CS490 Senior Design

Product Backlog

MyMapper

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Contents

1. Problem Statement

Although there are many mapping applications currently available that can show you the location of any building or establishment, it is currently impossible to easily and efficiently locate moving points of interest. Our application aims to do just that.

For our senior design project, we will design and implement an application to model the geographic locations of various points of interests in real time. The application will be different from other similar projects because it will use a distributed in-memory database system in its backend, making the transactions very efficient and safe for big data. Additionally, we will support dynamic moving objects data in the map and support queries on not only static POIs (Point-of-Interest) but also moving objects.

2. Background

To collect the locations of all static points of interest, we will use OpenStreetMap's open data set. As this geographic information map may be very large and diverse, we will use a distributed in-memory database system to store the map data and object information. We will also support moving objects and dynamic queries.

2.1. About SPARK

Apache Spark is a fast and general-purpose cluster computing system. It provides high-level APIs in Java, Scala and Python, and an optimized engine that supports general execution graphs. We will use SPARK to save all our data and make sure any transactions that query the data are quick by utilizing the MapReduce model.

2.2. About Open Street Map

OpenStreetMap(OSM) is a collaborative project to create a free editable map of the world. We will get the information of building, street and non-moving objects by using the OSM data set.

2.3. Target Users and Domain

We are targeting anyone that regularly searches for the locations of any type of building or establishment while traveling or planning a night out. Specifically, we are targeting:

- Travelers who wants to find nearby POI or tourist attractions.
- People who wants to find nearby taxis or busses.
- Drivers who wants to find nearby police cars.
- Commuters who want to avoid areas of heavy traffic or congestion.
- Entrepreneurs who wants to find a good location for their company

For this project, we are extending the domain of the application of SPARK system to the location based map service, that will support various queries and visualize results in a map interface.

2.4. Similar Products, Their Limitations and Our Resolution

All other similar mapping applications (Google Maps, Bing Maps, iMaps) have support for only static points of interest. Unlike these products, MyMapper will support real-time queries on moving actors, like busses, police cars, etc. Additionally, the backend datastore of our product will be implemented using an in-memory distributed database cluster, potentially making transactions with our product much faster than those seen with any similar product.

3. Requirements

3.1. Functional Requirements

As a user (such as drivers, travelers etc), I want to:

- visualize my query results in a web based map interface.
- query for nearby POIs (Point Of Interests, including locations and buildings etc.).
- get the real time data of any moving objects in or around a specific area.
- use the query instance while I'm moving (the query moves follow the user and update results in real time).
- check how busy or congested an area is, such as checking how taxies are there in a giving area.
- view the closest object or POI of any type.
- create an account with the system so the application can deliver personalized results. (If time allows.)

As an administrator, I want to:

- generate moving objects data and insert them into the Spark database.
- add/delete/modify already existed data in the database.
- edit build-in queries in the system and provide more query options to the end user.
- have the ability to update the map data in the database when OpenStreetMap's repository is updated.

As a developer, I want to:

- distribute all map and object data into multiple machines in an efficient manner that allows for fast queries.
- generate the whole map in one user machine.
- update the locations of moving objects in real time, which requires a fresh batch of data inserted at regular, short intervals.

3.2. Non-functional Requirements

3.2.1. Performance Requirements

As a user I want the query information to be real time.

As a user I want the moving objects' location to be updated without too much lag.

As a user I want to have an intuitive and clear UI.

As a user I want the information displayed to be accurate.

As a user I want the application to rank the results I find.

As a user I want the application to return as many results that satisfy my requirements.

As a user I want when the application crashes will have no impact on the other processes currently running on the machine.

As a user I want the application to gracefully handle and process a heavy amount of data.

As a user I don't want my phone or computer goes slow when i am using this application.

As a user I want to see a pop up from the application if my internet connection is lost.

3.2.2. Platform Requirements

As a user I want to access the web application from any major type of browsers.

As a user I want to access the web application from any type of devices such as phones, tablets and computers, in which the screen size may vary.

As a user I want to operate this application always in the same way, even when I run this application on different platforms.

3.2.3. Process Requirements

As a developer, we will use github for source control, and rely on it to store finalized versions of all iterations of our design documents, in addition to source code.

As a developer, Google docs and spreadsheets used by team members for collaboration will have final revisions duplicated to the github in PDF or other common format for recordkeeping purposes.

3.2.4. Other Requirements

As a user, I want to see a user guide or tutorial when I use this application for the first time.(if time allowed).

As an administrator, I want to validate and sanitize any user-inputted information for security concerns.

As a developer, I want the system to support 100 concurrent users querying and using the application.