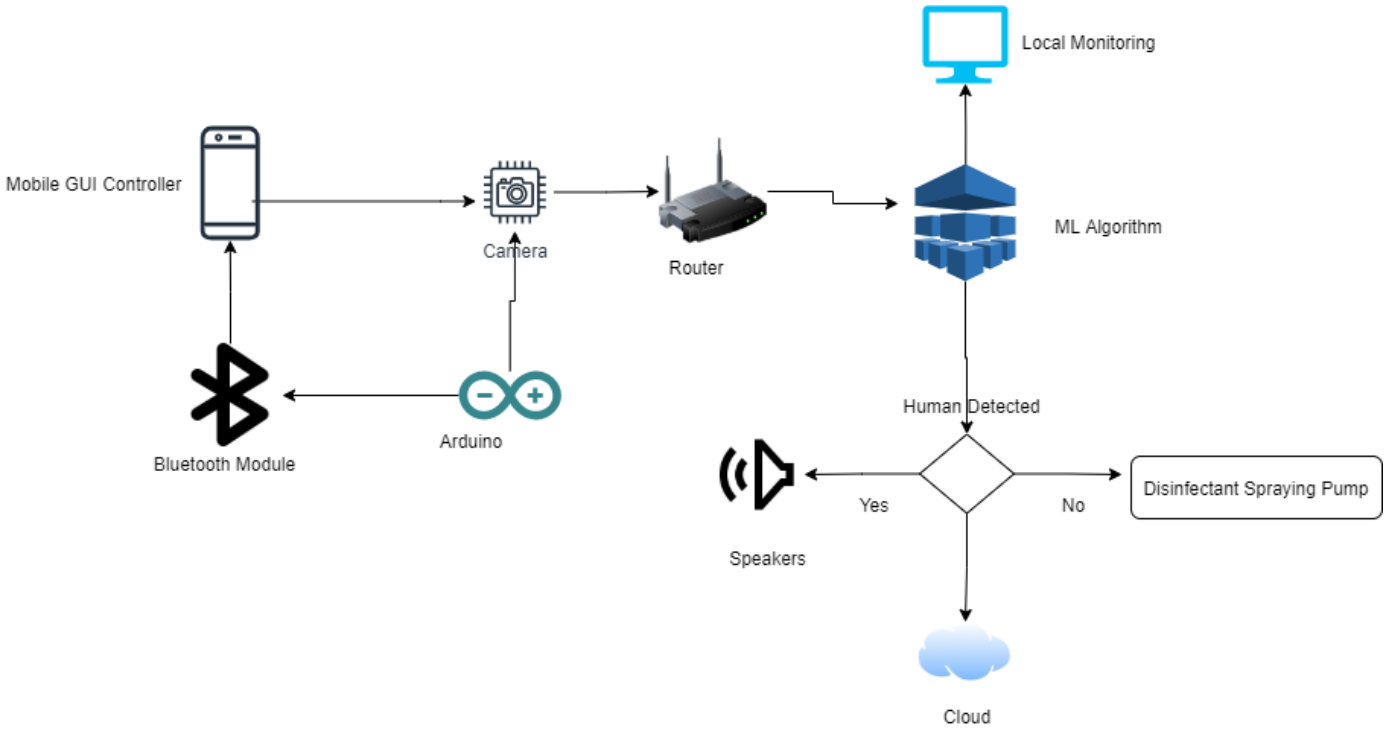

Fig 3.2 Proposed System Architecture

The IP camera is connected to it which will capture all the real time images/video of a particular area and pass the data to cloud over internet. From cloud the data is accessed and here Machine Learning comes into picture.

The main purpose of using Machine Learning is to make sure that any object (humans particularly) are detected and then depending upon the output the further action is taken. For object detection we have used YOLO algorithm i.e. You Only Look Once (YOLO).This algorithm is used for real time object detection and it is the most effective object detection algorithm. It has CNN (Convolutional Neural Network) that uses Deep learning algorithm for object applies one single neural network to an entire image and then divides the whole image into boundaries and predicts the bounding boxes. For this it uses pre-trained data set called COCO data set. It classifies the objects within the images frame. It is prominent because it brings about high efficiency there by also being able to run it in real-time. The meaning of algorithm "you only looks once" is that the algorithm scans the given image or video at once and requires one forward propagation to pass through neural network to predict the object in the given image or video.

