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Automated Drone

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Abstract: Today is the world of automation. We put forward an idea of automated drone which will make our security or surveillance system sturdy. The automated drone as the name indicates will automatically detect the path once the co-ordinates are provided. It will operate automatic path planning algorithms. Also surveillance will be done through raspberry pi camera. The cameras will not only be used for surveillance but will also be a substitution for sensors, as any barrier will be4 detected by processing the images captured through camera. The drone will change its track or direction accordingly. We also plan to bluster the AI module of Object detection. YOLO (You Only Look Once) will be used for object detection. The core idea is to detect object and keep surveillance in real world by using a drone that works on the principle of automatic path planning.
Keywords: Object detection, Automatic Path Planning, Convolution Neural Networks, Classification, YOLO

I. INTRODUCTION

There has been much work recently in the area of automated vehicles using Artificial Intelligence for example (Tesla based Self Driving Vehicles). This proposal put forwards a method, which allow an unmanned airborne vehicle to automatically detect the desired path of interest while recognizing and tabulating objects in its field of vision in real time. This can have numerous applications in rescue, surveillance, delivery, traffic management, disaster management, review of construction sites, military etc. A lot of money and time is invested in human resources for simple mechanical task like delivery, area surveillance, monitoring which are automated in their approach and don't desire much high cognitive analysis for their processing which in turn if a human had done would drain them with monthly expenditure and investments without even having the opulence of an automated machine to perform the task. The key idea of the approach is to learn object detection, classification and path planning which would be used in the drone to track, discover and notice objects in real time. Thus, the put in include the path which the drone requires to follow and the live video feed a camera attached to the drone. The model will learn automatic path planning and object detection. The generated output would be live video stream along with detection and classification of environment or various objects in its environment. This information can be used to do anything ranging from spot detection to environment tracking. Using deep learning for object detection and classification our airborne vehicle will be able to classify and discover images in all environments. This will be able to bifurcate between different products for delivery, security purpose, various sites of construction also can be used in analysis of traffic by detecting the number of vehicles present in its path. The airborne vehicle will also be autonomous that is it will have least human intervention sometimes it takes skill to manoeuvre the airborne vehicle and depending on various obstacles also certain parameters have to considered of such as wind resistance, battery life and how it will make use of an optimal path using TSP (Travelling Sales Person) algorithm which would yield much better results. Our objective is to create an unmanned airborne vehicle that can execute certain tasks such as delivery, security, construction review with minimal human interface.

II. OBJECT DETECTION ALGORITHM

A. Introduction to Object Detection Algorithm

In this project, we have reviewed the state-of-the art of Object Detection models. We have provided details about the evolution of the architectures of the most accurate objects detection models from 2012 up to today. One of our analysis criteria are on their speed at interference allowing real-time analysis. Note that researchers test their algorithms using different datasets (PASCAL VOC, COCO, ImageNet) which are different between the years. Thus, the cited accuracies cannot be directly compared per se. We have gone through the details of the evolution of various architectures of the most accurate object detection models (as of October 2018) for the analysis criteria. We will check the speed at interference allowing real-time analysis. We will also like to note that many researches at that time in order to test the algorithm used from different dataset.

B. Datasets

The PASCAL Visual Object Classification (PASCAL VOC) senseFly, Image Net, Open Images Dataset, VisualQA SVHN (Street View House Numbers), etc. these datasets are well known for object detection, classification, segmentation of objects and so on. They consist of around 1000 images for training and validation containing bounding boxes with objects. Although, some of the datasets above like PASCAL VOC contains only 20 categories, we shall consider it as a reference dataset for object detection.

