University of Arkansas – CSCE Department
Capstone I – Final Proposal – Fall 2021

University of Arkansas Campus Map

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Abstract

The problem is that there is not an application to help students who may not have time to find their respective classes before school starts. The objective is to be able to give students a view of the campus to help students be able to navigate to their classrooms without having to step on campus or risk being late to class. The significance of the project is to be able to have students, parents, faculty, and guests be able to find their way around campus easier.

1.0 Problem

The problem is that there is not an efficient map for students to use to be able to find their way around campus easily. The current solutions that are available are using Google Maps or the current campus map, but neither of those options show the inside of the buildings to be able to find the rooms easier.

The impact of not having the solution is the first week of classes or the week before students meander through each building trying to find the proper rooms for each of their classes. Students can be late to their classes if the location of the classroom is difficult to find.

2.0 Objective

The objective of this project is to create a map application focused on the University of Arkansas campus that will offer more features and usability compared to the current campus map already offered by the university. This application will be interactive and offer features such as navigation, interior map view of buildings, and allow users to save marked locations. The Google Maps platform will provide easy implementation for most of these desired features, and extra development will have to be done in order to provide the interior views of buildings on campus. In order to accomplish this part, building floor plans will need to be acquired and adjusted to this app's needs. The end goal is to maximize ease of use and functionality for this app by creating a user interface that is easy to learn and uncluttered.

3.0 Background

3.1 Key Concepts

Flutter/Android

We chose to use an Android app because a student will most likely only have a phone on them to find the location of their class. We are using a framework called Flutter to build the Android app. Flutter is a framework that is cross platform, created by Google and is built on a language called Dart. Dart is a language created by Google and is very easy to learn as it is an object oriented language that is very similar to other object oriented languages.With this we can make an app without specifically targeting a single platform. Using this framework gives us the opportunity to target iPhone in the future. This framework allows us to make the app using one language instead of having to use a language for the layout and a language for the logic.

Google Maps API

For the base campus maps view, we are using the Google Maps API. This allows us to have an accurate map view of the buildings and to create routes throughout the campus.

3.2 Related Work

[1] The current University of Arkansas map shows an aerial satellite image of the buildings on campus with the 4-letter codes for the buildings, bus routes and where they are currently at, directions for walking from building to another, parking spots, sights in the University of Arkansas, and services. The bus route option allows people to be able to see which of the nine bus routes they are wanting to take and see where the busses are currently on that route. The parking option allows people to be able to see where all of the current parking spots are for reserved, faculty/staff, resident reserved, student, ADA, and remote parking as well as the

parking and short term meters. The sights option shows the historic markers, public arts, accessible points, emergency boxes, and senior walk. The services option shows the cafeterias and computer labs on campus. The aim of the project is to only have the map and directions to the desired building location as well as showing the floors of each of the buildings.

[2] Google Maps is the most downloaded map application in the mobile space (statista.com). We are not trying to reach Maps' scope, but we do want to do what Maps does correctly. We aim to only map out the campus and do not aim to have reviews or any other type of user review/ feedback on locations. We do want to have each building named and have each department's main building labeled as such. Google Maps does this for half of the U of A's buildings but is inconsistent with campus-specific information.

[3] Missouri S&T has a campus map application that does some things that we want to accomplish, and some things we want to extend. The campus map has a map for select building interiors, but does not include all academic buildings interiors. It also does not have an option to select individual building floors, which would be very important for the U of A campus.

