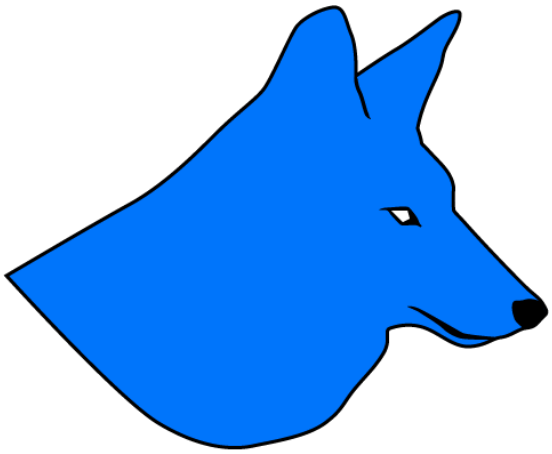

CoyoteQuest Mobile Navigation App

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Software Requirements Specification
Version 1.3
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1. Introduction

1.1. Purpose

Students, visitors, and faculty of California State University, San Bernardino (CSUSB), both on the main and Palm Desert campus, often find themselves having difficulty navigating and locating their desired locations. As a result, an idea arose that, if implemented, would provide users a mobile application that would remedy these issues.

To clarify, the idea involved creating a mobile app for Android and iOS devices that would serve as a map and location finder while on campus, whether it be outside or inside the buildings of CSUSB.

After the idea was validated, it became a software project and was commenced in the winter of 2015. The development of the software was requested by Dr. Gerard Au and Dr. Samuel Sudhakar, whose ideas which were implemented during the first stages of development still continue to be developed today. The following is a continuation of the software project and will be carried out by the Mobile App Development (MAD) team, under Thomas Saldana, as consultant, and CSE 455 Software Engineering students during the quarter of Spring 2019 under Dr. Concepcion.

The mobile app that will be developed will be information based and will use the geographic information system, ArcGIS, to display building floor maps from both the main and eventually the Palm Desert campus.

In this version of the app, the app will include basic navigation features such as a map of the main campus, a dot signifying the user's GPS location, a search bar, and other navigation information which will allow users to find their way more conveniently.

This document gives an overview of the functionality, specifications, and requirements of the application being developed.

Features

In summary, the application will include an internal building map of the main campus and eventually the Palm Desert campus. It will have a search bar where a user can search a destination on the campus by typing either a room number or a faculty member's first or last name. This version of the app will be created by using ArcMaps for desktop application which will create the maps for the app. The app will also include a navigation system that will locate users and route them to their destination. The app will also use a geodatabase to hold the information of rooms and faculty.

1.2. Scope

The following documents the boundaries of the project and will serve as a summary of the functions the application is expected to perform according MAD Team intern, Thomas Saldana, and project advisor, Dr. Concepcion.
The software that is to be developed will be an Android application which will aid students, who are unfamiliar with the CSUSB campuses, locate their destination.
Two Prototypes will be delivered during the Spring 2019 Quarter.

The following documents what will be delivered by the first prototype:
First, the mobile application will be strictly developed for the Android platform and be published to the Google Play store. The app will contain a home screen of a map zoomed in on the CSUSB campus. The app will be modeled after the Google Maps app since the user interface is familiar to most users. Located on the home page will be a button that allows users to switch between the floors of a building, a grid button displaying available student services and information, and a navigation drawer that will display other useful features for the user.

The following documents what will be delivered by the second prototype:
Upon completing the first prototype, the team will further implement a search feature that will allow users to look up room numbers and faculty offices. In addition, the application will display all the layers on the ArcGIS Enterprise server: https://coyotequest.cse.csusb.edu:6443/arcgis/rest/services/CampusMapVersion0/MapServer.
Lastly, a navigation & routing feature that will provide users at least one route to a building on the main campus will be implemented. This will be the initial routing implementation and basis for future development in allowing users to get directions and routing from one location to another. This prototype will be delivered by Finals Week.

The following documents what will be attempted and not guaranteed for delivery by the second prototype:

Due to time constraints, attempts will be made in implementing a navigation & routing feature with floor determination that will provide users a route within the building. In addition, an iOS version of this app will be attempted as well.