C. Object Detection Flowchart

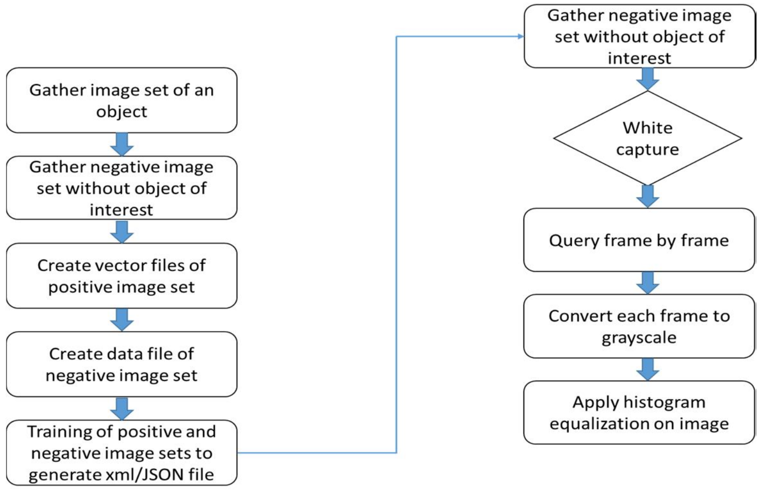

Fig 1. Flow Chart for Object Detection

D. Implementation

YOU ONLY LOOK ONCE will be choice of our object detection algorithm. Earlier detection algorithms used to rely on classifiers for detection. But in YOLO we circumambient the detected object with respect to a regression problem, i.e. it will have a bordering box attached with a class probability informing us how much does the detected object references are trained class of models. Here solo neural network is required to foretell the bounding box and display its corresponding class probability from pictures in one iteration. The base model of YOLO has capability of processing images in real-time at about 50 FPS. There are various iterations of the matching algorithm that supply us more FPS at the cost of classification accuracy. The trump card of YOLO is that despite in making localisation errors as compared to its rival it is less likely to falsely predict false positive on background. YOLO has capability of understanding general representation off real life objects and is much faster to other algorithms comparatively.

III.PATH PLANNING

A. Introduction

Unmanned Aerial Vehicles, commonly referred to as UAVs. A number of UAVs presently exists. Their potentialities in terms of payload (weight carrying capability), accommodations (volume), mission profile (altitude, range, duration) and on board systems (control and data acquisition) differ remarkably. Historically, the substantial use of UAVs have been in the fields of intelligence surveillance and reconnaissance (military). A similar autonomous vehicle is able to aid the operator with executing a number of subtasks, which helps the operator able to concentrate on the key task or mission in our case that is inspection and analysis based on the observation. The prime focal point is on vehicle's ability to perform autonomous navigation.

B. Path generation

Two of most frequent used heuristic search methods are:

1) *Potential Field Algorithm and Vector Force Field: One* frequently used method in path planning applications is the Potential Field Algorithm. The Potential Field approach allocates a calculated value via an artificial potential function to each and every point in the world and vitalize the reaction of the vehicle to the potential field as it steers towards the minimum potential. The prime point has the minimum potential and thus the UAV is engaged towards the goal. Potential field algorithms need evaluating forces in the configuration space and the complexity of such algorithms can be often be O(MD) where M stands for number of nodes in the space of computation and D stands for the dimension of the space.
2) *Floyd - Warshall Algorithm:* Contrary to the potential field approach, which is uninterrupted and differentiable, the Floyd-Warshall method makes use of predefined discretised sells to determine the path. It obtains the shortest path through a weighted graph, a discretised domain where each sell has associated weight or cost. This method associates positive or negative edge weights (but with no negative cycles). A vertex signifies a physical space in the environment and the edge signifies the distance between two vertices. This algorithm resolves the "all pair shortest path problem" (APSP)

