CSUSB Room Quest Mobile Application

Software Requirements Specification

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1 Introduction

1.1 Purpose

This software requirements specification provides a detailed description of the CSUSB Room Quest Mobile Application, a prototype that is being developed in CSE455. This document outlines all requirements, specifications, and conditions that pertain to the development, and usage of the application. The expected audience of this specification document is Doris Casillas Administrative Analyst, division of Information Technology System, the software team responsible for the development and implementation of the application, the team responsible for external testing and quality assurance for reference, and Dr. Concepcion who will oversee the progress of the application development.

1.2 Scope of the Project

The software will be a mobile application, for use on any Smartphone that is running the Android operating system 2.2, or higher. The app is called CSUSB Room Quest and it is an indoor mapping and positioning system that operates inside campus buildings. The application makes use of Redpin, an open source technology that is capable of measuring the radio frequencies from Wi-Fi access points. These measurements are then associated with room locations. Unlike other IPSs, Redpin does not give precise user locations (i.e. in feet). Instead, tags are placed on floor plans, to indicate which room a user is in (or nearest to). The application uses theses measurements to reference room numbers, create paths, and directions to rooms of interest- within a building. All measurements will be stored in a central server, which will be responsible for matching measurements with known locations. A user will submit the name of the building they are in, and the room number they are trying to find. The mobile phone will be instructed to read the measurements of RSS and the nearest BSSID, in order to produce directions to a room, its corresponding floor plan, and the appropriate path to take. If, for any reason, a measurement is not taken, or is found to be erroneous, the user will have the option to manually find their destination. Room numbers act as location points. If a user knows the number of the room he or she is standing near, directions to the desired destination will be produced upon submitting that number.

The application is not meant to be a Global Positioning System, and will not function outside of CSUSB buildings. Due to time constraints, it is expected that functionality will be limited to the JBH building, for this iteration.

1.3 Definitions, Acronyms, and Abbreviations

Android

A Linux-based operating system designed primarily for touch screen mobile devices such as smart phones and tablet computers.

IPS

An indoor positioning system is a network of devices used to wirelessly locate objects or people inside a building

PHP

A server-side scripting language designed for web development**.**

DB Database

Implies MySQL as the database engine & language.

BSSID

Basic Service Set Identifier. A unique address that identifies the access point/router that creates the wireless network.

RSS

Received signal strength is a measurement of the power present in a received radio signal.

Map Window

The portion of the computer screen that displays the floor plan of a building.

Development Environments

A collection of procedures and tools for developing, testing and debugging an application or program.

Design Resource

A graphical component- often bundled with other, similar looking components- that is available for use in an application's layout.

Redpin

Redpin is an open source indoor positioning system that was developed with the goal of providing at least room-level accuracy.

Fingerprint

A unit of measurement used to differentiate locations, based on RSS intensity.

Layout

Software component that takes marked up content (such as HTML, XML, image files, etc.) and formatting information, and displays the formatted content on the screen

1.4 References

IEEE Std 830-1998 Software Requirements Specification

Student Advising SRS Revision 2.2

Redpin's website: http://redpin.org/

Redpin - (Philipp Bolliger, 2008), "Adaptive, Zero-Configuration Indoor Localization through User Collaboration: http://www.vs.inf.ethz.ch/publ/papers/bolligph-redpin2008.pdf

1.5 Overview

The rest of the document is split into sections. Section two provides an overall description of the mobile application. This includes its interfaces, accessibility and usability requirements, user characteristics, constraints, and dependencies. Section 3 contains detailed UI requirements regarding the actual implementation of the screens and pages.

2 Overall Description

2.1 Product Perspectives

This mobile application is meant to supplement Tour CSUSB. Room Quest is an indoor positioning system that uses the measurements of Wi-Fi signals, to determine a user’s location. Tour CSUSB is a GPS application that can direct a user to a desired building. In the future, Room Quest may be integrated into Tour CSUSB; however, it will initially be developed as a standalone application.

