Forest Frames

Design Review III

Mentor

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Problem Statement

Rural and more isolated parts of the world are more likely to experience degradation of its biodiversity due to a lack of conservation efforts.

- Less reported on areas due to a lack of funding or resources
  - Malaysia, Kenya, Colombia

- Citizens are not incentivized or lack resources to be collecting data themselves

Dr. Camille Gaillard

Dr. Chris Doughty

Solution Overview

Our solution is a mobile app that is easily available to citizens in these areas.

- Our app will allow users to upload gathered data to our server, where it will be verified through existing methods and stored in our database

- The app collects coordinates from the NASA GEDI Satellite to show acceptable areas for users to collect data. Users are guided to data collection sites using a built in map interface.

Dr. Duan Biggs

Dr. Jenna Keany

Key Requirements

Data Processing Requirements

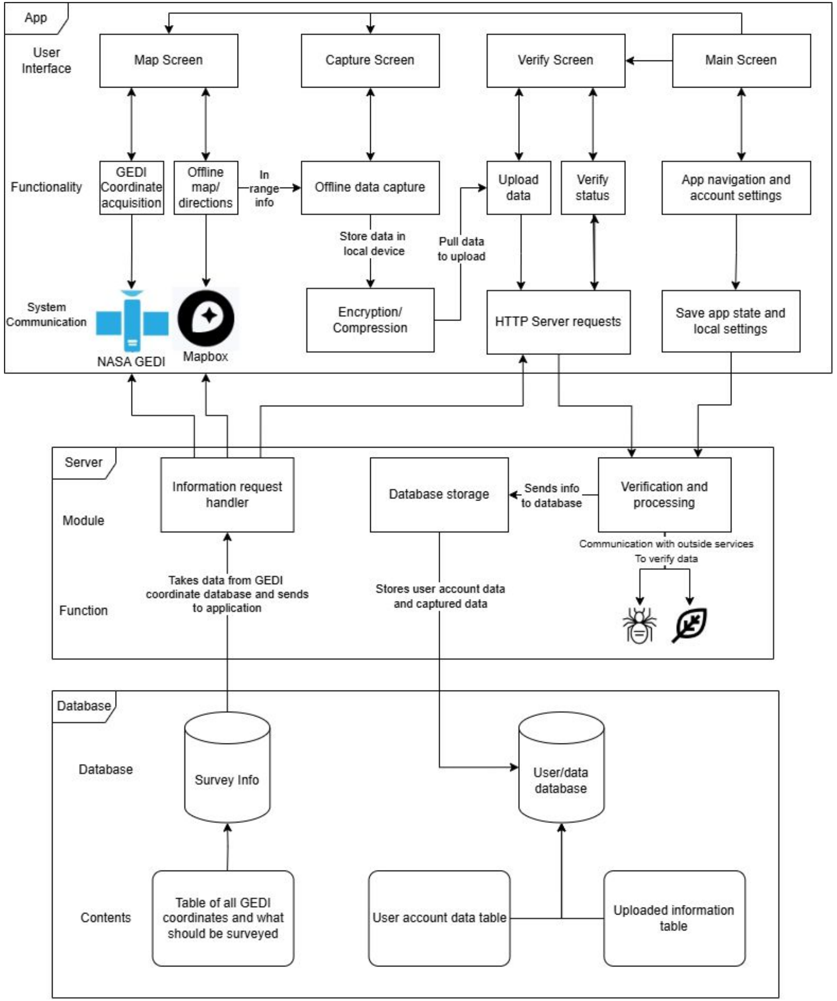
- Collect visual/audio data natively
- Transfer data from app to server
- Verify images of animals through detection/classification
- Store and retrieve user data from database

Map Requirements

- Display GEDI satellite coordinates
- Display user location and bearings
- Show the map offline
- Track if a user is within 35m of a GEDI coordinate

