Lightning Weather Station

Damien Fabiano, Chase Santovasi, Thomas White, Owen Cannon, Gavin Tucker, Evan Czerwinski
Project Advisor: David Benedetto | Sponsor: Matthew Argall

Introduction

As UNH's research capability expands there is an increased need for automated ways of collecting important data. By using modern day technology, the Lightning Weather Station provides a simple and replicable system for capturing and cataloging lightning events. The automated photo transfer allows all users a hands-free method of accessing data gathered by the center, while keeping it organized and timestamped. Retrieving files from the center is quickly done through the Flask web application, allowing for wireless transfers of necessary data.

Requirements

Functional Requirements:

- Automated lightning capture
- Wireless photo transfer
- Remote photo access
- Duplicate photo prevention
- Consistent file naming (Camera_Date_Time.jpg)
- Photo deletion after transfer
- Web interface via Pi's self-host

Technical Requirements:

- Python automation scripts for photo management
- Flask web application for photo viewing and download
- Database or file system for photo metadata
- Network resilience (offline-first design)
- Automatic startup of all services on Pi boot
- Verification of successful photo transfers before deletion

Implementation Tools

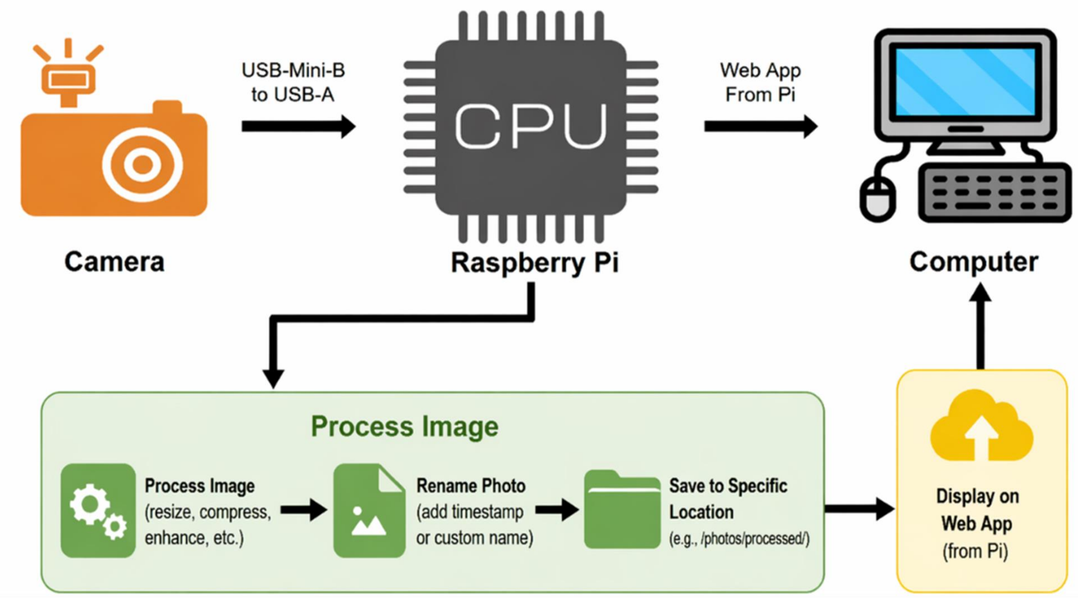
Hardware:

- Raspberry Pi 3B+
- Canon DSLR camera
- Pi Camera Module 2

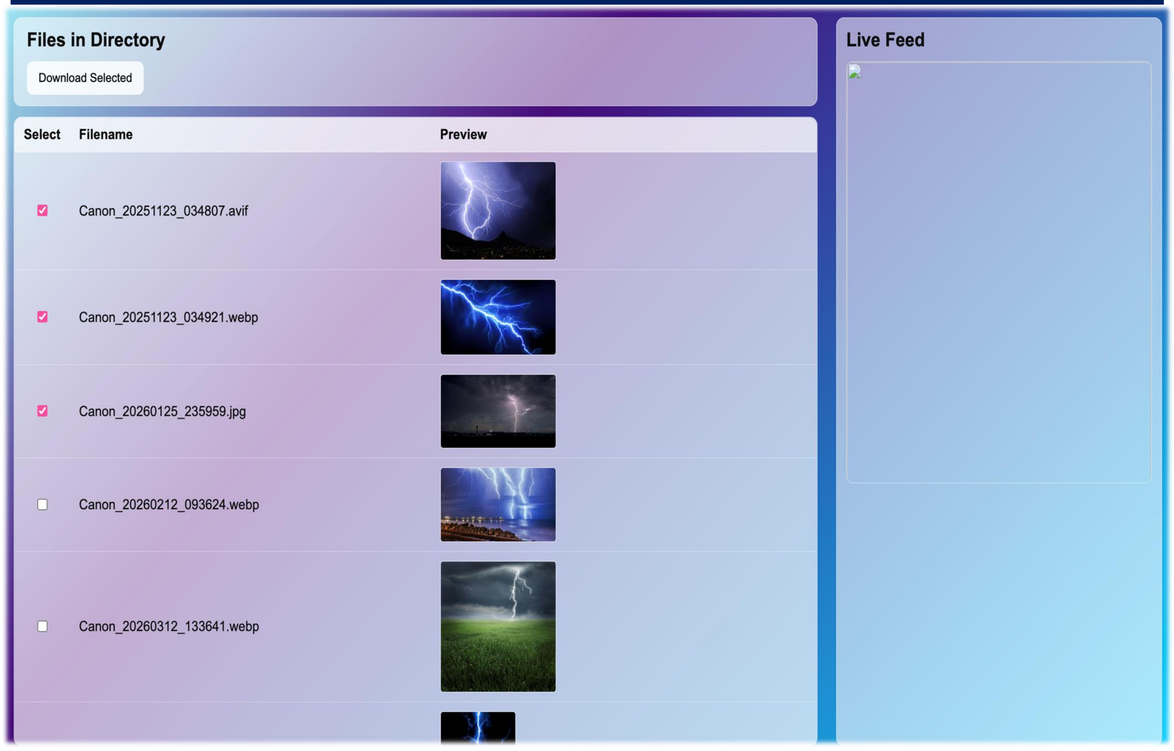
Software:

- Flask
- Picamera2
- Watchdog
- Gphoto2

System Hierarchy Diagram



User Interface/Web Application



Web application hosted via the Raspberry Pi

Testing/Results

Our hands on testing focused on the automated systems. Each test would start by taking a picture on the Canon camera. We would then check that the photos were being automatically transferred to the raspberry pi. Finally, we would connect to the pi's network and check that the photos were available on our webapp.

We tested each individual component of our project first to make sure that they worked in isolation, before combining them all. Our final testing showed the product working consistently to deliver pictures to the locally hosted webapp, allowing for any network capable device to connect and download the saved pictures.

Evaluation/Conclusion

Evaluation

Our system consistently works to save photos, rename them, and make them available to view and download through the webapp in every test we have run. Unfortunately, due to time constraints we have yet to meet with the rest of the project groups and assemble the final product, but we are confident that the final deployment will be smooth and successful.

Limitations

The sites for the centers were not set in stone until late into the end of the project's development, so many factors like network connection and ease of access could not be guaranteed. If the sites had for example, decent wireless network connections, then the web app could have been designed to be accessible from anywhere.

Next Steps

Our future plans include uploading pictures directly to a UNH server, eliminating the need to be physically present with the Pi to view photos. We also plan creating a database to house lightning strike analytics such as current and polarity.