Now depending upon the results which we get from ML the further action i.e. if the output show that the area is free from crowd then decontaminates the area by spraying the disinfectant with help of nozzle and splitter The drone is enabled with flight controller, it directs the RPM of each DC motor depending upon the input received. The command is fed to the flight controller and it in turns manipulates the DC motor accordingly. The

flight of the drone is controlled using Bluetooth low energy module which makes use of Web Bluetooth .Web Bluetooth is a technology mainly used of making 2 bluetooth devices communicate with each other. All these components are powered using Lithium polymer or Lipo Batteries.

The Fig 3.3 represents the Flow of Module.The flow include first monitoring secondly counting and announcing for alerting the crowd in frame and lastly storing the captured frame

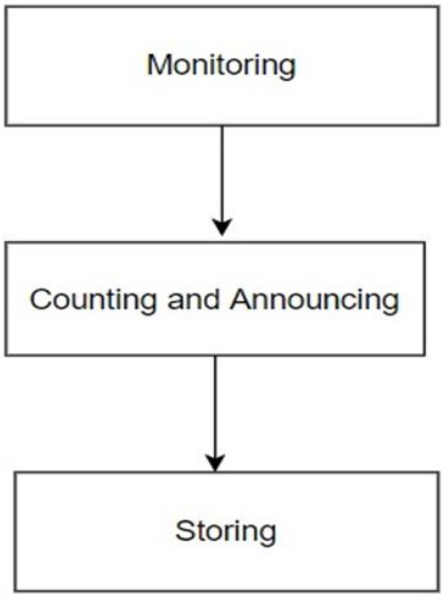

Fig 3.3 Design:Flow of Module

This Fig 3.4 is diagrammatic representation of Use Case. It includes the steps that the administrator can do.

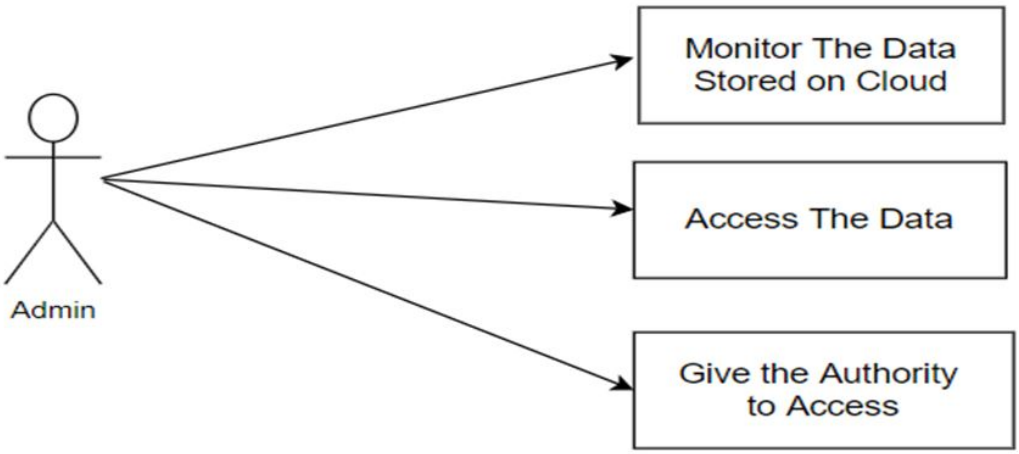

Fig 3.4 Use Case Diagram

The Fig. 3.5 represents the Activity Diagram of the system.Which helps us to understand how the system would work and the pattern of processes that would take place.

