A Proposal for a Web Application for Location Analysis

Team Location Analysis
Joey Lemon

Abstract—**There is strong potential to realize some benefit to the development of software that would perform an in-depth analysis and presentation of a user's location data. This proposed software would include a mobile and web application to obtain a user's location data and visualize the data in a browser.**

I. INTRODUCTION

The project proposed in this document will result in an end-to-end suite of software to discover location data of a user, upload the data to a remote database, perform analysis on the data, and visualize the data in a consumable and simple format. Such software would provide several benefits to a user:

- Observing exactly where a user spends the most time, both in their local town and in the context of the entire globe.
- Observing the furthest and shortest distance a user has traveled in a single day. These data points could even reveal information to the user such as how many miles they have added to their vehicle in a timeframe.
- Observing how often a user is on the move.
- Allowing a user to remember where they have been recently, in the event that they have forgotten, or they need to provide evidence of their travel history.

The motivation behind such a project stems from the general curiosity of the members. Understanding where time is spent is useful for potentially making decisions in the future. For example, one can observe how long they spend at class and at what time they tend to leave campus. Based on this information, one can then tell their peers when to expect them to be free on any given day. Additionally, having the ability to rank one's furthest trips across the world is a fun fact to share with peers. This data could also be able to calculate the total average speed of a user, both walking and driving, that could satisfy some users' curiosity.

II. TECHNOLOGY

This project will require the usage of several technology stacks to be able to acquire, store, and analyze the data. Specifically, this data collection process will require a different technology for each step.

To acquire the data, a mobile application will need to be installed on the user's phone. This application will be written in Swift to target most iOS devices. Apple provides several development kits to developers to utilize the phone's built-in functionality, with one development kit being the core location service. This service allows the application to obtain the geographic location of a device, with detailed information such as latitude, longitude, altitude, and accuracy. This service makes use of Wi-Fi signals, GPS, Bluetooth, magnetometer, barometer, and cellular hardware to obtain a highly accurate reading of the user's location. The crucial aspect of this service is its ability to run in the background without the application being open. Therefore, any time the user's location changes, the data is instantly available and ready to be transferred.

The readings coming from the mobile device will be immediately transferred to a remote database operating in the Amazon Web Services (AWS) cloud. The database will be based on Amazon's DynamoDB database system. To interface with the database, a RESTful API service will be constructed with Node.js via the AWS Lambda Function capability. This API will perform rudimentary data transformation to conform to the table structure of the database. The most important aspect of the API is its ability to asynchronously receive user's location data and securely store it in the database.

Finally, a React frontend web application will be utilized to analyze and visualize the data. For example, a heatmap can be used to observe which locations on the globe are most frequently visited. This heatmap

visualization can be performed through a plethora of open-source libraries, one of which being heatmap.js. Basic grid web layout standards will be used to present information such as furthest distance traveled, frequency of travel, and recent locations visited.

III. DATA

As described previously, the data coming from the mobile device will include information such as latitude, longitude, altitude, and accuracy. This data is sent directly to a remote database. Therefore, one table in the database will describe each user of the application, including their unique identifier number, their name, and their status to describe whether they currently wish to upload location data. Another table in the database will host each individual location gathered throughout the lifetime of the application. This table will have columns including a unique identifier number, a reference to the corresponding user's unique identifier, the latitude, longitude, accuracy, and retrieval timestamp.

IV. TEAM

The team behind this software consists solely of Joey Lemon. Therefore, the responsibilities include the development of every aspect of the software, including the mobile application, the API, and the web application. Below is a tentative schedule to describe the timeline of the project and its milestones:

Date	Activity
Tuesday, Sep. 28	Finalize the project proposal to outline the technology and development of the project. Begin work on the project.
Tuesday, Oct. 12	Finalize the API and database to store and retrieve all of the collected data.
Tuesday, Oct. 26	Finalize the mobile application with location tracking capabilities.
Tuesday, Nov. 16	Finalize the web application with data analysis and visualizations.

Table 1. A tentative week-by-week schedule for project milestones

V. EXPECTED OUTCOME

This project is intended to result in a usable and helpful suite of software designed to perform analysis on a user's location data in a completely hands-off manner.

The frontend web application will be designed using modern frameworks and technologies to provide an easy-to-use and simplistic visualization of the analyzed data. The mobile application will work entirely in the background and will require no effort by the user. The mobile application will hopefully be entirely invisible to the user as the location data is constantly streamed to the remote database. Additionally, the user will always have the option to pause and resume the streaming of location data as they please to respect their privacy.