Implementation Overview

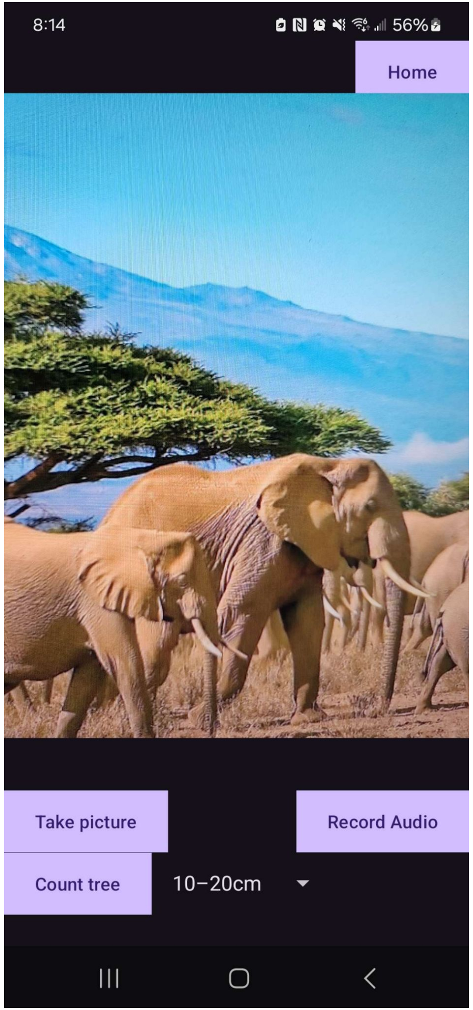
- App - Frontend
  - Collecting data natively (Kotlin)
  - Offline mapping functionality (Mapbox)
  - User authentication
  - Simple and accessible UI
- Server & Database - Backend
  - Verification of image data (Pytorch Wildlife)
  - Storing user data in database
  - Storing and searching GEDI coordinates



App
User Interface
Map Screen
Capture Screen
Verify Screen
Main Screen
Functionality
GEDI Coordinate acquisition
Offline map/ directions
In range info
Offline data capture
Upload data
Verify status
App navigation and account settings
Store data in local device
Pull data to upload
System Communication
NASA GEDI
Mapbox
Encryption/ Compression
HTTP Server requests
Save app state and local settings
Server
Module
Information request handler
Database storage
Sends info to database
Verification and processing
Communication with outside services To verify data
Function
Takes data from GEDI coordinate database and sends to application
Stores user account data and captured data
Database
Database
Survey Info
User/data database
Contents
Table of all GEDI coordinates and what should be surveyed
User account data table
Uploaded information table

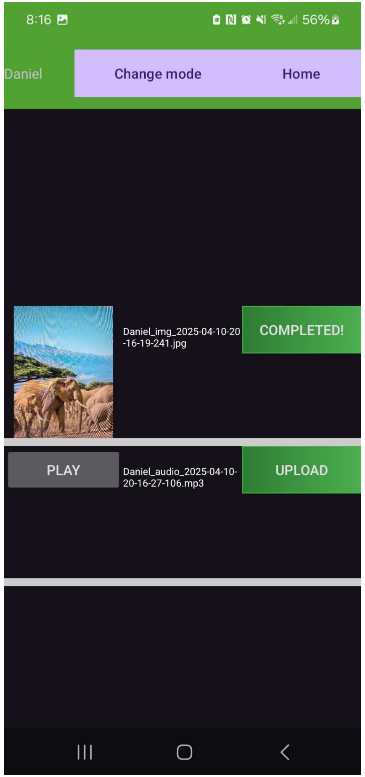
Prototype - Data Collection

- Recording audio/visual data
  - Ensure that the recorded data is within the needed coordinates
  - Records images and audio recordings to local storage
- Counting trees
  - The user can count the number of trees they encounter within the GEDI coordinates and that is uploaded to the server along with the audio/visual data

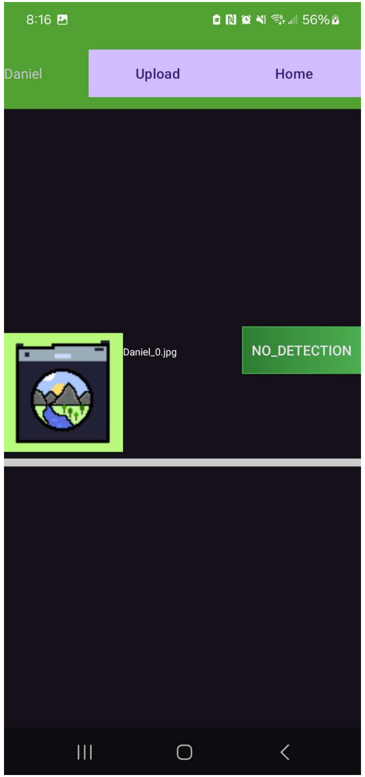


Prototype - Data Upload & Verification

- Upload collected data
  - Upload image/audio
  - Upload associated tree counts
- See status of data verification
  - Pulls users data
  - Informs user of the verification status


