Hydro Citizens

Citizens Science Mobile App for Hydrology Reporting

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Dr. Benjamin Ruddell

Client: Dr. Benjamin Ruddell

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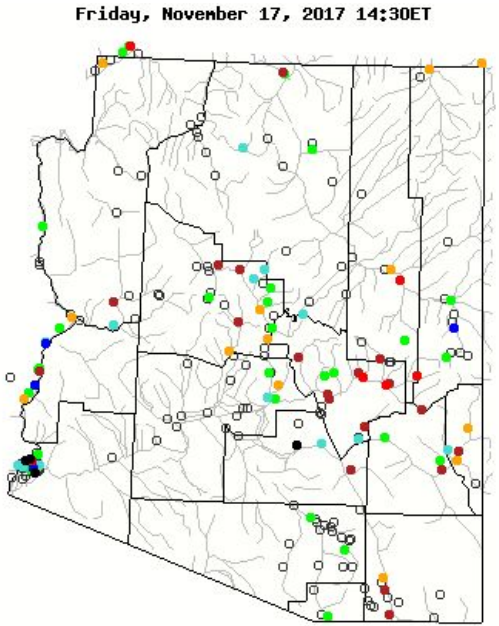
Why Hydrological Data Collection is Important

- Flood Prevention
  - Better warnings
  - Flood preparation
- Water Management
  - Measure river flow, runoff levels
  - Infrastructure design
- Public Education Knowledge
  - Influence how community votes for public officials based on how important they think water management is
  - When to evacuate

What's Wrong With The Current System?



- USGS - United States Geological Survey
- The USGS installs stream gauge sensors that monitor water level
- Works with the National Weather Service to provide emergency flood data

Solution Vision - Crowdsourced Hydrology

- Dr. Benjamin Ruddell
  - Associate Professor at NAU
  - Complex Systems Informatics Laboratory
- Dr. Robert Pastel
  - Associate Professor at Michigan Tech

- Overall Plan
  - Build a station
  - Take a picture with their phones
  - Upload the picture to the website
- Drawbacks
  - Only works on the website
  - Requires an internet connection
  - No instant feedback
  - Slow process

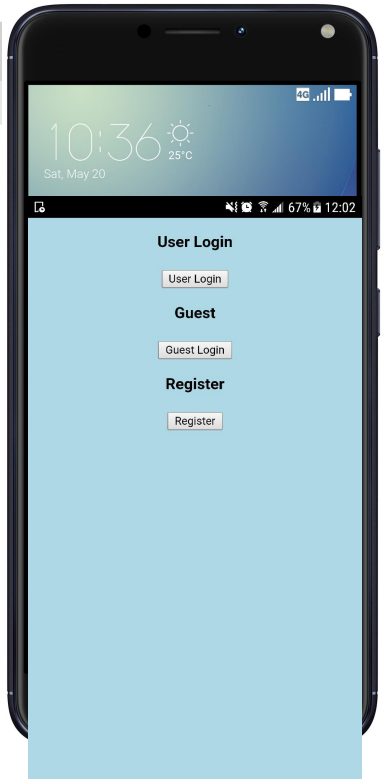
Key Requirements

- Mobile
- Offline Functionality
  - Access graphs
- Geolocation
  - Pull users location
- Image Processing
  - Calculate water height on phone
- Database Management
  - Store collected data
- User Accounts
  - Option to create account
- Gamification
  - Notifications and data visualization

Our Solution: Overview

- Our Plan
  - Build a station
  - Take image through our application
  - Upload data through our application
- Key features
  - Works on mobile
  - No internet connection required
  - Instant display of data on collection
  - Faster, more accu