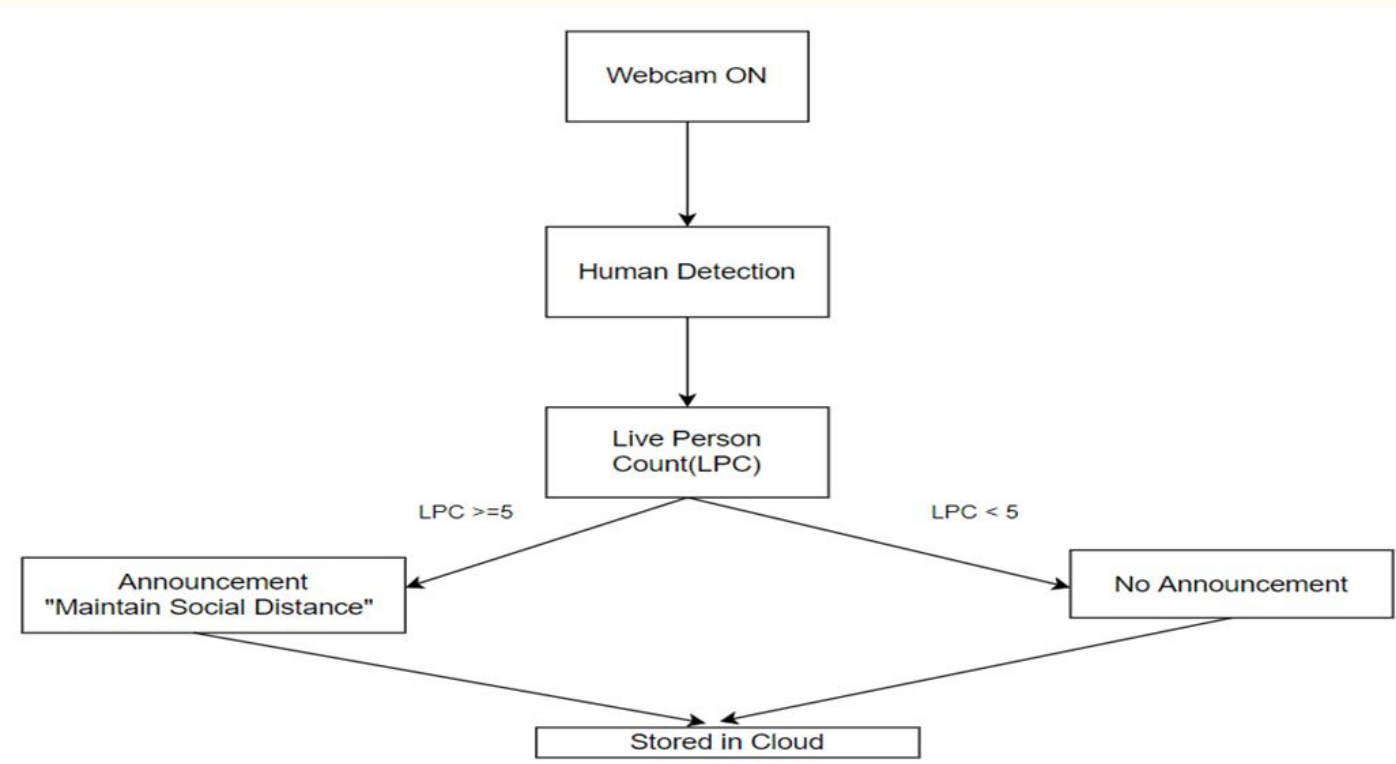

Fig 3.5 Activity Diagram

Chapter 4

Project Implementation

Using Tinker Cad we have shown the circuit connection for the DC motors.Here we have used Arduino as the core component and all the other components are interfaced with Arduino. The DC motors are connected to the Arduino .These motors are mainly used for motion controlling and positioning the drone. The DC motor creates its own magnetic field which is an input to the motor's rotor which will help the drone to take off from the ground. The brush less DC motors are attached to the propellers these DC motors produce the necessary thrust that helps propellers to cause the circular motion. These components are covered with drone frame that gives shape to the drone and helps to hold all the components together. The code below is used for detection and storing the output.

