Software Design Document

for

Augmented Reality BC Campus Tour App

Version 1.2
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Electronic version Google Drive

Revisions

Version	**Primary Author**	**Description**	**Date Completed**
1.0	All team members	Original document	11/6/2018
1.1	All team members	Minor corrections to each chapter and revised diagrams	11/25/2018
1.2	All team members	Minor corrections to reflect letter recognition	3/15/2019

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1. Introduction

1.1 Purpose

The purpose of this document is to give a detailed description of the software design requirements, software structure, and brief overview of the physical hardware implementation that the AR Campus Tour app has. This document is for the software team in the company so they can refer to the design while developing it as well as teach new hires about the system in its entirety.

1.2 Scope

The AR Campus tour app will allow users to see useful information on buildings, depending on their location. After the app has identified the given building, it will provide information regarding departments and services provided in the building.

Constraints for this release are:

1. The client must be aware in advance that this service is only offered for buildings on the main BC campus.
2. The application only identifies provided letters at the moment. Further functionality will be added next quarter.
3. The application currently supports buildings: E, F, G, K, L, Q, R, S, U, Student Housing
4. The client needs to have one of the following AR supported devices with Android version 28.0 or better:
    - Asus Zenfone AR
    - Asus Zenfone ARES
    - Google Nexus 5X
    - Google Nexus 6P
    - Google Pixel, Pixel XL
    - Google Pixel 2, Pixel 2 XL
    - Nokia 6 (2018)
    - Nokia 8 Sirocco
    - Huawei P20, P20 Pro
    - Huawei Mate RS Porsche Design
    - LG G6
    - LG G7 ThinQ
    - LG V30, V30+, V30+ JOJO
    - LG V35 ThinQ
    - Moto G5S Plus
    - Moto G6
    - Moto Z2 Force
    - OnePlus 3T
    - OnePlus 5
    - Samsung Galaxy A5 (2017)
    - Samsung Galaxy A7 (2017)
    - Samsung Galaxy A8, Samsung Galaxy A8+ (2018)
    - Samsung Galaxy Note 8
    - Samsung Galaxy S7, Galaxy S7 Edge

- Samsung Galaxy S8, Galaxy S8+
- Samsung Galaxy S9, Galaxy S9+
- Xiaomi Mi Mix 2S

1.3 Definitions, Acronyms, and Abbreviations

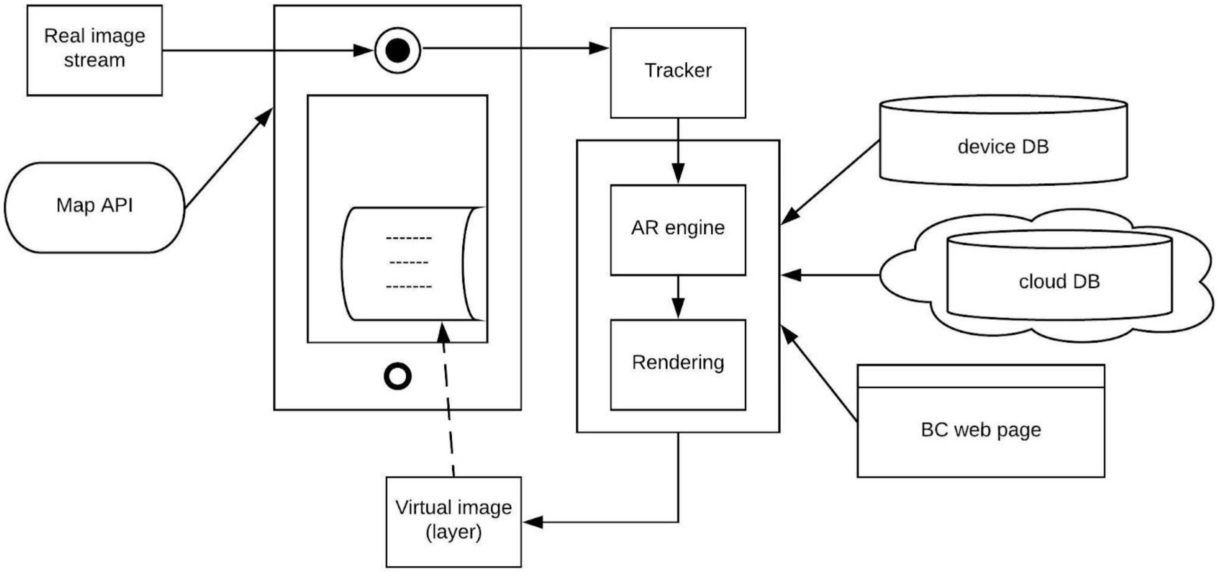
- AR: Augmented Reality
- BC: Bellevue College
- App/ application: AR BC Campus Tour
- GPS: global positioning system
- DB: Database

1.4 References

1. Google AR Documentation [https://developers.google.com/ar/develop/java/quickstart]
2. Google Android Documentation [https://developer.android.com/docs/]
3. Google Map API Documentation [https://developers.google.com/maps/documentation/]

2. System Overview

The app works on the Android Device and accesses Internet, GPS, and Camera within the phone. The location server is what the GPS uses to recognize location. The app gets parsed information from the BC website which also talks to the DB for any of the information we need to store in a DB.

