Individual lab report #3

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Individual Progress

- Modification on cyberphysical architecture
- Finish schematic drawing of power distribution system
- Preparation for doing aerial human detection

Modification on cyberphysical architecture

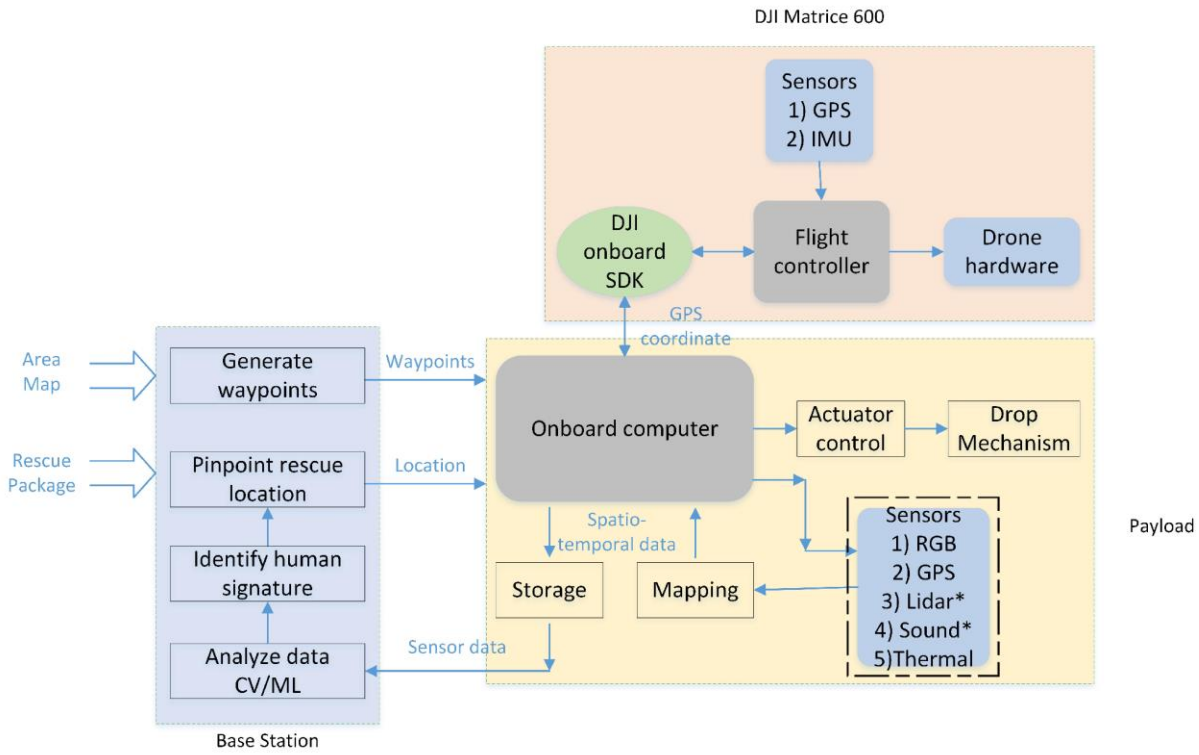

Figure.1 draft version of cyberphysical architecture

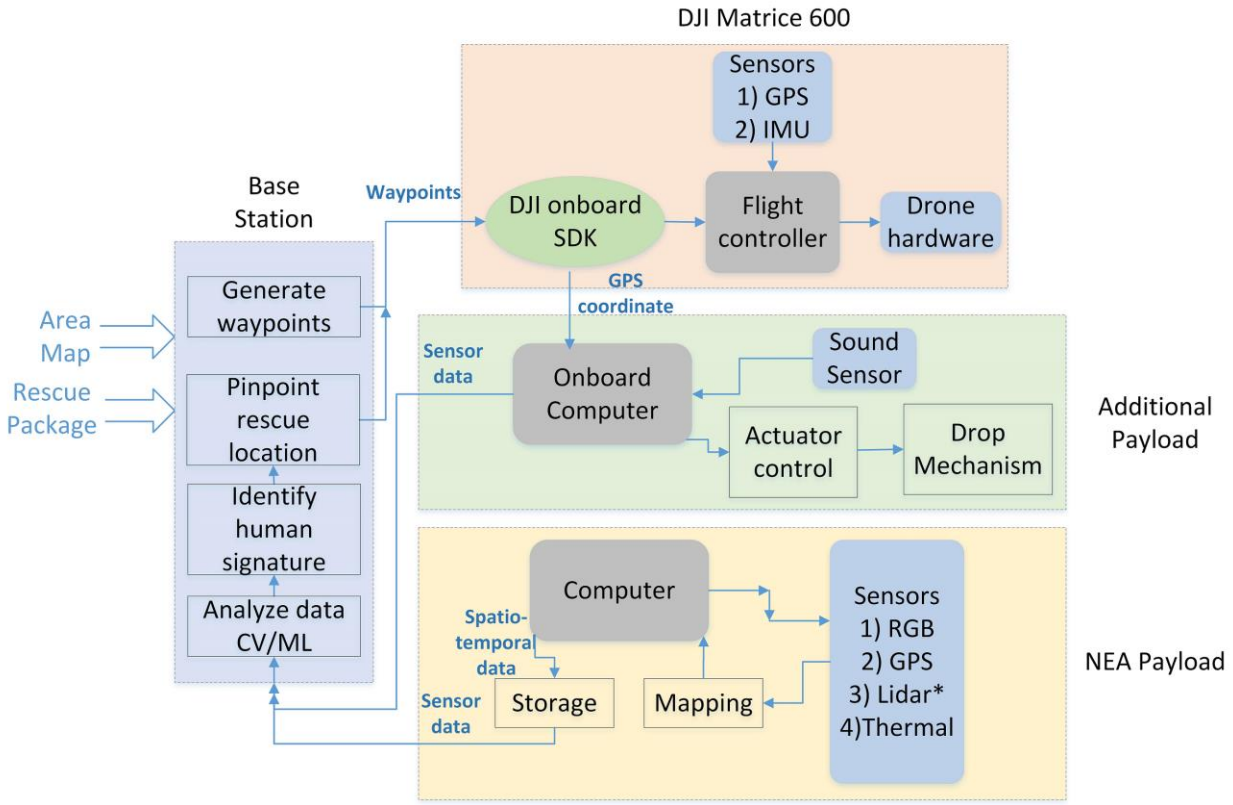

Figure.2 Revised version of cyberphysical architecture

Above is the original version and the revised version of cyberphysical architecture graph. We add one more block in the revised cyberphysical architecture compared to the previous version. To illustrate, we need to add another payload for conducting actuator controlling and sound sensor data processing. After talking with our sponsor: Near Earth Autonomy, they promised that they can provide us a sealed payload containing four types of sensors except for sound sensor. Since we cannot do further development on the sealed payload, we decide to add another onboard computer in our additional payload, which can be used to process sound information and control drop mechanism.

Besides, we correct the wrong expression in the draft cyberphysical architecture that after generating waypoints in the base station we don't have to process the GPS coordinate in onboard computer, instead we can communicate with DJI SDK directly. The modification is a stepping stone of our project since it can specify the task we still need to do, for instance, the software and hardware integration of additional payload.

