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Object Detection in UAVs

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ABSTRACT

The aim of the paper is to embed UAVs with A.I and explore possible application of the same. Face Recognition is needed and applicable in various fields like Defense, Health Care, Search & Rescue, Surveillance and Delivery System. Dataset creation, training and recognizer are the basis of Face-recognition system. Face recognition systems developed are acceptably effective with detection and identification of the objects. We aim to create an artificial intelligence which is integrated in an UAV for face recognition and surveillance. We also intend to introduce anti-collision system on the A.I to help the drone be safer and prevent damages to itself and the surround. The same is based on sonar sensors which would measure the distance the between the drone and object. Once detected the drone will maneuver itself out of the trajectory of collision. A path finding algorithm is part of the A.I to help the drone navigate 2 dimensional maps on its own. by integration of both object detection and path finding we aim to create an automated drone capable of functioning without human intervention of any kind.

KEYWORDS: *Artificial intelligence (AI), Image processing (IP) Face recognition, Unmanned aerial vehicles (UAV), Enhanced vision Applications of artificial intelligence*

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INTRODUCTION:

The Project A.I DRONE will be a project that covers both Robotics and A.I Development and Usage. Project intends to combine the pathfinder algorithms and develop new efficient ones from them to be applied in the fields of Mapping, Traversing and Examining Data. The Idea of a fully automated flying device eludes chains of minds and let us have the gift of flight which we desire. We can complete this desire by seeing through the eyes of the drones. The idea of a flying machines is not a new but always be an intriguing one. To create a machine that is capable of automated flight is our ambition and goal; the vast application of the same is nothing but a bonus to us developers.

*[1]*With the rise of Deep Learning approaches in computer vision applications, significant strides have been made towards vehicular autonomy. Research activity in autonomous drone navigation has increased rapidly in the past five years, and drones are moving fast towards the ultimate goal of near-complete autonomy. *[2]* There is undoubtedly hype around drones and their applications for private and professional users. Based on a brief overview of the development of the drone industry in recent years, this article examines the co-evolution of drone technology and the entrepreneurial activity linked to it. The project also includes construction of a drone that is completely controlled by A.I. The drone will have collision detection and on board stabilization for smooth functioning. As well as speed detection and basic awareness of its surrounding which will be given by the user to the system. The drone will be implemented with different operation modes which will include:

- A.I mode (drone will take commands directly from A.I)
- Manual Mode (Drone will take commands from a user)
- Follow mode (Drone will follow the user)
- Hover/Idle (When no commands are coming in)

The amalgamation of the two should give a A.I which can very well Map the data, find shortest and fasted node points to reach the final state; A drone that can be used in surveillance which doesn't require a user to be present and can as also find a shortest path to be taken to reach a the destination by its own. *[23]*Many UAV studies have tried to detect and track certain types of objects such as vehicles *[7, 8],* people including moving pedestrians *[9, 10],* and landmarks for autonomous navigation and landing *[11, 12]* in real-time. However, there are only a few that consider detecting multiple objects *[13]*. Despite the fact that detecting multiple target objects is obviously important for many applications of UAVs. In our view, the main reasons for this gap between application needs and technical capabilities are due to two practical but critical limitations: (1) object recognition algorithms often need to be hand-tuned to particular object and context types; (2) it is difficult to build and store a variety of target object models, especially when the objects are diverse in appearance, and (3) real-time object detection demands high computing power even to detect single objects, much less when many target objects are involve.

Fig no. 1 Unmanned aerial Vehicle

LITERATURE REVIEW

There are plenty of Drone kits and AI for object Detection available on the market and the combine application of the both is also seen. The most prominent of all AI for object Detection is *[1]* OpenCV Object Detector which is open source and free to use for educational purposes. The same also served as inspiration for the problem of special awareness for the drone which we encountered in the start. The application of this is easier said than done, to integrate the different type of systems available and make a program which is stable is completely different endeavor. Similarly many small I/O based drones are available at very cheap prices (Though the same are very one dimensional in application and the build is very fragile) the drones are simply put just an input and output device with no AI to control and rather depend on a human input to function. They do have some prominent features including camera and audio recording and transmission which gives the user a perception and sense of the environment in which the drone is functioning. Many of Path finding algorithms which are very good for grid mapping and finding the shortest path between two nodes or points are namely:

