Floodbusters

Project HydroCams

The Team

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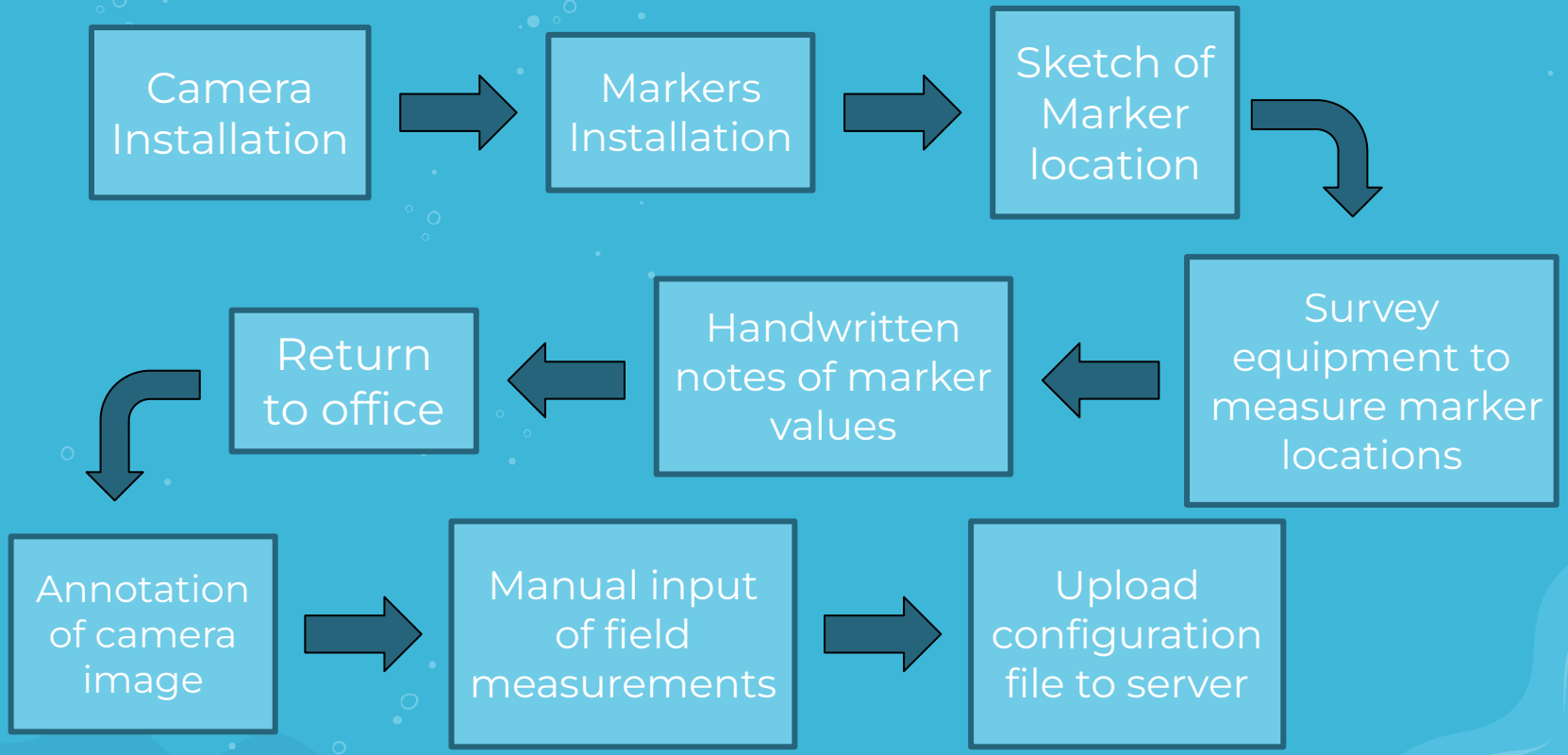
Our Client

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

Dr. Eck Doerry

Current Process



Problem Statement

- Current flood monitoring systems require expensive and labor-intensive processes to generate image calibration files
    - Specialized, expensive surveying equipment
    - Highly trained installation technicians
    - Relies on hand drawn images and notes
    - Manual input and annotation
    - Prone to user error requiring repeat trips back to camera site

Solution Overview

- We will develop a cheap, efficient monitoring system involving...
  - Online Image Workbench
    - Users can manually annotate images by selecting markers and inputting known measurements
  - Computer Vision (CV)
    - Enables automatic detection of markers and zero point
  - Structure from Motion (SfM)
    - Provides automatic calculation of distances between markers, zero-point
  - Mobile Application
    - Allows field technicians to upload images while deployed, allowing them to detect errors before leaving the site

Key Requirements

After deliberation with our client, and some review of the project documents, we settled on the following key user requirements:

- A browser-agnostic image workbench front end
  - For marker identification
- A supporting back end
  - To handle image fetching and storing
- Basic CV marker identification program
- 3D marker-to-marker measurements using SfM
- Mobile application for Android and IOS
  - To take SfM pictures and receive data in the field