Schematic drawing of power distribution system

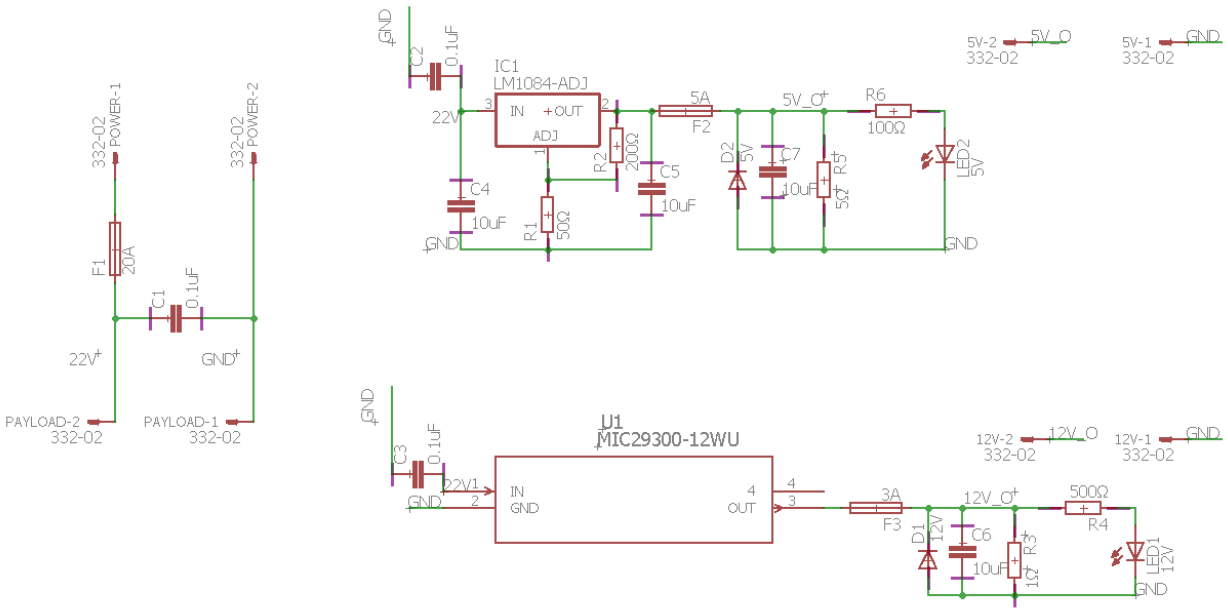

Figure 3. Schematic for power distribution system

Above is the schematic for the power distribution system of TeamF. 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

For each of the subsystem, there is one independent connector. Also, there is one instruction signal LED to show the working status of each subsystem. I used different voltage regulator to convert battery voltage into different output voltage: MIC29300-12WU for 12V/3A system, and LM1084-ADJ for 5V/4A system. These regulators should meet both the voltage and current requirements. I also added different capacitors for each subsystem to filter the noise of the input power. Capacitors, diodes and fuses are part of the protective circuits, which contains the overcurrent protection circuit and the reversed voltage protection circuit.

Preparation for doing aerial human detection

We plan to implement the basic computer vision algorithm for aerial human detection in fall semester. This week, I began to do search on Histogram Oriented Gradient(HoG) algorithm for feature extraction and Support Vector Machine(SVM) for classifying different features extracted in HoG.

I tried to use both algorithms to do the digit classification using HoG features, it turns out that the precision of the classification is nearly 60 percent. It partially proves that the combination of

HoG and SVM can be used for extracting similar features from aerial videos and then classifying them into human class.

To begin with, I need to grab a huge dataset from Internet and then train the classifier in order to get the accurate classifications.

Challenge

The biggest challenge since last demonstration was that due to the delay of purchasing the drone, we had no progress on DJI operations. It is out of expectation because we planned to have our drones ready for navigating to certain waypoints. So, we had to think of some other things to do before we get the drone. The drone is predicted to arrive next week, so we can continue focusing on DJI SDK and the navigation part.

Also, it's not an easy task finding the aerial dataset from the Internet which contains human features mainly because most of dataset in Computer Vision areas is ground-based videos and frames, which can be used for human face detection and pedestrian recognition. Finally, I found it in ICPR 2010 Contest and converted all the videos into frames in MATLAB. But there are only fewer than 200 frames, and obviously, it's not enough for training purpose. Since we don't have our own drones collecting aerial data, the applicability of HoG and SVM is still hard to prove.

Team Work

Juncheng(Henry) worked on doing research on other computer vision algorithm without using machine learning algorithm, and he was also in charged on adjusting our project schedule. Karthik worked on building software which can generate certain set of waypoints based on calculated trajectories. Sumit found a way generating GPS coordinates according to google map, so that it can be used in Matrice 100. In addition, Karthik and Sumit also worked on risk evaluation and work breakdown system for our project.

Future Work

Before next-week progress review, I will

- Find a larger dataset for training the classifier and get the recall and precision of the classification result by using SVM and HoG algorithm.
- Finish designing PCB layout of power distribution system.