8:16
56%
Daniel
Change mode
Home
Daniel_img_2025-04-10-20-16-19-241.jpg
COMPLETED!
PLAY
Daniel_audio_2025-04-10-20-16-27-106.mp3
UPLOAD

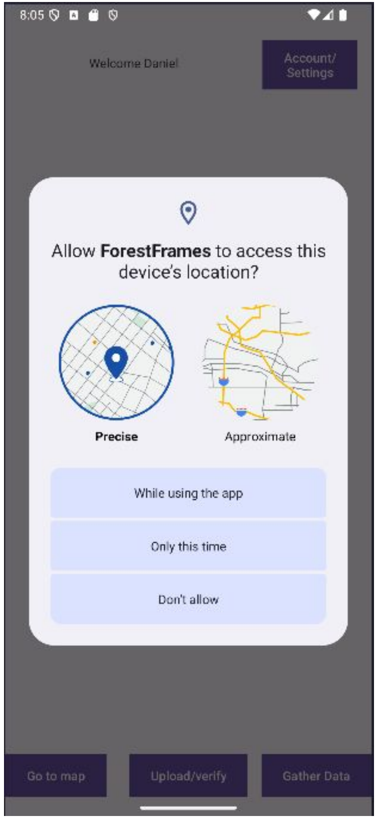
Upload Screen



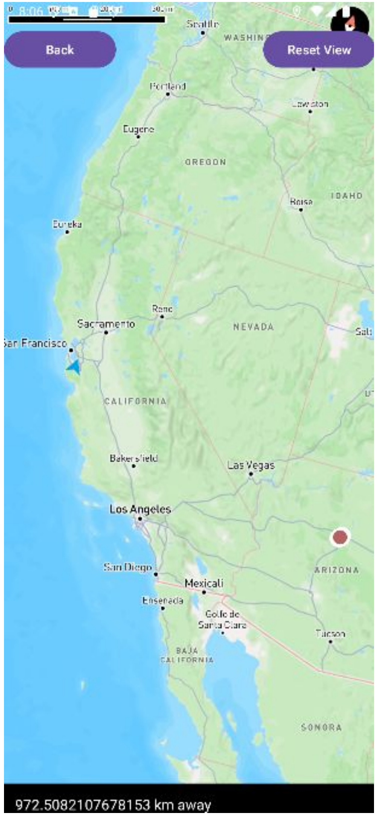
Verification Status

Prototype - Map Location Tracking

- Get Permissions
    - Prompt for precise location.
    - Ensure the user can't collect data without it.
- Track their location with a puck
    - Accurately track a user's orientation.
    - Actively update user location.



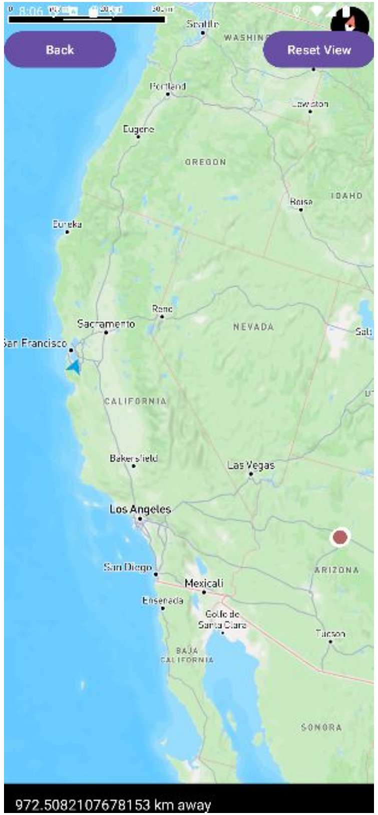
Allow **ForestFrames** to access this device's location?



