DJI M300 platform development plan

Shun Li, Zhewen Xing, Linhan Qiao

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Contents

Chapter 1   Objects

From easy to hard, currently a 4-steps development plan is proposed after our discussion, which is shown below in the form of 4 list following by several sub-tasks.

1.1   Communication:

In this step, we aim to get familiar with the whole platform, establish the connection between the onboard computer, sensors as well as the drone autopilot. Only the **ground test** is needed to achieve this step.

Sub-Tasks:

- Read the state estimation data(height, velocity, acceleration, attitude, latitude, longitude, etc.)

- Send the test command to the camera and autopilot, check the responding.

- Read, store and covert the RGB and IR images

1.2   Waypoint flight

In this step, the automatically flight along the given path should be conducted. The onboard computer can control the drones to fly along a given path, and take photos at some certain waypoint.
Both **ground test** and **flying test** are needed in this step.
If the synthetic fire and smoke can be done outdoor, we could make a data set by combining the RGB and IR images captured by the drone and H20T.

Sub-Tasks:

- Waypoint flight simulation with simulator provided by DJI.

- Accomplish some given mission(take a photo, drop something, etc.) at a certain waypoint

- Fly along the given path(waypoints) and take the picture(RGB and IR) of the synthetic fire and smoke(an oven, if possible)

1.3   Fire and smoke detection:

In this step, The forest fire detector should run on the YunGuan2.0 onboard computer, detect and segment the fire and smoke in real time while the drone flies along the given path.
Please note that there is no feedback from the detector to the navigation part for the path replanning, the 2 parts work separately.
Both the ground and flying test are needed in this step.

- Implement the fire and smoke detector which runs on the onboard computer.

- DJI M300 flies along the path and detects the synthetic fire and smoke along the path

1.4   Detection and Navigation

In this step, the feedback from the detector is established for the path planning and replanning after the fire or smoke is detected.
Also, both the ground and flying test are needed in this step.

- Detect fire and Navigate around the fire according to some given strategy

- Motion control under the navigation module after the fire is detected.

Chapter 2   Schedule

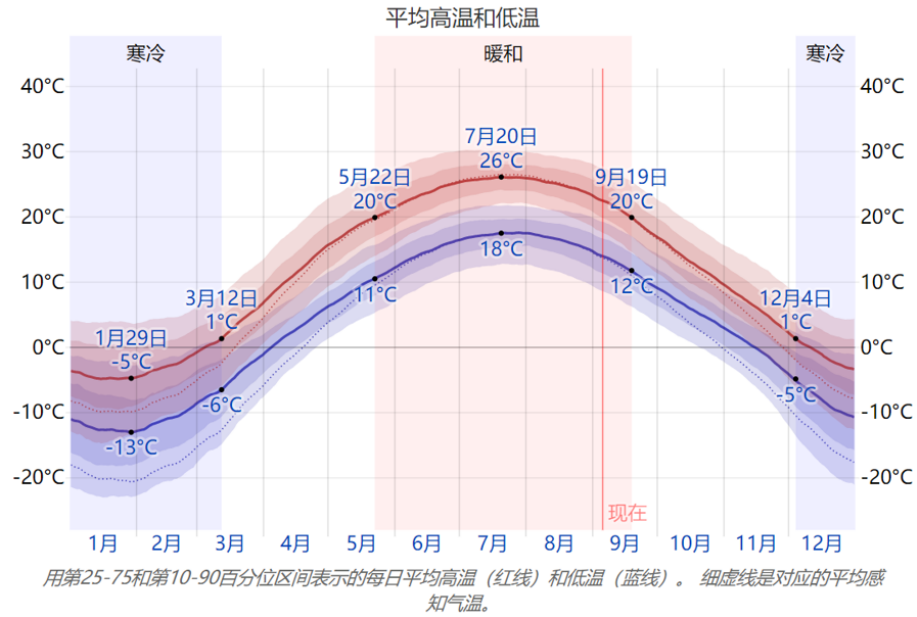According to the annual climate data, the temperature will be only around 10 ℃ by the end of October.

Figure 2.1: The annual temperature of Montreal

Once it is lower 10 ℃ outdoors, it will be harmful for the battery working and also very cold for us to perform the experiment. So the following timetable is ended by the end of October, 2021.

The hight rows stand for the 2 outdoors experiment content and time.

Steps	Test Type	Sub-task	Beginning Time	Ending Time	Backup
Communication	ground	Read the state estimation data(height, velocity, acceleration, attitude, latitude, longitude, etc.)	2021/9/8	2021/9/12	
	ground	Send the test command to the camera and autopilot, check the responding	2021/9/13	2021/9/16	
	ground	Read, store, covert the RGB and IR images	2021/9/17	2021/9/22	
	ground	Waypoint flight simulation	2021/9/23	2021/9/28	
Waypoint flight	ground	Accomplish some given mission(take a photo, drop something, etc.) at a certain waypoint simulation	2021/9/29	2021/10/1	
	Flying	Fly along the given path and take the picture(RGB and IR) of the synthetic fire and smoke(an oven, if possible)	**2021/10/3**	**2021/10/4**	1. prepare the flight test first. 2. arrange data set on the second day
Fire and smoke detection	ground	Implement the fire and smoke detector which runs on the onboard computer.	2021/10/5	2021/10/10	design the detector earlier.
	ground	Test and debug the algorithm embedded with the picture that are captured before.	2021/10/11	2021/10/18	
	ground	ground simulation	2021/10/19	2021/10/22	
	Flying	DJI M300 flies along the path and detects the synthetic fire and smoke along the path	**2021/10/25**	**2021/10/26**	1. prepare the flight test first. 2. arrange data set on the second day
Detection and Navigation	Flying	Detect fire and Navigate around the fire according to some given strategy	~	~	
	Flying	Motion control under the navigation module after the fire is detected.	~	~	

Table 2.1: Timetable

Chapter 3   Challenges

In this section, some of the currently known challenges to use the platform are demonstrated below:

3.1   Transplantation of the Algorithm

Although we currently have the mature detection algorithm, the transplantation to the onboard computer may be an onerous task. It may involve some knowledge of the software engineering and embedding system.

3.2   Monitoring and Display the real-time experiment

We may want to monitor the self-developed detector and navigation algorithm while in the real-time experiment. To accomplish that, we need to pass back the images both captured by the H20T and after the detection with mask, as well as the path planned by the navigation module. So the passing back could be a hard task to accomplish due to our lack of communication background.

3.3   Operator

As far as we know, some license or certificate are needed to use the DJI M300. So it should be settled before the outdoor test.

3.4   The synthetic fire and smoke

The heat source maybe a little easier to handle than synthetic fire and smoke. Moreover, the latter option may not be permitted by the government. But the detector should be trained on the date set containing at least the fire and smoke.