Dwight Look College of
ENGINEERING
TEXAS A&M UNIVERSITY

ECEN 404 Final Presentation
ElevateXY

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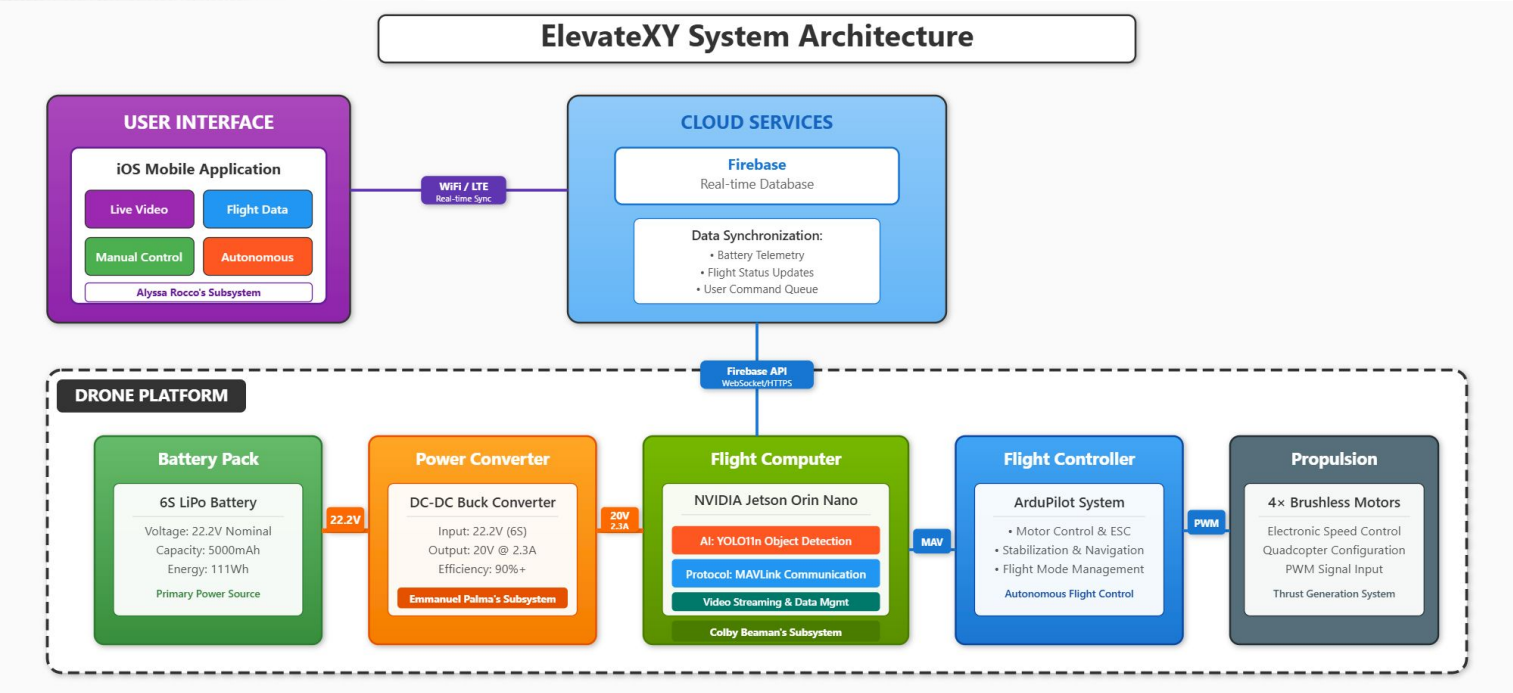
Project Summary

