MICHIGAN STATE UNIVERSITY

Project Plan Presentation

General Motors: Remote Wildlife Habitat Monitoring System

The Capstone Experience

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Fall 2024

From Students…
…to Professionals

Project Sponsor Overview

- Parent of Chevy, Buick, GMC, Cadillac
- Autonomous driving innovator
- Industry leader in environmental sciences

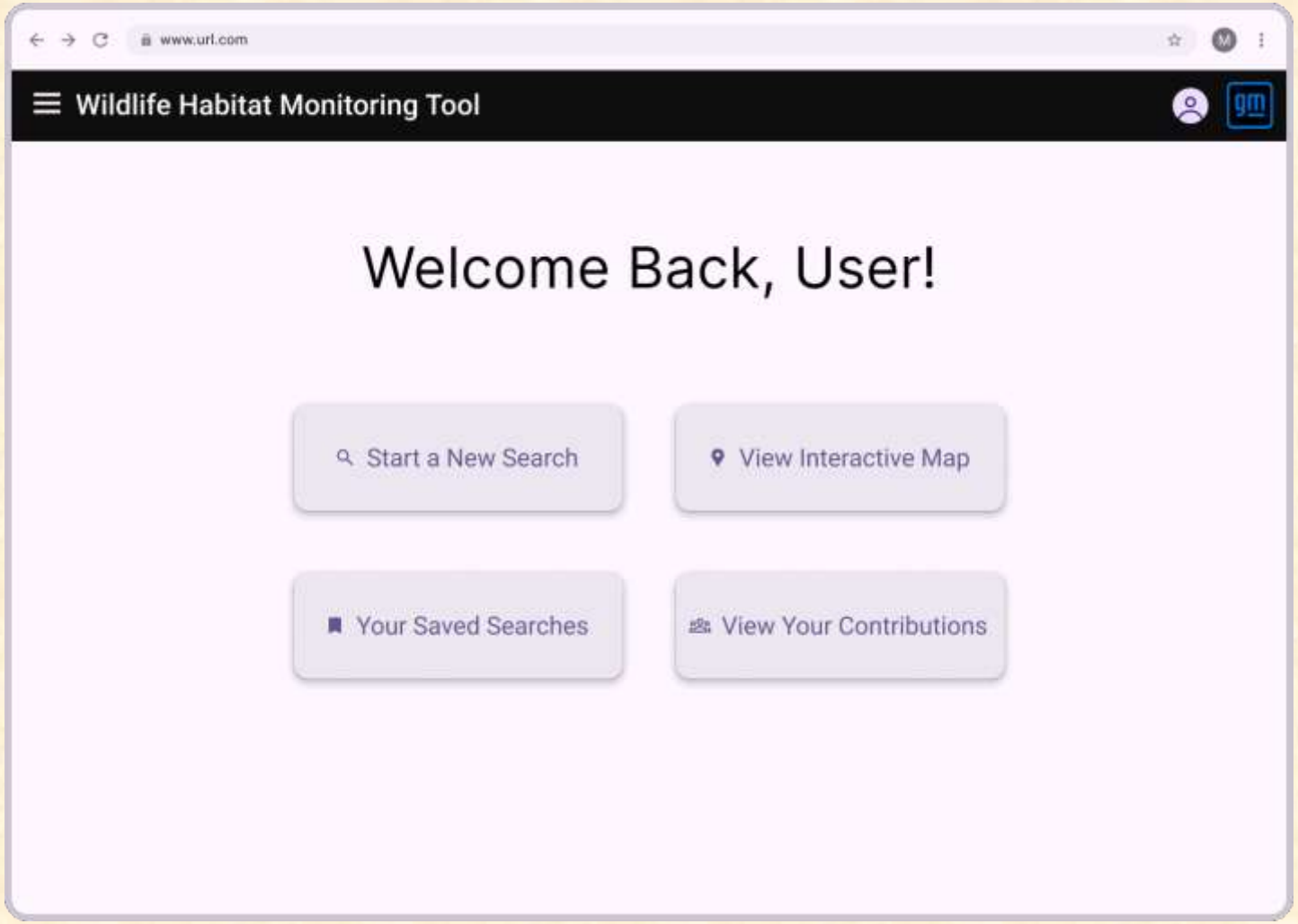
Project Functional Specifications

- **Problem:** Managing and analyzing biodiversity data across multiple independent platforms is time-consuming and complex, making it difficult for General Motors to monitor and support species in their habitats effectively.
- **Solution:** Our software centralizes biodiversity data, automates collection, and provides an interactive, user-friendly platform to document, filter, and analyze habitat species with ease, while allowing for on-the-go data uploads and geotagging
- **Impact:** By streamlining data management, our solution reduces manual workload, enabling GM engineers to spend more time on strategic conservation efforts, both in the field and remotely.