1.3. Definitions, Acronyms, and Abbreviations

Android
An operating system designed by Google that is based off of the Linux kernel. operating system that is used on many mobile devices such as phones and tablets that has been designed for touchscreen.

ArcGIS
a geographic information system used to develop maps; compiling geographic data; analyzing mapped information; sharing and discovering geographic information; using maps and

geographic information in a range of applications; and managing geographic information in a database.

ArcGIS Enterprise Server
A back-end server software component of ArcGIS Enterprise that makes your geographic information available to others in your organization and optionally anyone with an Internet connection. This is accomplished through web services, which allow a powerful server computer to receive and process requests for information sent by other devices.

ArcMap
A map document that is a file containing one or more maps; one-page layout; and the associated layers, tables, charts, and reports. These types of files have an mxd extension.

Wi-Fi
Is a technology that allows electronic devices to connect to a wireless LAN (WLAN) network, mainly using the 2.4 gigahertz (12 cm) UHF and 5 gigahertz (6 cm) SHF ISM radio bands.

Geodatabase
A geodatabase is an alternate way to store GIS information in one large file, which can contain multiple point, polygon, and/or polyline layers.

API (Application Programing Interface)
Refers to a set of routines, protocols, and tools that is used in the building of software applications.

CSV (Comma Separated Values)
Microsoft Excel can export files in this format. A CSV file contains a single spreadsheet, which can hold information like professor name and room number.

Disk space
A very common form of long-term data storage for computing devices. It is where saved files such as documents, movies, and music, as well as system files are stored.

GPS
Stands for 'Global Positioning System'. It is a navigation system that uses satellites to locate a device in geophysical space.

HTTPS
Stands for 'Hyper Text Transfer Protocol Secure'. It is an encrypted data transfer protocol for use in Internet communications that prevents eavesdropping.

IEEE
Stands for 'Institute of Electrical and Electronics Engineers.' It is an organization that is responsible for setting technology standards, among many other things.

MB/MiB
The megabyte (MB) and mebibyte (MiB) are two measures of data storage space that are multiples of a byte (or 8 bits) of data. These two measures are frequently used interchangeably. A megabyte is calculated in base-10 (or decimal) and is 1,000,000 bytes and a mebibyte is calculated in base-2 (or binary) and is 1,048,576 bytes.

Navigation Feature
Provides turn-by-turn navigation that will show directions to the user's destination.

Grid Tools
Another side tool on the user interface to display school campus amenities.

Pixel Density
A measure of the screen resolution of a device measured in pixels-per-inch (ppi).

RAM (Random Access Memory)
8 RAM is the solid-state memory in a device that it stores its current state in. It is very fast compared to physical disk storage.

Server
A computer that stores data and programs that other computers connected to it can download. It is usually located remotely from the computers accessing its stored data.

UI (User Interface)
This includes all the buttons, combo-boxes, sliders, menus, and windows etc. that the user uses to interact with the program.

WiFi
A wireless data transfer protocol that allows varied devices such as laptops, desktops, phones, tablets, and routers to communicate with each-other over a local area network.

1.4. References

Esri Developing Website https://developers.arcgis.com/

Ersi Software Engineer Erwin Soekianto (esoekianto@esri.com)

IEEE Std 830-1998 IEEE Recommended Practice for Software Requirements Specifications

Android Studio Website https://developer.android.com/studio/index.html

CSUSB School Color Policies Document https://www.csusb.edu/policies/official- school-colors

SRS CoyoteQuest Winter 2018 (Version 1.2) by Neol Lora, Mario Victorino, Ruben Lopez, Reinier Sandoval, and Kudirat Ganiyu Opolo

Main Campus Floor Plans https://www.csusb.edu/facilities-planning- management/forms-documents/csusb-main-campus-floor-plans

1.5. Overview

The remainder of this document is comprised of two sections. Section 2 presents an overview of the entire application. It describes the application's interface and functions. It also describes the application's constraints, and dependencies. Section 3 presents a detailed set of requirements that pertain to the implementation of the application. These include interface requirements as well as functional requirements that the application must meet.

