Identifying and Detecting Real-Time Objects Using Drone Camera

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***Abstract*: Commercially there is tremendous increase in the application of Unmanned Aerial Vehicle (UAV) which is publicly known as Drone. In this paper we are proposing application of Drone in Real Time Object Detection. It uses Artificial Neural Network and Algorithms of Machine Learning to successfully detect all kinds of objects. Object detection has wide applications in many autonomous and non-autonomous sectors and integrating this technology with Drone will be boon to human kind. We will exploit drone technology and the detection module will detect all the target objects and give the detected object details as output. Object detection will be used for many applications like surveillance, delivery, crowd analysis, traffic surveillance, etc .This article also describes possibilities of further development of system.**

***Index Terms*—Object Detection, Deep Learning, Neural Network, Recognition, Artificial Intelligence**

I. INTRODUCTION

In recent years, there has been increasing interest in autonomous UAVs and its applications. Visual object detection is an important component in such applications of UAVs. Many UAV studies have tried to detect and track certain types of objects such as vehicles n etc. Image recognition has become a part of our daily lives, and the technology behind it is advancing at a steady pace. We thought it'd be good to use the increasing speed and tiny size of lightweight computers like the Raspberry Pi, as well as the efficiency and portability of machine learning libraries .Man has always been fascinated with a view of the world from the top — building watch-towers, high fortwalls, capturing the highest mountain peak. To capture a glimpse and share it with the world, people went to great lengths to defy gravity, enlisting the help of ladders, tall buildings, kites, balloons, planes, and rockets. As of today drones are being used in domains such as agriculture, construction, public safety and security to name a few while also rapidly being adopted by others.

Object Detection is a trending technology across the world related to computer vision that deals with detecting instances of semantic object certain class for example Human, Building, cars and many more Objects that exists. This technology has now been combines with UAV (Drone) to expand its application and provide solution to many human problems.

Figure 1. Drone [Source : Google]

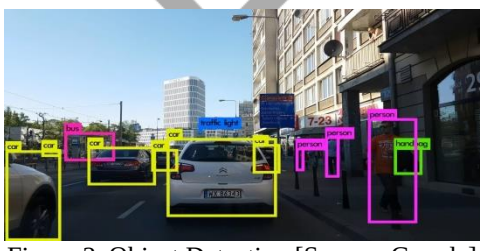

Figure 2. Object Detection [Source: Google]

II.LITERATURE SURVEY

1) FAST OBJECT DETECTION FOR QUADCOPTER DRONE USING DEEP LEARNING.

Authors of the paper have researched on development of object detection using deep learning based on drone camera. Their purpose to make develop this project was to deliver medical aids for patients in emergency situations. So basically it's a deliver drone which flies from a starting point and reach the target position and detects the goal position through object detection module and GPS.

In this system they have used Mobile Net and Single Shot Detector(SSD)framework for fast and efficient deep learning based method of object detection. Their system comprises of Parrot AR Drone with camera, object detection module MobileNetSSD with deep learning technology and GPS module.[1]

2) Objects detection and recognition system using artificial Neural networks and Drones

In the paper authors have presented about digital image object detection and recognition system using artificial neural networks and Drones. In this system face was the key object of detection and using an application which was used for learning process and another one for pattern creation , the system was developed to recognize digital images.

Histogram equalization and normalization of input images was done, learning and detecting by neural networks was followed , several pattern generation was done and comparing the images by intelligent system the whole working was done and the desired results of detection were generated.[2]

3) Pedestrian Detection in Aerial Images using Vanishing Point Transformation and Deep Learning

Drones are well-liked nowadays and formally known as Unmanned Aerial Vehicles (UAV) or unmanned aircraft systems.However, deep learning models for object detection still cannot have high detection rates for pedestrians in aerial images even though they already show high precision on PASCAL VOC 2007. The main challenges of aerial image analysis are:

I)The size of an object in aerial images can be very small.

II) The objects in aerial images are tilted outward due to perspective projection deformation, which make the pedestrians hard to recognize in aerial images.

In this paper, Author utilize image partition and vanishing point transformation to overcome the above challenges.And also the experimental results done by them demonstrated that such pre-processing methods can increase the detection rates significantly for some deep learning models.[3]

4) Human Crowd Detection for Drone Flight Safety Using Convolutional Neural Networks

In this paper a novel human crowd detection method is used, which utilizes deep Convolutional Neural Networks (CNN), for drone flight safety purposes. The aim author is to provide light architectures, as imposed by the computational restrictions of the application ,that can effectively find difference between crowded and non-crowded images, captured from drones,and provide crowd heatmaps that can be used to semantically to enhance the flight maps by defining no-fly zones. At the end they did two things:

I) Propose to adapt a pre-trained CNN on task, by totally discarding the fully-connected layers and attaching an additional convolutional one, and transforming it to a fast fully-convolutional network that is able to produce crowd heatmaps.

II) They also propose a two-loss-training model, which aims to enhance the separability of the crowd and non-crowd classes. The experimental validation is performed on a new drone dataset that has been created for the specific task, and indicates the effectiveness of the proposed detector.[4]

III.Relevant mathematics associated with the project.

System Description:

A mathematical model is a description of a system using mathematical concepts and language

.A model may help to explain a system and to study effect o different component of a system to predict the behaviour of system.

The mathematical model for our system is as follow:

Pm + Pe = Pm + Pe1 + Pe2 + Pe3 + Pl....[1]

Lm*Vm+Le*Ve=Lm*Vm+Le1*Ve1+Le2*Ve2+Ve3+Ll*Vl....[2]

m = motor/motor supply

e = Battery

el=Camera

l =Loss

Pm=Vm*Lm=Tm*Wm

Equation[1]is derived from the hardware block diagram Level 2.

