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SENIOR PROJECT PROPOSAL

Title: Raether Map

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1. Background

My senior project, named Raether Map, is an Android application that allows users to locate library materials, particularly books, DVDs, and study rooms. I work part-time at the Trinity Library's Circulation desk. When working here, I notice that many students, especially freshmen during the first few weeks of school, have difficulty finding books or rooms in the library. They can go to the circulation desk for help or use the paper map. However, this process is inconvenient because the paper map can be hard for students to comprehend and might not contain temporary or updated information such as the location of an event held in the library or change in location of a classroom in the library. The library has tried creating an updated map of the library with more comprehensible location's names, but that means some other old information was deleted to make space for the new visual effects. It is also inefficient to have many students coming to the circulation desk asking the same question about a book or the location of a room. With a mobile indoor map, students can find the best path to a book or a room right on their phone.

2. Goals and Objectives

- Complete a map of the library on Android that generally allows user to search for the shortest possible path to the library material the user is looking for (by the shelf).
- Learn Android programming to develop a complete Android application, this includes:
    - Front-end (client-side): Understand the principles of designing clean, nice, and user-friendly user interfaces for the application.
    - Back-end (server-side): Retrieve and study the database of all library materials. Find a way to build the application's separate database to maximize the performance of the application.
- Understand the criteria for indoor mapping and find the most suitable tool to create the indoor map on Android.

3. Significance

Currently the library only has a website for the catalog and paper maps of the building. Therefore, students and faculty would need help locating the library resources they are looking for. Raether Map is a combination of library catalog and indoor mapping. With this application, users can conveniently search for and locate library resources. In addition, the app will save library staff from tons of repeating questions about books' or rooms' location, at the same time providing users with a more private and personal experience in the library. There are existing

applications for mapping library on demand, such as the Google Indoor Mapping project or StackMap. Raether Library is currently well mapped on Google Map. However, this only allows us to see where things are, but does not provide a direct search for book's location or broader search of library materials (search through topics or author). On the other hand, StackMap does provide both catalog and mapping features. However, the school would need to pay for this service. Moreover, since StackMap is a mapping tool for many libraries in the US, it is unlikely to offer customized features for Trinity Library. Having worked at the library for two years, I understand the wants and needs of the library staff as well as the students and faculty who go to the library, thus will be able to pay attention to the details that serve Trinity Library well.

4. Methods and procedure

To develop the UI for the app, I will use Android Studio as the IDE. In Android Studio, XML is used for designing layouts, while Java is used for designing the logic of and among components. Eclipse is also an IDE that can be used to build an Android app. However, I chose Android Studio because it is designed specifically for Android app design. In addition, Android Studio has "better code completion, more organized arrangement of projects, and higher stability than Eclipse".

Android has three ways to save data, share preference (for key-value type of data), file (for photos, videos), and SQLite (for big amount of data). In order to save the information of all the books in the library, I will use the relational database, particularly SQLite, the only database system that runs on Android. A higher level would be to save all information in the cloud or connect to the online database of the Trinity Library website.

For the indoor mapping, I am planning to use the SDK from IndoorAtlas. One special requirement for indoor mapping is that it needs to work without the support of GPS, Wi-Fi, and cellular signals. IndoorAtlas meets this requirement by using gyroscope and magnetometer for identifying the location of the user. Gyroscope "senses the angular velocity along the rotational axis." On the other hand, magnetometer is like a compass that "measures the magnetic field". Other methods for tracking the location of user is using cellular signal, GPS (which is not recommended because GPS is not good for indoor location tracking), or Beacon to give out Bluetooth signal that can be used to locate devices.

This project will be test-driven, in which there will be unit tests every time a new feature is created. I will use TestNG for unit tests.

5. Expected outcomes

The expected outcomes of this project include deliverables on Android devices, a paper consisting clear and detailed documentation of the project, and a presentation on the application.

Overview of the application features

Most basic and core feature of the app (Must – haves):

- User enters information of a book (call number, name, major) or a room in the building. If the query is valid, the result will be the approximate location of the bookshelf holding the book (if the book is available) or the exact location of the room.
- The map will show the shortest possible path from the user's current location to the result destination. This minimum path calculation should account for floor differences.
- As the user walks, his/ her location will be updated, but the path will not be updated until the user hits refresh.

- The user should feel comfortable zooming in and out and rotating the map to have a better sense of direction.
- The app should not depend on Wi-Fi and cellular signals.

More advanced features, ranked in order of priority (Nice – to – haves):

- If the query the user enters does not totally match the result, the app will suggest possible results that could be what the user wants.
- User can search by topic, author, year, or course requirements. The search will give a list of related books. Then the user can click on each item to see where the book is.
- Step by step navigation.
- Users can book study rooms through the map.
- 3D Map: The objects in the map will be represented by shapes like cubes, spheres, … that roughly resemble the objects.

6. Timeline

Time	Task
Sept 18 – Oct 1	• Do more research on the most reliable and efficient method for indoor mapping. Currently the best option is IndoorAtlas. Other options are Beacon, Wi-Fi, and GPS. • Set up the indoor map User Interface. • Create the simple Search interface.
Oct 2 – Oct 15	• Set up the indoor map User Interface. • Create the simple Search interface.
Oct 16 – Oct 29	• Finish setting up the map interface. • Use mock data first to test completed UIs. • Get the database of the Trinity Library
Oct 30 – Nov 12	• Study and get familiar with the database of Trinity Library's properties, including physical books, articles, magazines, etc.
Nov 13 – Nov 26	• Add the location information to the dataset for the properties of the library.
Nov 27 – Dec 10	• Continue working on the database: Find an efficient way to add the new attributes that define the location of items or rooms in the library. • Prepare for the the mid-term presentation
Dec 11 – Dec 24	• Continue working on the database if necessary • Give presentation on the project at the end of the fall semester
Dec 25 – Jan 7	• Continue working on database if necessary • Add new feature: shortest path possible
Jan 8 – Jan 21	• Continue working on the database if necessary • Add new feature: suggested results for incorrect input search
Jan 22 – Feb 4	• Add new feature: more advanced search (by topics, authors, subjects, years, etc.)
Feb 5 – Feb 18	• Continue developing the additional features listed above if necessary/ possible.

	• Revise the tests written for these features.
Feb 19 – Mar 4	• Do research on creating server for Android application • Start creating server for the application
Mar 5 – Mar 18	• Create server for the Android Application
Mar 19 – Apr 1	• Continue working on the server side for the application
Apr 2 – Apr 15	• Gap time for unexpected problems/ project delay
Apr 16 – Apr 29	• Gap time for unexpected problems/ project delay • Prepare for the presentation
Apr 30 – May 13	• Prepare for the presentation.

7. Special considerations

It is very important that I get access to the database containing information of the items in the Library so that I can use the data for my application.

The minimum requirement for using IndoorAtlas SDK is as follows:

- SDK minimum API level 10 (Gingerbread)
- Physical Android device (emulator is not supported) with Wi-Fi connectivity
- Gyroscope and Magnetometer are preferred.

If there happens to be something wrong with IndoorAtlas during the development process. I might need to use Beacon as a backup plan for indoor location.

8. References

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