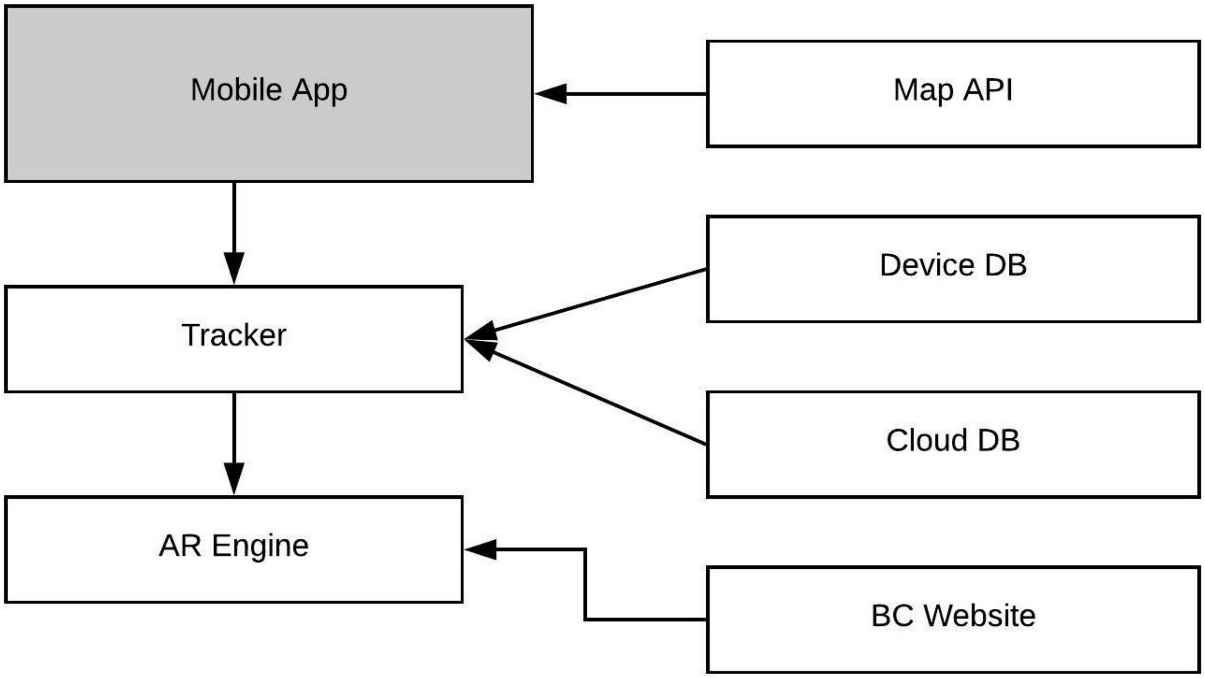


3. System Components

3.1 Decomposition Description

1. Mobile Application Module: Android app that orchestrates the other modules
2. Tracker: Based on camera state it will track and detect the buildings
3. Map: Gets current location
4. Device Database: Saves previous location (for later version)
5. Cloud Database: Stores building images to help with image recognition
6. AR: Evaluate virtual buttons (virtual layer)
7. BC Website: Needed for building information