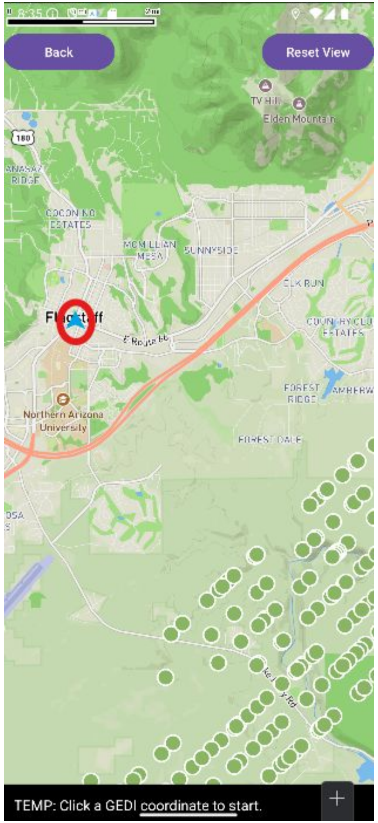
972.5082107678153 km away

Prototype - GEDI coordinates

- Extract nearby coordinates
  - ○ Check user location
  - ○ Request coordinates near user location
- Coordinates filtering
  - ○ Filter out 50 nearest coordinates from user location
  - ○ Filtering is done using K-D tree algorithm for efficiency



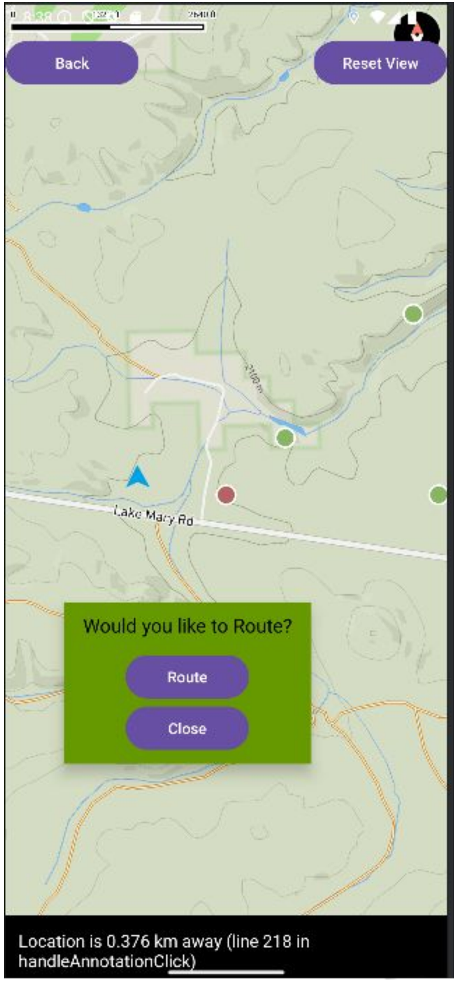
972.5082107678153 km away



TEMP: Click a GEDI coordinate to start.

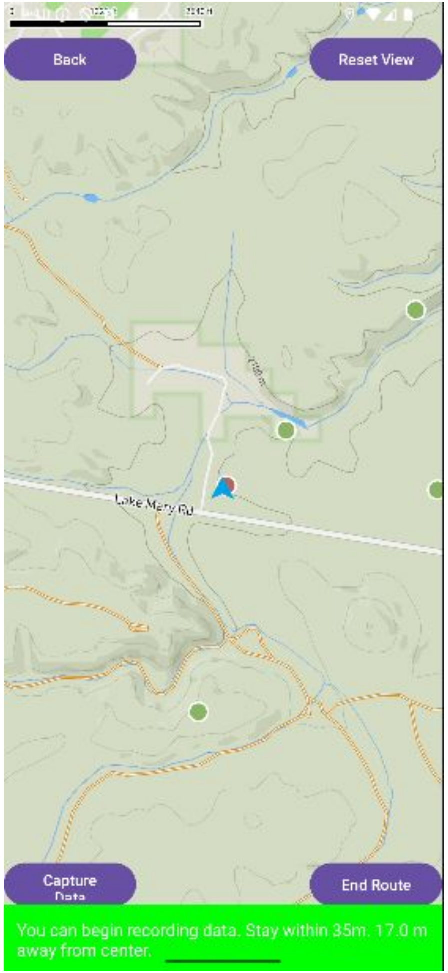
Prototype - Map Routing

- Choosing a Coordinate
  - A user can select a coordinate and see distance.
  - User can route to it if they want.
- Distance Tracking
  - A user can see how close they are.
  - A user will be notified when they are within an acceptable distance.



