

**REPORT
ON
D.R.D.O. SASE'S
UAV FLEET CHALLENGE**

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ABSTRACT

UAVs are emerging as the new super exciting remote-controlled tools highly capable of gathering very precise data. They can also be operated independently with specially designed onboard computers. The unique feature of the drones that makes them so special is that they have significant mobility advantages and their ability to explore any unreachable location. The main goal of this project is to build multiple UAVs that will be able to fly autonomously and can be able to collect information and share it with each other. This report focuses on the drone swarms communication technique to have good coordination among the drones and application of an object detection technique to identify the desired object. Choosing an effective communication mechanism is important because this is the key requirement for the drone swarms and their successful deployment.

INTRODUCTION

Unmanned Aerial Vehicle in short UAVs are vehicles that fly without any onboard pilot inside them. They can be controlled by humans as well as can fly autonomously. UAVs were originally invented to carry military tasks which were either very difficult or very dangerous for humans to perform. Especially detector drones are used for airstrikes, rescue operations, and surveillance purposes. Drones are also being used for many recreational activities by the common people. Multirotor drones are also available for aerial photography and videography. They are further classified by the number of rotors: tricopters have 3 rotors, quadcopters have 4 rotors. Hexacopter and octocopter are also available with 6 and 8 rotors respectively. Multirotors drones are electrically powered and have less flight time as the energy supplied to them gets distributed among all the rotors, thus they have less efficiency.

TECHNICAL DESIGN

PROBLEM STATEMENT: Every team is supposed to develop a UAV that can fly and land autonomously in grassy land outside. The UAVs are required to spot

a target amongst a bunch of different objects spread on the grassy land and send the information about the target location to the ground station.

IMPLEMENTATION OF THE IDEA :

Overview

- Master drone commands the path to slave drones.
- The slaves then capture images, while following the path assigned to them. The images are processed at the slave.
- If the object is detected, the slave communicates it's GPS location back to the master, which is then sent to the ground station and the location is pinned on the map.