3.2 Dependency Description



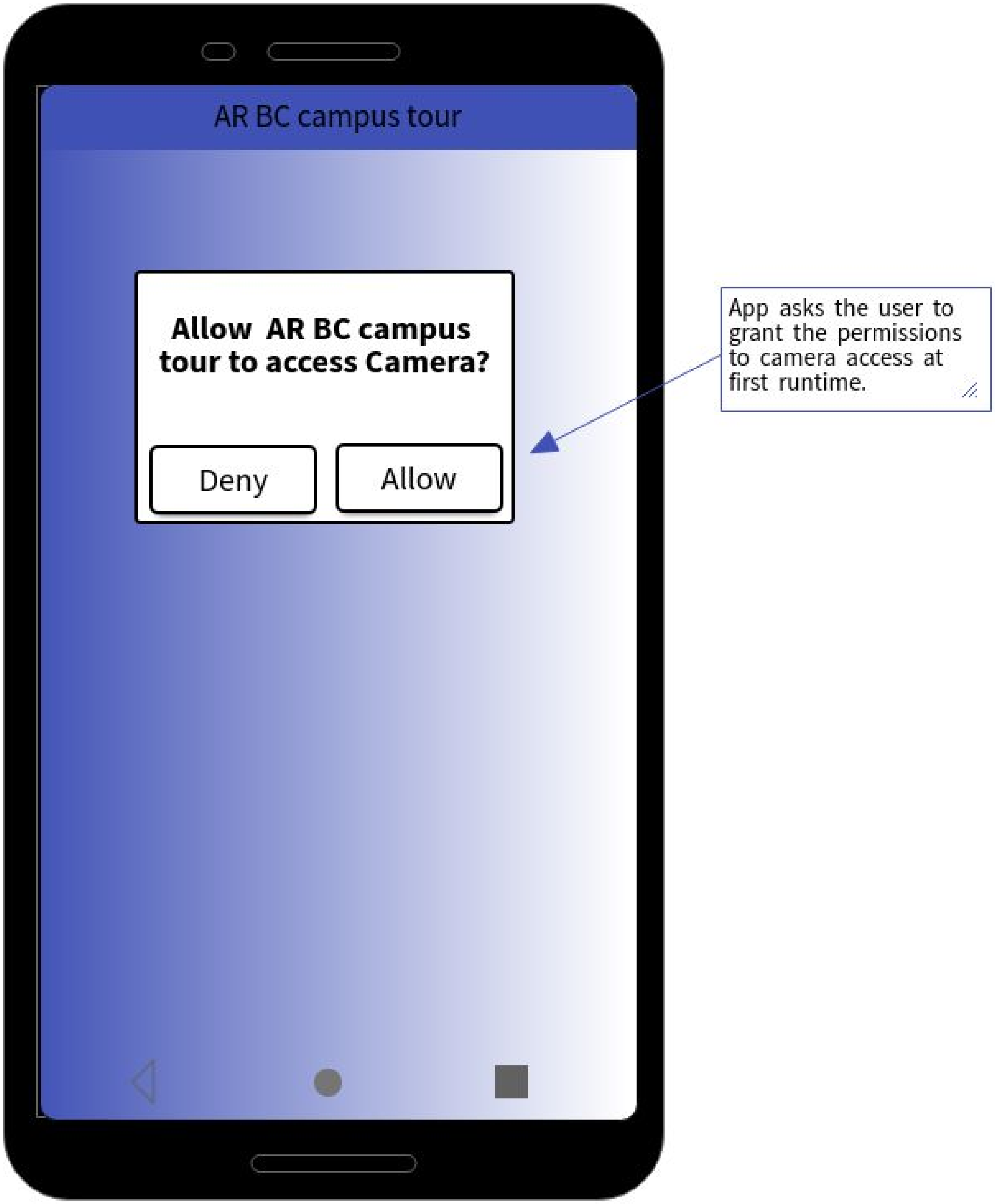
3.3 Interface Description

3.3.1 Module Interfaces

1. External Interfaces
   - Android Device
   - Server
   - Cloud Database
2. Internal Interfaces
   - Device Database
   - AR
   - Google Maps