Login Page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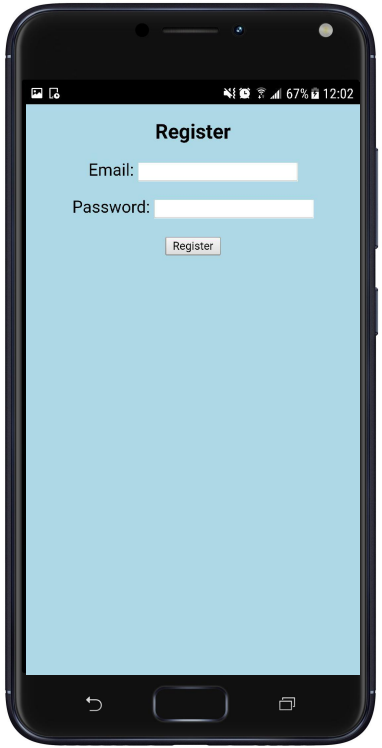
25°C
Sat, May 20
67% 12:02
User Login
User Login
Guest
Guest Login
Register
Register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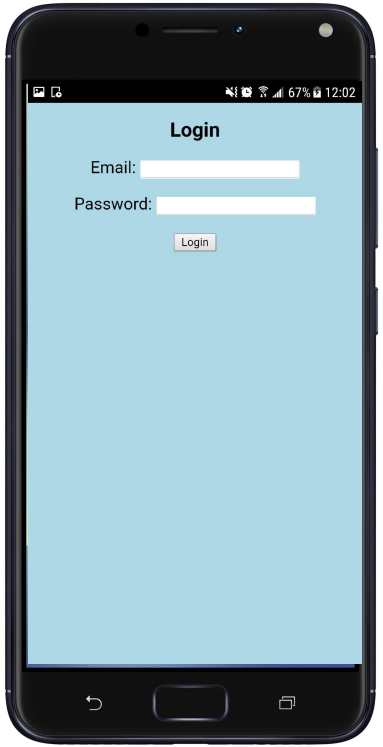
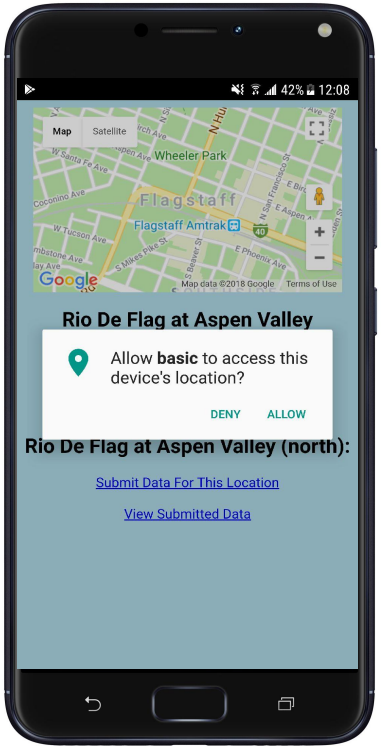
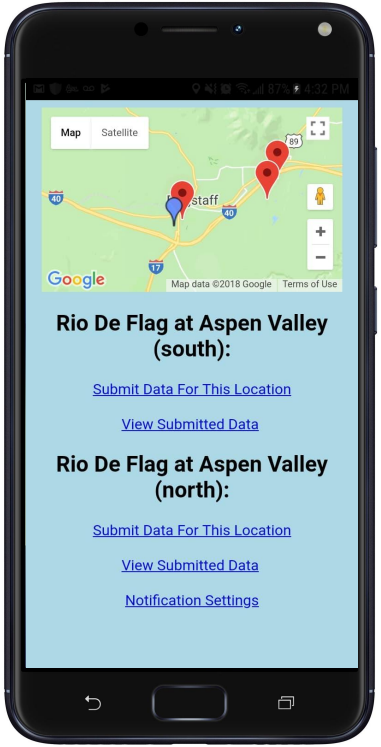
Register
Email:
Password:
Register