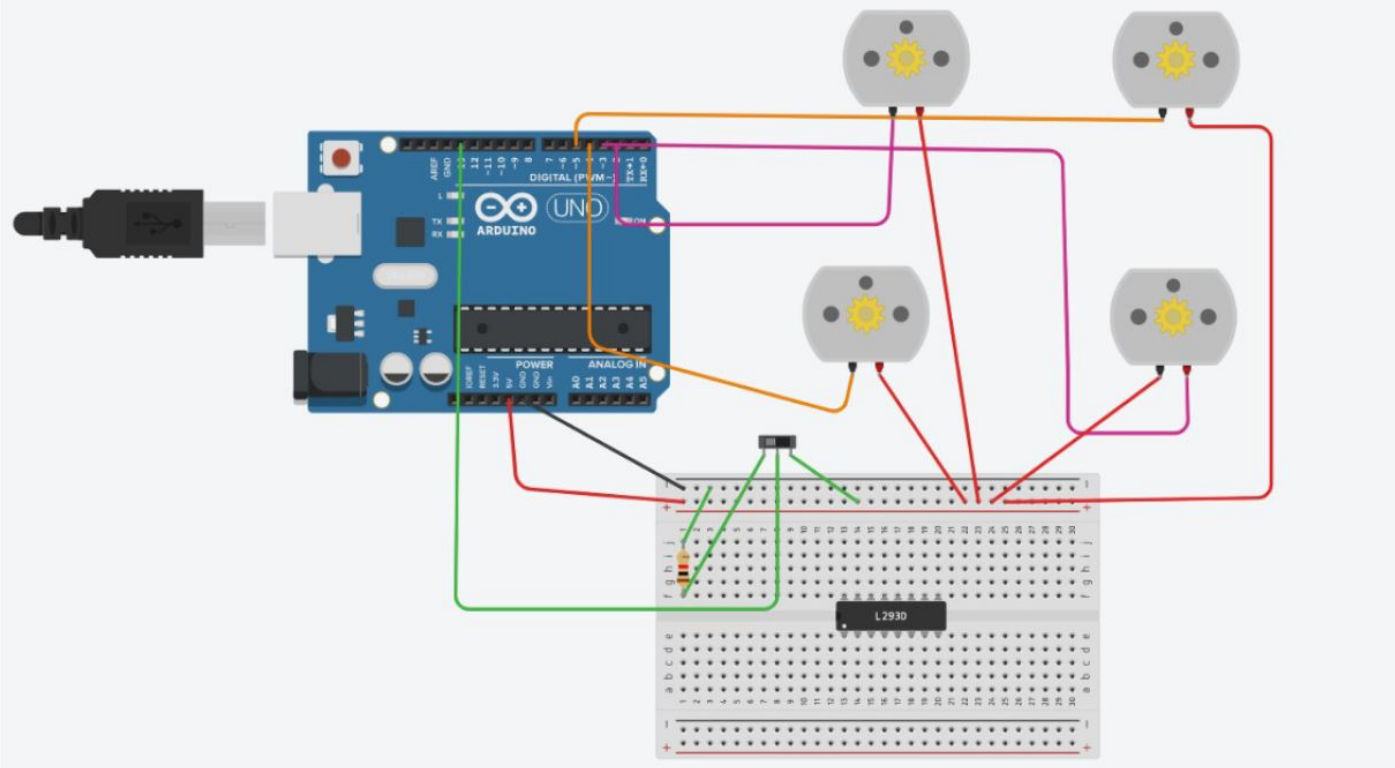

Fig 4.1 Proposed System Circuit Diagram

Chapter 5

Testing

The following figure Fig.2 represents the system architecture of UAV equipped with surveillance cameras, thermal imaging payloads and speaker for public announcements. The capability of UAV for aerial inspection is positively supplementing the police's ability to battle the spread of the pandemic. But providing situational awareness on a real-time basis, this technology gives the Police the means to understand and deploy resources very quickly and easily to manage evolving situations.