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C. Use Case Diagram

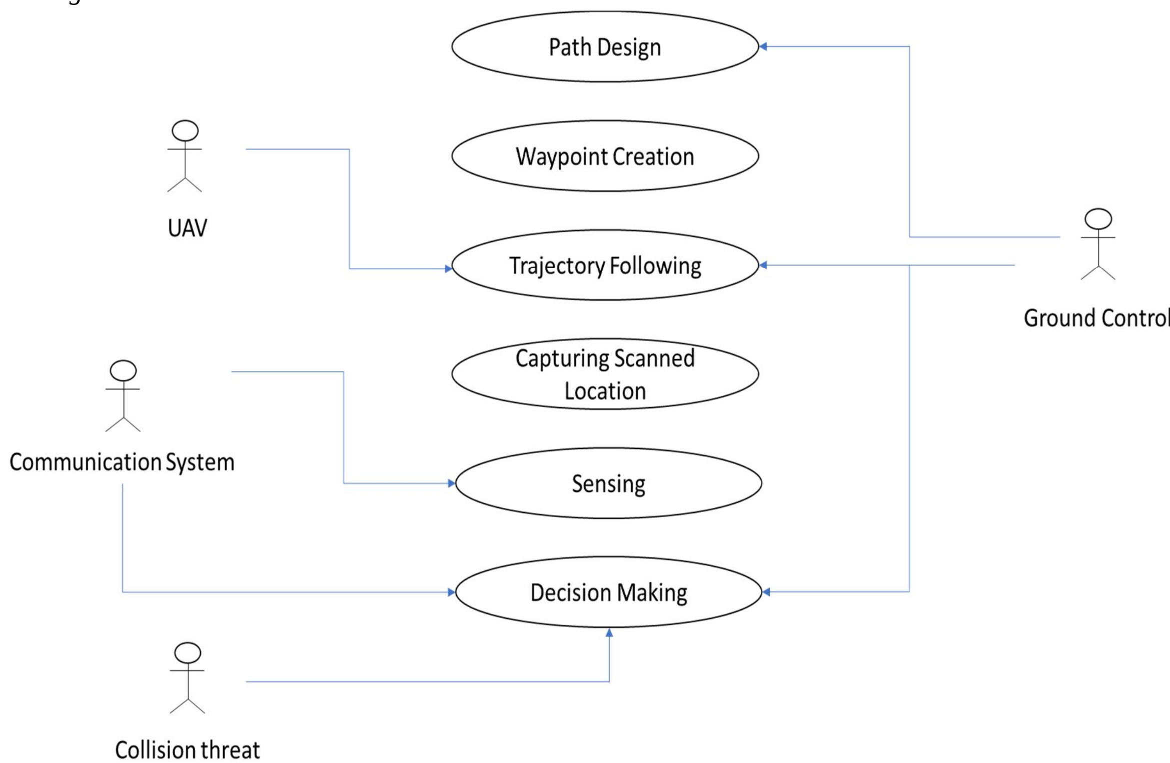

Fig 2. Use case diagram for path planning

D. Feasibility Study

Types of work	UAV	Human	Expenditure Analysis
Delivery	Simple drone with use of a robotic arm and a barcode to identify delivery locations.	Investment in a vehicle.	Drones have just a one-time investment and are better sorted for short term delivery.
Surveillance	Drone with extension a thermal camera using our path planning algorithm and object detection algorithm.	Normally human resources look after without aerial view advantage.	Drones are better located as they would have aerial view advantage, but they would also have to be in more number and would have to take care of collision with one another while scanning the area
Traffic analysis	Aerial advantage and would be able to map connecting roads even better for analysis	Would require human resource of a government employ who due to human limitation would not have the ability to demand the best view to address a certain issue	Drone can minimize but cannot easily replace the usage of traffic attendees this would make them get a broader and improved view of the street which would help in better traffic analysis and estimation as this would help in clearing traffic congestion.

Table 1. Feasibility study

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E. Design

The Mission Planner, consists some of these features:

1) Point and click way point entry, using Google maps/Bing/Open Street maps/Custom WMS
2) Choose mission commands from drop down menu
3) Download mission lock files and inspect them
4) Construct APM settings for your air frame
5) Coalition with a PC flight simulator to generate a full hardware-in-the-loop UAV simulator
6) Observe the output from APM serial terminal