This equation state that power drawn from the power source must equal the power used by each block plus some loss.

Equation[2] shows the same relationship,but it is broken down into voltage and current

Equation[3] shows the relationship between the voltage and current in the motor.

Mathematical model for object detection:

Module

Input: Capture Image

Output: Recognized image/Detection of Object

Capture image and send file to application.Let S1 be a set of parameter for selecting file

S1=(Image size,image upload)

Venn Diagram:

Let M be the Mathematical Model which consists of user set,Server and destination set M={U,S,D};

U=(U1,U2,U3....,Un)-Set of user

S-Server

D-(D1,D2,D3,...,Dn)-Destination

Let U1,U2,U3,Un be the set of capture images.

Let D1,D2,D3,Dn be the destination where image is store

S be the server

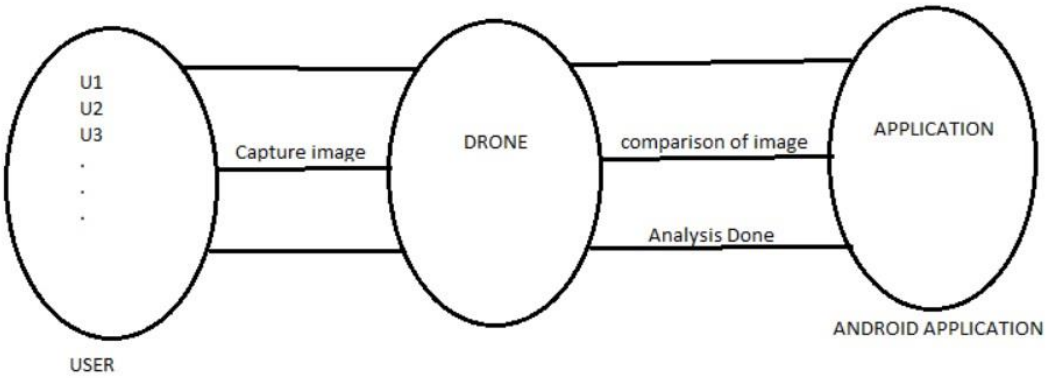

Figure 3: Venn Diagram

IV.PROPOSED SYSTEM

Idea is that a drone system can be made which will be easily able to analyze real time image/video data. The Object detection module and Repository will be build using YOLO algorithm, COCO repository , Tensor Flow and will be build in Raspberry Pi which when integrated with the drone and 4G /LTE video stream to stream the video to laptop or phone.

This system would be able to detect all general digital objects and give labels /title to them and also counting mechanism can be added which will be able to count particular number of any objects. This system will be able to do its work very fast with good accuracy and give desired results.

System architecture is clearly explained in Fig.3 below

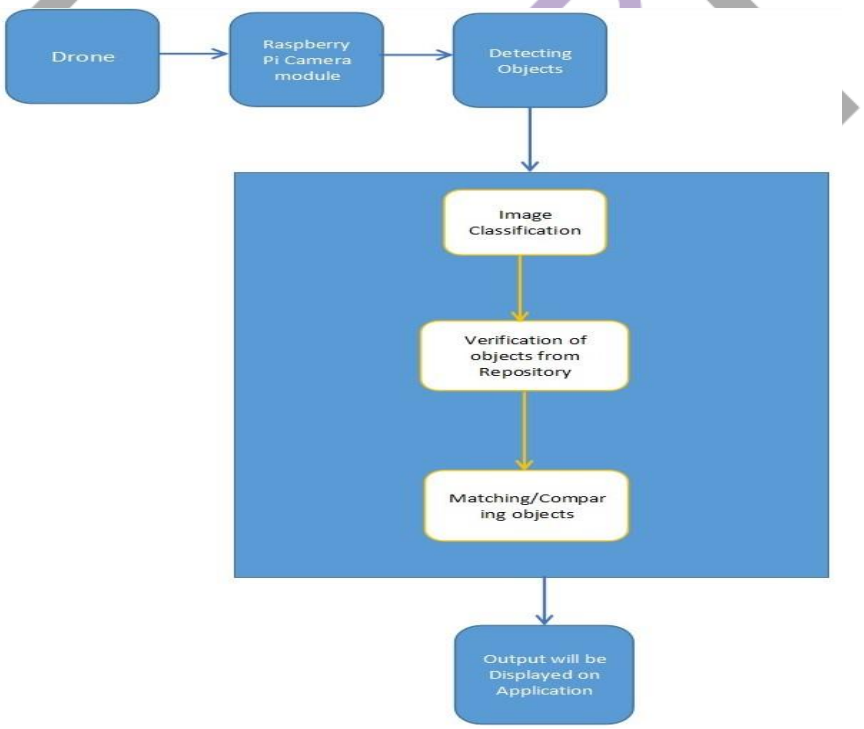

Figure 4. System Architecture

V.FUTURE SCOPE

1. System can be trained and used as Delivery drone which will be fully autonomous drone.
2. Object detection and obstacle avoidance can be done and then the drone can be used in many autonomous missions and military surveillance .
3. More emergency help services can be added and then drone can be used as fully emergency rescue drone.

VI.CONCLUSION

For development of this system both the knowledge about using algorithms correctly and handling hardware would be needed and then only the desired system can be made. Invention and development of AI technology has made it possible to imagine

and work to develop such a system. Detection of objects that too from sky can be very useful invention and all the knowledge and hardwork put to develop the system is worth it. More technology will be added and in future many more applications will be developed.

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