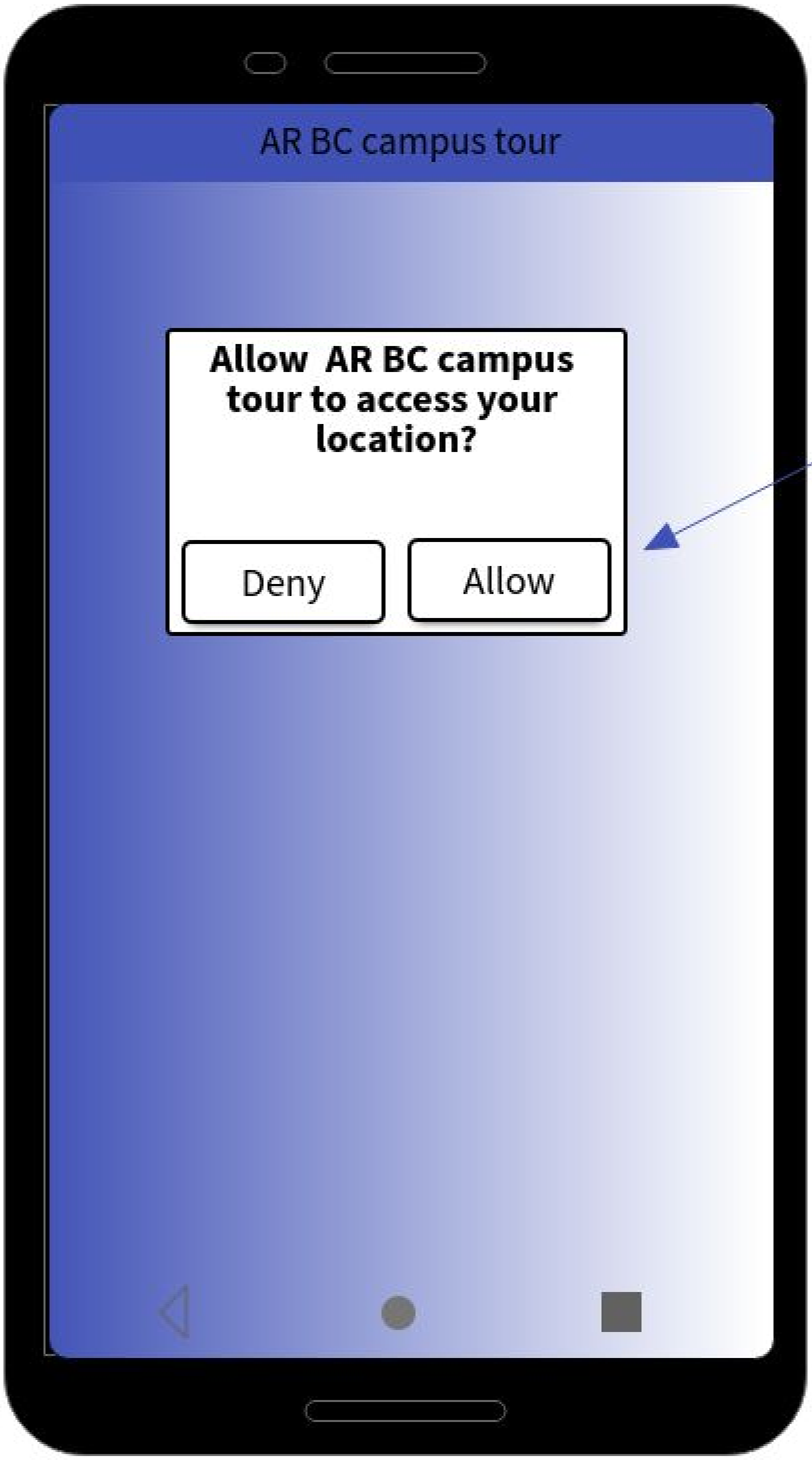
The devices' GPS first locates the user using Google Map APIs, devices' camera then gets the real image, ARCore tracks and detects building with the help of Cloud Database, AR engine evaluates the visual image with buttons and renderer renders the image.

3.3.2 User Interfaces (GUI)



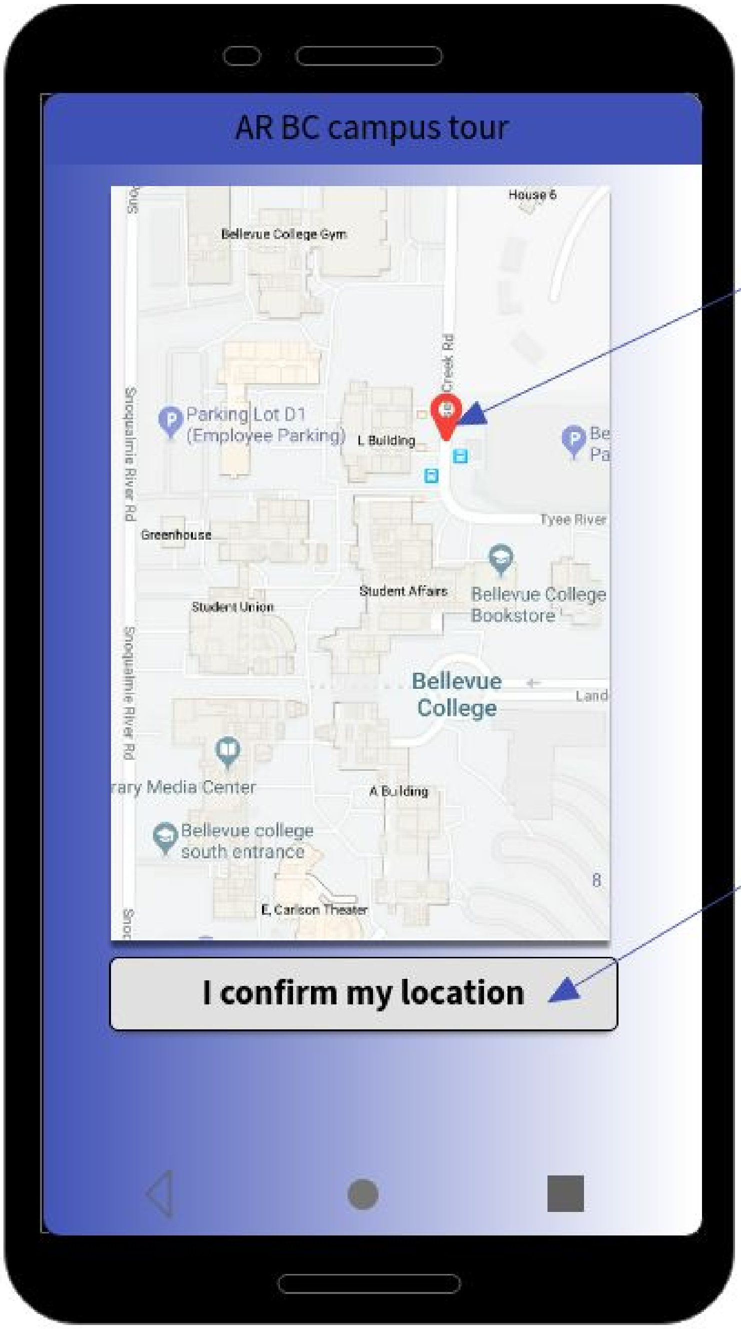
Allow AR BC campus tour to access Camera?

