TEAM MEMBERS:

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Nvidia Jetson AGX Xavier with GigE and USB-C Camera

For more information on our project including project videos, please visit our project website.

https://argh.anth.dev

SCAN ME

Oregon State University

AEROSPACE RECORDER FOR GRAPHICAL HISTORY

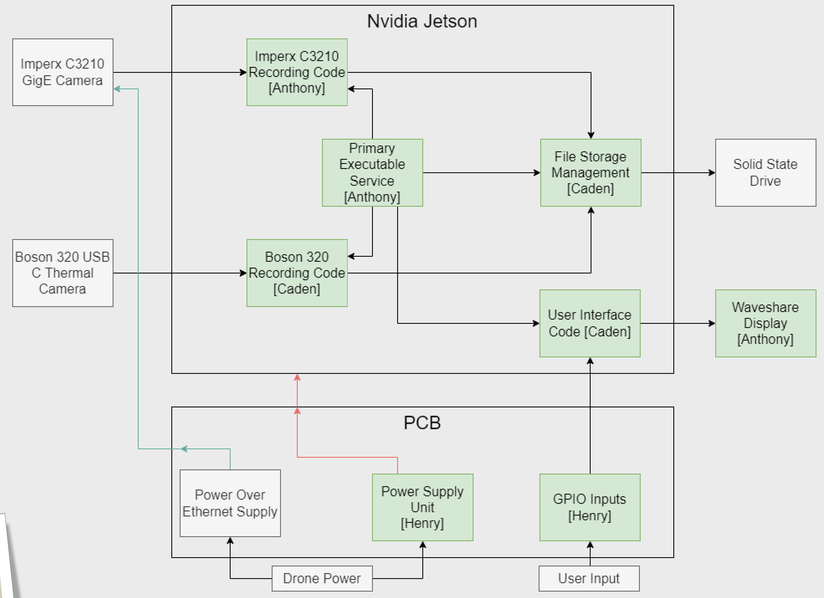
PROJECT OVERVIEW:

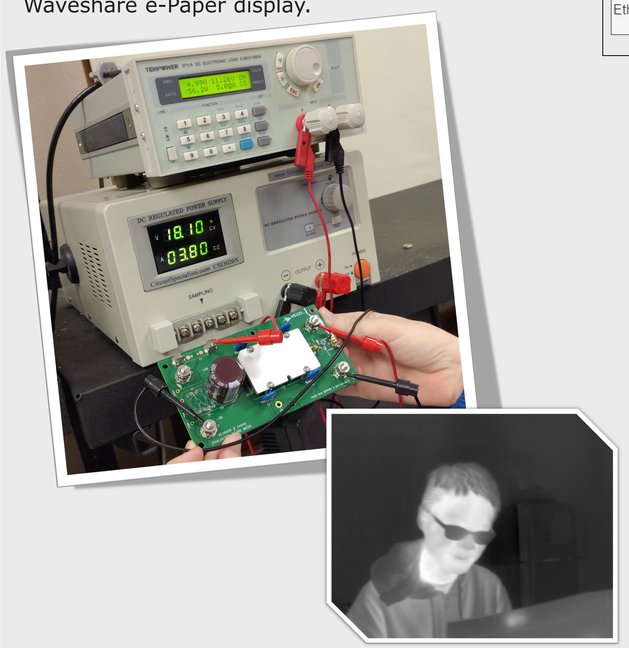
The primary objective of our project is to create a graphical history (video in the form of a series of images) recorder for large commercial and military drones. The goal for our project is to be able to save the data from a GigE Imperx camera and a USB Flir thermal camera using the Nvidia Jetson AGX Xavier platform. This will allow users to review the camera outputs later instead of just live. This is to facilitate an aerial reconnaissance mission where a large drone will be able to record aerial graphical data by taking pictures with multiple cameras at a high enough framerate to form video from them. Since this project will likely end up in a confidential application, our team does not know the specifics of what the drone will be doing, to the best of our knowledge the drone will be taking aerial footage of some remote regions for a long period of time meaning our system needs to be adaptable to long flights and possible power interruptions.

BLOCK DIAGRAM:

The block diagram to the right, which includes an NVIDIA Jetson AGX Xavier embedded platform, shows how the major pieces of our project were broken up among members. A unique part of this project compared to most ECE capstone projects was the fact that around 90% of our project was code.

The Primary Executable is a Linux systemd service that will run as soon as power is supplied to the Jetson. It will control all other code pieces that were written throughout the project including both camera recording blocks, the storage management code, the user interface controller, reading for button inputs, and updating the Waveshare e-Paper display.





CONFIGURATIONS:

The ARGH project allows the user to configure its functionality with an integrated user interface. The user interface is comprised of an e-Paper display as well as 4 buttons.

The 4.2-inch e-Paper display will display the system status, timed delay status, remaining recording time status, and the menu items for starting and stopping the recording as well as setting the timings mentioned previously.

The 4 buttons allow the user to switch between starting and stopping the recording, setting the delay timer, and setting the recording time. These buttons include a menu button, a select button, and the increment and decrement buttons.

Obtaining the stored images are as simple as removing the SSD and inserting it into a computer using an M.2 NVMe adapter. Alternatively, images can be removed from the Jetson via USB drive.

PROJECT DETAILS:

The ARGH project accomplishes its function by capturing images at high speed (around 16 frames per second for the Imperx camera and around 60 frames per second for the Boson320 camera) and storing them in an M.2 NVMe SSD onboard the Jetson AGX Xavier. These Boson320 images are thermal images that require an additional layer of decoding to store viewable data.

Our system will be enclosed in a large drone and will be inaccessible during flight. This includes RF communication, cellular, and the internet, which are all unavailable. This means our system must operate automatically and be robust enough to recover from any potential failure or resets that occur mid-flight.

ENGINEERING REQUIREMENTS:

Flir USB Camera – The system will capture image frames from the Boson320 thermal camera at a 10FPS minimum and a 320x256 pixel resolution.

Imperx GigE Camera – The system will capture image frames from the Imperx C3210 at a 10FPS minimum and a 3216x2208 pixel resolution.

Jetson Power Supply – A power supply will take a 28 volts 100 watts input and provide a steady 12 volts 30 watts minimum output for the Jetson.

User Interface – The system will provide the ability to preset timed delays, preset recording lengths, manually start/stop the recording, and reset settings to their previously chosen state.

Saved Settings – The system will save variables between uses. These variables will be Flight Number, Current Delay, Current Time to Record, and previously set delay and recording length times.

Storage Organization – The system will store image files by camera number and provide the storage structure to do so on a solid-state drive if it is missing.

File Timing – The system will store files with their timestamps to the milliseconds in their names to allow different camera's photos to be easily compared.

Autonomous Operation – The system will operate without user intervention whenever power is applied to the Jetson to protect it from midflight power failures.