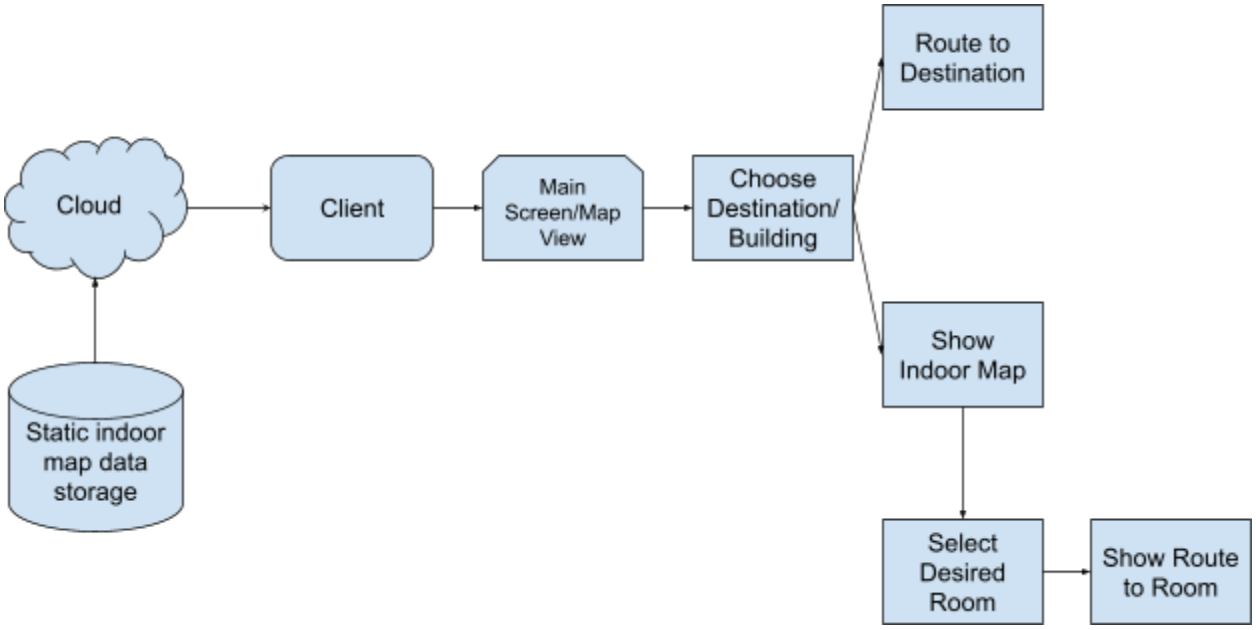
4.0 Design

4.1 Requirements and Use Cases

This project requires multiple parts in order to function properly. First, we will need to implement the Google Maps API into the project in order to have an actual map function. The Google Maps Platform allows developers to use Google's tools to create a real-time map experience that includes up-to-date map data, navigation, and points of interests. A dynamic map will be used to allow the user to interact with the app, and directions will be implemented to offer the navigation feature. Next is implementing the interior views for the different buildings across campus. Building floor plans will need to be acquired in order to offer the interior "map" for these buildings, and then development will need to be done in order to sync the user's location within the floor plan to offer navigation. Navigation will work just like Google's normal maps navigation except in a tighter, more accurate space. In addition to these functional requirements, there are other requirements that reach beyond the core of the application. For example, the design of the user interface needs to be simple and easy for the user to understand. If this is not accomplished, the application may as well be useless for the user. The goal is to offer a similar user interface from familiar maps applications, and expand upon that to fit the needs of the university. For example, the main screen will be the map of the campus itself, and UI elements (like a menu button or a task bar) will allow the user to use the features they need.

The primary users of this app will be people who commute around the U of A campus often. They will access the integrated maps application with their smartphone and use the app to navigate to different buildings or areas. The app itself will be interactive, so the user can drag around their surrounding area on the map to find point-of-interest locations to navigate to, or they can search for specific areas they need to go.

4.2 High Level Architecture



This app will be composed of two parts; a client side app that the user will use and a server application that stores user data and serves the map data. The client side app will feature a Map screen of the university using the Google Maps API, with buildings and other point-of-interest icons marked. A user can move around the map by dragging like google maps, select a building and choose to either navigate to that building, or they can choose to "enter" the building to view a more detailed interior view. We will be using floor plans of these buildings to create the interior view. When inside the building, the user can search the room number their class is in, and the app will show where the room is and show a route to it. The user can also enter in their building and room number from the main map view to be navigated to their desired location. In addition to these features, the app will allow the user to switch between different floors of a building. The app will also allow the user to save class locations to be able to quickly go to the selected class. This class location will be stored in a database in the cloud. All of the inside map data will be served from the backend running on the cloud. We will be using an Android phone for hardware to do development and testing on, and we will use Flutter to code the app.

4.3 Risks

Risk	Risk Reduction
Cloud Storage Risk	Maps and saved locations data will be stored on the cloud. For security, the end-user must not have access to modify any data on the cloud through the app.
Location Risk	The app will assist users in navigating around the U of A campus, and navigation may include having to cross roads with traffic. In order to ensure user safety, the app will notify users to be aware of their surroundings while navigating.
User Interface (UI)/Experience(UX) Issues	If UI and UX design is ignored, the app will not be engaging for the end-user. The app needs to be easily navigable, so to accomplish this constant testing needs to be performed from the end-user's perspective.

4.4 Tasks

1. Learn the Flutter for Android toolkit that we will use to develop the application.

2. Create a Flutter application that will show a map view of the campus as a whole with foundational functionality. Display a view similar to related mainstream applications with buildings and roads/sidewalks. This map must notify users to be aware of their surroundings while navigating.

