Floodbusters

Project HydroCams

The Team

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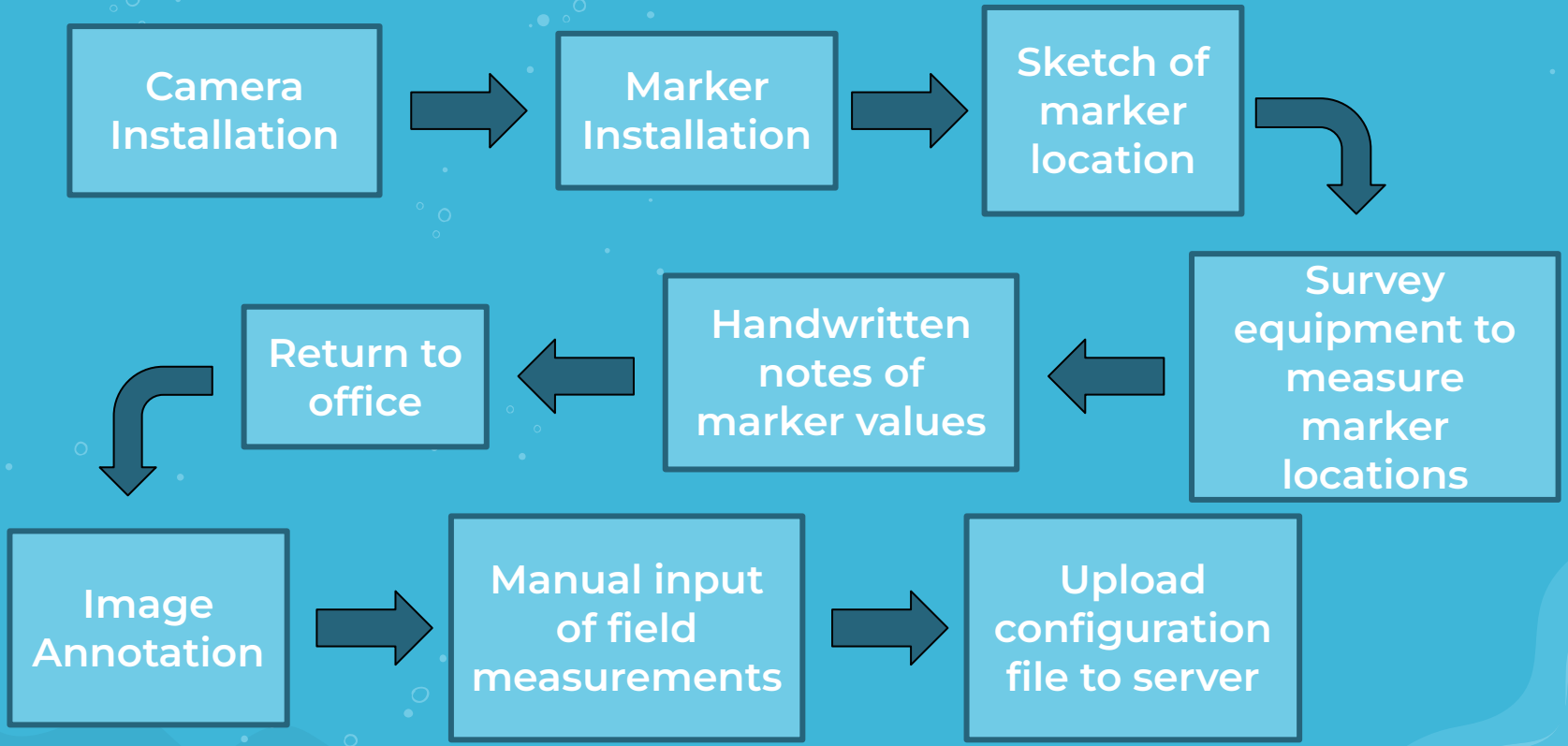
Our Client

- Professor of Computer Science and researcher - NAU SICCS
- Cofounder of the FloodAware Project, overseeing the development of HydroCams
- Dr. Doerry's Goals for HydroCams:
  - Easy to Install
  - Affordable
  - Solar Powered
  - Cell-Connected
  - Automatically Calibrated