2.1.1 System interfaces

CSUSB Room Quest App
Deployment Diagram

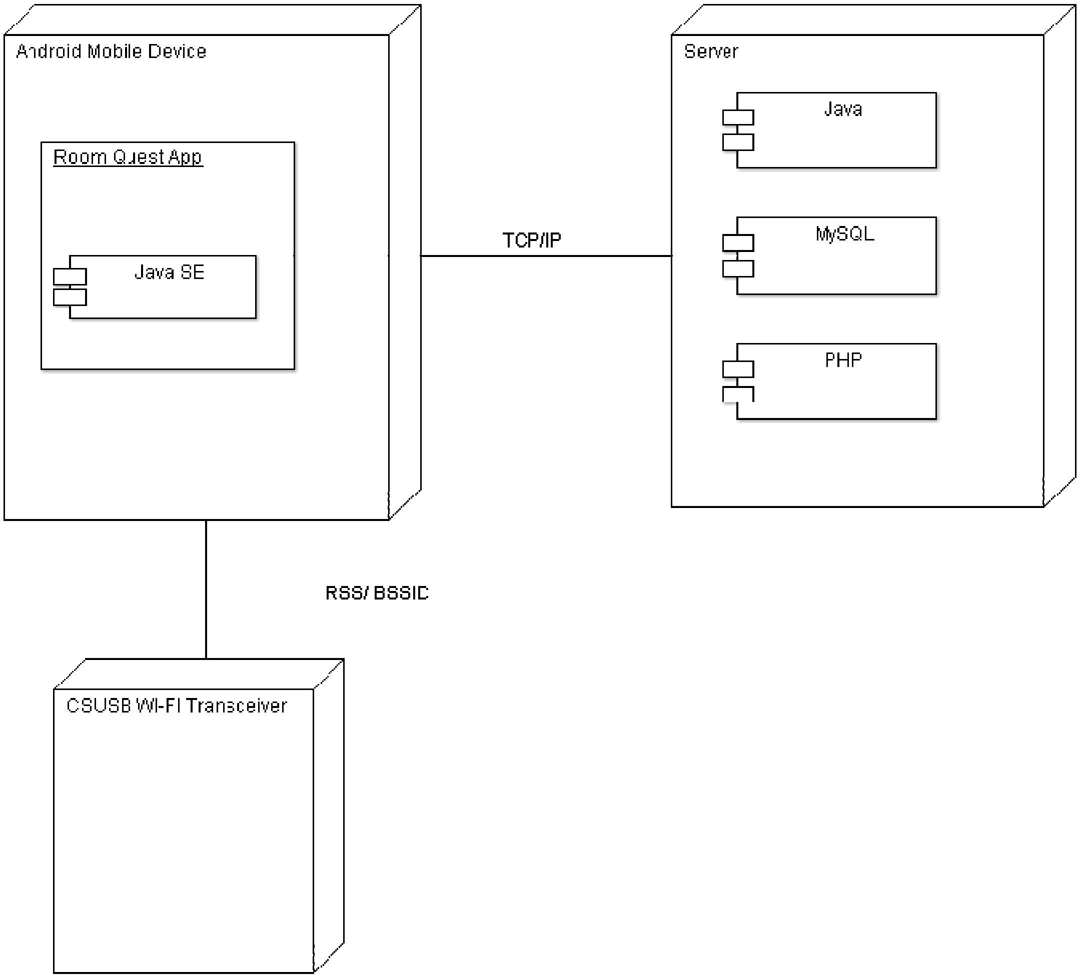


Figure 1: CSUSB Room Quest App Deployment Diagram

2.1.2 User interfaces

- **The Home Screen**- The Application will request the name of the building, and where the user is currently located. A list of buildings will be provided, in the form of a list box. A text field will be provided to accept the room number that the user is seeking.