App asks the user to grant the permissions to camera access at first runtime.



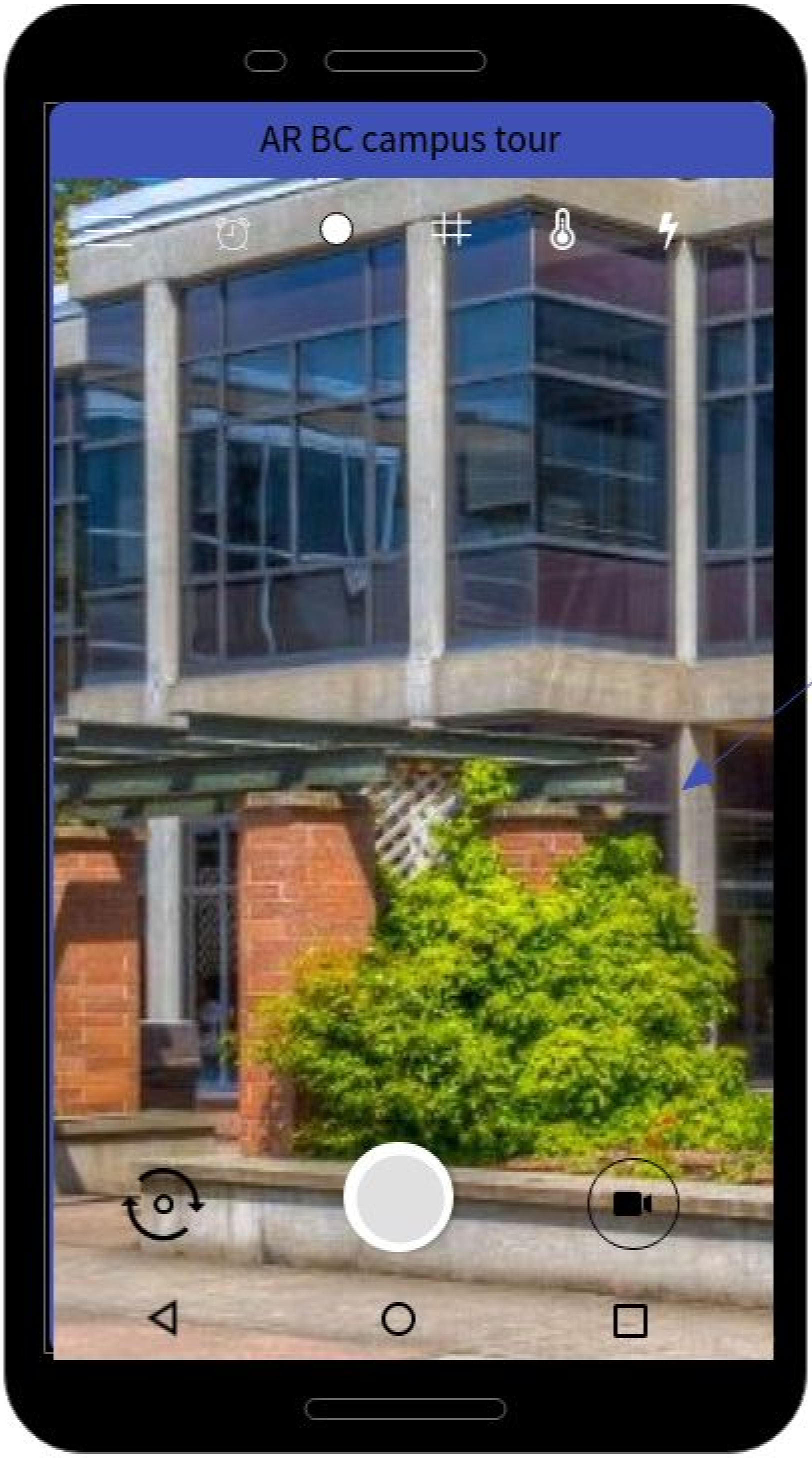
Allow AR BC campus tour to access your location?

App asks the user to grant the permissions to find users location at first runtime.