- Djistkra's Algorithm
- DFS Algorithm
- BFS Algorithm
- Greedy best Algorithm

The number of unmanned aerial vehicles (UAVs) is growing rapidly. In the US alone, approximately 3.55 million small UAVs are expected to be deployed for consumer use by 2020. *[6]*Artificial intelligence and drones are a match made in tech heaven. Pairing the real-time machine learning technology of AI with the exploratory abilities of unmanned drones gives ground-level operators a human-like eye-in-the-sky. More than ever before, drones play key problem-solving roles in a variety of sectors — including Defense, agriculture, natural disaster relief, security and construction. With their ability to increase efficiency and improve safety, drones have become important tools for everyone from firefighters to farmers. Smart UAVs are so popular. Thanks to artificial intelligence software, drones can now process what they see and report back in real-time.

Below are five companies that install AI technology in Drone:

- DroneSense
- Neurala
- Scale
- Skycatch
- Applied aeronautics
- Aerovironment

Recent work on UAV based vehicle detection appears to largely focus on the detection of moving vehicles *[14], [15*], *[16]* or the specific tracking of identified ground objects *[17]*. The work of *[14]* uses an approach based on identifying consistently moving subsets of edges within an overall flight sequence as a moving vehicle using a graph cuts driven technique. Previously *[15]* followed a similar methodology through the use of camera motion estimation and Kalman filter based tracking of a moving object within the scene but extended over optical/IR sensing. In *[16]* the authors present an approach based on layered segmentation and background stabilization combined with real-time tracking which then leads to the classification of identified moving objects as {people | vehicle} based on *[18]*. The more general work of *[17]* makes use of the classical mean-shift

tracking approach to track generic ground object descriptors, including but not limited to vehicles, from a UAV image sequence but does not explicitly tackle the initial object detection problem. In all of these cases *[14], [15], [16]* 2 the detection of vehicles is primarily driven by the isolation of a moving component from the overall scene. By contrast recent work in people detection *[19]* investigates the problem of people detection in UAV aerial imagery independently of movement using modern classifier approaches *[20]* aided by multi-spectral (optical/IR) imagery. However, [19] is aided by the IR temperature characteristics for human bodies that cannot be readily relied upon in the vehicle detection case. Overall work on the specific detection of vehicles, encompassing both static and dynamic vehicles, within UAV imagery is limited. Current work specifically addressing this problem *[21]* relies upon auxiliary scene information and additional thermal/IR sensing. Here we present an approach for the application of the object detection methodology of *[22]* for the detection of both static and dynamic vehicles using only an optical camera based on a perspective viewpoint from a medium level UAV platform.

Proposed System

The following is the system we intend to create and the requirements for the same. The working and application of the A.I are also included. Further improvements and changes can be made if needed.

A. A. I Training

Training data is paramount to the success of any AI model or project. Think of it as garbage in, garbage out. If you train a model with poor-quality data, then how can you expect it to perform? You can't and it won't. Having the right algorithm doesn't mean we are done, we need to train the A.I with the right data set. If wrong data set is used the A.I will not work in the correct way. The effectiveness of the A.I can be directly related to the quality of the dataset. Once the training of the A.I is completed, we can validate the A.I in the next step. In validation we provide the A.I with the new data set and check how effective it is. As with the training phase, you will want to make sure to evaluate the results so you can confirm the AI is behaving as expected, and account for any new variables that you may not have considered previously. Over fitting if in the system can be found in validation stage. Once the validation is completed, we give A.I a real world test. a data set without any tags or targets is provided to the A.I, if the A.I is successful making accurate decision with the unstructured data set, it is ready to go. We can repeat the validation process for more accuracy for the A.I until we are satisfied with results produces by A.I.

There are three key point to train AI well that is:

1. High quality data

For AI Installation high quality data required if you used poor quality data or a collected data that isn't relevant so Individuals face many problems while performing task. If AI does not get the high quality data then AI produces undesirable results. It can create AI that is Bias. In advance building robust models the reality is that noisy data & incomplete data remain the biggest hurdles to effective end-to-end solutions. To avoid all these problems there is two main lines on which you have to focus and work towards goals. 1) Clean that data you have 2) Generate more data to help train needed models.