2. Overall Description

2.1. Product Perspectives

• The application will contain the following attributes:
• Android phone/tablet compatibility.
• Access to building layouts with labeled room numbers and doors.
• Using a building's name to locate it(on the basis of the resources given by the school).
• Using a room number to locate a room within a Campus building.
• Using a School department' name to locate a room.
• Using a faculty/staff member's name to locate his/her office.
• Navigation capabilities using WiFi triangulation
• Allow administration/staff to log in and see Utilities (plumbing, electrical, etc).
• User-Friendly Interface

2.1.1. System interfaces (deployment diagram)

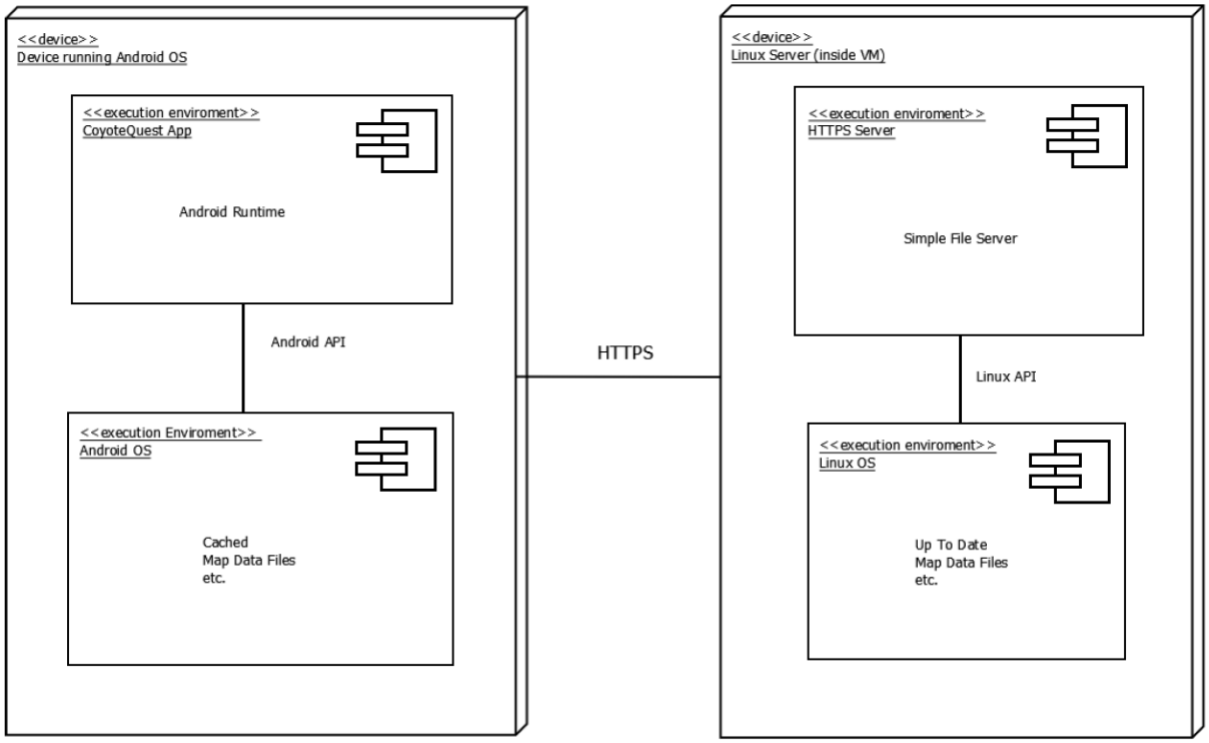


Figure 1: CoyoteQuest Deployment Diagram

This deployment diagram shows how data will flow through the CoyoteQuest client-server system for an Android app. The data represented by this map will change quite frequently during the development phase of the application, but the overall basis is the same. This necessitates storing it on a server that all on the development team have access to.

2.1.2. User interfaces

The user interface will provide the user with a map of the building that they search or are looking for. It will also provide the user the ability to search and find the exact location of a room inside a building. The app will not navigate the user to their destination for this prototype, but a navigation feature will be included in the app in future prototypes.