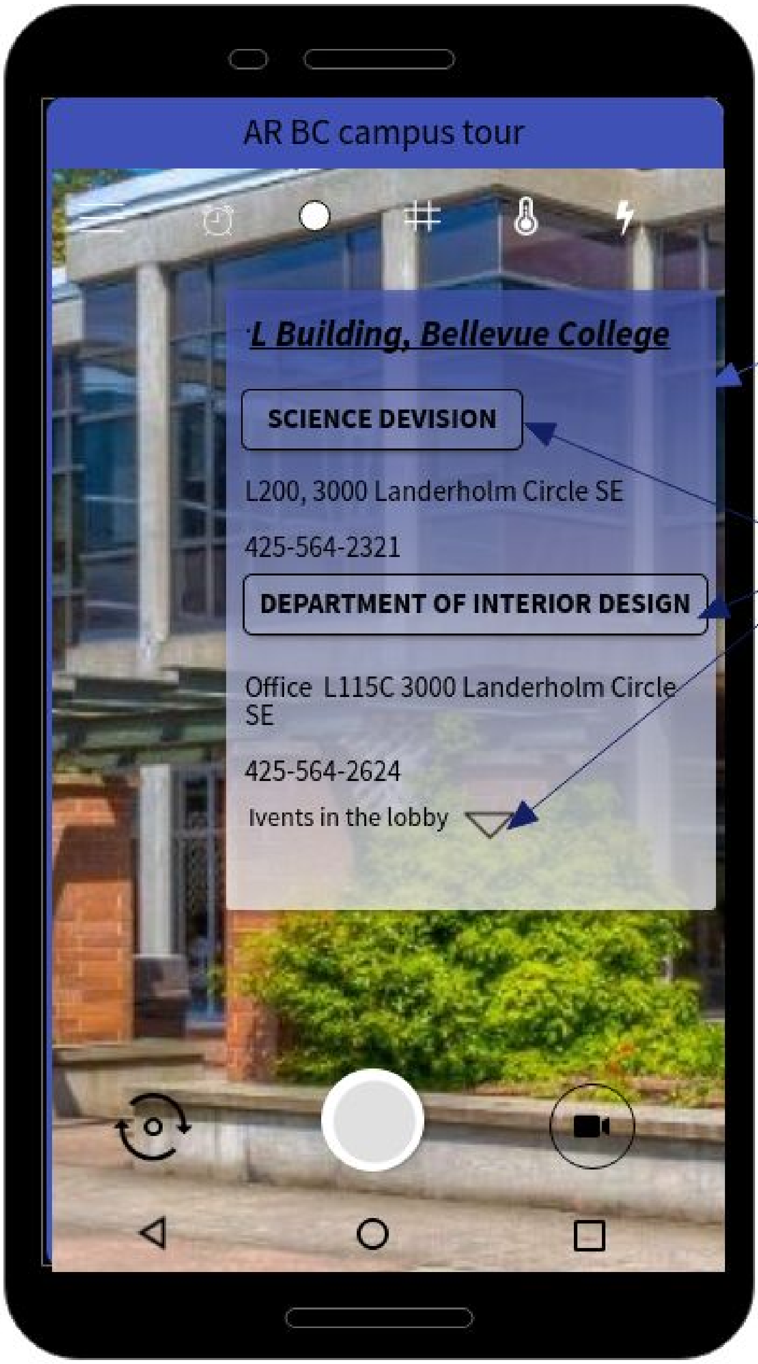


If user want to correct his position, he can move the pin

The click on this button confirm users location that helps to reduce the matrix search. So it's open new window.