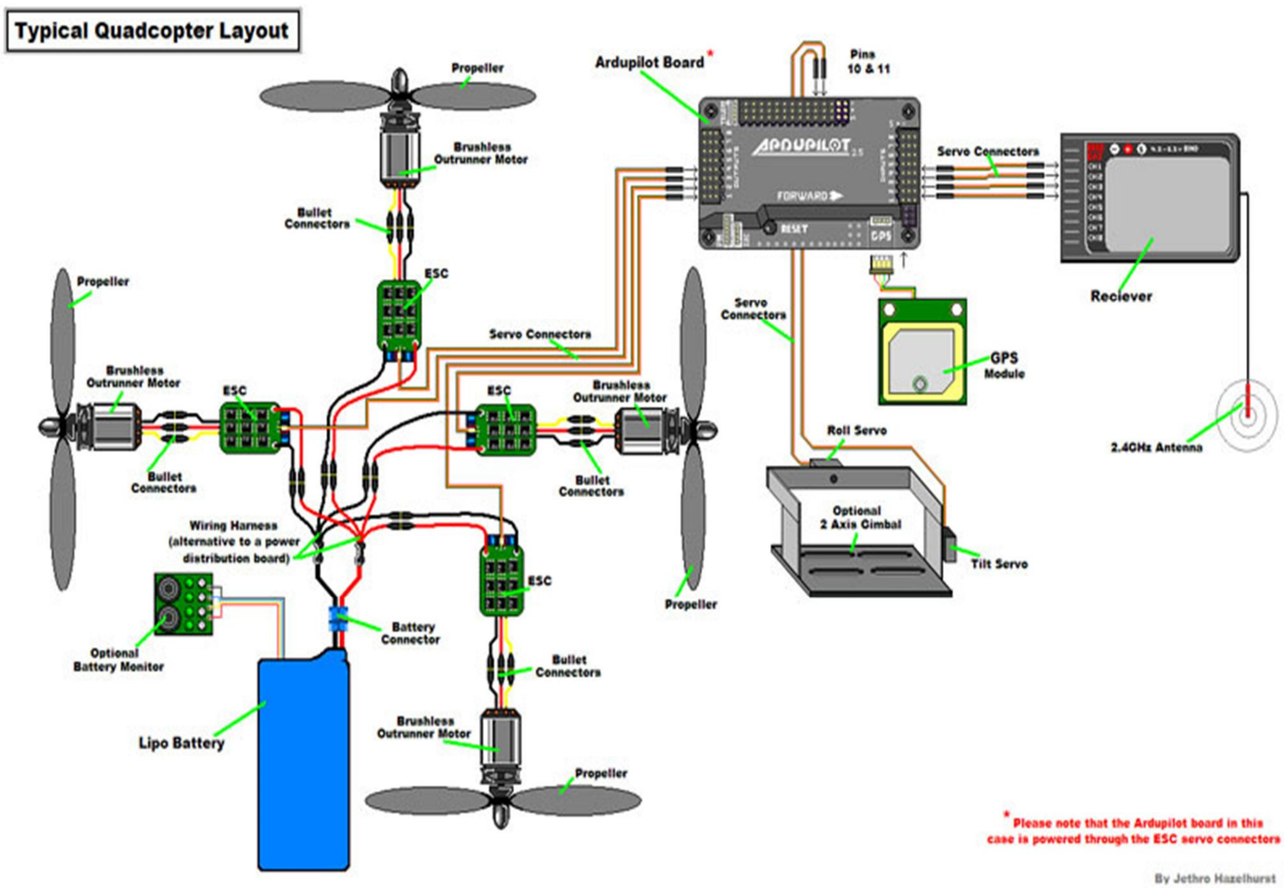

Fig 3. Block diagram of drone

a) Standard Prop
b) Pusher prop
c) Brushless motors
d) Motor mount
e) Landing gear
f) Main drone body part
g) GPS module
h) Electronic speed controllers (ESC)
i) Flight controllers (APM)
j) Receiver
k) Antenna
l) Battery with monitor
m) Collision avoider sensor

F. Implementation

The design is directed at a small unmanned aircraft vehicles (UAV) under autonomous operation which are generally subject to constraint arising from restricted onboard processing capabilities, power incise and field programmable gate array (FPGA). Implementation for the design is chosen for I's potential to address such constraints through less power and high speed in hardware computation. The MAVLink protocol offers a low bandwidth bond for the FPGA implemented path planner to communicate with an onboard flight computer. A control system plan is introduced that is capable of receiving a string of GPS waypoints generated, onboard from a earlier developed in hardware genetic algorithm (GA) path planner and feeding them to the open source PX4 auto pilot, while correspondingly responding with flight status information.

IV. APPROACH

The prime idea of approach is to acquire knowledge of object detection, classification and path planning which would in return be used in the drone to track, discover and identify objects in real-time. Thus, the inputs include the path which the drone needs to follow and the live video feed from a camera adjacent to the drone. The model will master automatic path planning and object detection. The generated output would be a live video stream along with detection and classification of environment or any other objects in its environment. This information of data can be used to do anything ranging from identity discernment to environment tracking.

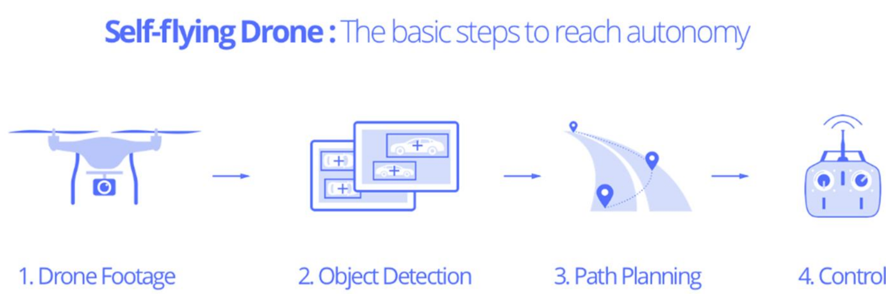

Fig 4. Block diagram of system

V. RESULTS

A. Quadcopter Drone

Fig 5. Constructed Quadcopter drone

VI. CONCLUSION

With the execution of this project, we can steer clear the extensive use of the human resource to implement small tasks like delivery, area monitoring and surveillance. Business owners would end up wasting less time and money on human resources to execute similar mechanical tasks which could be carried out by intelligent agents like our drones at a one-time investment only. Our drone will be able to automatically navigate itself to a particular area or terrain and will also be able to identify objects depending upon the statistics it receives and make calculated operations depending on data it perceives. This work symbolizes the usage of real-time object detection and classification of automatic path planning without any human intervention.