Dr. Eck Doerry

Current Process



Problem Statement

Current flood monitoring systems require expensive and labor-intensive processes to generate calibration data

- Specialized, expensive surveying equipment
- Highly trained installation technicians
- Often rely on hand-drawn images and notes
- Prone to user error, potentially requiring multiple trips to the camera installation

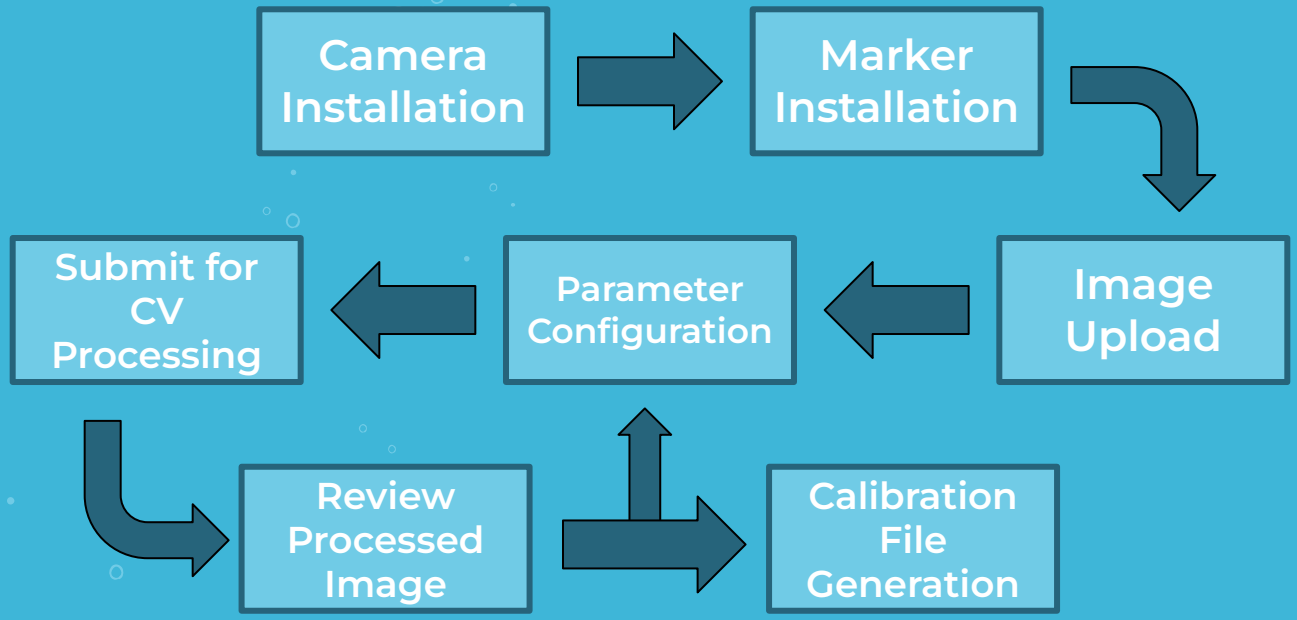
These factors culminate in an impractical and inefficient system, ripe for improvement

Solution Overview

Online Image Workbench for Calibration File Generation

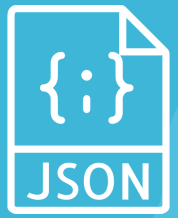
- Configurable CV parameters
- Automated marker / zero point detection
- Detailed information about markers and relationships
- Downloadable calibration file
- Easily iterable workflow, with large time and resource improvements

Solution Process



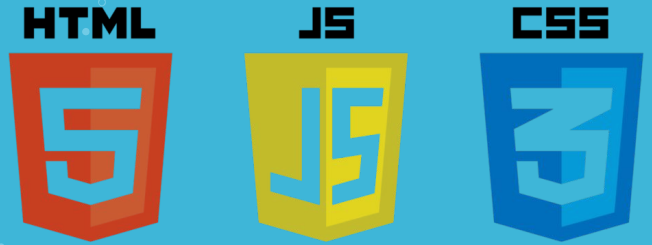
Requirements Review

- Accurate Marker Detection:
  - Must reliably detect multiple markers with varying attributes (color, size, shape)
- Precise Distance Calculation:
  - Must compute real-world distances between markers and zero-point with minimal error
- User-Friendly Interface:
  - Include intuitive controls to easily adjust parameters and clearly understand results
- JSON Export Capability:
  - Must provide calibration in JSON format for seamless integration with HydroCams hardware

