Design Review 6
Emergency Management Drone
Team 307

Team Introduction

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Joshua Reid

Sponsor

Florida State University
Emergency Management and Homeland Security Program

- David Merrick, Director

Joshua Reid

Project Background

- Purpose
  - ➢ Design a drone capable of assisting search and rescue teams in finding targets.
- Requirements
  - ➢ Range of at least 1km with an ideal range of 2km
  - ➢ Flight time greater than 20 minutes
  - ➢ Stabilization of the camera
  - ➢ Object detection
    - An algorithm that detects targets on the ground.
  - ➢ Weight constraint of 2kg.

Joshua Reid

Final Changes to Design

- Motor power converter has been removed.
  - ➢ One converter results in a simpler design, easier installation, cheaper components.
- One 8000mAh battery will be installed instead of two.
  - ➢ This reduced weight by 355g.
- Neural network replaced the color filtering algorithm for object detection.
  - ➢ The neural network identified obscured targets better than color filtering.
- Telemetry radio range was extended with RFD900s
  - ➢ Telemetry range is increased up to 15km.
- TI CC1310 Transceiver was replaced with a RFM95 LoRa module.
  - ➢ Lora modules are easier to interface with the PI and provide more output power.
- Wing airfoils were changed to MH60 for the tip and HS522 for the root.
  - ➢ These airfoils offered better structural stability and were significantly easier to cut

RFM95 Lora module

Joshua Reid

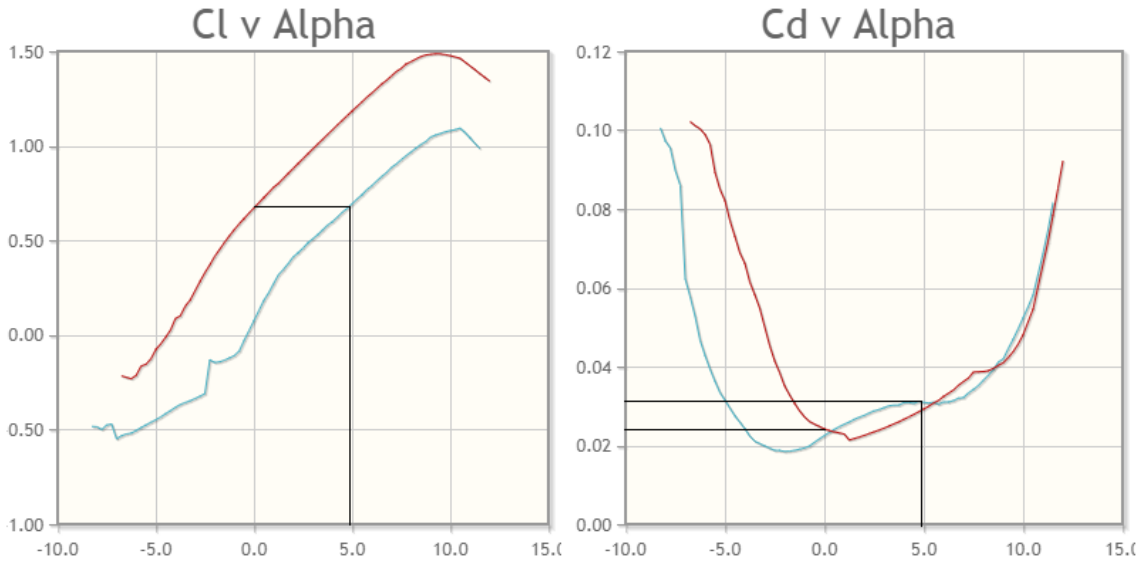
Accomplished

- The power converter has been assembled.
  - ➢ Testing produced results of 80% efficiency.
  - ➢ Operated underneath optimal load current.
- New communication system was programmed.
  - ➢ Images were received in close range testing.
- First iteration of the neural network has been trained.
- Construction of the body has been completed.