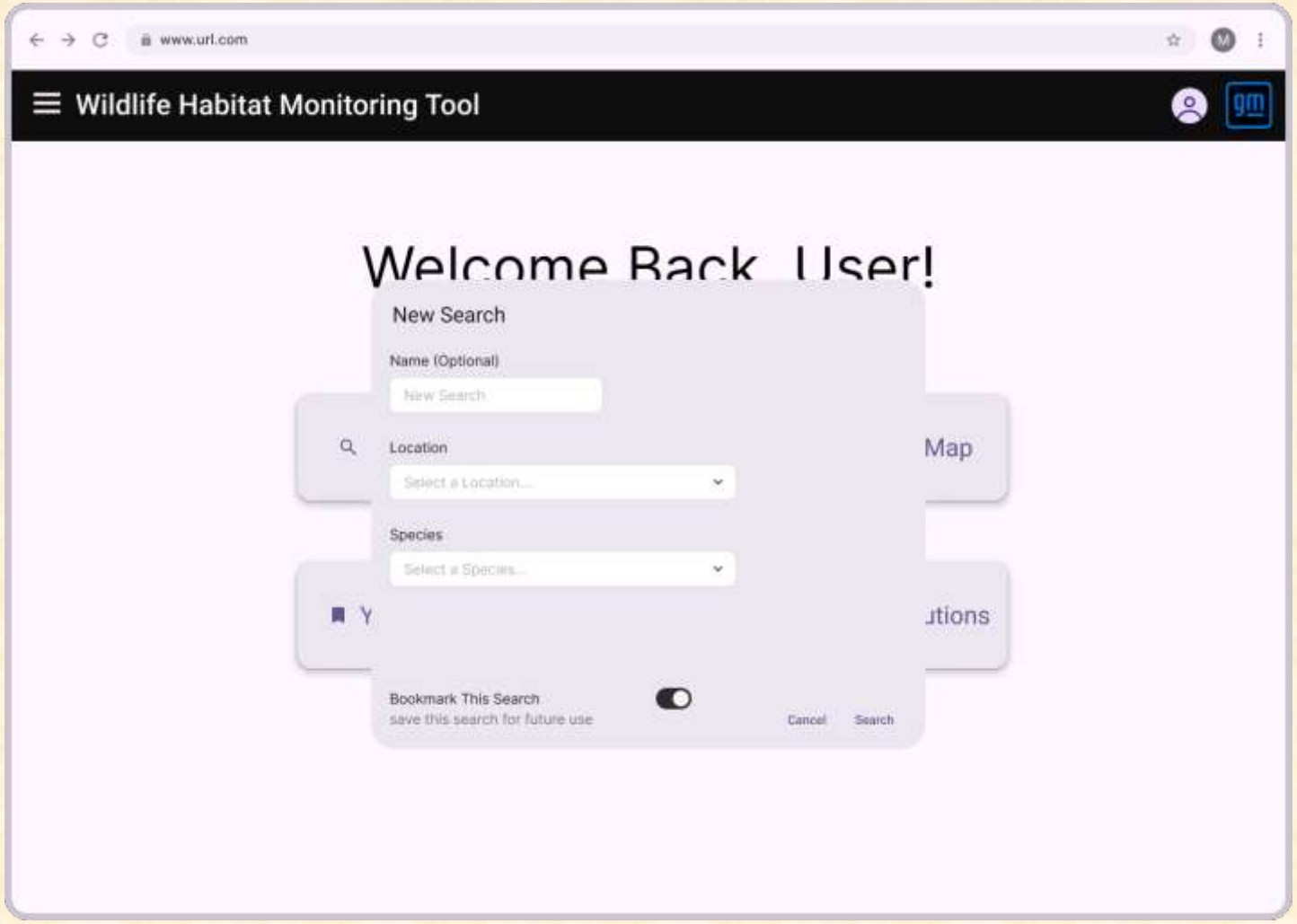
Project Design Specifications

- Web & Mobile Platforms
- Aggregates real-time wildlife data from multiple sources for a wide audience
- Interactive Map for Viewing & Submitting Data
- Database Search with Filtering Options
- Data Visualization & Export
- User Contributions & Saved Searches

