Individual Lab Report 10

Team: H

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1. Individual Progress:

1. Setting up the test environment

Tent building: foam board cutting to fit the tent's size, and cropping windows and doors with proper size: large enough for the UAV/AGV to enter, but not too large to make the mission lack of challenges.

Fig1. Tent for testing (with robot in the scene)

2. Solved the issue of power supply for the water deployment system

Initially, there are two plans for the water deployment system's power supply: 1. divert battery power directly from motors to the pump. 2. Add a separate battery.

Apparently, the first approach requires to open up the drone and figure out how the internal electronic system are set up and how the wires are connected, which makes it a too much complicated to work out.

So, we turned into the second approach: adding a separate battery. The whole system works well, and the fig 2 is the integrated drone hardware system:

3. Multi-ROS setup between NUC and Jetson

Since there are quite a number of software/hardware sub-system that consumes computational resources, e.g. SLAM, door detection, UR5e arm manipulation, there isn't much computational power left for the heat source detection using thermal cameras.

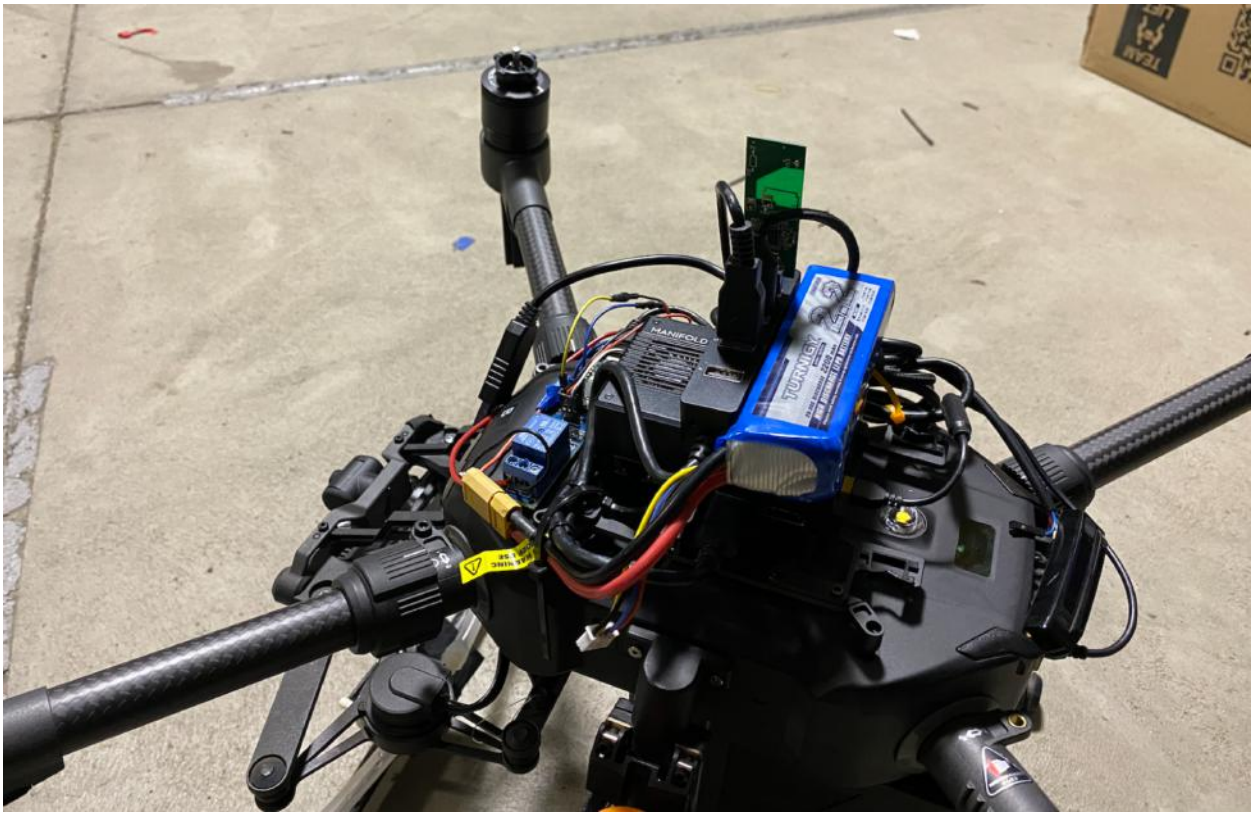

Fig2. Drone hardware system

So, our solution is to set up another computing unit (Jetson TX2) specifically for heat source detection. TX2 has already been interfaced into a multi-ROS setup with our main computing unit-NUC, and the TX2's role is just to process the thermal images, get the heat source detected, and publish the joint angles to the NUC to enable that to move the UR5e arm towards the heat source.

4. More robust door/window detection and centroid localization

Mainly tested and fine-tuned some hyper parameters to adapt to our FVD environment set-ups, which makes the point cloud-based door and window detection become more robust.

2. Team Work

The team worked together to build up the testing environment for the robot system, including the tent, heat source and barriers. And also, we worked together to fix the power supply issue of water deployment system, as well as the multi-ROS system set-up for the Husky in order to make it able to perform the desired task without being lack of computation resources.

3. Challenge

The biggest challenge is probably the autonomous flight mission with the drone. It involves complex tasks being performed sequentially and dependently. For instance, the fire detection might rely on the lifted height of the drone, because we only designed the drone's flight logic to fly to certain height and search horizontally to face towards the fire, not horizontally (which means the height is not adjustable in our current progress). And also there are a sequence of commands that need to be executed correctly, where even one got failures, all the following might fail. During our test, we had a wrong command for the drone to land, and it directly leads to the drone bump into the wall and crash. We also had a scheduling issue as different teams might use the same Husky, and each time we switch the Husky usage, we need to re-set up the hardware, which takes quite a lot of time.

4. Future Work

1. Start doing collaborative missions
2. Repair the UAV
3. Integrate the UAV global planner properly
4. Single map frame between UAV and UGV