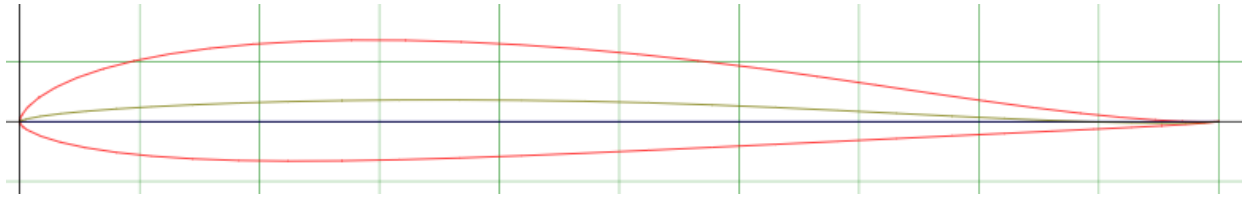
Kody Koch

Mechanical Design

- The wings of the drone have been constructed.
  - ➢ New airfoil shapes were used to provide more structural integrity.
  - ➢ Final drone will have to fly at a high angle of attack to generate efficient lift.



X Martin Hepperle 60 Airfoil
X Dillner 2032-C Airfoil



Martin Hepperle 60 (MH60) Airfoil

Kody Koch

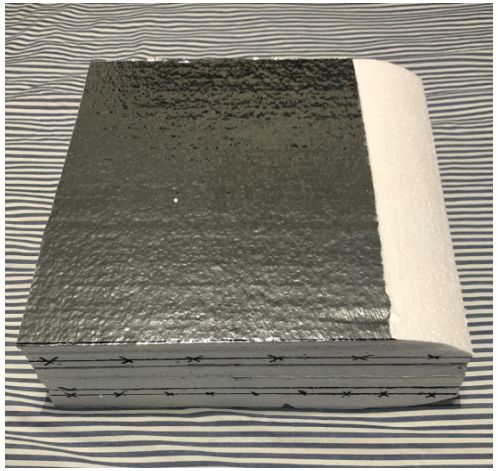
Swept Wings

- Airfoil templates were laser cut on 6mm thick plywood.
- The hot wire cutter followed airfoil templates to create the desired shape.
- Wings were reinforced with packaging tape to reduce skin friction.

Kody Koch

Final Frame

- The body of the drone was also cut, with a 12”x12”x2” body with a tapered front.
- Body will be taped and fitted to the wings after electronics are placed inside the drone.
- The center of gravity can be adjusted with clay, if needed.



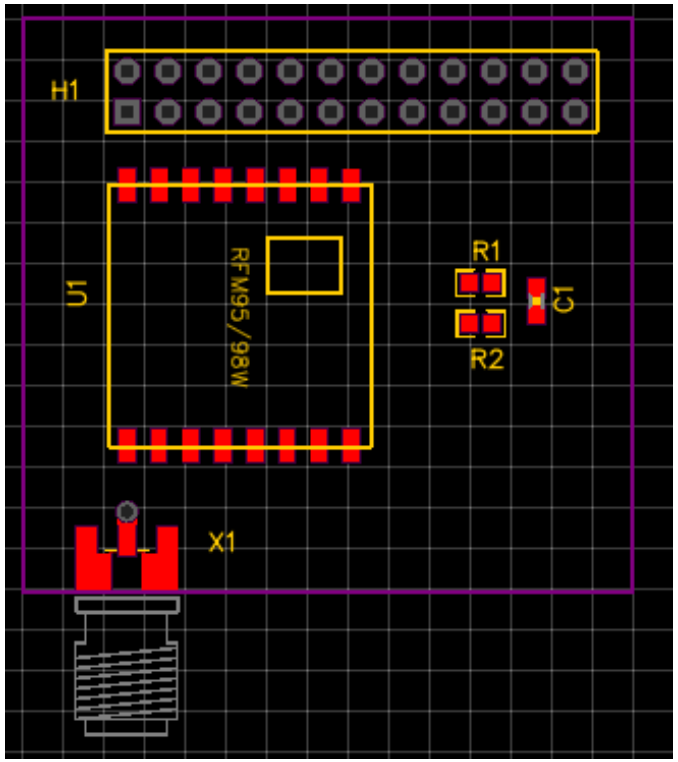
Drone Fuselage

Drone Fuselage With Wings

Kody Koch

Communications

- Changed the TI CC1310 Transceiver for the RFM95 LoRa module.
  - ➢ The new transceiver provides 100mW transmit power, better compatibility with the Pi, and simpler range testing.
  - ➢ It has four times more transmit power than CC1310.
- Two Adafruit RFM95W LoRa Radio transceivers were bought to prototype and design the communication process.
  - ➢ RFM95W was replaced for a custom designed PCB using the module.
- Transmitting images with less chance for error is of priority.