2. Accurate Data Annotation

Data annotation is the process of attaching the meaning to data. This process can be manual but is usually performed or assisted by software and requires a human touch Data annotation is the most important part of data processing for machine learning algorithms, particularly for supervised learning, in which both in out and output data are annotation for classification. These data annotation can be in any forms such as image, text, video or audio annotation. We know that AI system required massive amount of data to establish a foundation for reliable learning patterns. We need thousands of training images, even for a simple application like a model able to differentiate a dog from a cat.

3. A Culture of Experiments

Approaching experiments isn't an easy task, which why you should think of way that can facilitate your desired results. Experiments here means adding things to the insights from that data you have & planning processes on a test & learn a basis to see how they respond.AI can make mistake during training errors/ mistakes are valuable & normal part of the AI training process. Experiments will help to create AI that is even better & more innovative for your goal.

B. Interfacing AI with UAV

The main Challenge with interfacing the Command module (RPI3) with the drone flight controller (cc3d) is to generate stable PWM signals using GPIO pins on the Rpi3 Board. We use python3 for general controls on the RPI3 board itself. The Pigpio Library is utilized to Generate PWM signals with frequency of 1000µs to 2000µ. The flight controller interpret 1000µs as minimum value and 2000µ as the maximum input value. The Pigpio library lets us enable to run Pigpio Daemon which continuously generates stream of PWM Signals. The jitter on the output was lowest compared to other GPIO libraries.

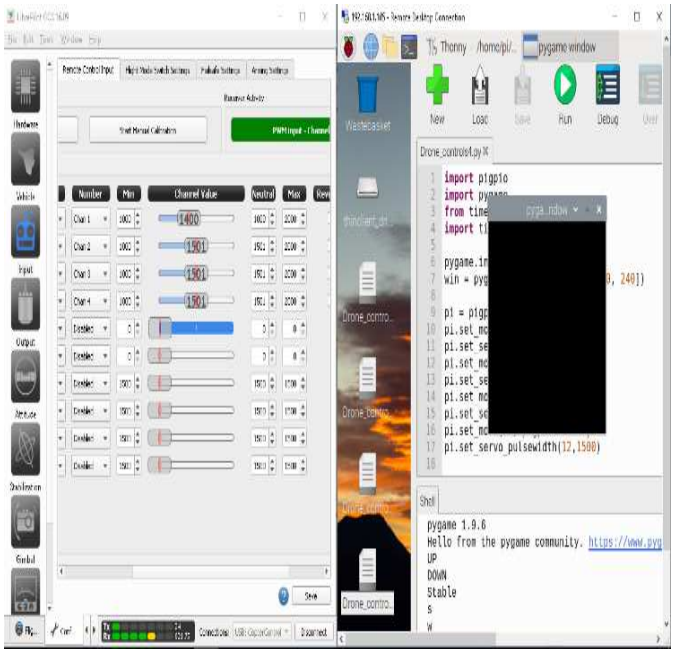

Fig no. 2 Ground control Station Interface

C. The Object Detection Module

This module would be integrated in all the modules while the functioning of the drone as itwill help the drone be aware of the environment and take necessary actions for its safety. This module will identify the object with help of a camera and analysis the video. The module when than detect different objects in each frame and compare it to the database to recognize the object and then decide the course of action based on the proximity of the same. Though the initial module would only react to a small number of objects as a much larger database and more powerful AI will be needed to function the same module on the level of humans.

