**Auto Drone Exploration**

**Introduction**

An unmanned aerial vehicle (UAV), commonly known as a drone, is an aircraft without a human pilot aboard. Nowadays, drones have been applied to various scopes, including commercial, agricultural, scientific usage and so on. As we know generally, most of drones need to be controlled by individuals on ground, or remote controlled from PC end.

The focus of this project is to make the drone explore environment automatically, detect events and response to it.

* *Performance*. The drone should be able to explore the real environment situation, in order to make next movement decision, avoid potential risks, and be able to detect the event in a particular environment. After detected the event, it may continue exploring the rest of the map. (The assumption for this project is that the map will be divided into identical grids, and the drone may move to each grid in sequence to detect events.)
* *Environment*. Places that are drone-friendly, and have been approved to fly.
* *Actuators*. Signal sends back to individuals.
* *Sensors*. Camera…

**Navigation Problems and Objectives**

One issue to include is how to navigate the drones and find the event. First of all, we need to know the area of exploring map, and the current location of our agent. There might be two ways to divide a geographical area.

1. Based on the known map, divide the area into sectors with edge of 1 meter.
2. Evenly divided the area with 10\*10 sectors.

For finding the events in the area, since the locations are unknown, it is reasonable to use a brutal force way.

* For four corners, agent may start from the one with closest distance, and fly to that corner.
* Set the center of each sector with a coordinate, and set the starting point with (0,0).
* Explore the area in sequence:
  + If the start point is the most northwest, the agent may fly from west to east, and after exploring one line, fly to the next southern line and explore from east to west;
  + If the start point is the most northeast, the agent may fly from east to west, and after exploring one line, fly to the next southern line and explore from west to east;
  + If the start point is the most southwest, the agent may fly from west to east, and after exploring one line, fly to the next northern line and explore from east to west;
  + If the start point is the most southeast, the agent may fly from east to west, and after exploring one line, fly to the next northern line and explore from west to east;
* If the agent finds an event, it will send signals back.

**Further (Long term) Goals and Objectives**

The goal for this project is to realize artificial intelligence on UAV to achieve automatic detection and exploration. The event can be a image recognition, object recognition, or facial recognition from camera, or we may equip UAV with other sensors to detect events. The response can be various also, depending on a specific situation.

One further goal can be multiple UAVs exploration at the same time, and in this way, events can be detected more efficiently. Another further goal is to improve the exploration algorithm based on events that appear in a fixed time cycle.

This can be applied to many real life situations. For example, it may play a role of fire alarm when detecting fire, a role of police finding a specific criminal in a large crowd, or even a role of commercial product such as video camera.

**Softwares and Tools**

* UAVs (Drones)
* Python editor
* SITL
* DroneKit-Python library for communicating with Drones via MAVLink