The following are the screen pages that will be developed:

• Welcome Page with CoyoteQuest logo
• Display of a map zoomed in on the CSUSB campus with buttons and search bar

The following summarizes how the user will interact with the app:

• The user downloads the app from the Google Play store over WiFi or a cellular data connection
• The user opens the app
• The user inputs either a faculty/staff member's name or room number

• The user is shown their location with a red pin
• The location of the user's destination is presented to the user
• The user is navigated to his or her destination
• The user finds his or her destination
• The user closes the app.

2.1.3. Software interfaces

CoyoteQuest will be programed using Java in Android Studio.The maps within the app will be created using ArcGIS software. The server side will be programmed in a programming language that is preferred by the server-service provider, which in this case will be Esri. The navigation feature will be provided by Esri technologies.

2.1.4. Communication interfaces

The application will download ArcMaps from Esri servers or ArcGIS online on request. The information regarding rooms and faculty will be stored in an Esri geodatabase. As a result, the apps information will be updated/modified as needed. If time permits and approval is given, the CoyoteQuest app will be modified to retrieve faculty room data from the CSUSB Directory database.

2.1.5. Memory

The amount of RAM the application uses will vary based on factors such as Android version and pixel density. Devices with high pixel density screens usually use more RAM at any given time. This is because there are simply more pixels to represent in memory for any given screen dimensions. However, they are usually designed with more RAM to accommodate the extra usage. Bearing this and the graphics-intensive nature of the application in mind, the RAM usage should not exceed 100MiB. Furthermore, the application should never be allowed to exceed 20MiB of disk space when all of the maps are downloaded.

2.1.6. Operation

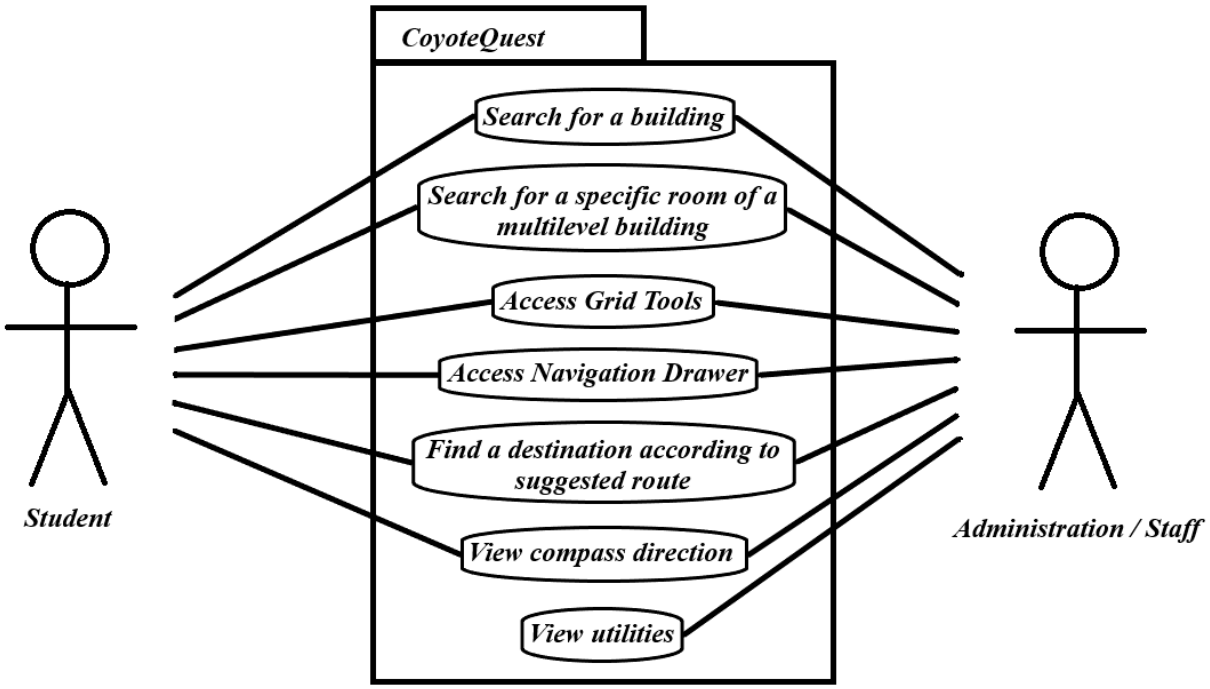
The application is expected to be used all year round by students. Quarterly maintenance will be required to update buildings, faculty offices, and other building changes. However, if approval is given to CoyoteQuest's use of the CSUSB Directory these quarterly updates will not need to be performed.