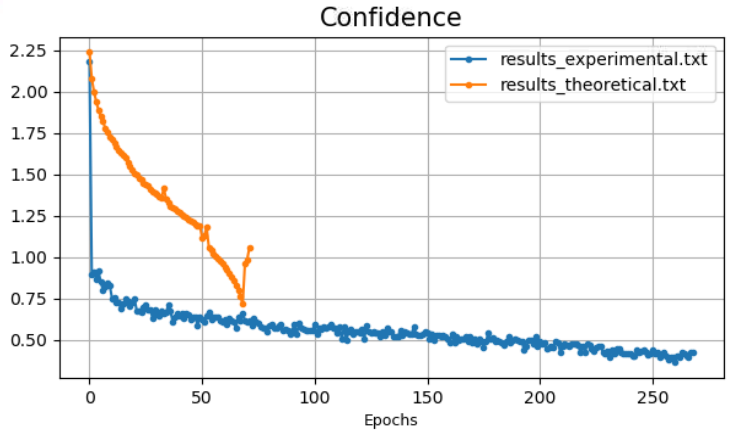
RFM95 PCB

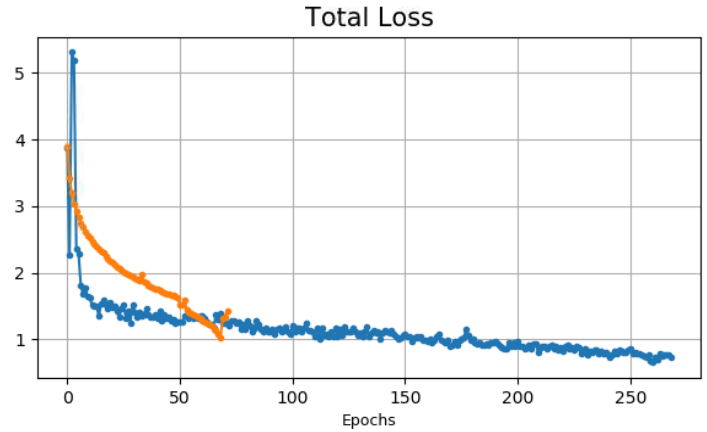
Matthew Roberts

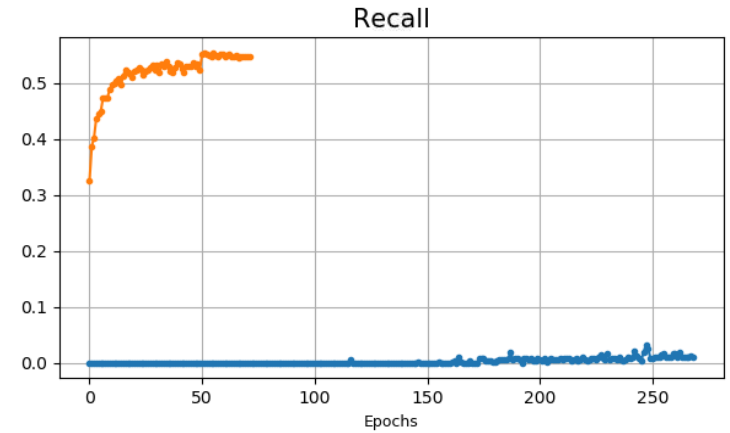
Image Processing

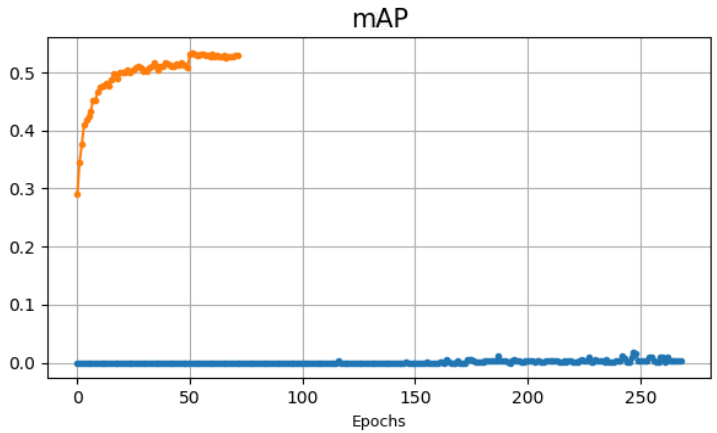
- Neural network was trained using a python script based on PYTorch.
  - ➢ The training is to be continued with different parameters and a larger database.

