RoCat v2

Following is a documentation of the flight computer designed primarily by Hamza Anver (author) with the assistance of members from nyuad.space. Initially developed to be used by the HALOSHIP rocket in the SpacePort America Cup. *2 Pages in this document*

Goals of the flight computer:
- Record sensor data
- Communicate with ground station
- Control rocket pyro channels
- Determine kinematics of rocket for deployment times
- Determine absolute position of rocket for recovery
- Servo PWM control
- Be expandable to include other modules

Hardware Overview

PCB designed with EasyEDA, made and assembled by JLCPCB
https://oshwlab.com/aha9251/rocatboardone - All project files available on OSHW
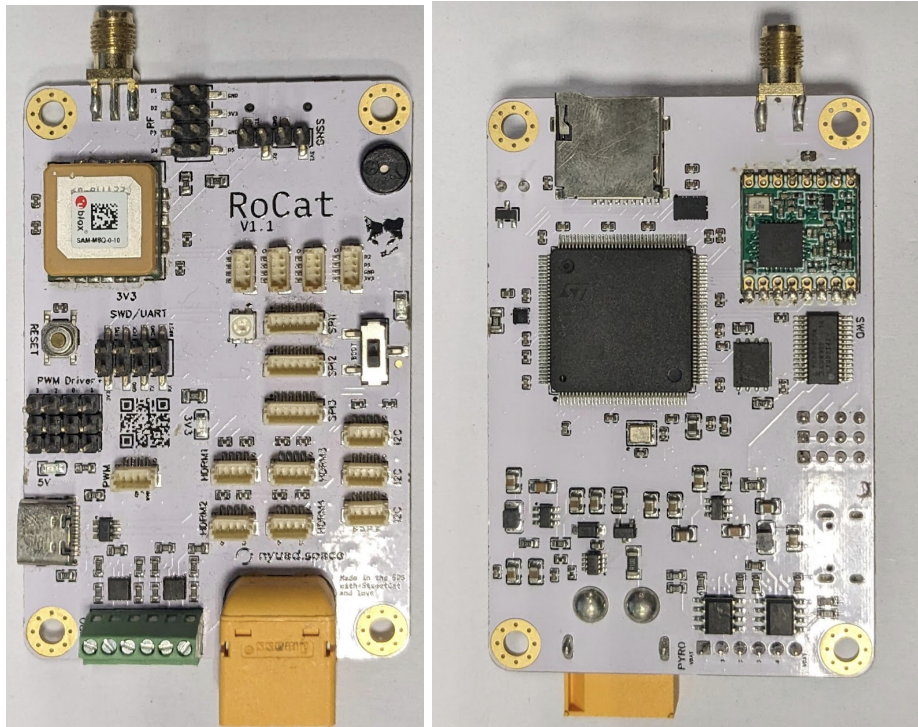
Physical images of produced PCBs - 54mm by 80mm PCB

Component Choices

Owing to this iteration still being a prototype, picking absolute final components was not absolutely critical. We picked components with a bit more flexibility where we could. We picked the somewhat arbitrary size of a credit card to be our maximum, we aimed to be smaller and more capable than the HALOSHIP flight computer developed a couple of years prior by a now graduated student.

Most of the other components followed a similar pattern of choosing a module that had some use and example code made by others and was available to be assembled by JLCPCB.

PCB Design

Used EasyEDA for this along with KiCad on occasion, used a 6 layer PCB and optimized placement of components to be functional if the board is vertical in a tube, in case there was a size constraint.

Software

https://github.com/nyuad-space/roCat-fc - Repository containing the software during development, the software was not completed.

Used the Arduino Framework and stm32duino with PlatformIO, since I and other members had some familiarity with the Arduino platform. First tested that the hardware was functional. Issues were uncovered here, but development could still proceed. Used the TaskScheduler library by ArkhiPenko initially to allocate tasks and do them at regular intervals. Unfortunately before the launch date there was too much of a time crunch to make a fully functional test program. A commercial flight computer was used as per the requirements of the organizers. RoCat v1.1 flew with a basic program logging data through the flight.

Future

Post launch, on my own time I tried moving into the use of FreeRTOS to handle different parts, this was more just as a test bed for me to try some things at this point.

The project and my effort in it will be moving in a different direction, where ultimately we can have a system that can characterize more behaviors. Ideally I will be able to develop a platform that will be able to characterize how different sections of an airframe interact and move relative to each other, and also be able to quantitatively measure magnitudes and frequencies of aeroelastic flutter, among many other open ended questions left after the successful flight of the HALOSHIP high powered rocket.