The information contained in the app will be held in an Esri geodatabase. This will allow maintenance personnel to quickly update the apps information without having to revise the app in the google play store.

2.1.7. Site adaptation requirements

• No site adaptation required

2.2. Product Functions (use case diagram)



2.3. User Characteristics

The intended user base of the application consists of CSUSB faculty, students, and visitors of both the San Bernardino Campus, and eventually Palm Desert Campus. Any user of the application should be able to access the same information for the location of any room in any building. Users can also expect to find more ease in navigating through campus buildings and searching for location recommendations from the app than reading a static campus map. As shown in the use case diagram, there mainly two types of users: students and administrators or staff. Each type of user shares the functions with the exception of administrators having access to utilities.

Explanation of use cases:

- Employees in charge of pipeline, for instance, will have access to the layout of utilities or pipeline network from the app instead of having to locate printed copies from a facility.
- Users can use the app to search for a specific building. If the building exists on campus, people using the app can find it on the map.
- If there is a specific room in the building that a user wishes to locate, the app will show the location of that room with its room number labeled.
- Some buildings will have multiple floors. The app can reveal each level of the facility including the rooms. Users can know ahead of time the layout of a building before entering when accessing this feature of the app.

- There is an additional grid tools button located on the user interface. When accessing grid tools, a list of icons appear on the screen which represent the different services that the campus offers such as the health facility, bike racks, and restaurants.
- Near Grid Tools is Navigation Drawer. This feature of the app allows users to pick from a list of existing destinations.
- Users can follow a suggested route according to pre-selected destination from the Navigation Drawer panel.

Currently the application is being developed for the Android operating system. As such, it will be released on the Google Play store.

2.4 Constraints

The CoyoteQuest app has the potential for growth. Mapping software is a major tech component in logistics and software development. Based on the ArcGIS software developed by Esri, students of CSUSB using the app may benefit in more ways than merely as another navigation tool.

The features of CoyoteQuest includes but is not limited to:

Displaying bike racks, emergency exit routes, parking-ticket vending machines, dorm buildings, study areas, campus club-meeting locations, department offices, colleges that reside within given buildings, history of buildings, facilities and programs offered by CSUSB (e.g. the Veterans Center, Women's resource center, etc).

Seeing the services and rooms that the university offers will allow students and non-students to become aware of the many campus accommodations. Since the app must be fully developed and published within a 7 week period, some key locations may not be included as the campus is in the middle of construction projects and renovations.

In the future, after completion of this app, CoyoteQuest will be integrated with the MyCoyote app which includes all of CSUSB's apps.

Some general software constraints include the following:

• Files of buildings should be stored independently of each other
• App should display a dot on floor maps to indicate to the user where he or she is located
• Additional floor maps of buildings added to the CoyoteQuest app should match in design with the floor maps that are already in the app
• App files should be backed up
• Every building should have its files grouped in the server
• Experts and previous developers of the CoyoteQuest app should be consulted in the case that the software needs to be modified
• Software should be secured by the server team
• CoyoteQuest will run on devices with stable versions of Android
• Accessing a new map may require an Internet connection

2.5 Assumptions and Dependencies

While CoyoteQuest can accommodate many more navigation tools, the app will need careful maintenance and an understanding of GIS technology. Using the ArcGIS software developed by Esri, CoyoteQuest can greatly benefit from including a global positioning system to locate users with respect to the campus while logged into the app.

The following improvements will later be included:

high-quality image, inclusion, more destination routes, and general graphical changes to make the app more aesthetically appealing and user friendly.

3. System Requirements

3.1 External Interface Requirements

3.1.1 User Interfaces

All Icons and the overall theme will adhere to CSUSB policies regarding school colors. The policies can be found here: The general theme will be blue, white, black, and grey. Main shades of blue and grey will be Pantone® 300 and 60% Grey.

