ROCKET PAYLOAD AND AVIONICS

Electronic hardware integrated in the NASA University Student Launch Initiative (USLI) Competition

PAYLOAD SUMMARY

- The USLI rocket will launch and land in a 5000 square foot grid divided into 400 square sections.
- The Payload autonomously calculates which square the rocket has landed in.
- The value of the grid square will be sent back to the team near the launch site.
- GPS was not allowed to determine the rocket's landing location. Our design uses a polar coordinate method where landing distance and angle are both calculated.
- Two independent methods of location: Inertial Measurement Unit (IMU) that calculates relative position, and a more accurate Time of Flight (ToF) sensor.
- The landing direction is calculated by observing local known landmarks through the four USB arducams on the payload.
- Vision processing is used to examine the colors in each image and find which direction the payload lands.

USLI Website

Launch Video

Payload

PAYLOAD SYSTEM

The payload system collects data from a number of sensors and processes the information using Raspberry Pi 4bs and Arduino. The payload includes a custom PCB which provides connections for all components. The determined grid square is then sent over a 2.4GHz RF band to a home station.

Payload Methodology
The payload aims to determine the distance, with time of flight, and angle, with vision processing, from the home station.This is used for determining the polar coordinates of the rocket body and converting that to a viable grid square. The IMU is used to verify this output.

VISION PROCESSING

We designed a tent structure that has a different colored fabric on each of its four sides. It is intended to act as a known orientation at the rocket launch site. The vision processing will look for the four colors found on this tent upon the rocket's descent. It will calculate the percentage of each color captured in an image to find the landing direction.

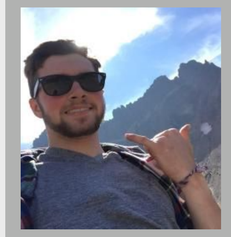
This is similar to how NASA searches and identifies natural landmarks in interplanetary missions.

Vision processing uses Hue, Saturation, Value (HSV) techniques for greater accuracy.

AVIONICS SYSTEM

- In order to track the landed rocket location after it's launched, it is important for the vehicle to carry the Avionic system on-board. Also, to recover the rocket base, the GPS location data is sent from the rocket to the base station.
- The Avionic system can be divided into three systems:
  - **Ejection System**
  - **GPS System**
  - **Transceiver System**

Avionics



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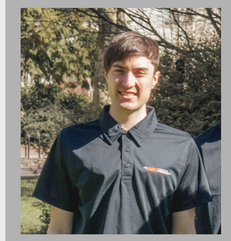

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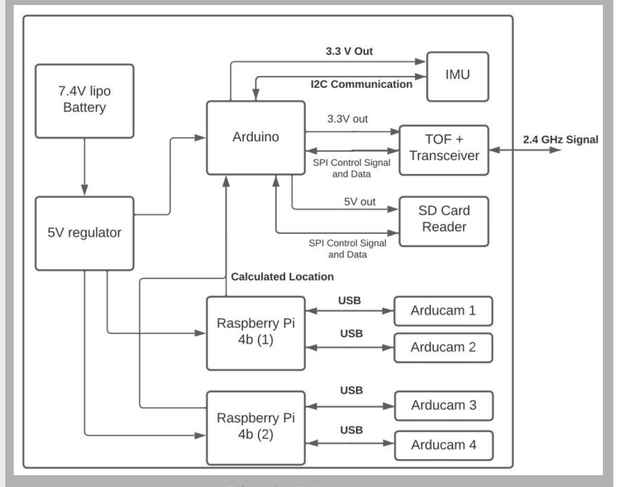

Block Diagram

Oregon State University