Functional Requirements

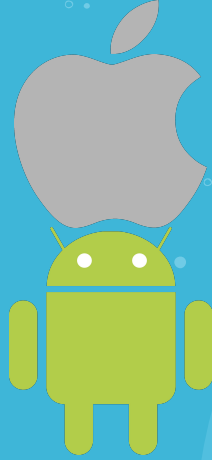
- Image Workbench Front End
  - Image Upload
  - Navigation
  - Markup
  - Calibration / Annotation Output
- Automatic Marker Identification via CV
- 3D Measurements via SfM
- Mobile App
  - Camera Functionality
  - Server Communication

Performance Requirements

- Quick computation times
  - CV / SfM should take <5 minutes total.
- Long-term data storage
  - Images and calibration files should be held until no longer necessary
- UI/UX
  - Non-technical users should be capable of using the interface
- Reliability
- Maintainability

Environmental Requirements

- HydroCam installation hardware
  - Limited resolution
  - Limited connectivity
- Mobile OS compatibility
- Browser compatibility
- Limited hardware compatibility



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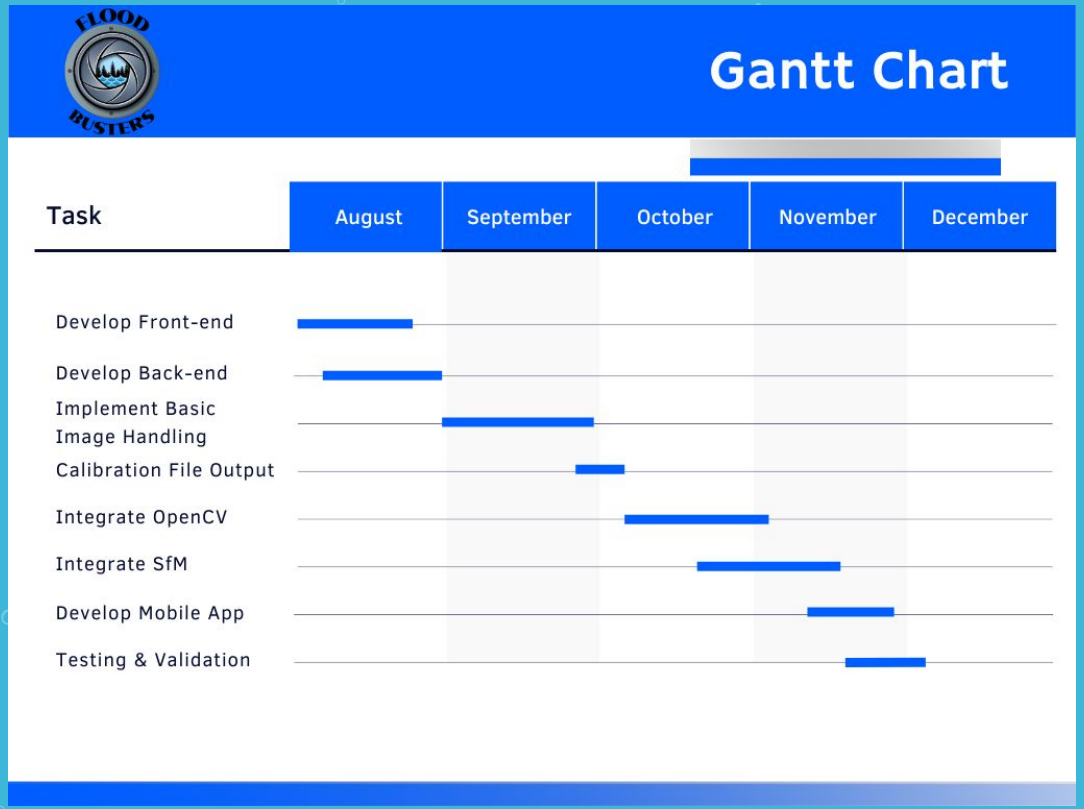
Risks and Feasibility

- Calculation Inaccuracies
  - Potential inaccuracies from CV or SfM could lead to misidentification of floods
- Injury during HydroCam Installation
  - Requirement of multiple images for SfM can introduce physical risks for technicians on rough terrain
- Destruction of Markers
  - Markers may be damaged or displaced by weather, wildlife, etc...
  - Renders the on-site camera useless

Schedule


FLOOD BUSTERS
Gantt Chart
Task
August
September
October
November
December
Develop Front-end
Develop Back-end
Implement Basic Image Handling
Calibration File Output
Integrate OpenCV
Integrate SfM
Develop Mobile App
Testing & Validation

Conclusion

- Flooding regularly wreaks havoc on lives and property
- Current flood monitoring systems are too cumbersome and expensive to be practical or effective
- Our solution involves an online image workbench that utilizes a live network of cameras, computer vision, and structure-from-motion to automate flood detection
- Our next steps include prototyping and thorough testing / research
- We are confident that our efforts will revolutionize the world of flood detection, saving lives and millions of dollars in the process