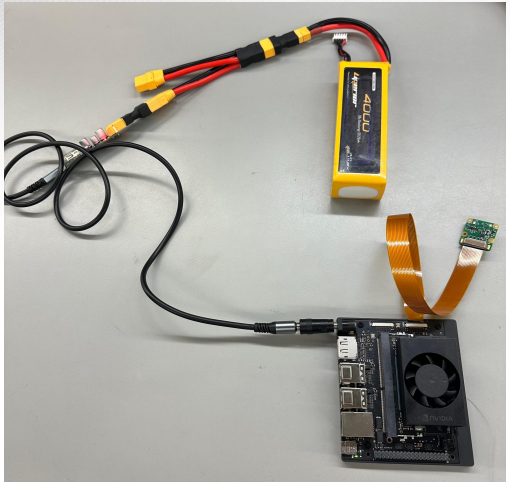
Problem statement: Despite the growing adoption of drones in the delivery, surveillance, and agriculture sectors, existing solutions suffer from inefficient power management and limited autonomous navigation capabilities.

Solution proposal: Offer a DC-DC Converter meant for increasing efficiency along with flight time. In tandem with an iOS application offering real-time power consumption analytics, battery health monitoring, and dual-control functionality.

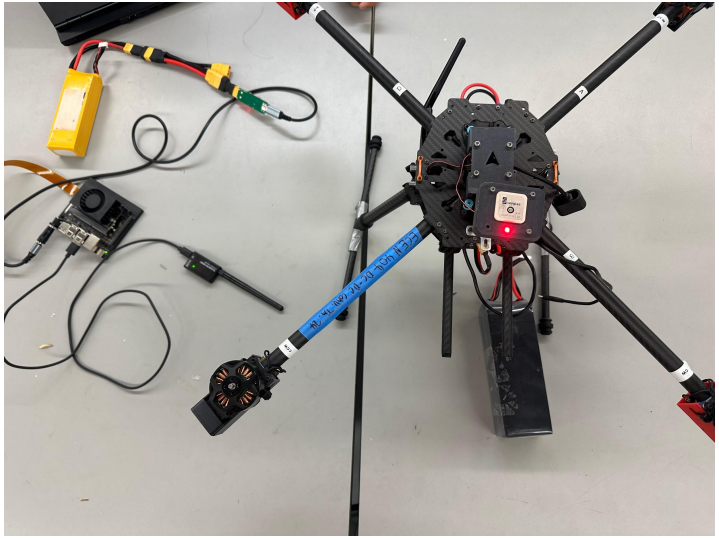
Final System Diagram



Integrated System Diagram



Jetson Nano Powering on by Converter



Jetson Remote Connecting to Drone

Engineering Design Accomplishments - MCU

- Integrated YOLO object detection model on Jetson Nano
- Implemented dual-mode operation (Manual/Autonomous) with mode switching, and battery telemetry
- Obtained FAA Part 107 Remote Pilot License

Design Requirements

- Real-time AI object detection: 91.4% accuracy
- Video streaming: 640×480 @ 30 FPS to mobile app
- MAVLink communication with flight controller
- Pass and Receive necessary documentation for Flight (Insurance and Licensing)

Challenges and Solution - MCU

Challenges

Original Jetson Nano was insufficient for real-time YOLO processing (roughly 2 fps)

Verification of Protocols without propellers (No flight testing)

External Factors (Flight Controller / Drone Swapping and FAA Timing)