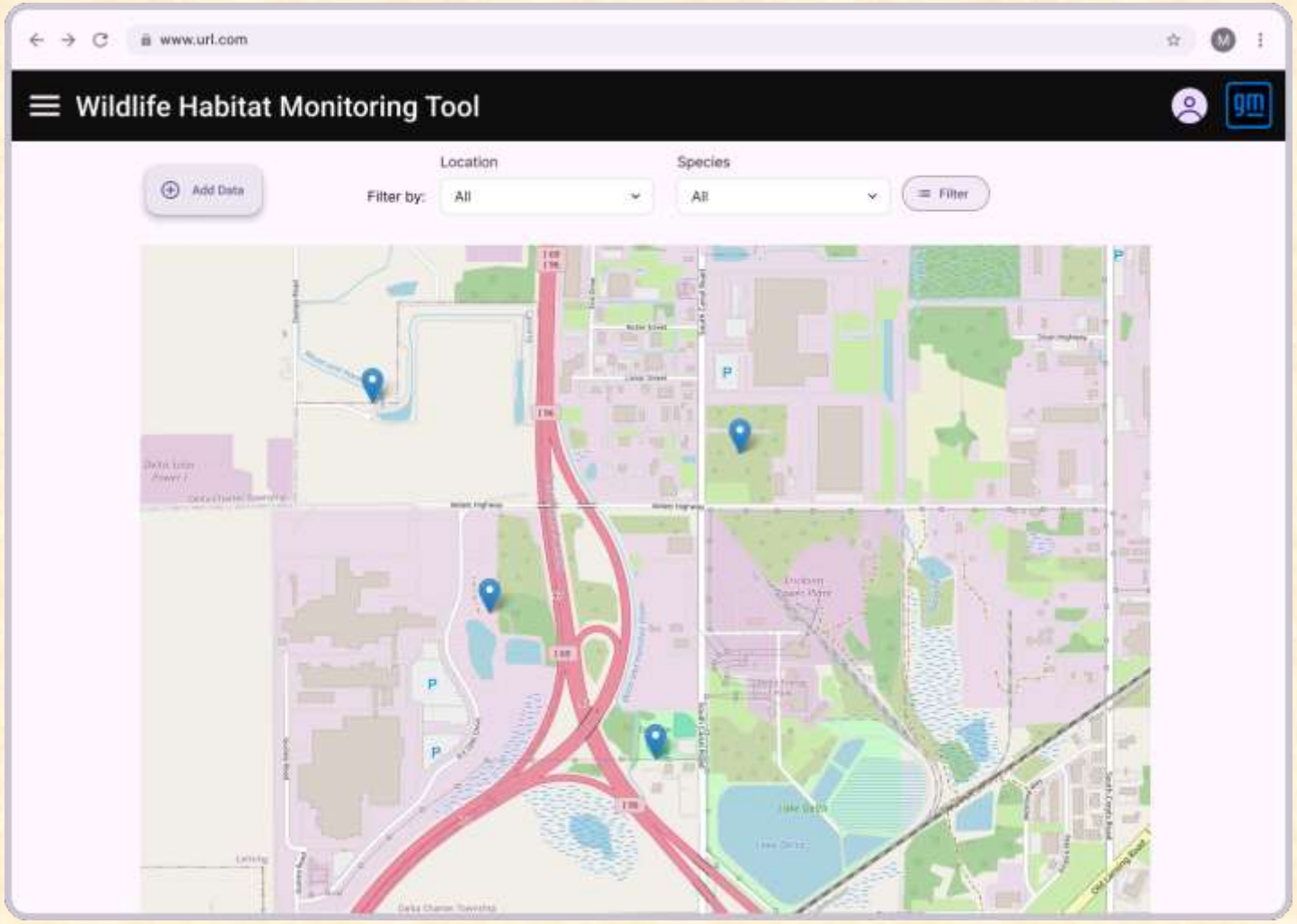
Screen Mockup: Home Page



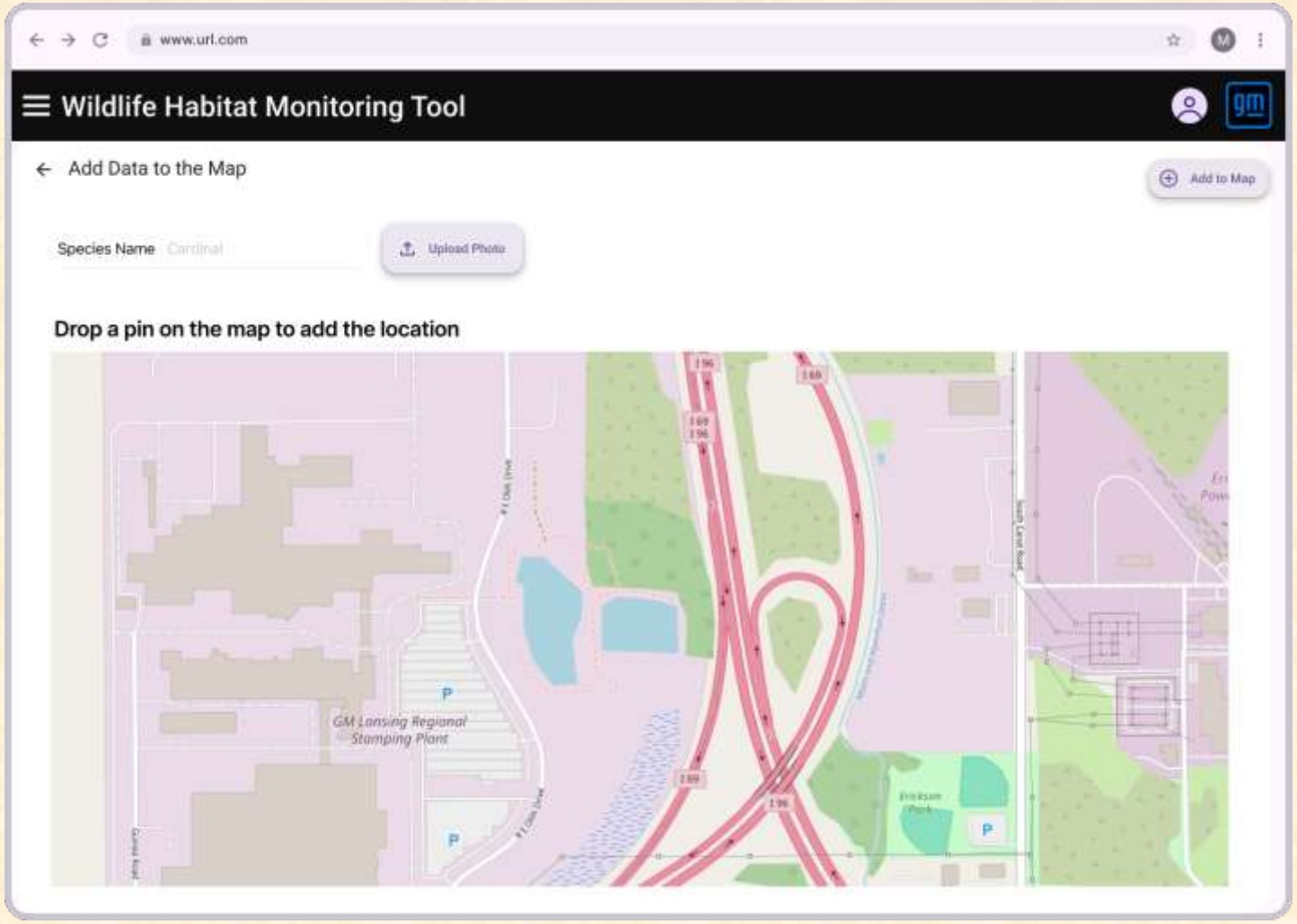
Screen Mockup: Search Popup



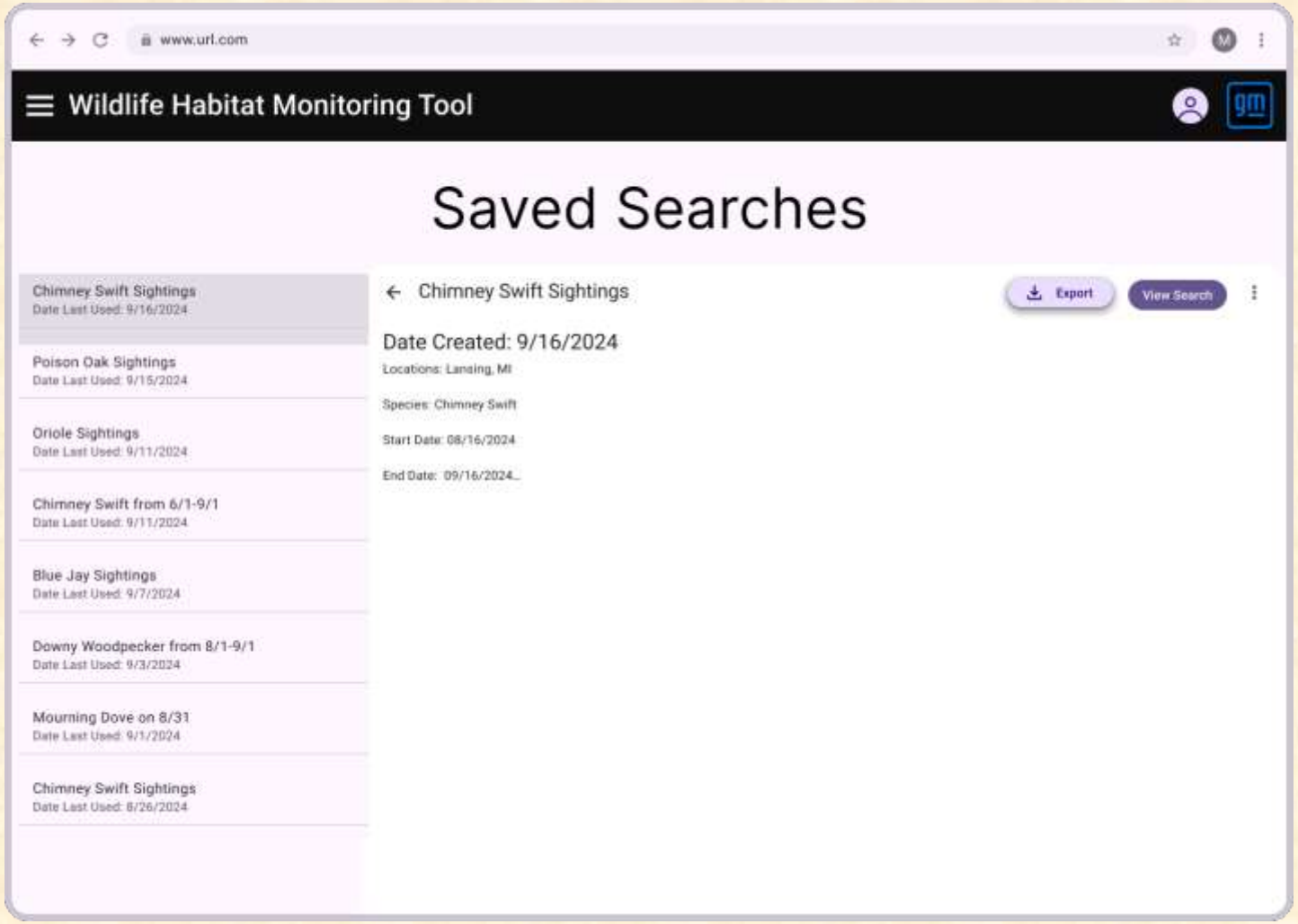
Screen Mockup: Interactive Map Page



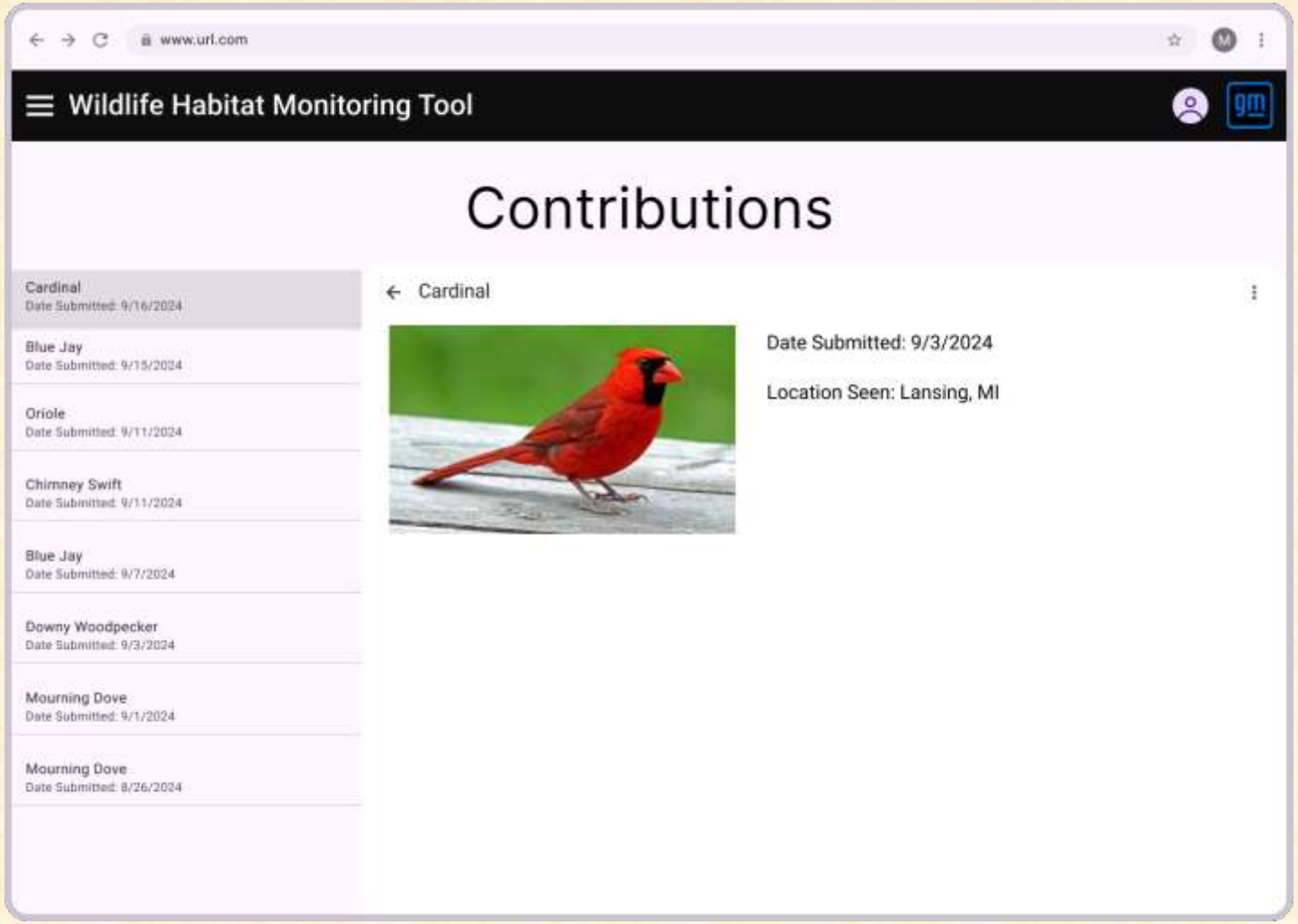
Screen Mockup: Add Data to Map



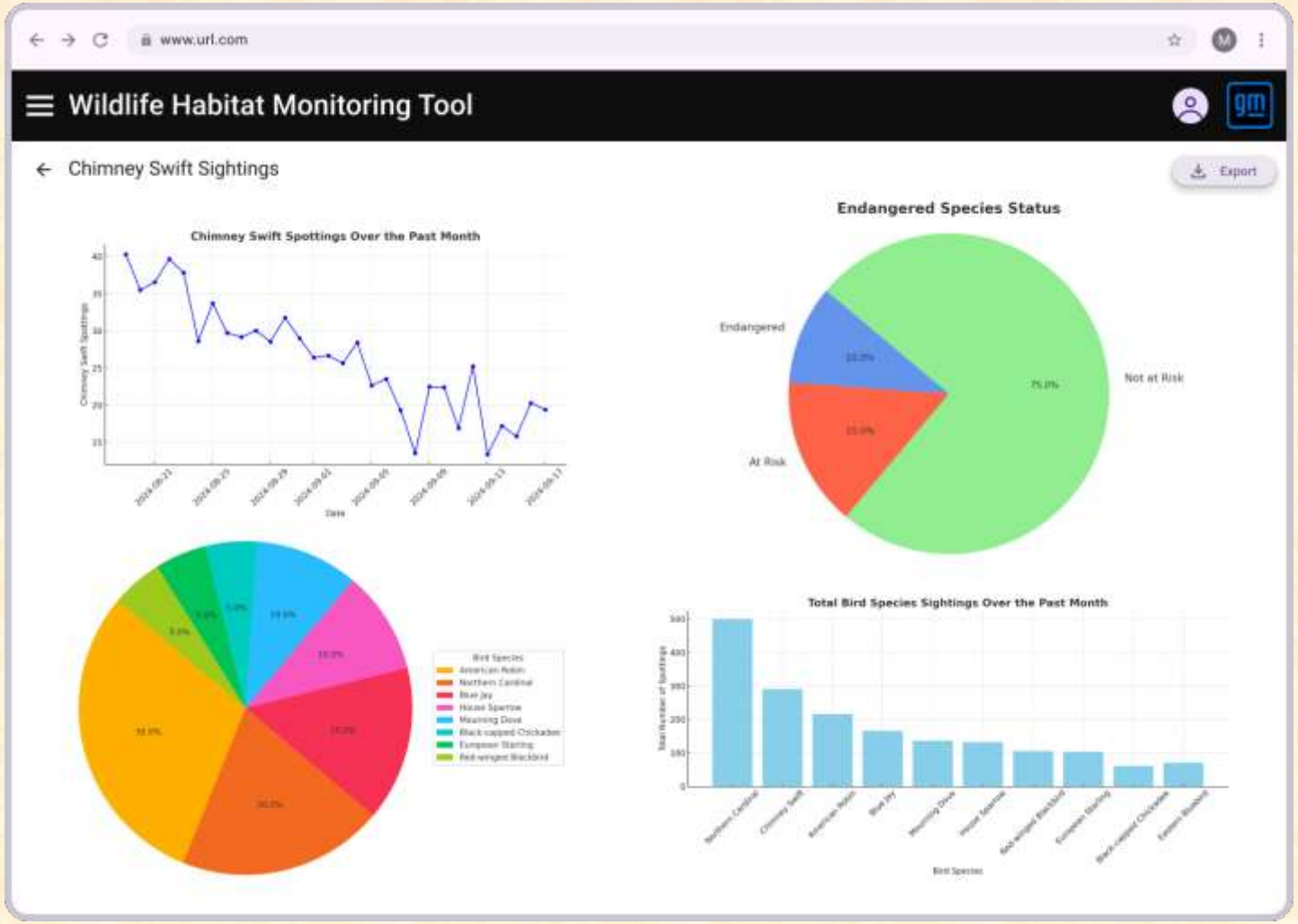
Screen Mockup: Saved Searches Page



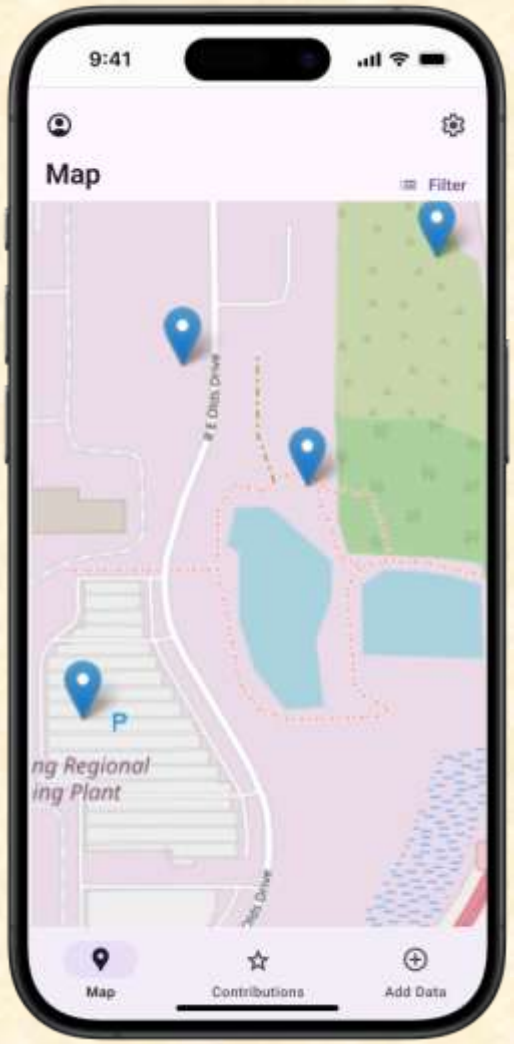
Screen Mockup: View Contributions Page