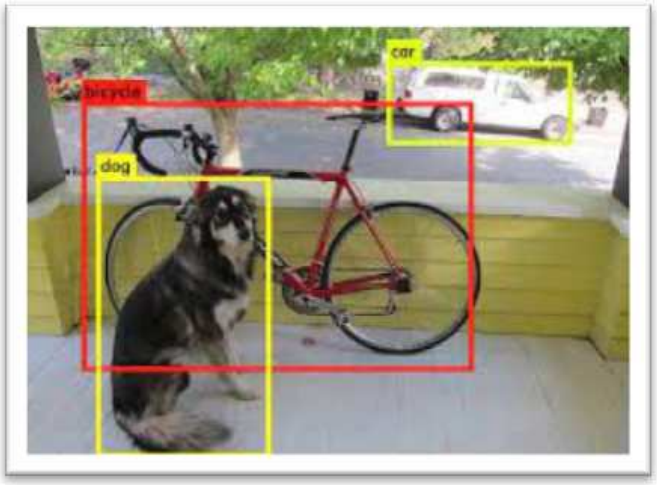

Fig -3: Object Detection

Open CV Object Detection is playing a key role in detecting the various types of objects while flying in mid-air. A high-performance on board image processing and a drone neural network is used for object detection, classification, and tracking while flying into the air. In AI, computer vision is playing a big role to train visual perception-based machine learning or deep learning models to work in a real-life environment. Artificial intelligence is getting upgraded with high-quality training data that are used while developing the machine learning models. Role of Object Detection in Artificial Intelligence The main motive of integrating Object Detection in AI is creating a visual perception model that can visualize the situation and perform the task itself without human intervention while taking the right decisions. The whole process involves methods of acquiring the datasets, processing, analyzing, and understanding the digital images to utilize the same in the real-world scenario. Object Detection in AI is playing a substantial role in developing machine learning models for different sectors, industries, or fields. From object detection to expression recognition, Object Detection is providing detailed information about various things to machines around the world. Making the AI possible with useful information the machine learning algorithms, perceive the information precisely and learn from that taking the right decision to perform the next action. Object Detection is helping AI to make more and more intelligent with correct information that a machine can see only when objects are preciselylabelled with image annotation techniques. Object Detection is playing the Following Role in Various Fields:

- Face Recognition ·
- Video Surveillance
- Object Detection
- Object Recognition
- Medical Imaging
- Localization and Mapping
- Augmented Reality/Virtual Reality
- Human Expressions & Emotional Analysis
- Transforming the paperwork into digital data

Face Recognition is a type of biometric software that maps an individual's facial features mathematically and stores it as a face print. The system uses deep learning techniques to compare a live capture or digital image to the stored face print in order to verify an individual's identity. Once the recognized face matches a stored image, attendance is marked in corresponding excel sheet for that person. The other reason for taking face recognition as biometric parameter is this technology reduces the physical touch of objects/records providing a contagious-by-touch free environment which the whole world is adopting these days. Automated attendance system using machine learning approach automatically detects and recognizes face and marks attendance which saves time and maintains a record of the collected data.

System Requirements

A. Software

- Pycharm
- SQLite databases
- Librepilot GCS
- Pigpio library

B. Hardware requirements

- Drone Frame F450 Quadcopter
- Raspberry Pi 3b+
- CC3D flight controller
- A2212/10T Brushless Motors
- ESCs
- Camera 3mp
- [6]2200 mah 11.1 V 3S Lipo Battery & Charger
- Four 1405R Propellers
- Barometric sensor

These are the major components, though additional or lesser components might be required while actual assembly of the drone. The intent is to keep the cost to minimum and create a stable and functioning drone.

CONCLUSIONS

Overall from the results presented we can see the successful detection of objects. The results suggest that the cloud based approach could allow speed-ups of nearly an order of magnitude, approaching real-time performance even when detecting objects of various categories. We demonstrated our approach in terms of recognition accuracy and speed, and in a simple target searching scenario. Our approach enables the UAVs, especially lightweight, low-cost consumer UAVs, to use state-of-the-art object detection algorithms. In essence what we have learned that capabilities of A.I and its development will far exceed in the coming decade and we will see more and more automation in the day to day life. The UAVs are being utilized for everyday usage and with the current lockdown and covid 19 pandemic, the need to exclude contact is than fulfilled by Robotics and A.I. To be able to create and train new algorithm would help us to cast our will onto the machines and thus improve the standard of living.

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[4] International Research Journal of Engineering and Technology (IRJET) e-ISSN: 2395-0056 Volume: 09 Issue: 03 | Mar 2022 www.irjet.net p-ISSN: 2395-0072 © 2022, IRJET | Impact Factor value: 7.529 | ISO 9001:2008 Certified Journal | Page 182 Face Recognition based Smart Attendance System Using IoT Tippavajhala Sundar Srinivas1, Thota Goutham2, Dr. M. Senthil Kumaran3

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