Individual lab report #2

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Individual Progress

- Ramp-up on DJI operability
- Conceptual design of the power distribution system for Task 12

Ramp-up on DJI operability

Our group decided to use DJI Matrice 600, so my job in this week is to get familiar with software and hardware of DJI.

1. <u>The hardware connection</u>

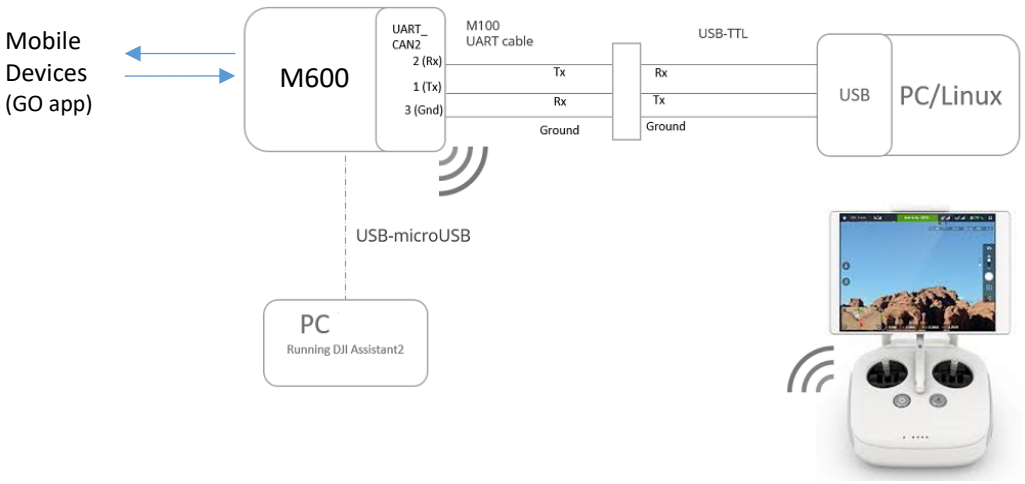

Figure.1 the hardware connection between Matrice 600 and PC/mobile devices

Above is the figure which shows the connection between DJI Matrice 600 and PC/mobile devices. We can run DJI Assistant2 on our PC or run GO app on our mobile devices to control the drone. Also, if we want to manually control it, we can connect the drone with a remote controller.

2. <u>Software development</u>

1) Choosing an applicable platform

To program on flight firmware, we should utilize onboard SDK core library, and we need to first choose a platform to call on APIs in the library. Three main platform candidates and their main features are shown as below.

Custom Applications on Linux/Windows

- DJI API, two for a Linux target (GUI-based sample built using Qt and C++ sample built using CMake) or for a Windows target (GUI-based sample built using Qt)

High-Level Applications on ROS/Linux

- Conduct a high-level implementation that requires very little housekeeping

Applications on Embedded Systems(STM32)

- Not applicable if we plan to have additional processing (e.g. computer vision) in our application

Thus, we will start with using Linux/Windows because we can write applications with zero overhead by using the DJI API as a starting point. Maybe after the basic goals are achieved we can use ROS/Linux platform for integrating the DJI Onboard SDK into larger ROS projects.

2) Useful APIs in the onboard SDK library
   - Ground Station CMD Set : Waypoint
   - Movement Control: `setFlightControl ()`
     - position control(HORI_POS)
     - attitude control
     - velocity control

In conclusion, if GPS coordinate is available, we can navigate to certain waypoints as well as fly in a designated pattern.