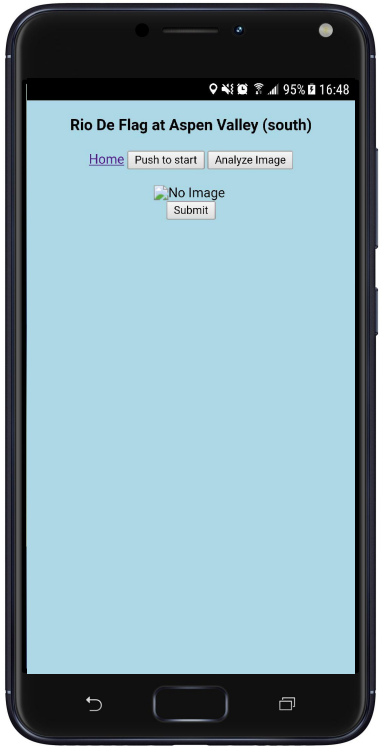

67% 12:02
Login
Email:
Password:
Login

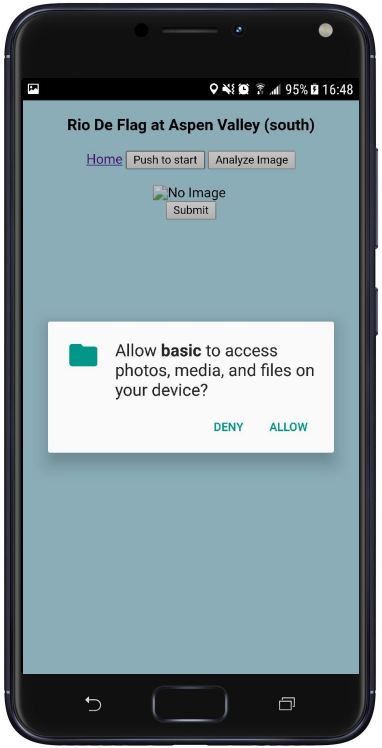
Home Page


42% 12:08
Map
Satellite
Wheeler Park
Flagstaff
Flagstaff Amtrak
Google
Map data ©2018 Google
Terms of Use
Rio De Flag at Aspen Valley
Allow basic to access this device's location?
DENY
ALLOW
Rio De Flag at Aspen Valley (north):
Submit Data For This Location
View Submitted Data

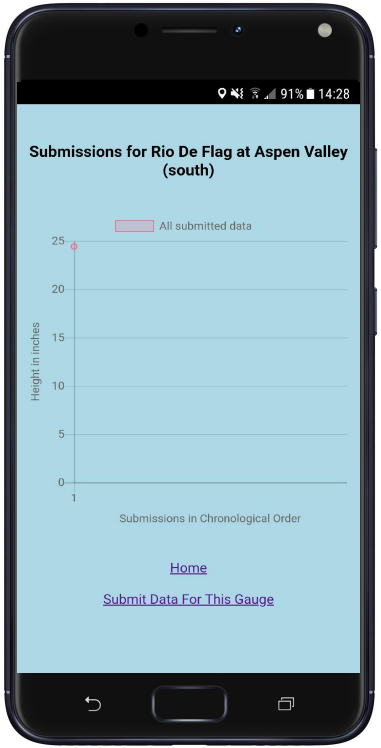

Map
Satellite
Google
Map data ©2018 Google
Terms of Use
Rio De Flag at Aspen Valley (south):
Submit Data For This Location
View Submitted Data
Rio De Flag at Aspen Valley (north):
Submit Data For This Location
View Submitted Data
Notification Settings