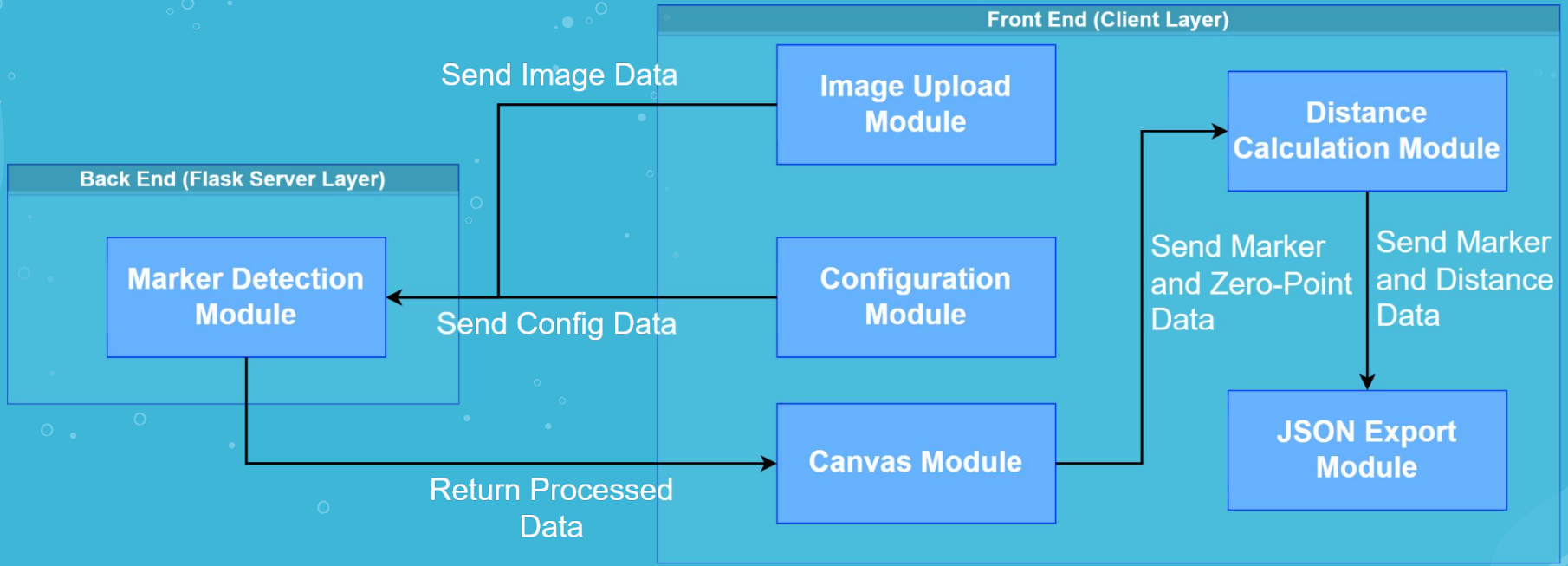


Architecture Review

- Front End: Built using HTML/CSS/JavaScript
- Back End: Python Flask server for image upload and processing via OpenCV
    - Temporary file system image storage for processing; no long-term storage needed



Implementation Review



Prototype Review

Challenges and Resolutions

- C1: Structure-from-Motion (SfM) was too resource-intensive
  - R1: Switched to pixel-based distance calculations for simpler, efficient processing
- C2: Inconsistent marker detection under varying lighting
  - R2: Added configurable color selection, multicolor selection, and re-run functionality to improve detection
- C3: Depth causes skewed distance calculations
  - R3: Implemented known-size Zero-Points to improve accuracy

Testing Plan

Unit Tests: “Hard” data

- Marker Detection will be tested to ensure that, using the correct set of parameters, we receive the correct number of markers in return, using images with a known quantity of them.