Conceptual design of power distribution system

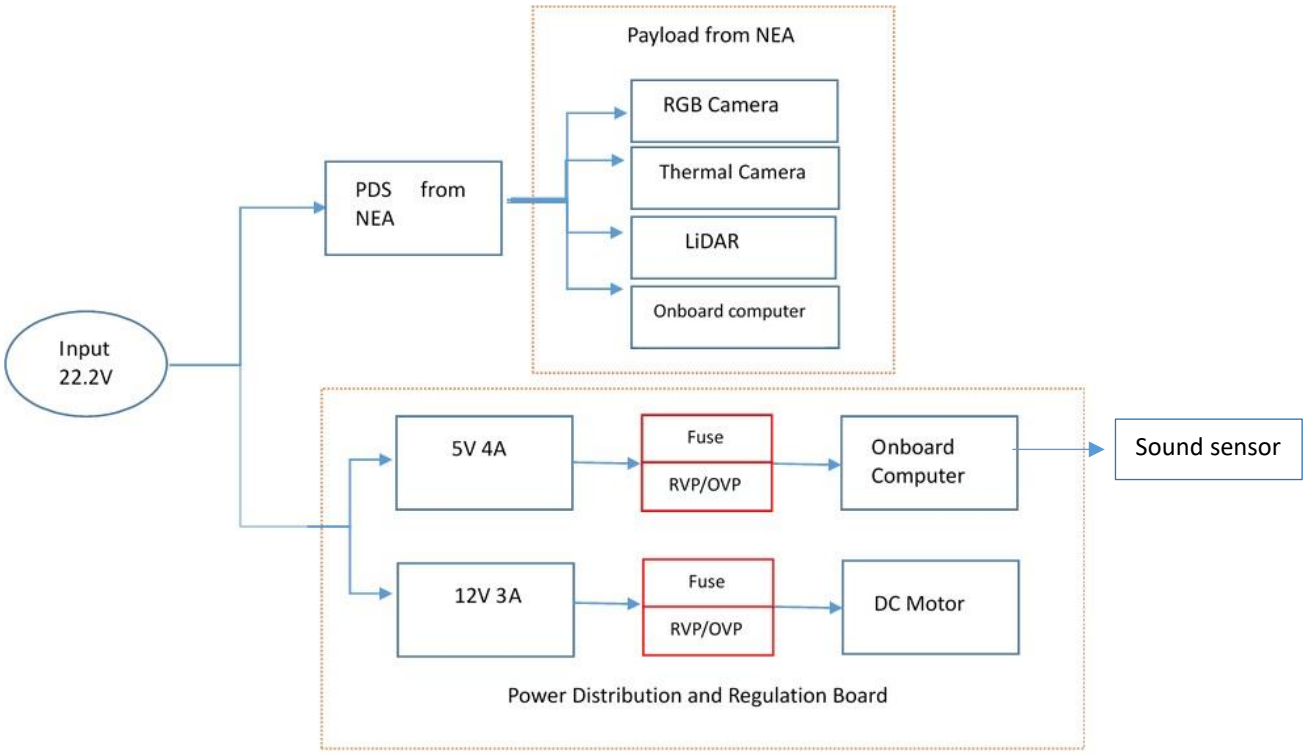

Figure 2. Power distribution diagram

Above is the conceptual design for the power distribution system of TeamF. Me and Juncheng Zhang are in charge of Task12. For the first part in task12, we designed a conceptual design of power distribution system together. First of all, the only power resource in our system will be a 22.2V battery of Matrice 600. Then we considered each sensor's electrical features separately and decided the power input of each subsystem.

There are 3 subsystems in our power distribution system:

- PDS from NEA
- 5V/4A system to support onboard computer and sound sensor
- 12V/3A system to support DC motor used in driving drop mechanism

Next, we need the power regulation and protection circuits which can protect against short circuits, overvoltage, and reversed input. Since the payload provided by NEA has already been packaged with all required circuits in it, we only need to consider RVP/OVP in the other 2 subsystems.

Finally, our system also includes two status LEDs to show whether the protected supply for each subsystem is operating. Finally, there are 4 connectors for the 5V and 12V inputs as well as the motor and sensor outputs.

Challenge

The biggest challenge since last demonstration was that our workload of each course was so heavy that all of us had to balance the project course work with other things like internship interview, CV and ML assignment as well as the midterm exams. We supposed to test each sensor in the payload, but we don't have enough time going to NEA and finishing the test. This won't be a problem in the next week though.

Also, since there are many strict rules for flying a drone, we have few opportunities borrow the drone from NEA and doing our tests in the RI basement. The only way is to use the drone in NEA, which is not convenient for me to do the ramp-up on DJI operability. However, we are planning to buy a Matrice 100 in order to conduct our tests on campus.

Another challenge was that when me and Juncheng designed the power distribution system, we didn't know the electrical features of sensors inside the payload. After we talked with Paul, the senior engineer in NEA, we found out that we do not need to worry about designing circuit for the payload, whose only requirement of electricity power is a 22.2V battery in DJI Matrice 600.

Team Work

Juncheng(Henry) was in charge of choosing RGB camera, and he also contributed to the conceptual design of power distribution system. Karthik worked on selecting sound sensors. Sumit chose the thermal Imaging camera as well as design the navigation pattern. In addition, Karthik and Sumit also worked on refining our website.

Future Work

Before next-week progress review, I will

- Do research on human detection algorithms and decide the algorithms we will use in recognizing human signatures.
- Get familiar with OpenCV and MATLAB so that I can start implementing the chosen algorithm after next progress review.
- Finish the schematic of our power distribution system.