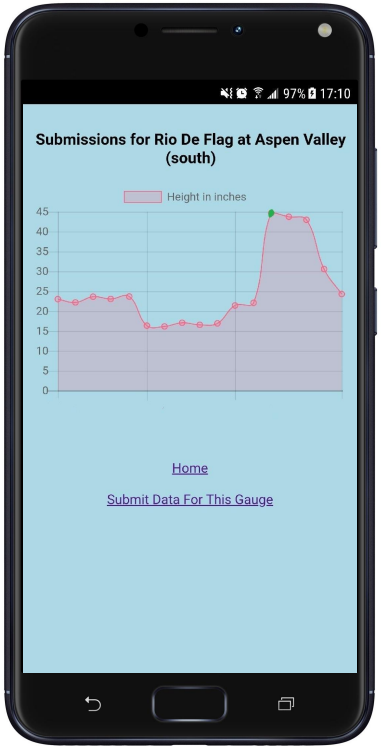
Submission Page



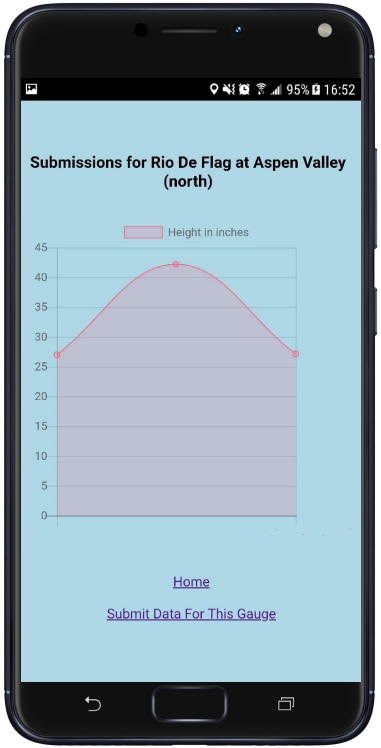


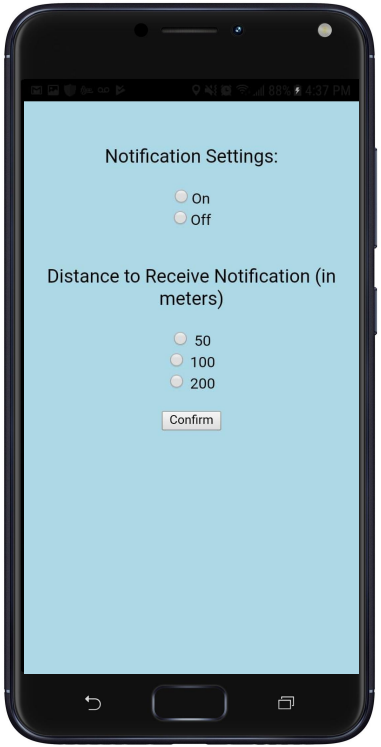
View Data Page

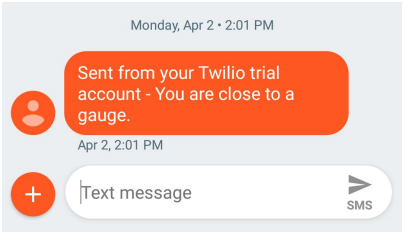




Notification Page







Architecture Overview

Platform
Android, iOS

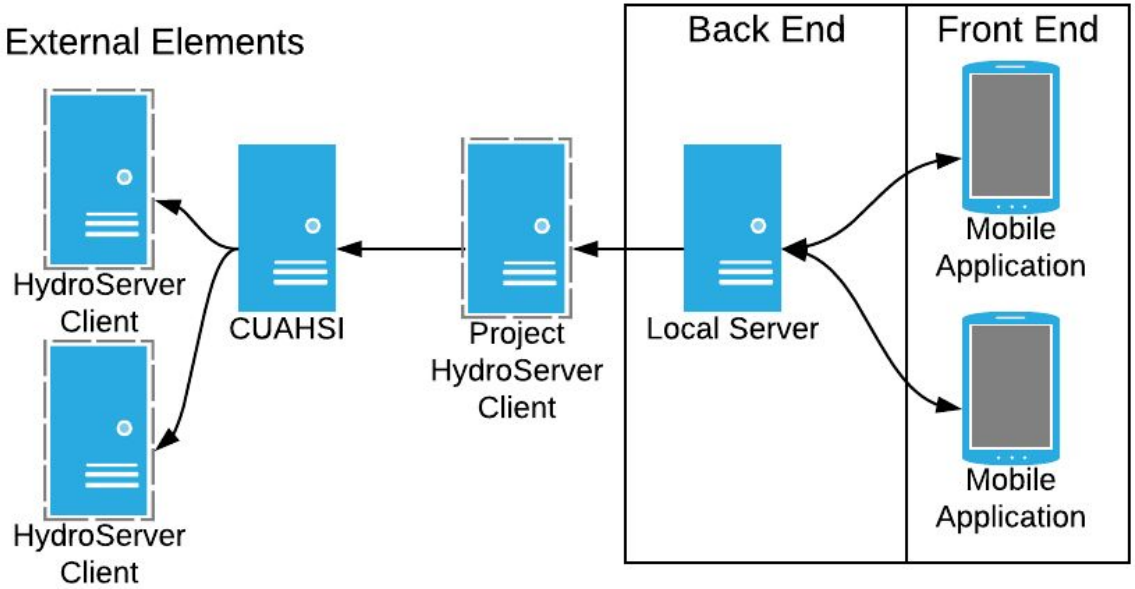
Application Framework
Meteor, PhoneGap, Android Studio