Figure 3: Color Theme

The following graphics demonstrates some of the older visuals of the user interface:

Fig 1.

Fig. 2

Fig. 3

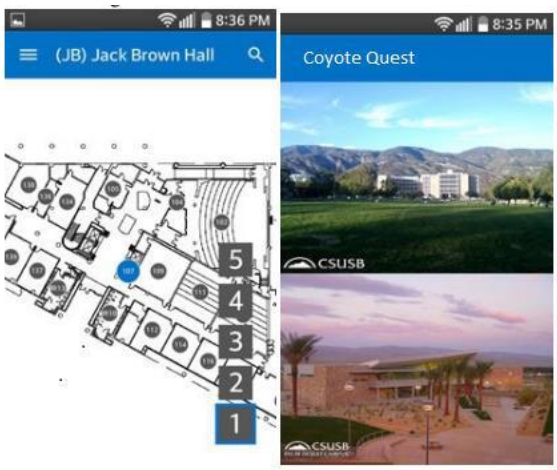


Fig 4:Image of a map with a selected floor

Fig 5: Current app homescreen

The following images are screenshots of a conceptual app with a navigation implementation.

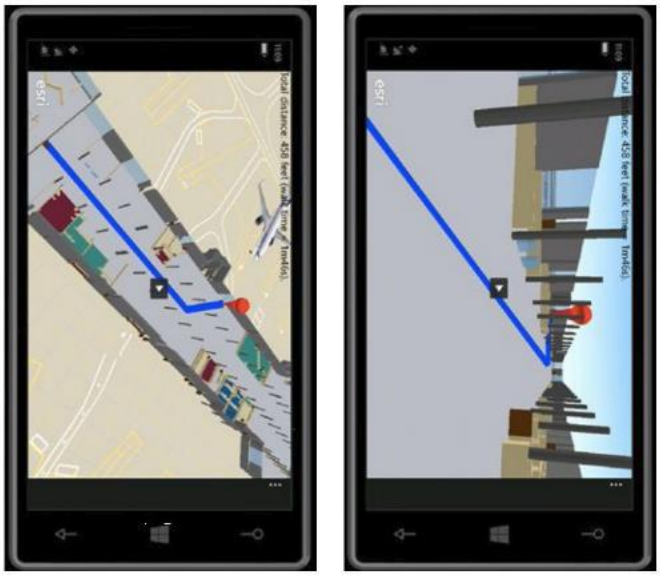
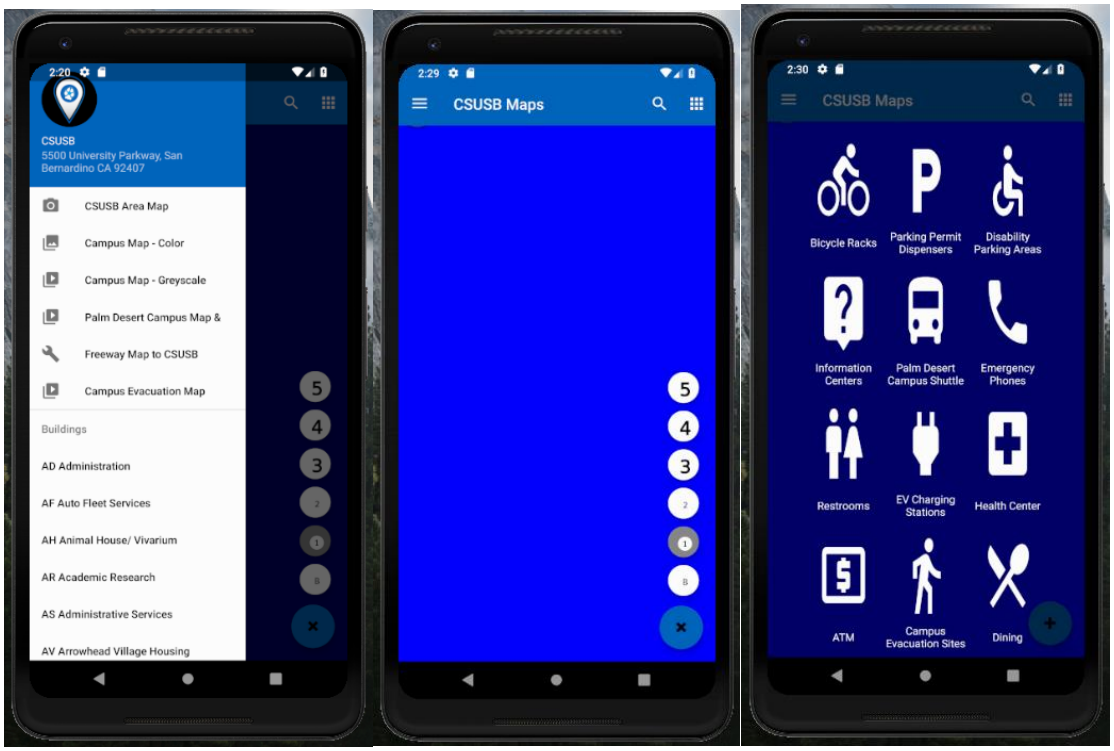