Fig 5.1 Component Testing and Implementation

Chapter 6

Result

Thus with this system we can capture the real time frame over a specific area and sort only the humans in the frame These detected humans are bordered and highlighted in the frame.People crossing the desied distance which is expected to be maintained are labelled with red borders. The top left corner shows the Live Person Count i.e LPC where in if it exceeds 5 the recorded announcement gets triggered and make people alert about the same. Mega the storage Cloud is used for storing the captured footage which can be accessed whenever required

Fig 6.1 Person Detection Output

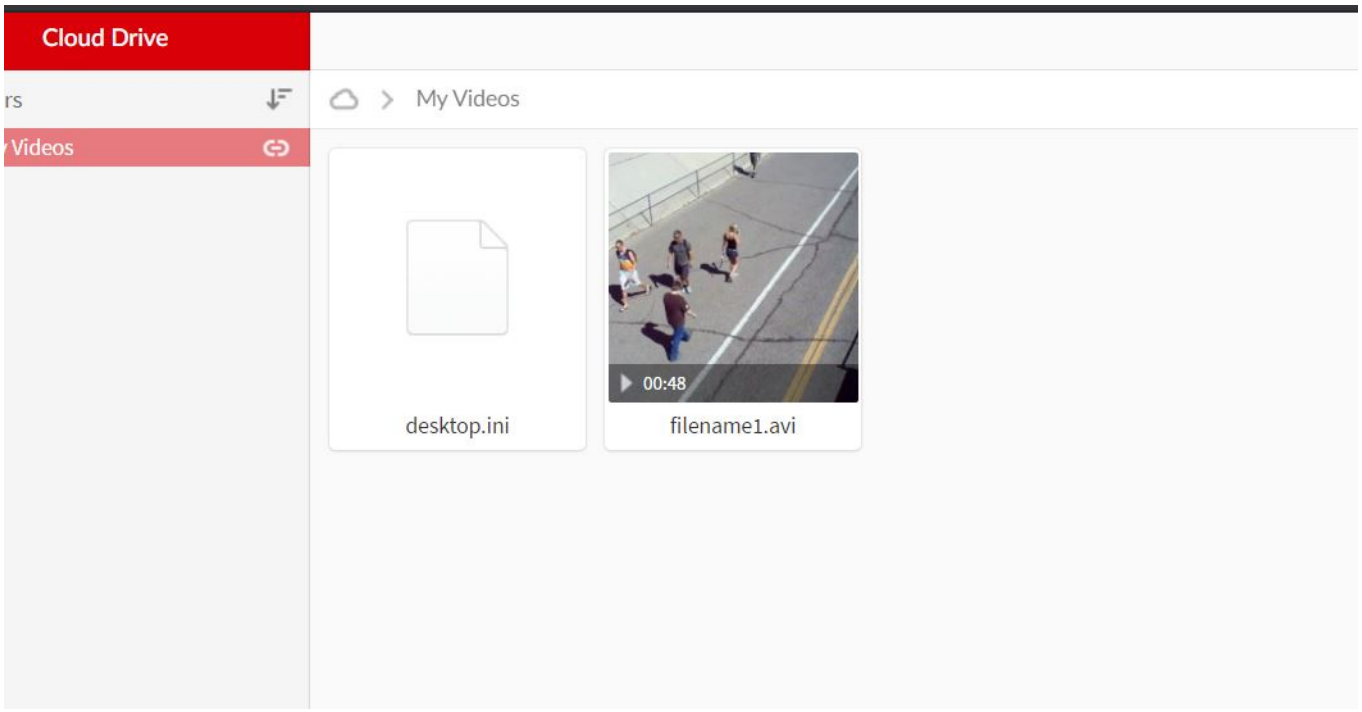

Fig 6.2 Storage Output

Chapter 7

Conclusions and Future Scope

The UAV can provide the best and quick possible medical attention to all needy people over a specified region along with optimizing for time and cost efficiency. The drone can also be used as a function of surveillance and counting a crowd in a specific location which can be treated as future advancement of our UAV. Also drone can be made more efficient by increasing its weight capacity which can be then also used for emergency delivery system in remote regions as to bring healthcare at convenience . The change in direction of wind flow, increase in distance between controller and the drone, or any other environmental changes like heavy rain, fog can limit the efficiency of proposed UAV.