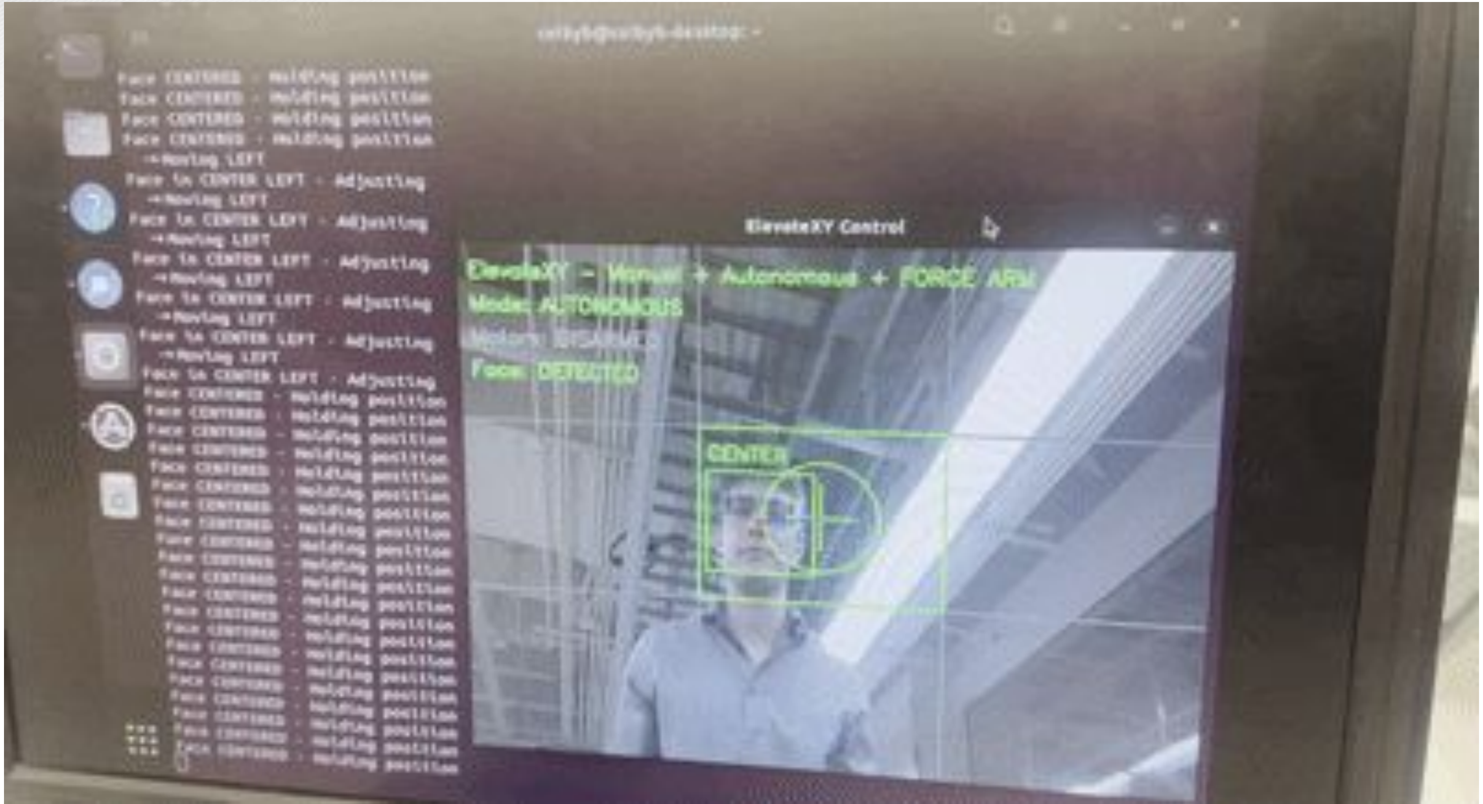
Solutions

Upgrade to the Jetson Orin Nano, along with reconfiguring to a CUDA-based inference with TensorRT optimization

Verification through 403 Simulation Code, using ArduPilot SITL

Constant Communication between Professors and TA's, along with receiving personal documentation

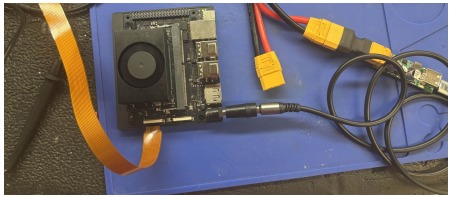
Data Results - MCU



Engineering Design Accomplishments - Converter

Purpose :

Powering the MCU with a regulated and stable voltage from an input voltage from a LiPo battery. Aid in optimizing the battery life and providing consistent power to the MCU with maximum efficiency.



Requirements :

Must consist of having an efficiency of 80% or higher for a 10+ min of flight

Must not exceed a weight of 100 grams in order to meet MTOW limit of the drone.