- **Directions Screen -** A map window will be presented with tags indicating where the user is located, and the user's destination. A path graphic will be displayed on the map, to indicate the length of the user's journey. A listing of directions will also be presented to the user, and will be updated automatically.

- **Path Continuity Screen** – If a user is required to move to another floor, a separate screen will appear, instructing the user to move to another, floor, or around obstacles, before further directions are given.

2.1.3 Communication interfaces

3G, 4G, or an internet connection will be required to download the app for the first time.

Mobile application to Server

TCP/IP Connection over port 80

RSS

The measuring of Wi-Fi signal strength is used to indicate the location of the user's device.

2.2 Use Cases

The following diagram is a complete description of the application use cases.

CSUSB Room Quest App
Use Case Diagram

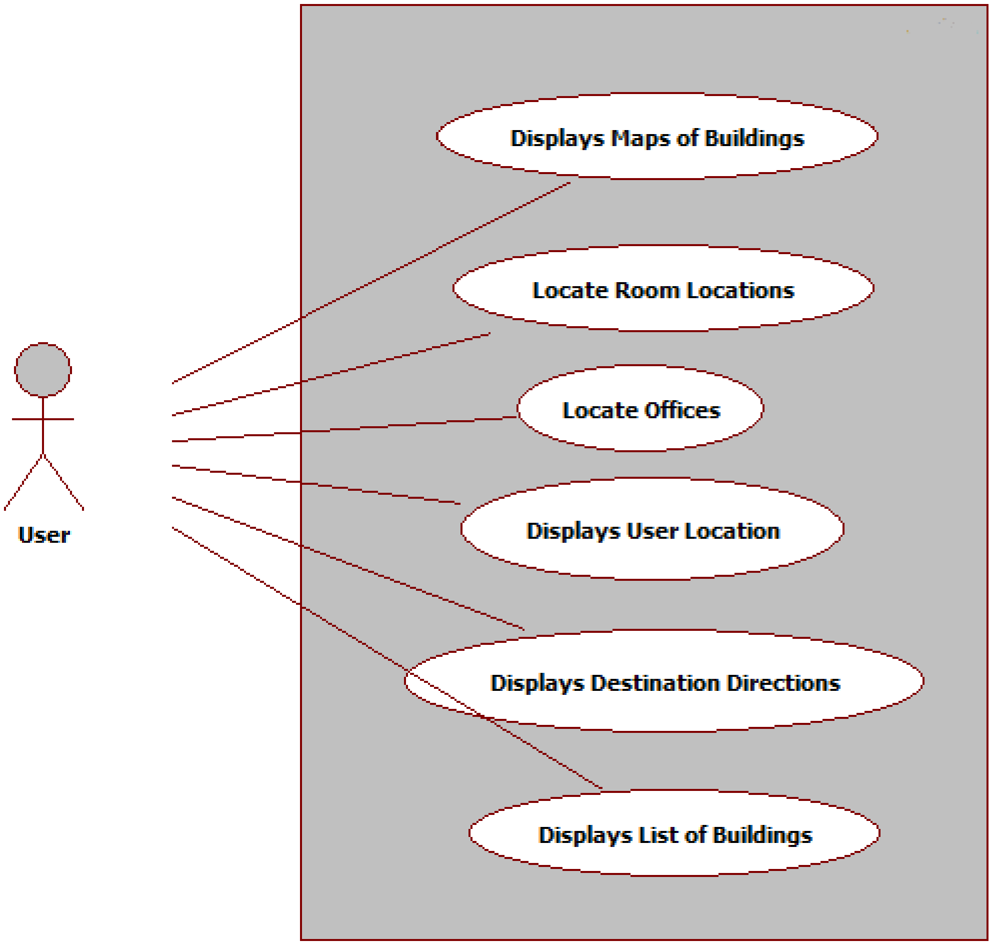

User
Displays Maps of Buildings
Locate Room Locations
Locate Offices
Displays User Location
Displays Destination Directions
Displays List of Buildings

Figure 2: CSUSB Room Quest App Use Case Diagram

2.3 User Characteristics

Students, staff, faculty, visitors, will all be able to use the application.