Bibliography

[1] Dr. Usha Rani. Nelakuditi, M. Manoj Vihari , M. Purna Teja IoT based Unmanned Aerial Vehicle system for Agriculture applications. 2018 International Conference on Smart Systems and Inventive Technology (ICSSIT). doi:10.1109/icssit.2018.8748794.

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[4] Mikhail Yu.Kataev, Maria M. Dadonova Qadeer. 2019 International Multi- Conference on Engineering, Computer and Information Sciences (SIBIRCON)

[5] Taku Noguchi Komiya, Y. (2019). Persistent Cooperative Monitoring System of Disaster Areas Using UAV Networks. 2019 IEEE Smart World, Ubiquitous Intelligence Computing, Advanced Trusted Computing, Scalable Computing Communications, Cloud Big Data Computing, Internet of People and Smart City Innovation

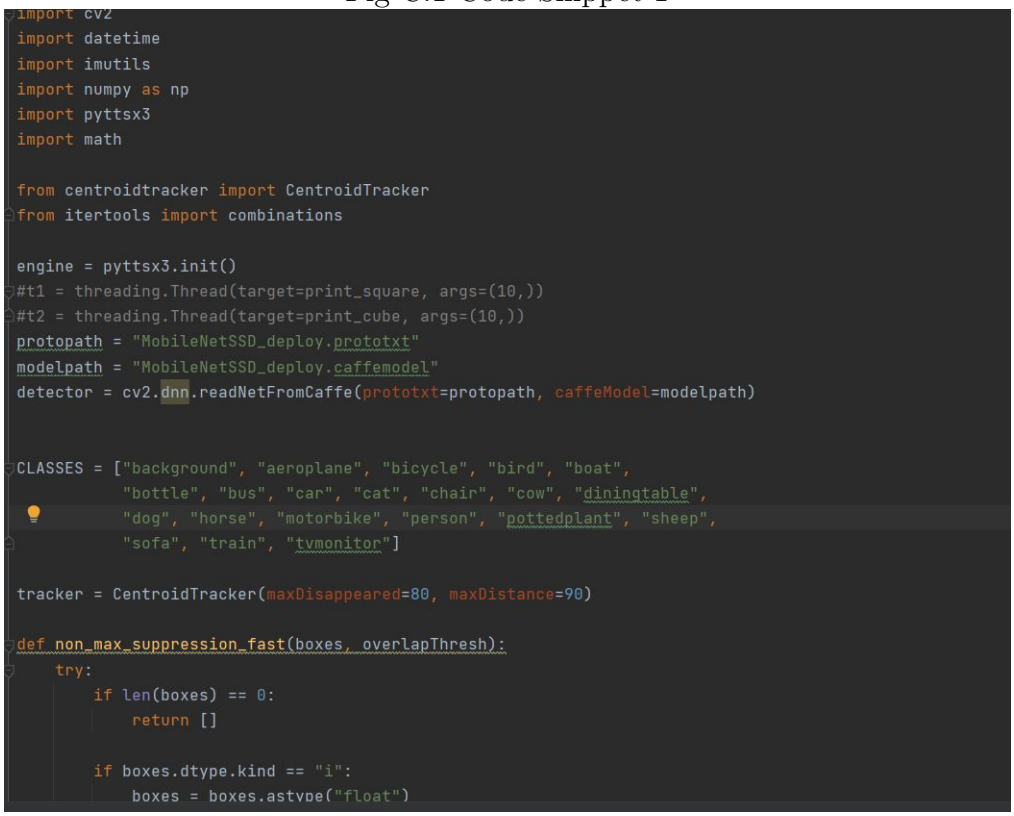
Appendices

1. Download the Pycharm Community Edition 2020.3.5
2. Python 3.9
3. Install all the requirements in Pycharm

    a. pip install open cv python
    b. pip install imutils
    c. pip install numpy
    d. pip install dlib
    e. pip install cmake
    f. pip install scipy
    g. pip install pyttsx3