Challenges and Solution - Converter

Challenges

Powering the MCU from a LiPo battery without any major interference with space or weight for the drone.

Redesign to adjust to new Jetson Orin which requires 9~20 V output at 2.3 A

2.5 power jack found are wired for a 700mA which we need a higher rated current.

Solutions

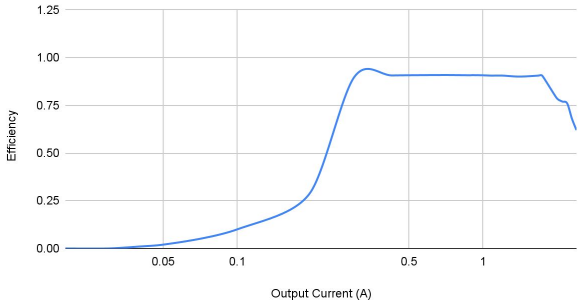
Install an xt60 bullet connector input which will be paired with a parallel Y splitter.

Power is distributed by a USB C output to be connected with a USB C to powerjack allowing required output.

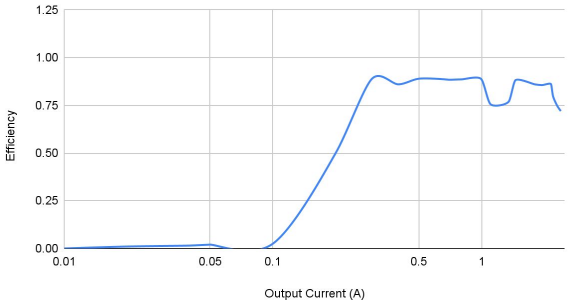
Met validation requirements; light weight (15 grams) , efficient (~90%)

Data Results - Converter

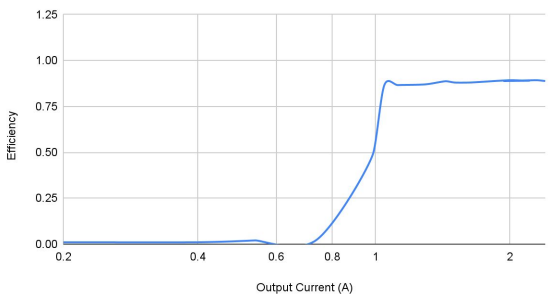
Vin = 12 V



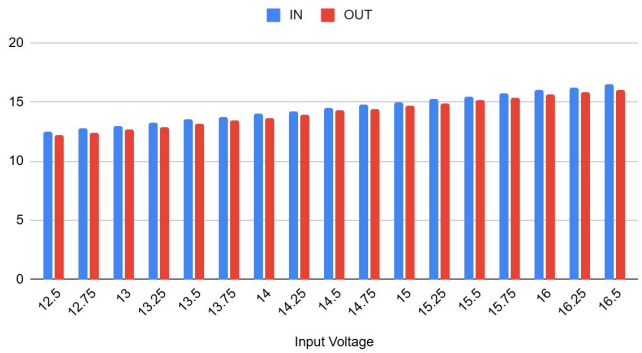
Vin = 14.8 V



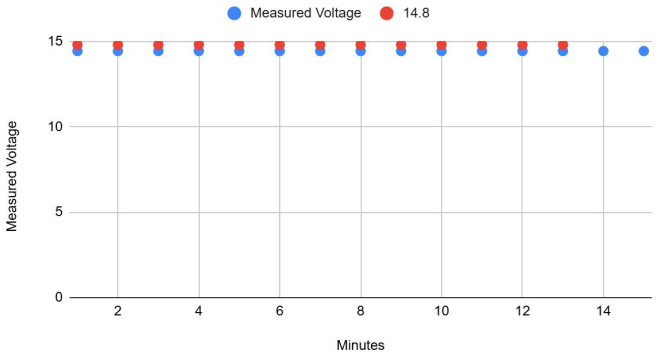
Vin = 16V



Input and Output



Flight simulation at nominal Voltage 14.8V



Engineering Design Accomplishments - Mobile Application

Purpose :

To be able to view live data feed, access the camera feed, as well as see the history of the drone's data. The commands that were developed can also be access from the mobile application.