2.4 Constraints

2.4.1 Operating Systems

The application will require an android Smartphone. An Android operating system version 2.2, or higher, will be required.

2.4.2 Connections

Wi-Fi will be required.

2.4.3 Platforms

The application will be written exclusively for the Android OS.

2.4.4 Content Creation

A building name and desired room number will be required to pinpoint the appropriate BSSIDs. The user's location will then be presented with a base map of the floor of the building, along with the destination and directions to the destination.

2.4.5 Accessibility

The application's ability to find locations of interest will require the knowledge of Wi-Fi access points, in the JBH building. The location of these modules will be stored in the central server, and will not be made public.

Handicaps- It is assumed that the user has the ability to interact with the app UI. If an individual is capable of downloading the app from Google Play, that individual will be able to use the app with ease.

2.5 Assumptions and Dependencies

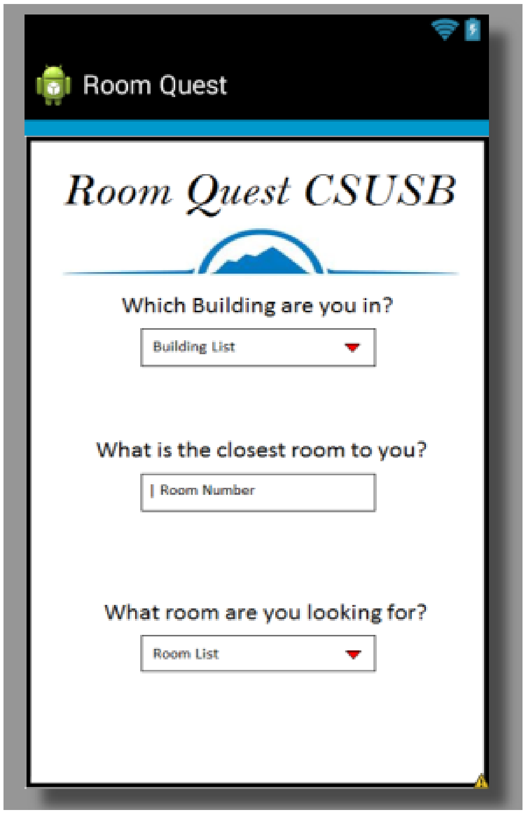
Although the components that are necessary for building the app are not likely to change (during the extent of the quarter), Wi-Fi sources could. It is difficult to say if changes to Wi-Fi sources will disrupt the functioning of the application because Redpin was built to be a learning system. It is constantly adapting and re-evaluating fingerprint data. Although, this illustrates redpins robustness and adaptability, it is considered a risk to Room Quest's long-term reliability.

3 Specific Requirements

3.1 External Interface Requirements

3.2 User interfaces

It is a project goal to ensure that the user interface conforms to a similar style as Tour CSUSB. The buttons and fields will most likely change, but their locations will stay the same.



Room Quest

Room Quest CSUSB

Which Building are you in?