- Confidence - How precise the results are
- Loss - Inconsistency between predicted and actual label
- Recall - Proportion of positive identified correctly
- mAP (Mean average precision)









PYTORCH

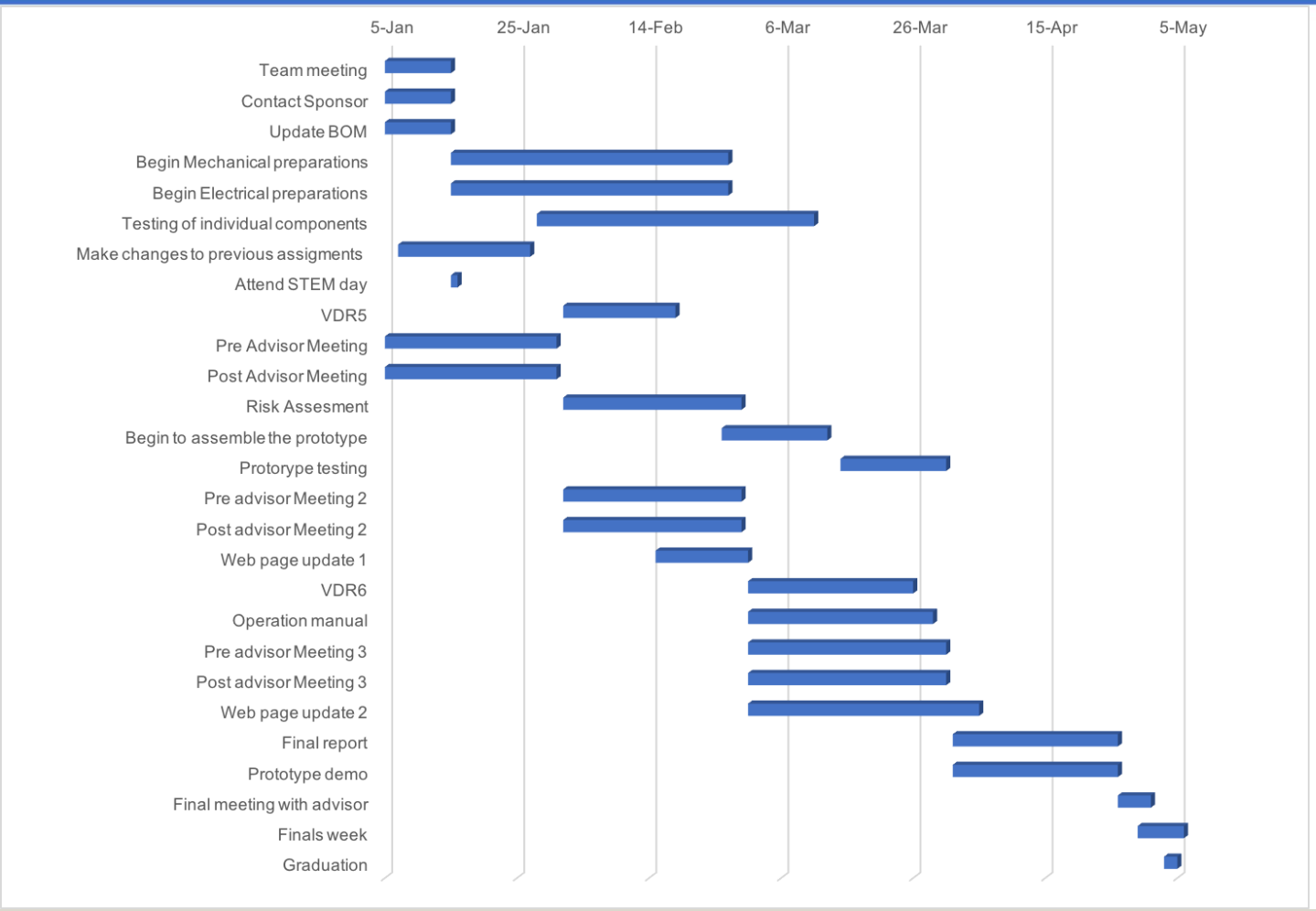
Francisco Silva

Budget Update

Budget Sector	Price Total ($)
Total Budget	1500
Sum of Parts Ordered	1,001.32
Sum of Remaining Parts	0.00
Total Sum of Parts	1,001.32
Budget Remaining	498.68

Juan Patino

Timeline



- Current Progress
  - ➢ Phase two of range testing is in progress.
  - ➢ The second iteration of the neural network is being trained.
- Future work
  - ➢ The construction and final testing of the prototype needs to be completed.

Juan Patino

Questions?