Requirements :

Must be able to display real time data values as they change in the firebase database

Access the camera feed with only a 1-2 second delay

Send commands to the drone with a two second delay

Challenges and Solution - Mobile Application

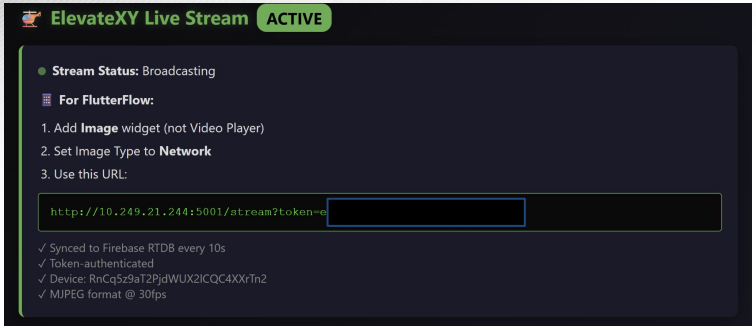
Challenges

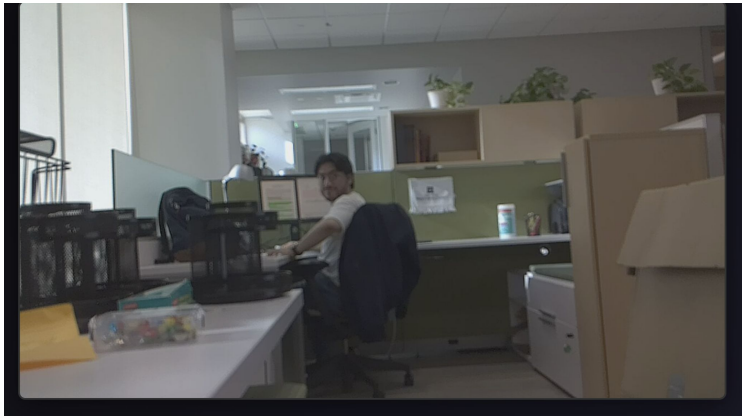
- Connecting to the new Jetson Nano and properly displaying the camera feed
  - Many issues arose when testing due to trying to connect to a not fully secured site
- Being able to display the correct data properly
  - The app had some tendencies to display previous days data or didn't properly save the samples of data

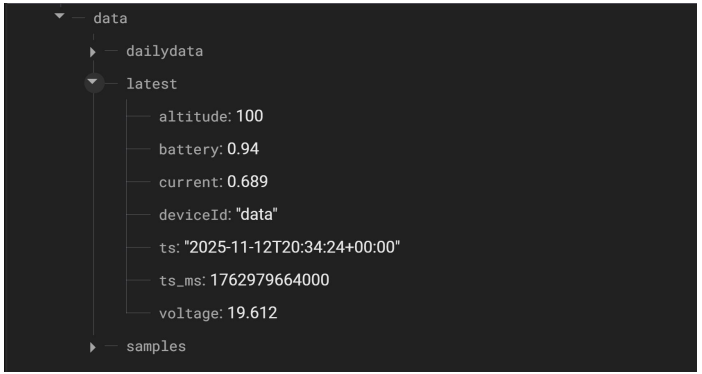
Solutions

- Created a HTTP with a token authentication to properly view the feed.
- Connected to a Realtime Database in Firebase for the live data and used Firestore for the data history