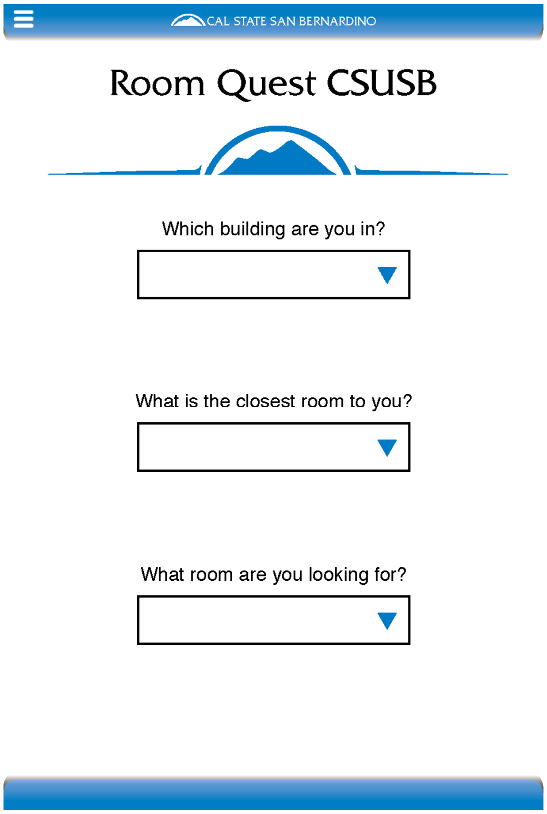
Building List

What is the closest room to you?

| Room Number

What room are you looking for?

Room List



CAL STATE SAN BERNARDINO

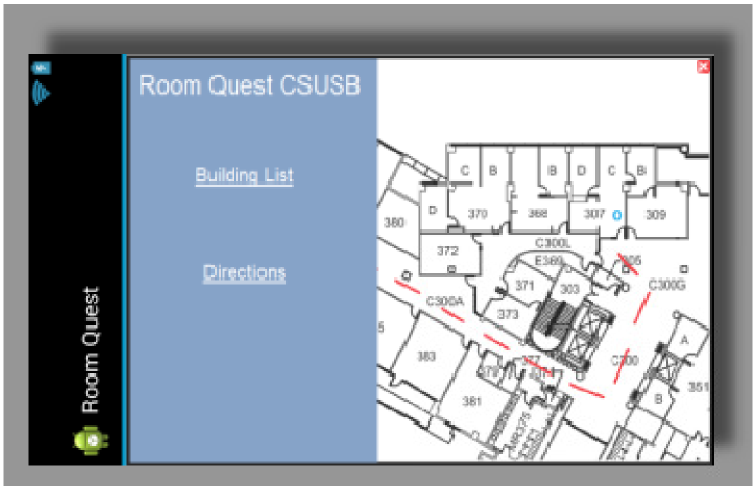
Room Quest CSUSB

Which building are you in?

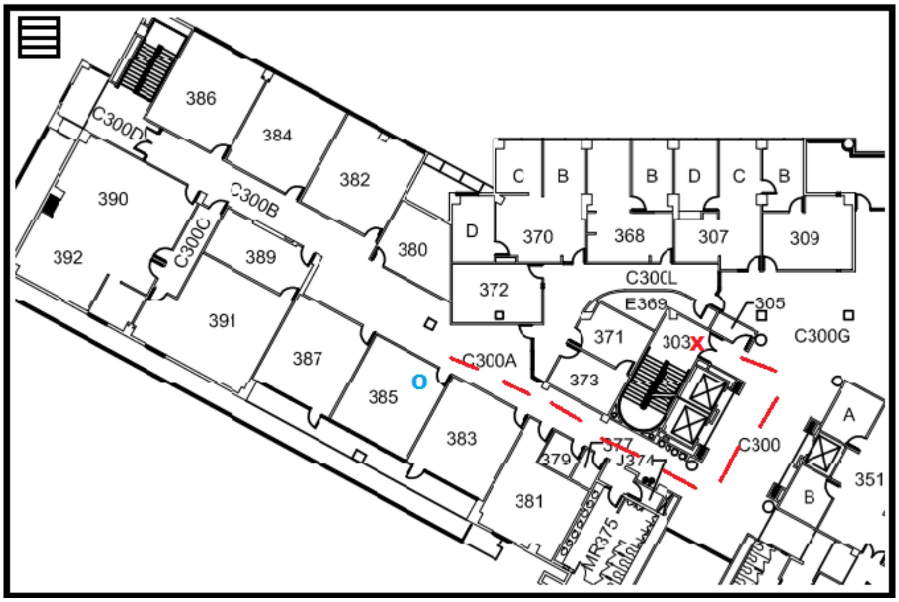
What is the closest room to you?