Gamification (Notifications)
Firebase, ***Twilio***

Gamification (Visualization)
Charts.js, D3.js

Database
MongoDB, MySQL, Apache Cassandra

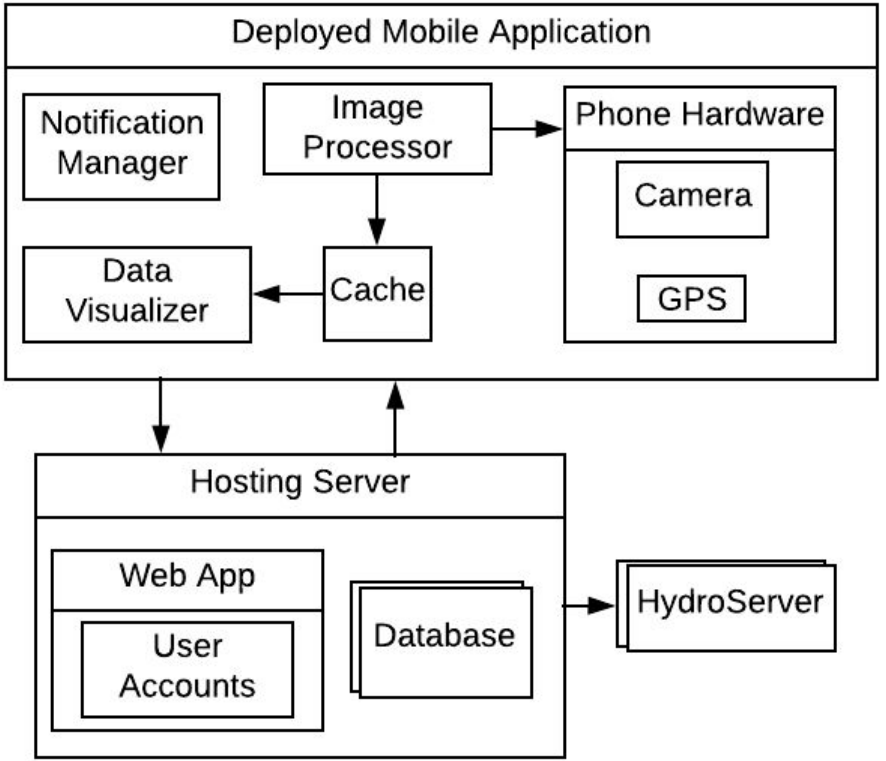
Computer Vision
OpenCV, Tracking JS, JS Feat



Implementation

Key Design Features:

- Image Processing
- Notifications
- Data Visualization
- Data Distribution
- User Accounts

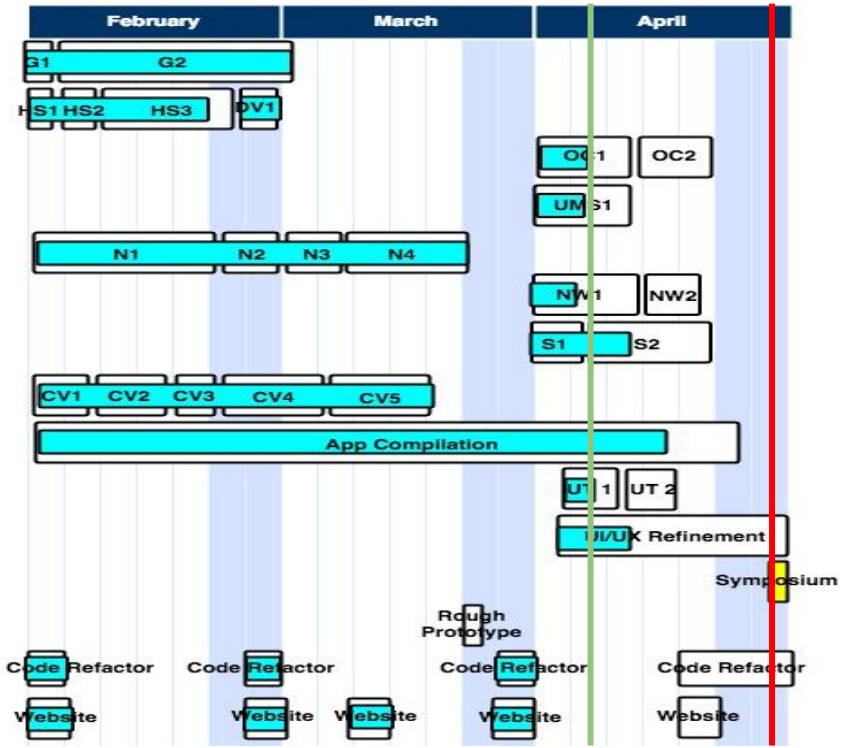


Challenges and Resolutions

- OpenCV
  - Modify the build settings
- Send offline and online notifications
  - Send SMS text messages.
- Auto upload to the HydroServer
  - Contact CUASHI

Schedule

- Geolocation (G)
- User Management System (UMS)
- Data Visualization (DV)
- Notification (N)
- Computer Vision (CV)
- HydroServer (HS)
- National Water Model (NWM)



Testing Plan

- Unit Test
  - User login form
  - User data submission
  - Accuracy of the Image Processing
- Integration Test
  - Database Functionality
  - Image Processing
  - Performance Testing
- Usability Test
  - Phase 1
    - Client, grad students, high-level CS students
  - Phase 2
    - Non-tech savvy individuals
    - Given lab manual

Conclusion

<u>Key Functionalities</u>

1. Mobile application
2. Offline functionalities
3. Data Visualization

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