Now Camera is active and matrix can be applied on the picture



AR BC campus tour

L Building, Bellevue College

SCIENCE DEVISION

L200, 3000 Landerholm Circle SE

425-564-2321

DEPARTMENT OF INTERIOR DESIGN

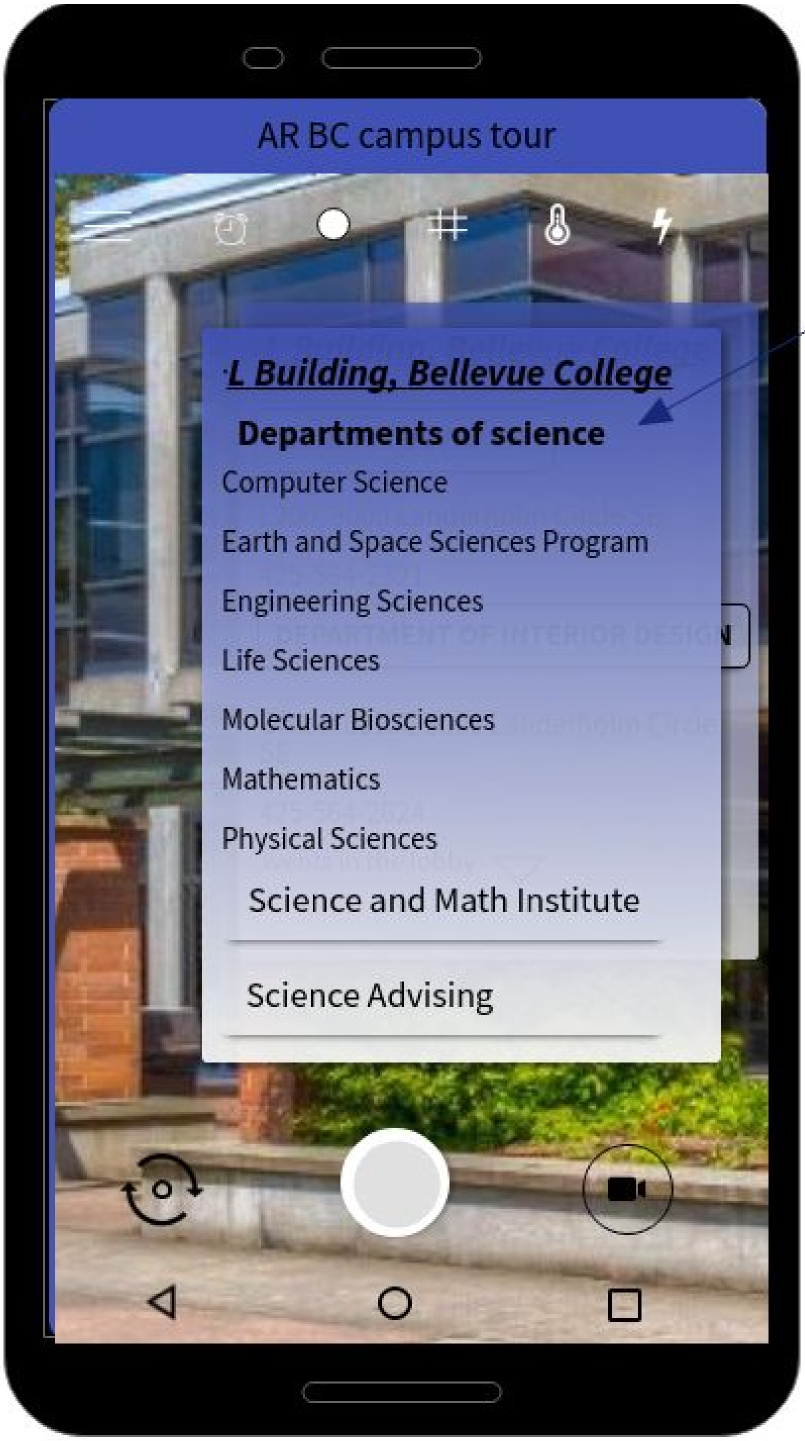
Office L115C 3000 Landerholm Circle SE

425-564-2624

Ivents in the lobby

AR give the first layer with main information about the building.

User can receive more information going throw layers by pushing the buttons. Some buttons will forward the user to web-pages or make a phone call.