What room are you looking for?

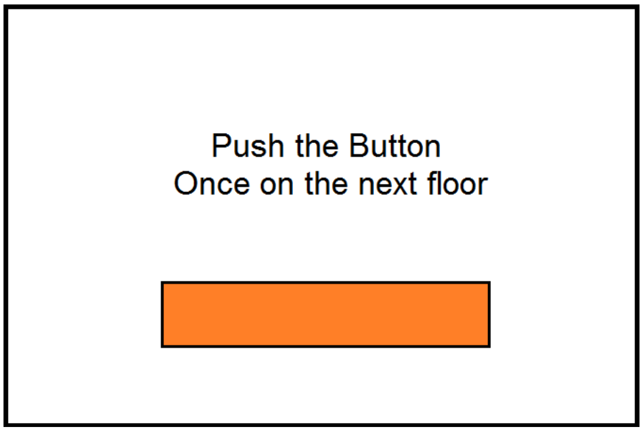
This is the layout of the **home screen**. A user can expect to find a list of building names, and fields for choosing/inputting their destination. They will optionally be able to manually input their destination, using their closest room to them as a point of reference. The version on the right side more accurately reflects the color scheme and layout resources that will be used in the user interface.



An image of the side view of the **Directions Screen**. Search buttons will be located on the left, along with an area for directions. A Map window populates the right side of the interface.



Map window, used for loading floor plans, and drawing paths.



Push the Button
Once on the next floor

Above is example of a Path **continuity Screen**, which will be used to halt further instruction, until a condition (in this case the user moving to another floor) is met.

3.3 Hardware interfaces

Android uses the wpa_supplicant as the platform interface to the various Wi-Fi devices, which are built into Android smart phones.

3.4 Functional Requirements

The following features will be provided to the user, by the application:

1. List of on-campus buildings.
   - *The user will be presented with a list of all CSUSB campus buildings.
   - The buildings will appear in the form of a drop-down list box.

2. Building Map
   - A floor plan of the building will be provided to the user.

3. Room Locations.
   - Room locations will be provided to the student as a layer on top of the floor plan map.
   - Unique tags will be used to indicate the location of the room.

4. Office Locations.

5. User Location.
   - A unique tag will be used to indicate the location of the user's current position.

6. Directions.
   - Directions to the desired location will be presented to the user.

- A path will be drawn on the floor plan, connecting the user’s current location with the user’s destination.

The following input must be provided to the application, by the user:

1. Desired Building.
    - The name of the building must be selected, by the user, in order for a floor plan to be provided.

2. Destination.
    - A room number must be provided, before the correct floor plan can be presented.
    - A room number is also required before the location tag will be visible on the floor plan
    - No path can be drawn without a floor plan and a user destination.

Functions marked with * are not guaranteed to be completed by end of quarter.

3.5 Performance Requirements

The time it takes to initialize a map window will vary, depending on the number of RSSs being measured.

All application functions (buttons), following the initial room submission, will respond within 1 second.

The time it takes to update a user’s location will also depend on the number of RSSs being measured. This shall not exceed 4 seconds.

3.6 Design Constraints

The user interface will be designed to look similar to Tour CSUSB. However, differences in development environments, could limit design resources.

3.7 Security

SQL Injection

All code that works with the database will be run through prepared statements which validate and filter input before being released to the database.

Code Review

Application code will be inspected by a QA team to look for any potential security vulnerabilities.

Further measures will be taken, to ensure that all user and CSUSB Wi-Fi information will be kept confidential.

3.8 Document Approval

Document must be approved by:

- Anthony Strey
  Project Manager

- Dr. Arturo Concepcion
  CEO/Project advisor

- Doris Casillas, client
  Administrative Analyst/Information Technology System