UAV FORGE-EECS

Che-Wei Chang, Junbai Hou
Professor Ian Harris
Department of Electrical Engineering and Computer Science
Department of Computer Science

Introduction

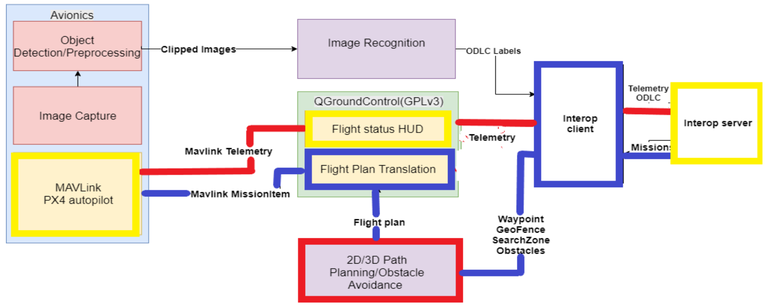
This project aims to build a **fixed-wing** UAV that could autonomously complete flight missions including obstacle avoidance, image capture and recognition, and payload dropping. The project will compete in the 2019 AUVSI SUAS competition[1].

Design Approach

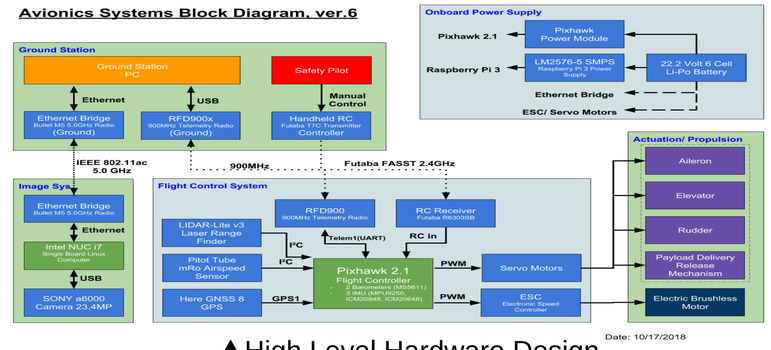
- Design a fully autonomous UAV that can takeoff, cruise, and land.
- Design a ground client that connects with the remote server hosted by the competition
- Implement an obstacle avoiding algorithm for the fixed wing airframe.
- Design computer vision module to process image and identify target object.

Achievement

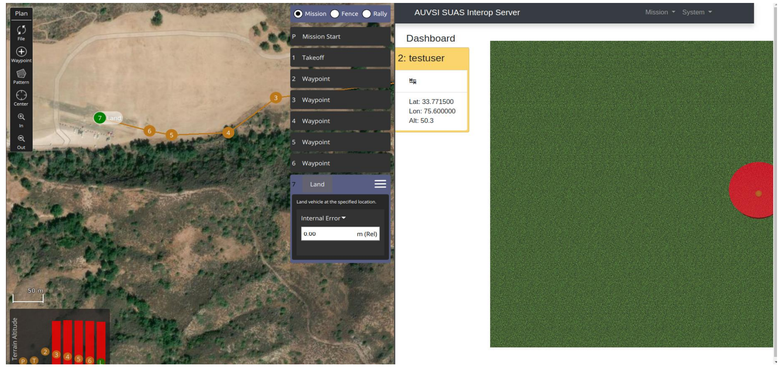
- Implemented a client to communicate with a remote server through RESTful API using Qt framework.
- Implemented utility tools to automate the data stream.
- Researched popular obstacle avoiding algorithms such as Rapidly-exploring Random Tree[2], and came with our own naïve algorithm.
- Implemented a 3D obstacle avoiding algorithm that inserts new waypoint around obstacles to avoid intersection, and adaptively chooses the altitude of the waypoint.



▲High Level Software Design



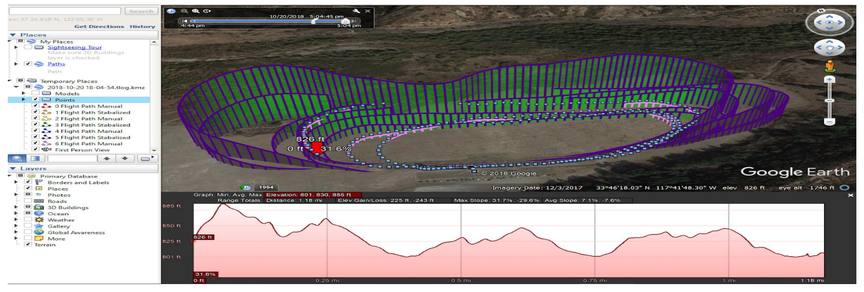
▲High Level Hardware Design



▲Interaction between the ground control software (left) and the server(right)

Challenges and Future Researches

- The current software was designed from a monolithic perspective which tends to be high coupling and hard to maintain. A good alternative will be using a microservice architecture to reduce coupling and improve extensibility.
- The naïve obstacle avoiding algorithm was aimed to maintain the flight pose of the fixed-wing plane. It was implemented without any optimization. Future projects could be conducted to optimize the algorithm.



▲Flight Test Result

References

[1] Association for Unmanned Vehicle Systems International, "Competition Rules" *Association for Unmanned Vehicle Systems International.* [Online]. Available: http://www.auvsi-suas.org/static/competitions/2019/auvsi_suas-2019-rules.pdf
[2] Rodriguez, Xinyu Tang, Jyh-Ming Lien and N. M. Amato, "An obstacle-based rapidly-exploring random tree," Proceedings 2006 IEEE International Conference on Robotics and Automation, 2006. ICRA 2006., Orlando, FL, 2006, pp. 895-900.
doi: 10.1109/ROBOT.2006.1641823

UCI Samueli School of Engineering

UAV FORGE

UCI Donald Bren School of Information & Computer Sciences