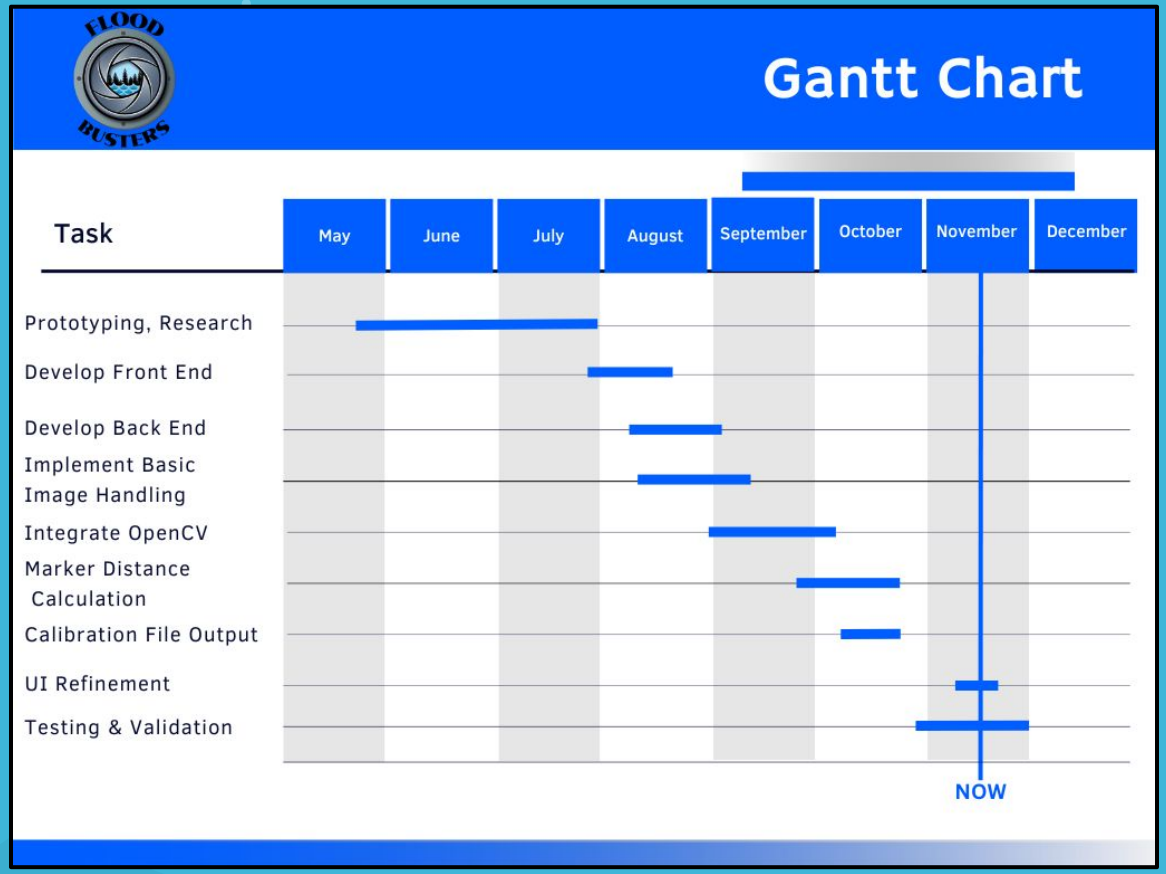
Integration Testing: The “seams” of the system

- Configuration to Marker Detection will be tested to ensure that the configuration parameters are passed properly.

Usability Testing: “Soft” data.

- Real users will perform a set of tasks, and report their experiences using a user survey.

Schedule


FLOOD BUSTERS
Gantt Chart
Task
May
June
July
August
September
October
November
December
Prototyping, Research
Develop Front End
Develop Back End
Implement Basic Image Handling
Integrate OpenCV
Marker Distance Calculation
Calibration File Output
UI Refinement
Testing & Validation
NOW

Conclusion

- Flooding regularly wreaks havoc on lives and property, and is only expected to worsen
- Current flood monitoring systems are too cumbersome and expensive to be practical
- Our solution involves an online image workbench that utilizes computer vision to provide streamlined calibration data to help automate flood detection
- Our next steps are to finish refining our UI before executing usability testing
- We are confident that our efforts will revolutionize the realm of flood detection, saving lives and millions of dollars in the process

Thank you!