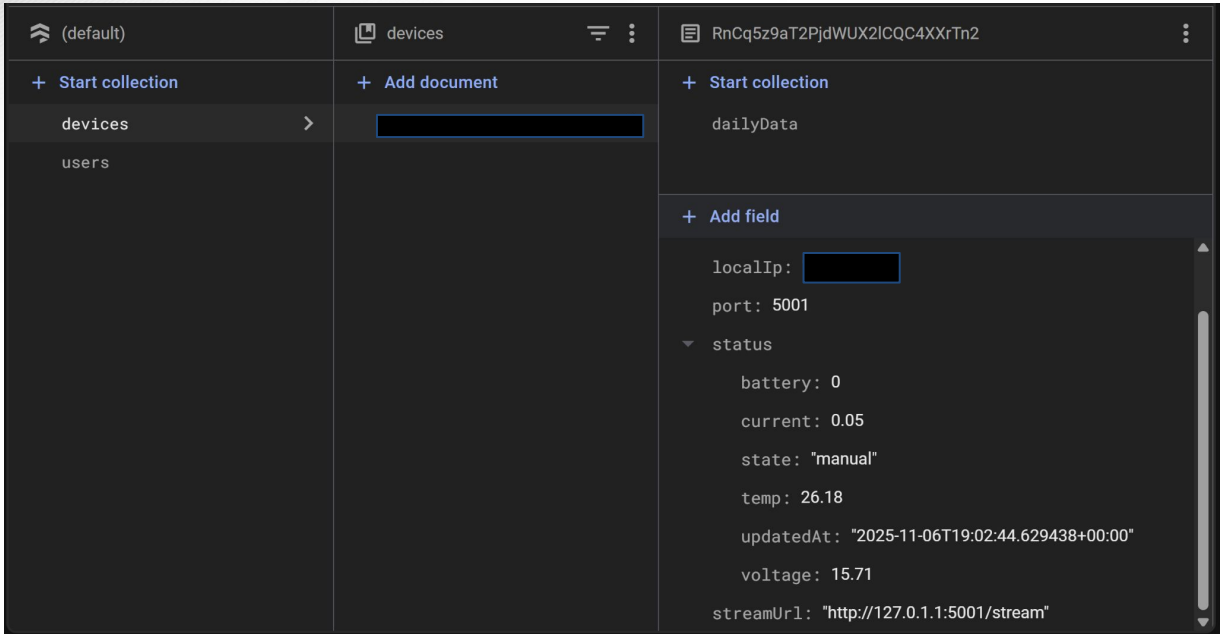
Data Results - Mobile Application

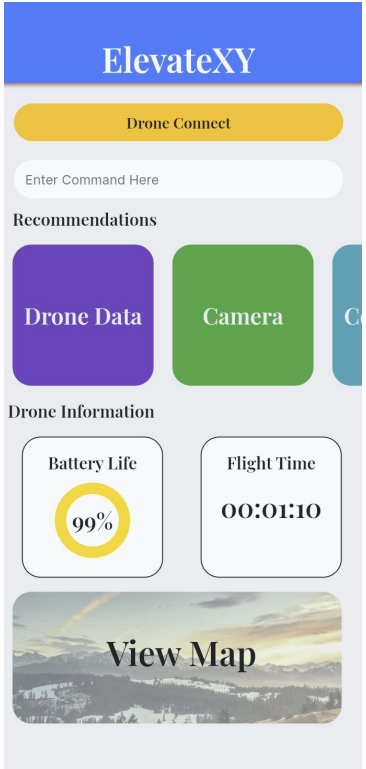






Data Results - Mobile Application





Integrated System Results

Converter to MCU

- Successfully power the MCU with the converter powered by a 4s LiPo battery
  - 10 minute constant powered test with little to no voltage drop at 90% efficiency

Mobile App to MCU

- Successfully displays all the data points collected and displays a live camera feed.
  - All data is properly saved into the database which is sent to the app with little delay.

Conclusions

- Repeating testing for the converter, specifically with Jetson running full load
- With the licence in hand, we will be able to perform a flight test now
- Ultimately, we need a housing unit for the Jetson for the flight test
- Finalize the Code to run on boot (display/keyboard not necessary)
- Finalize downloading the app to iOS device and checking display on the device
- Finalize integration to perform a video demo with all functionality shown with high efficiency

Thank you for your time