

# Find my kitten, AI!

## 1. Introduction

Why do those kitty cats always want to escape? When I brought my kitten to the cottage, she found her way to the dark forest the very first night. How to find her? With a search and rescue drone, of course!

Robotic killer drones are familiar from movies, but why wouldn't drones search and rescue instead? Drone technologies, lightweight sensors and AI have advanced recently at a fast pace. Would it now be easy to create an autonomous, intelligent drone that can fly in a complex environment and locate targets, without GPS?



## 2. Project Goals

The Project will build a quadcopter from a kit, and attempt to add as much navigational intelligence as possible. The drone should be able to navigate in an occluded environment such as a forest, browsing a predetermined area efficiently and recognizing objects.

Navigation algorithms should rely on visual, inertial and sensor data only, such as visual odometry for 6D pose tracking and optical flow + LiDAR for collision avoidance. An initial scouting mission may reconstruct a 3D model of the environment. Initial flight plans may be designed using simulations and ground control software.

As a subgoal, the project evaluates the easiness of utilizing free software packages and tools in pursue of the main goal. This evaluation phase will start at the very beginning, to choose prominent software candidates for integration.

## 3. Technologies

The drone, based on the *HolyBro X500 V2 ARF Kit*, will be operated by a flight controller that houses an *Nvidia Jetson Orin* host computer, running Ubuntu. The flight controller will be one of the Pixhawk family, possibly *Pixhawk 6X*, running the open source *PX4 autopilot*. *QGroundControl* will be used for initial flight control and mission planning. Python, C++ and possibly CUDA will be used for development, along with all the available libraries.

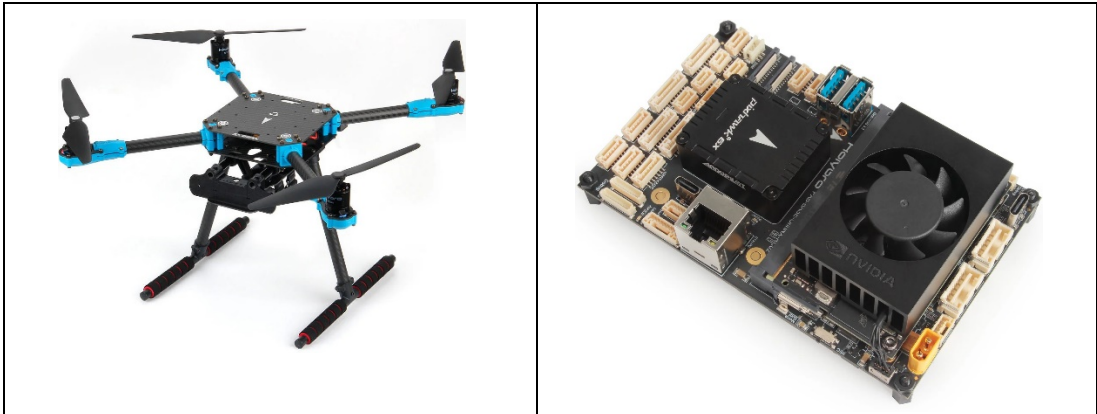


Figure 1. HolyBro X500 V2 drone frame (left); Pixhawk 6X autopilot with NVIDIA Jetson Orin NX (right)

## 4. Requirements for the students

The students are expected to possess:

- A research-oriented mentality!
- The ability to program in a common programming language such as Python or C/C++; knowledge of CUDA is a bonus
- Capability to handle IoT data; hopefully 3D point cloud data
- Familiarity with Linux environments
- Capability for self-organization and self-learning
- Ability to split a complex system into smaller, manageable parts
- Interest in flying things and AI
- Ability to document in English

## 5. Legal things/IPR

The results will be published under a permissive free software license such as BSD or MIT.

## 6. Client

The project will be executed under the Department of Computer Science, Aalto University. The project is guided by the Product Owner (PO) Antti Nurminen. The PO will provide a short introduction to drone control algorithms, visual-inertial navigation algorithms and neural networks at the beginning of the project.

### **Product Owner**

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