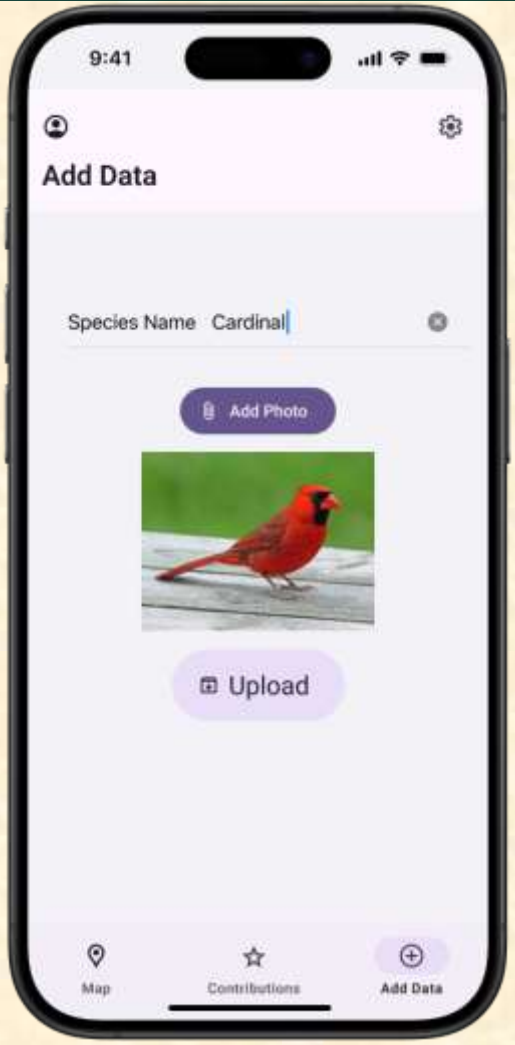


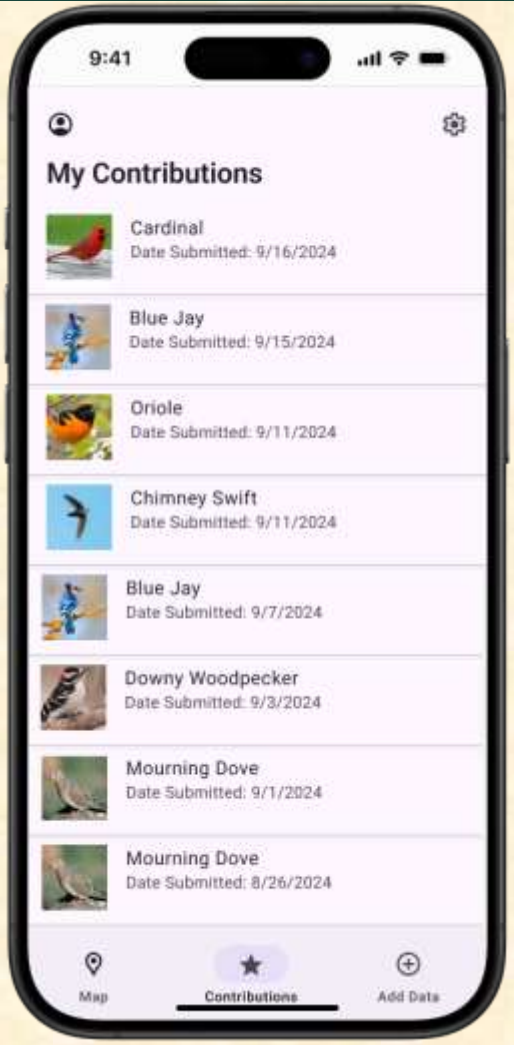
Screen Mockup: Data Visualization



Screen Mockup: Mobile Interface



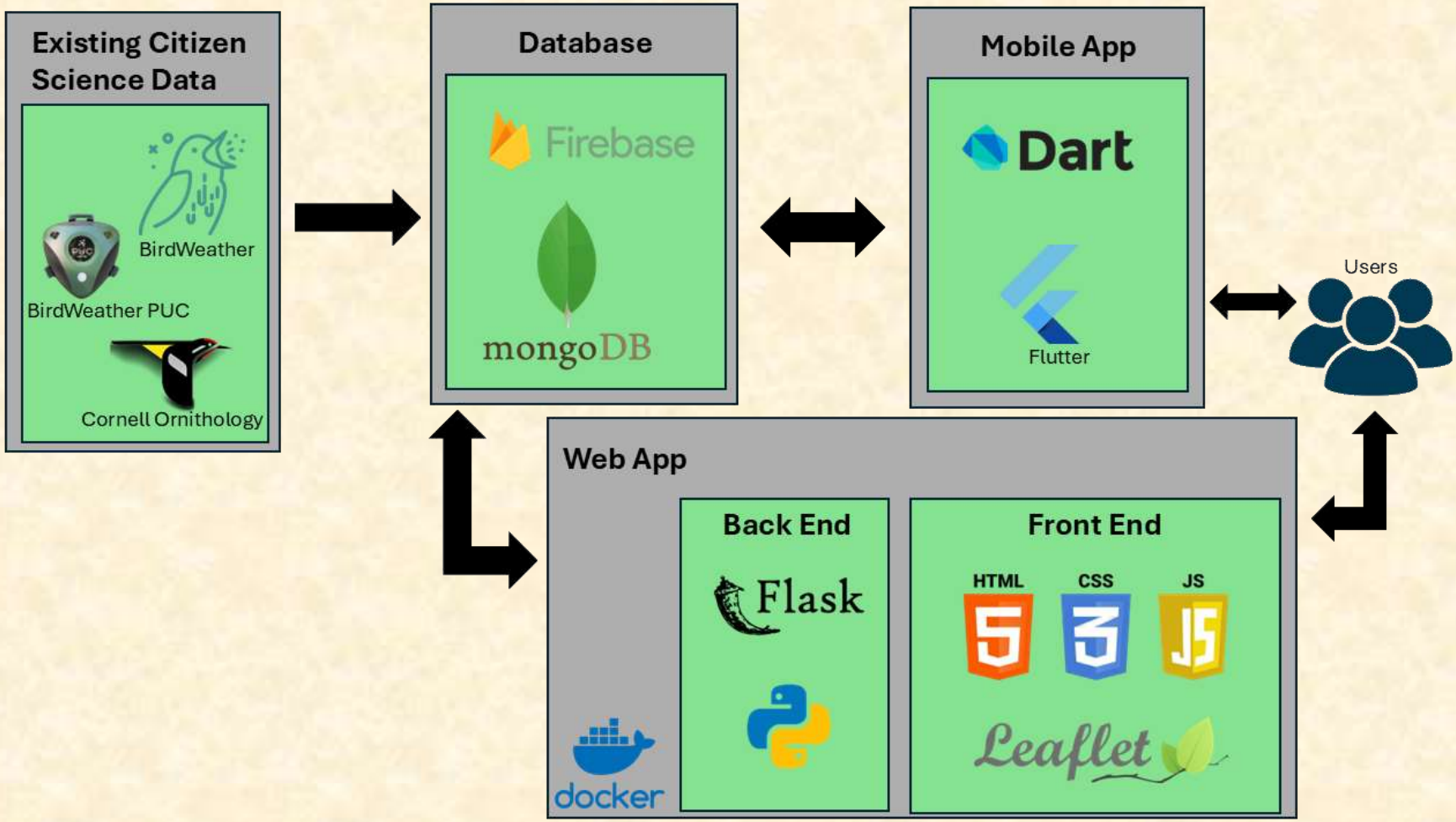




Project Technical Specifications

- Habitat Hardware Kiosk
- MongoDB Database Hosted on Ubuntu Server
- Web app using Flask and Python Framework
- PyMongo to Connect Database
- LeafletJS for Interactive Map
- Flutter and Dart for mobile app
- mongo_dart to connect to MongoDB