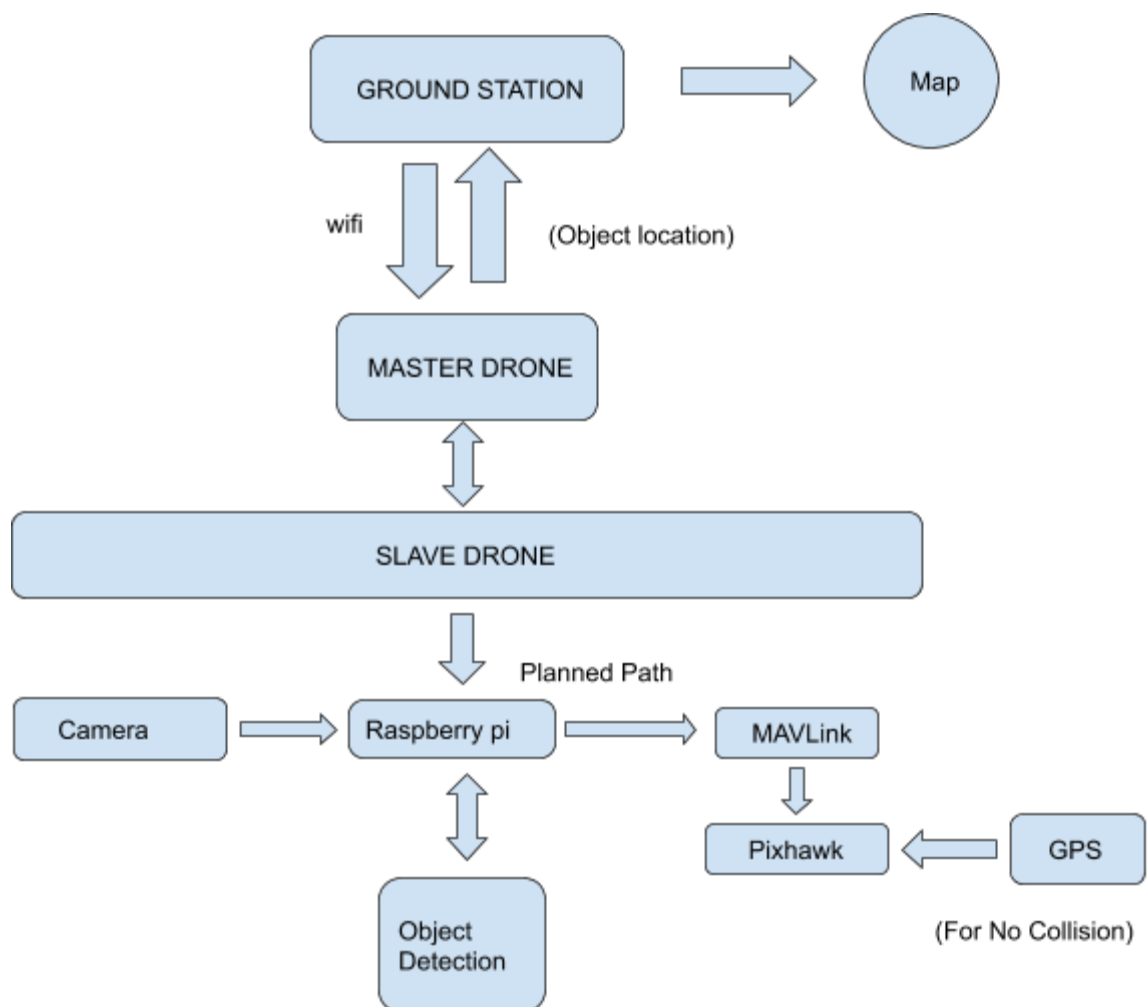
SWARMING

- For swarming, we have used the **master-slave** concept.
- There are a total of 4 quadcopters, out of which one will act as the master the rest as slaves. Master drone acts as the common link between all the drones and the ground station.
- Commands will be given from ground station to master and the master will forward the command to other drones. This is way easier than using individual ground stations for every drone because we need not keep track of all drones, the master drone will do the needful.
- The master drone will guide the other drones on the path to follow and perform the object detection task.
- The drones are connected to each other through a common wifi source. MAVProxy was used to link the master drone to the other drones.
- A well-programmed python script is uploaded to the master drone which enables us to give commands to all the drones via the master drone.
- The system works by transferring data from the master drone to the ground station and the master drone communicates with the other drones.
- With the uploaded python script, the master drone is ready to fly autonomously.
- But the problem that arises is to check that the drones do not collide with each other. To tackle this problem we wrote down another python script for the paths to be followed by the drones so that each of them will continue with their own route without any collision.

OBJECT DETECTION

For object detection, we are using Python OpenCV which allows us to recognize a specific object.

- First of all, the python script uses the color gradient and Sobel operator for edge detection on the captured image using OpenCV.
- The program detects clusters of straight edges and crops the image to this location.
- Next, it uses a custom trained CNN for checking whether the located object is a cube or not.
- If the located object turns out to be a cube, then the location of the cube is sent to the master drone and then to the ground station to plot the location on google maps.



PROGRESS TILL DATE

Milestones	Current Status
Building the drones and drone calibration	Done
Establishing a connection between master and slave drones	Done
Testing of the drones to follow the planned path	Done
Object detection by the drones and sharing information to the master	Working on it
Final testing	Working on it

BENEFITS TO SOCIETY

The sale of drones is rising with every passing year indicating their increasing importance in different fields. Though drones were initially built for military use, now they are well linked to social life too. Also by using the improved version of the designed UAV system we can achieve the following feat.

1. Military uses -- UAVs can be used to detect unexpected enemy camps located within a range and can alert the army. Usually having a small size drone can penetrate to restricted zones and their high megapixel cameras can be used for bomb detection purposes. They can also be used for secret surveillance of the border areas to avoid surgical strikes. Regular surveys of unreachable places can ensure the safety of people and places. Not only for defending the nation but also they can be used for airstrike purposes by detecting the enemy camps.
2. Non-military uses -- Apart from military uses, we can use drones for delivery purposes by specifying the coordinates of the delivery address. We can also get full media access to very remote areas. They are also extremely useful in the case of rescue operations and disaster management by giving exclusive footage of the affected area. Thus helping to save lives.