4. Configuring the environment with Mega cloud for storage purpose

Fig C.1 Code Snippet 1



```
import cv2
import datetime
import imutils
import numpy as np
import pyttsx3
import math

from centroidtracker import CentroidTracker
from itertools import combinations

engine = pyttsx3.init()
#t1 = threading.Thread(target=print_square, args=(10,))
#t2 = threading.Thread(target=print_cube, args=(10,))
protopath = "MobileNetSSD_deploy.prototxt"
modelpath = "MobileNetSSD_deploy.caffemodel"
detector = cv2.dnn.readNetFromCaffe(prototxt=protopath, caffeModel=modelpath)


CLASSES = ["background", "aeroplane", "bicycle", "bird", "boat",
           "bottle", "bus", "car", "cat", "chair", "cow", "diningtable",
           "dog", "horse", "motorbike", "person", "pottedplant", "sheep",
           "sofa", "train", "tvmonitor"]

tracker = CentroidTracker(maxDisappeared=80, maxDistance=90)

def non_max_suppression_fast(boxes, overlapThresh):
    try:
        if len(boxes) == 0:
            return []

        if boxes.dtype.kind == "i":
            boxes = boxes.astype("float")
```

Here in Fig C.1 all necessary libraries are imported in to the code along with the data set for detection

Fig C.2 Code Snippet 2

```
        boxes = boxes.astype("float")

    pick = []

    x1 = boxes[:, 0]
    y1 = boxes[:, 1]
    x2 = boxes[:, 2]
    y2 = boxes[:, 3]

    area = (x2 - x1 + 1) * (y2 - y1 + 1)
    idxs = np.argsort(y2)

    while len(idxs) > 0:
        last = len(idxs) - 1
        i = idxs[last]
        pick.append(i)

        xx1 = np.maximum(x1[i], x1[idxs[:last]])
        yy1 = np.maximum(y1[i], y1[idxs[:last]])
        xx2 = np.minimum(x2[i], x2[idxs[:last]])
        yy2 = np.minimum(y2[i], y2[idxs[:last]])

        w = np.maximum(0, xx2 - xx1 + 1)
        h = np.maximum(0, yy2 - yy1 + 1)

        overlap = (w * h) / area[idxs[:last]]

        idxs = np.delete(idxs, np.concatenate(([last],
                                               np.where(overlap > overlapThresh)[0])))

    return boxes[pick].astype("int")
except Exception as e:
```

The Fig C.2 is code that involves building the frame for each detection in frame.This removes the overlapping frame which is made using Non-max Suppression.

Fig C.3 Code Snippet 3

```
        print("Exception occurred in non_max_suppression : {}".format(e))


def main():
    cap = cv2.VideoCapture(0)  #

    fps_start_time = datetime.datetime.now()
    fps = 0
    total_frames = 0
    lpc_count = 0
    object_id_list = []
    centroid_dict = dict()

    while True:
        ret, frame = cap.read()
        frame = imutils.resize(frame, width=600)
        total_frames = total_frames + 1

        (H, W) = frame.shape[:2]

        blob = cv2.dnn.blobFromImage(frame, 0.007843, (W, H), 127.5)

        detector.setInput(blob)
        person_detections = detector.forward()
        rects = []
        for i in np.arange(0, person_detections.shape[2]):
            confidence = person_detections[0, 0, i, 2]
            if confidence > 0.5:
                idx = int(person_detections[0, 0, i, 1])

                if CLASSES[idx] != "person":
                    continue
```

Fig C.3 is part of code which is responsible for taking the input i.e the video input be it Web cam or mp4 video.

