# Project Tittle

Object Detection and Tracking in Autonomous Drones

## Applicant

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# Abstract

Object tracking is very important component of the computer vision system. It has multiple applications in video surveillance, navigation, 3D image reconstruction, robotics etc. It has attracted many researchers in this field. The aim of this project is to continuously track an object using a movable camera mounted on a quadcopter and instruct it to move towards the object. This paper will give a brief idea about algorithms used for object tracking, hardware setup used for movable camera on quadcopter and software's required for this task.

# Problem Statement

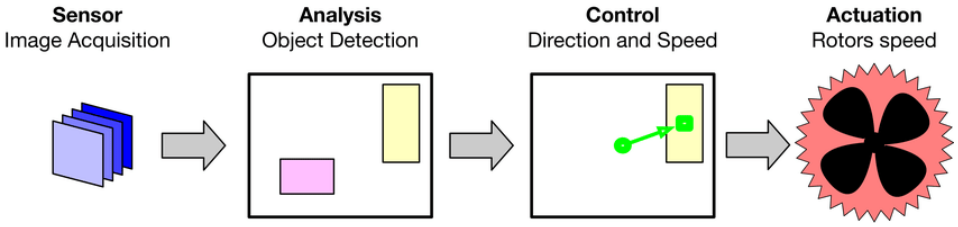
The aim of the project is to track the location of the object continuously with the help of a movable camera attached on the drone and instruct it to move accordingly. A 2-axis gimbal is used for carrying out the motion of camera. For the simplicity the problem statement is divided into three parts:

1. To track object in video feed, an object will be selected on computer screen with the help of drawing a box using mouse around the object. Tracking algorithm will run on computer and track the position of the object in video feed.
2. To carry out motion of the camera and try to bring/keep the target object always at the centre of the frame
3. To instruct drone to move in desired location by desired amount of distance and follow the object to be tracked.

# Introduction

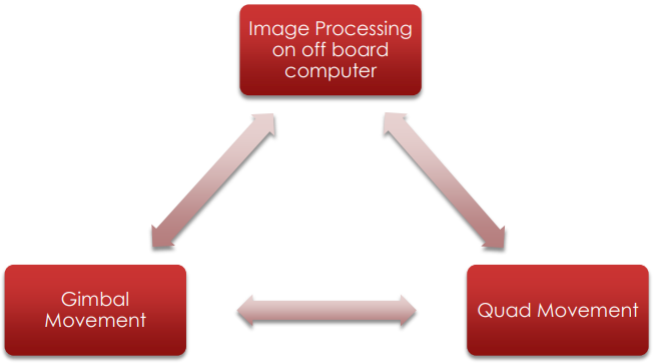
- The modern world is enclosed with gigantic masses of digital information.
- To understand and analyse and understand this huge sea of visual information, there exist many image analysis techniques.
- UAVs have been deployed in various object detection and tracking applications such as navigation, robotics, disaster management, traffic monitoring, and wildlife monitoring and crowd management.
- Increasing drone deployment contributes more precise spatial information to the remote sensing community.
- UAV serves as an intermediate between satellite image data and static camera data; Technical advancement in UAV is increasing rapidly.
- The up-gradation in navigation systems, sensing payloads, multispectral cameras, orientation systems, laser scanners and thermal imaging has enabled UAV to expand its application in various domains.
- Drones, or autonomous flying machines, use computer vision technology to fly along a designated route while avoiding obstacles. Drones take advantage of propulsion and navigation systems, sensors, cameras, and GPS technology to target their destination.

- Computer vision plays a critical role in drone technology by powering object detection, classification, and tracking while the drone is airborne. Without computer vision, a drone wouldn't be able to interpret and interact with its surroundings, including buildings, trees, and diverse terrain.




- Computer vision is a field of computer science that works on enabling computers to see, identify and process images in the same way that human vision does, and then provide appropriate output. It is like imparting human intelligence and instincts to a computer. In reality though, it is a difficult task to enable computers to recognize images of different objects.
- Computers today have the ability to depict vision and process images far better than the human eye.
- The methods of deep learning based detection and recognition of threats, evaluated in terms of military and defence industry, using Raspberry Pi platform by unmanned aerial vehicles.
- The Raspberry Pi is a pocket size microcomputer which makes it relatively simple to build projects with the advantage of requiring less hardware and in turn making it more cost efficient.
- For the next generation of UAVs, one of the basic requirements is the ability to localize and identify the interested objects, which is fundamental for more advanced features such as real-time decision-making and high-precision indoor/outdoor navigation.
- No one wants to look at 5000 plain white picture of a wind turbine and look for tiny cracks. Drones can only unlock their full potential when data acquisition and data analytics happen at a high (or someday full) degree of automation.
- To solve object detection and identification problems in computer vision, we use a convolutional neural network. The convolutional neural network has a different architecture than a normal neural network.
- The convolution neural network (CNN) has neurons that are not fully connected to each neuron of the next layer, but only to a small region (some neurons). This section of the CNN is called the feature extractor, its function is to detect and extract different features in the image.

# Methodology




- **Step1:** Acquiring images using sensor (camera).
- **Step2:** Implementing YOLO (You Only Look Once) algorithm using OpenCV library in python.
- **Step3:** Dividing image into grids and detecting box for object with probability.
- **Step4:** Implementing DeepSORT (Simple online real-time tracking).
- **Step5:** Use pre-trained neural network (CNN) for tracking.

- **Software/languages/technologies used:**
    1. Python
    2. OpenCV library
    3. YOLO and DeepSORT
    4. Deep Learning
- **Hardware used:**
    1. Raspberry Pi
    2. Camera
    3. Drone
- **Applications:**
    1. Delivery drones
    2. Military drones
    3. Vehicular object detection
    4. Face recognition