3. Create a system in the application that can save and retrieve "class" objects and map information. These objects will need to persist in app storage.

4. Extend the app to label individual buildings and open a new view per building. Views will be implemented fully at a later task, this deadline only requires that an interactive view be created on interaction with a building in the campus map.

5. Render a scrollable map in the building view and implement a multi-level floor plan for building views. These views should implement a tree of viable classrooms, transition

points, and hallways. Transition points are stairwells, exits, and any other means of leaving the current floor of a building.

6. Implement in the individual map views entry points of a building denoted by floor, street facing, and by cardinal direction. Include pins on the map that will mark desired destinations specified in the user route.

7. Implement a user interface such that the user can build a route by searching for building name and then by room number (BELL then 3160 for example).

8. Create route planning functionality accessible through the user interface that uses the route structure from task 8. This task will be implemented as direct lines drawn from the current location to the desired room.

9. Implement a dynamic route planner using a heuristic maze search algorithm. This task will require use of classrooms, transition points (read stairwells and exits), and halls as nodes.

10. Extra time will be dedicated to final passes on all features completed up to this point, as well as documentation of code and features that may have received minimal description.

4.5 Schedule

Tasks	Dates
Learn the Flutter for Android toolkit that we will use to develop our application.	1/3 - 1/9
Create a Flutter application that will show a map view of the campus as a whole with foundational functionality. Display a view similar to related mainstream applications with buildings and roads/sidewalks. This map must notify users to be aware of their surroundings while navigating.	1/10 - 1/23
Create a system in the application that can save and retrieve “class” objects and map information. These objects will need to persist in app storage.	1/10 - 1/23
Extend the app to label individual buildings and open a new view per building. Views will be implemented fully at a later task, this	1/24 - 2/13

deadline only requires that an interactive view be created on interaction with a building in the campus map.	
Render a scrollable map in the building view and implement a multi-level floor plan for building views. These views should implement a tree of viable classrooms, transition points, and hallways. Transition points are stairwells, exits, and any other means of leaving the current floor of a building.	1/24 - 2/13
Implement in the individual map views entry points of a building denoted by floor, street facing, and by cardinal direction. Include pins on the map that will mark desired destinations specified in the user route.	2/14 - 2/27
Implement a user interface such that the user can build a route by searching for building name and then by room number (BELL then 3160 for example).	2/14 - 2/27
Create route planning functionality accessible through the user interface that uses the route structure from task 8. This task will be implemented as direct lines drawn from the current location to the desired room.	2/28 - 3/13
Implement a dynamic route planner using a heuristic maze search algorithm. This task will require use of classrooms, transition points (read stairwells and exits), and halls as nodes.	3/14 - 3/27
Extra time will be dedicated to final passes on all features completed up to this point, as well as documentation of code and features that may have received minimal description.	3/28 - 4/18

4.6 Deliverables

- Design Document: Contains a design of the UI, descriptions of features that are implemented in the project
- Application Source Code: Uncompiled source code for the project application written in Dart using Flutter for Android Devices. This will also include any necessary code from the cloud storage end.
- Compiled Application: An android application.
- Final Report

5.0 Key Personnel

Robert Bell - Bell is a senior Computer Science major in the Computer Science and Computer Engineering Department at the University of Arkansas.

Michael Luster - Luster is a senior Computer Engineering major in the Computer Science and Computer Engineering Department at the University of Arkansas.

Caleb Parks - Parks is a senior Computer Engineering major in the Computer Science and Computer Engineering Department at the University of Arkansas.

Tyler Saitang - Saitang is a senior Computer Science major in the Computer Science and Computer Engineering Department at the University of Arkansas.

Mena Anderson - Anderson is a senior Computer Science major in the Computer Science and Computer Engineering Department at the University of Arkansas.

Dr. Lora Streeter – Dr. Streeter has been pursuing her love for technology at the University of Arkansas for more than ten years; she earned her B.S., M.S., and Ph.D. in Computer Science. When not using technology professionally, Dr. Streeter likes to play pinball and pokemon in her free time.

6.0 Facilities and Equipment

- Android phone
- Building floor plans

7.0 References

[1] Campus Map | University of Arkansas (uark.edu)

[2] https://www.google.com/maps

[2.1] https://www.statista.com/statistics/865413/most-popular-us-mapping-apps-ranked-by-audience/

[3] https://www.mst.edu/map/