Fig. 6 and Fig.7 are conceptual graphics of the app with navigation

When opening the app, the user will see the home screen of the app, which will contain an image of the CSUSB campus. Once opened, the user will see the campus map of the school, with a menu containing the building names. By selecting a building, the user will see a floor plan of a floor with labeled room numbers. The user will be able to toggle through floors with the floor buttons, and the user can also search for a room by clicking on the search icon on the top right of the app and typing their desired room or professor name. There is also a menu for student services and deans' services in the home screen. Selecting the deans' services will allow the user to find the offices of the school's deans. Selecting the student services allows the user to find important services offered to the students like the Pride Center, and other services.



3.1.2. Hardware Interfaces

The applications will use WiFi to provide the user with maps and locations of rooms and buildings. WiFi will also be used for the navigation in the app.

3.1.3 Software Interfaces

The application will need to communicate with a server that has all the data necessary to display all the layers within the application.

3.1.4. Communication Interfaces

The Coyote Quest app's communication will require the need for a non-real time connection that can be established with a Wifi connection. If successful, the WiFi and GPS function will be implemented into the application.

3.2. Functional Requirements

3.2.1. Searching

- User can search for a professor and be provided with the location of his or her office.
- User can search for a building and have it displayed.
- User can search for major offices including offices of all deans and student services.
- User can choose which campus they would like to search for a building in.

3.2.2. Display Map

- User needs to be able accurately see the map.
- User should be able to sort through the layers of the map via the floor buttons.
- User should be able to see their location in relation to the cardinal directions.

3.3. Performance Requirements

The user interface should appeal to the user and should give the user the ability to interact with the app in a feasible manner. The user should never have troubles finding the apps services. The user should be able to navigate through the app with ease. Moreover, the app must respond reasonably quickly to user input. That is, the app must not take longer than 2 seconds to download immediately relevant data from the server.

Further, the app should always contain up-to-date information. In other words, the users of the app should have the best experience possible interacting with the user interface and the contents of the app. Even more, the app should always navigate user accurately to their destinations.

3.4. Design Constraints

The development of the app is limited to object-oriented design.

3.5. Software System Attributes

3.5.1: Reliability

The first prototype is expected to show layers accurately while connected to the internet. Certain new locations will not be updated instantly without maintenance by an authorized official after alterations done to the campus such as construction of new buildings or areas. Thus the reliability is based on the decision of the client to continument of funding of its services.

3.5.2: Availability

For the first and second prototype of this android application it is expected to be able to be accessed anywhere on campus. Future implementations could possibly have restricted access in terms of whether it's a student or admin.

3.6. Security Requirements

The app is intended to be information based. The information in the app is general information available to the public by more than one means which means that it does not need a strong secure system. However, the app will have security features. These secure features will be decided upon the completion of the app if completed.

All information from the application will be delivered over HTTPS due to the knowledge of the user’s personal location. This will be done in effort to ensure the user’s trust in using the app without potentially being exposed to personal information violations.

3.7. Document Approval

This document must be approved by the MAD Team intern, Thomas Saldana.

Name: _____

Signature: _____

Date: _____