Fig C.4 Code Snippet 4

```
            (startX, startY, endX, endY) = person_box.astype("int")
            rects.append(person_box)

    boundingboxes = np.array(rects)
    boundingboxes = boundingboxes.astype(int)
    rects = non_max_suppression_fast(boundingboxes, 0.3)

    objects = tracker.update(rects)
    for (objectId, bbox) in objects.items():
        x1, y1, x2, y2 = bbox
        x1 = int(x1)
        y1 = int(y1)
        x2 = int(x2)
        y2 = int(y2)
        cX = int((x1 + x2) / 2.0)
        cY = int((y1 + y2) / 2.0)

        centroid_dict[objectId] = (cX, cY, x1, y1, x2, y2)

        cv2.rectangle(frame, (x1, y1), (x2, y2), (0, 0, 255), 2)
        text = "ID: {}".format(objectId)
        cv2.putText(frame, text, (x1, y1 - 5), cv2.FONT_HERSHEY_COMPLEX_SMALL, 1, (0, 0, 255), 1)

        red_zone_list = []
        for (id1, p1), (id2, p2) in combinations(centroid_dict.items(), 2):
            dx, dy = p1[0] - p2[0], p1[1] - p2[1]
            distance = math.sqrt(dx * dx + dy * dy)
            if distance < 75.0:
                if id1 not in red_zone_list:
                    red_zone_list.append(id1)
                if id2 not in red_zone_list:
                    red_zone_list.append(id2)
main() › while True › if lpc_count >= 5
```

The Fig C.4 is code which is used to allot the captured frame a specific bounding frames depending upon the resolution of device.

Fig C.5 Code Snippet 5

```
        red_zone_list = []
        for (id1, p1), (id2, p2) in combinations(centroid_dict.items(), 2):
            dx, dy = p1[0] - p2[0], p1[1] - p2[1]
            distance = math.sqrt(dx * dx + dy * dy)
            if distance < 75.0:
                if id1 not in red_zone_list:
                    red_zone_list.append(id1)
                if id2 not in red_zone_list:
                    red_zone_list.append(id2)

        for id, box in centroid_dict.items():
            if id in red_zone_list:
                cv2.rectangle(frame, (box[2], box[3]), (box[4], box[5]), (0, 0, 255), 2)
            else:
                cv2.rectangle(frame, (box[2], box[3]), (box[4], box[5]), (0, 255, 0), 2)

        if objectId not in object_id_list:
            object_id_list.append(objectId)

    fps_end_time = datetime.datetime.now()
    time_diff = fps_end_time - fps_start_time
    if time_diff.seconds == 0:
        fps = 0.0
    else:
        fps = (total_frames / time_diff.seconds)

    fps_text = "FPS: {:.2f}".format(fps)

    cv2.putText(frame, fps_text, (5, 30), cv2.FONT_HERSHEY_COMPLEX_SMALL, 1, (0, 0, 255), 1)
```

ain() › while True › if lpc_count >= 5

Problems Terminal Python Console

Above Fig C.5 is code which is responsible for highlighting the frames red when any two people cross the maximum distance that is required to maintain.

Fig C.6 Code Snippet 6

```
        fps_end_time = datetime.datetime.now()
        time_diff = fps_end_time - fps_start_time
        if time_diff.seconds == 0:
            fps = 0.0
        else:
            fps = (total_frames / time_diff.seconds)

        fps_text = "FPS: {:.2f}".format(fps)

        cv2.putText(frame, fps_text, (5, 30), cv2.FONT_HERSHEY_COMPLEX_SMALL, 1, (0, 0, 255), 1)

        lpc_count = len(objects)
        if lpc_count >= 5:
            engine.say("Maintain social distance")
            engine.runAndWait()
            engine.stop()


        lpc_text = "LPC: {}".format(lpc_count)


        cv2.putText(frame, lpc_text, (5, 60), cv2.FONT_HERSHEY_COMPLEX_SMALL, 1, (0, 0, 255), 1)


        cv2.imshow("Application", frame)
        key = cv2.waitKey(1)

        if key == ord('s'):
            break

    cv2.destroyAllWindows()
main()
```

Above Fig C.6 is the code that displays the capturing frame and the live person count with the frame.

Publication

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