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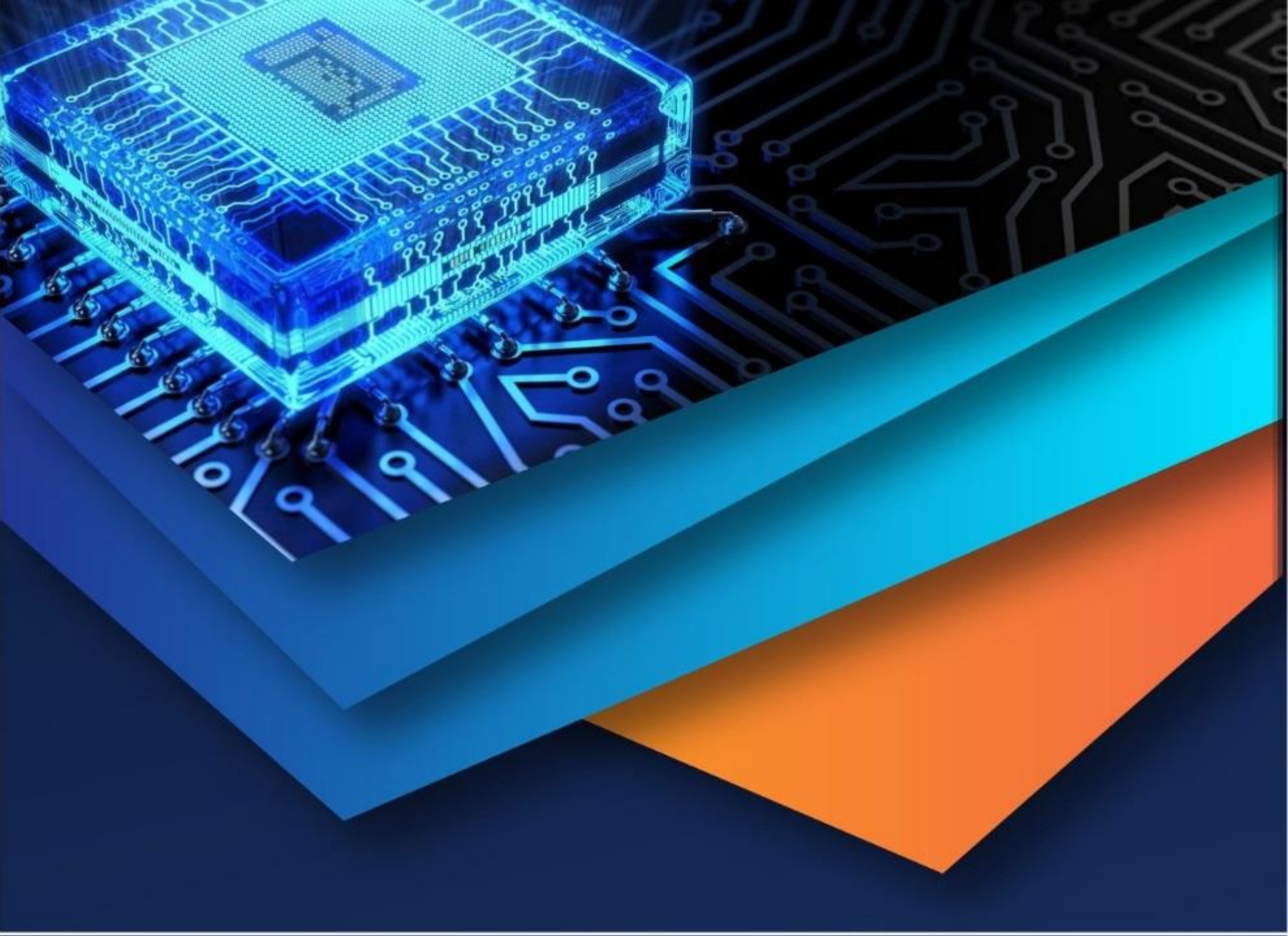

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