


# CS486C – Senior Capstone Design in Computer Science

## Project Description

<b>Project Title:</b> Anti-Poaching Mobile App	
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### Project Overview:

Elephants are keystone species, meaning they provide ecosystem services such as seed dispersal, nutrient transfer across large gradients, and habitat creation from foraging, trampling, and upheaval of vegetation. However, elephants are continuously poached at astounding rates; it is estimated that 96 elephants are killed every day, or roughly one every 15 minutes. To curtail this immense problem, a variety of anti-poaching methods are used throughout Africa and Asia, such



as walking patrols, driving patrols, scent detection dogs, remotely piloted aircraft, and shoot-on-sight policies. These sorts of measures can have some positive impact when applied consistently and with adequate support, but anti-poaching resources differ substantially by country leaving elephants vulnerable in many locales. With the demand for ivory and rhino horn growing rapidly in China as the economy grows, solutions must be found that rely less on efforts at the government level, and more on leveraging the power of modern network technologies to empower local individuals working to protect these

megaherbivores.

We propose the development of a mobile application/web-app framework that takes advantage of widespread cellular coverage and increasing penetration of smartphone technology to allow wildlife rangers as well as local persons to monitor their surroundings for suspicious behaviors and easily report poaching incidents; in a sense, the concept is to explore a crowd-sourcing approach to the anti-poaching problem. Data uploaded by Rangers and local participants will be combined with other regional datasets to produce both real-time displays of poaching activities and highlight developing threats, and will support retrospective analysis of trends and continuously updated regional threat assessments provided to the local and regional community.

We have many on the ground contacts in these regions that will help us to determine accuracy of the tool by comparing reported activity patterns to those observed on the ground.

A prototype solution could focus on the Android platform but, to maximize universal adoption, the app should be built on a cross-platform framework to allow generation of both Android and iOS apps from the same codebase (e.g. Ionic, React Native). Some specific features of this technology solution would include:

### **Basics (minimum viable product): barely proves the concept**

- Modern mobile app architecture, based on a mobile application backed by a cloud server.
- A basic role-based user authentication system that supports admins, authorities (which we'll call "Rangers" for simplicity), as well as public users.
- Allows users to send in reports of suspicious activities: poaching incidents, snares, fence damage, vehicle inspections, suspicious tracks, injured animals etc.
- If available on the device, uses the GPS on the phone to attach a precise location to the report. Else allows entry of location by textual description (e.g. "10 miles northwest of Anytown").
- Allows Rangers to view the app to receive submitted reports in near-real-time.
- Notifications to Rangers when new reports come in.

### **A complete solution: Features needed in a truly usable product**

- A matching web application to provide public information and provide a GUI for easy administration and configuration of the system.
- Product uses best practices in "internationalization"; GUI can be switched to several languages; initial languages will include English and French. Clients will provide access to appropriate linguistic support.
- A more complete user management system with editable user profiles and preferences. Allows creation of new users by admins, as well as editing of certain profile fields by users.
- A map-based GUI for plotting/viewing/browsing reports. Can easily see time and place of report; can click into a "pin" to see the full report.
- More advanced reporting capabilities, e.g., can use reporter's current location, or allows reporter to show (drag/place pin) the location of an incident different from their current location.
- Allows using the device's camera to take/attach picture to a report.
- Ability for admins to assign responsibility for investigating a given report to specific Rangers/Teams.
- Dashboard on app for authenticated Rangers shows all reports, but highlights those assigned to them.
- A dashboard screen for admins/Rangers that summarizes all current/recent activity on a timeline.
- Able to change status of reports (new, assigned, resolved, etc.)

- Supports anonymous report submission (no identifying information captured or stored) to protect participants from retribution.
- A public interface on both mobile and webapp that allows public to see reported poaching activity
- Provides a “danger meter” which essentially shows current poaching risk, which is estimated empirically based on historical activity, time of year, lunar cycle, etc.
- Provides a data request form for researchers from government or universities to download the data from a particular region, time window, or from a particular species.

### **Fancy extras (stretch goals)**

- Some sort of gamification (street cred, points, etc.) to motivate locals to participate and report suspicious activities.
- Ability for authorized users to use graphical tools to visualize and investigate poaching activity reports in the system, e.g., visualize the number and type of instances over custom timeframes.
- Ability to generate monthly and yearly reports based on reports archived in the DB.

During this time of unprecedented stress on biodiversity, park rangers need tools to protect elephants with actionable information that this app will provide. This app will close the gap between data scientists and on-the-ground conservation efforts to help preserve forest elephants, a critical endangered species, and can be used in any country. We will work closely with our collaborators in South Africa, Gabon, and Borneo to develop the app for usability, relevance, and accuracy.

### **Knowledge, skills, and expertise required for this project:**

- Knowledge of mobile application programming frameworks, with particular emphasis on cross-platform frameworks like Ionic and React Native.
- Knowledge of modern Web2.0 programming techniques required to develop the administrative web app
- Knowledge of back-end server and database technologies, with emphasis on configuration and deployment of cloud-based server resources.

### **Equipment Requirements:**

- There should be no equipment or software required other than a development platform and software/tools freely available online.
- A cloud-based server will eventually be required as a deployment platform. Development can be done on a free-tier server available from AWS. At product delivery, the client will take over this server and any future costs.

## Software and other Deliverables:

- The software applications as described above, deployed and tested successfully with simulated but realistic data. Must include a complete and clear User Manual for configuring and operating the software.
- A strong as-built report detailing the design and implementation of the product in a complete, clear and professional manner. This document should provide a strong basis for future development of the product.
- Complete professionally-documented codebase, delivered both as a repository in GitHub, BitBucket, or some other version control repository; and as a physical archive on a USB drive.