Project System Architecture



Project System Components

- Hardware Platforms
  - BirdWeather PUC – AI powered bioacoustics platform
  - Bird House/Camera – monitor offspring in the nest
- Software Platforms / Technologies
  - Docker – helps build, share, and run applications
  - Flask – enables quick and easy web application creation
  - Python – programming language to be used with Flask
  - LeafletJS – creating interactive maps on web applications
  - Flutter – enables multi-platform mobile development
  - MongoDB – storing wildlife and fauna data
  - PyMongo – bridging the application and database
  - Requests – enabling API calls from the application

Project Risks

- Accessibility of Data
  - Chance that some platforms will not have easily accessible data
  - Use of an ‘administrator’ account with further permissions may allow further data access and administration, where API’s and web-scraping fail
- Maintaining Real-Time Database
  - Our custom database needs to be persistent, mutable, and provide real-time updates to all platforms
  - We have identified MongoDB as the ideal platform for our web platform and Google Firebase as our ideal mobile candidate
- Graphical Data Aggregation
  - Web application needs to be able, given raw data, display intuitive and easy-to-digest visual representation and allow the user to export these graphics to actionable files
  - We have identified MongoDB Atlas Charts as a promising and streamlined framework for generating dynamic graphical data representations
- Live/Dynamic Geographical Analysis
  - We must utilize multi-platform geolocation services to dynamically mark data points on a virtual map
  - We have identified LeaftletJS as an open-source JavaScript library for mobile/web-friendly interactive maps, allowing for custom location marking and detailing

Questions?