Would you like to Route?

Location is 0.376 km away (line 218 in handleAnnotationClick)

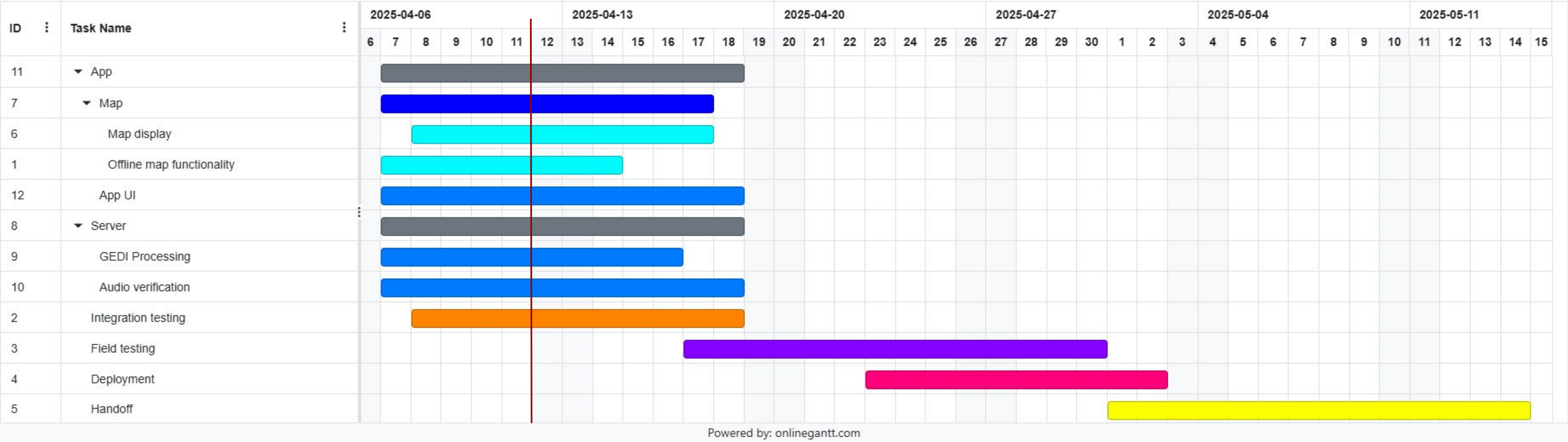


You can begin recording data. Stay within 35m. 17.0 m away from center.

Challenges and Resolution

- Offline Map View
  - Getting the view of the downloaded tiles is difficult. They do not work the same as setting original map.
- Coordinate Sorting
  - Finding a way to efficiently sort and store coordinates without taxing our database and server to help be cost effective as well as quick.
- Secure Network Data Transfer
  - Acquiring an SSL certificate and using it on the server for HTTPS requests, allowing our data to be encrypted over the network and prevent tampering

Schedule



ID	Task Name
11	App
7	Map
6	Map display
1	Offline map functionality
12	App UI
8	Server
9	GEDI Processing
10	Audio verification
2	Integration testing
3	Field testing
4	Deployment
5	Handoff

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- Finishing up development of key functionality
- Moving into integration and field testing before deployment and handoff

Testing plan

- Unit Testing - App
  - Will use JUnit for unit testing
- Unit Testing - Backend
  - Use Python ‘unittesting’ and ‘pytest’ libraries to conduct unit testing
  - Usage of mock database to simulate actions
- Integration Testing
  - Test responses of the HTTP requests between the server and app
  - Ensuring proper data transfer between server and database
- Usability Testing
  - Unguided ease of use of app
  - Readability of backend logging

Closing

- Our app will improve the accessibility of ecological citizen science to many areas unable to participate in it previously

- Prototype includes: data collection, data upload to server, location tracking, and map routing

- Currently finishing up development and working on app and backend testing

Thank you