AR BC campus tour

·L Building, Bellevue College

Departments of science

Computer Science

Earth and Space Sciences Program

Engineering Sciences

Life Sciences

Molecular Biosciences

Mathematics

Physical Sciences

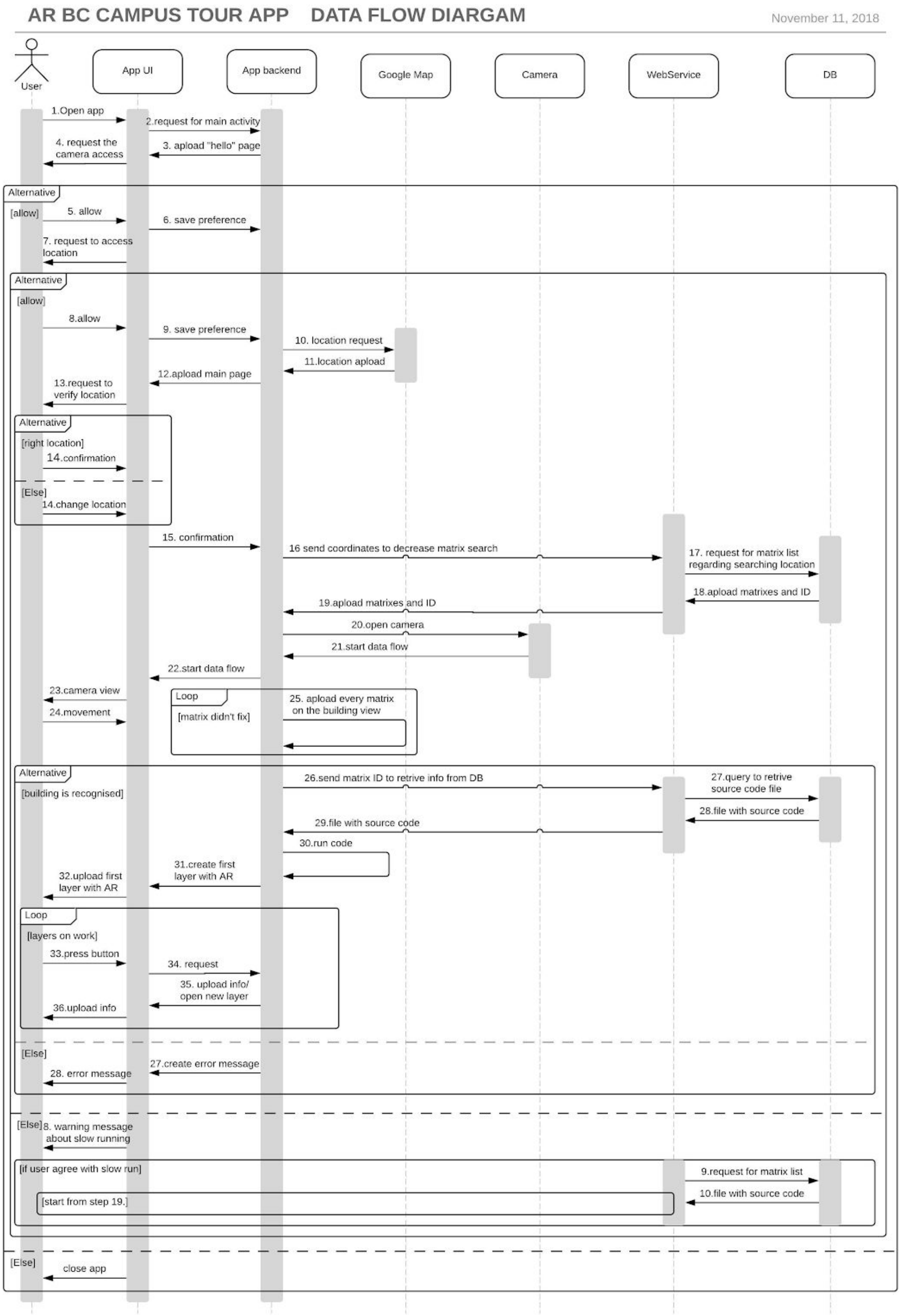
Science and Math Institute

Science Advising

Every new layer will contain more specific information and new links.

4. Detailed Design

4.1 Module Detailed Design



4.2 Data Detailed Design

All images are stored in the Cloud Database. Below is a description of picture insertion and retrieval.

Picture Insertion:

The main data component is pictures(bitmaps) of, for now, a letter representing a building. All buildings (in other words, building bitmaps) need to have an ID under which its bitmaps are going to be stored.

All image bitmaps need to be compressed and translated into a byte array before being stored in a database.

Picture Retrieval and Matching:

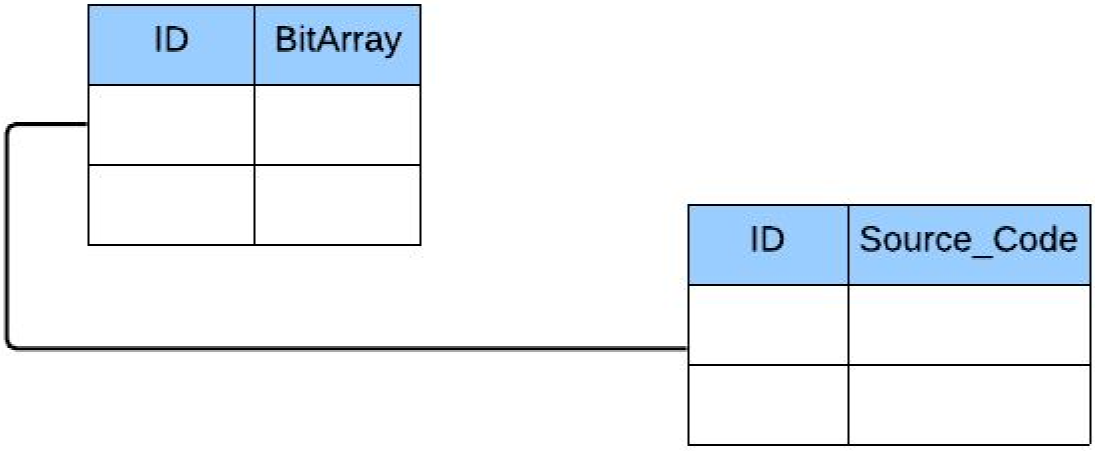
In order to recognize the building, the application needs to match the current view with one of the pictures from picture library from the Cloud database. To do so, it compresses the current view into a bitmap and then translates into a byte array. It then queries the Cloud database for a matching byte array. Once the match is found, ID is used to get a building name from a different table by matching IDs.

Source Code Insertion:

Source Code gets inserted once based on its building ID.

Source Code Retrieval:

Once image (building) is recognized, database grabs its relative building ID and looks for a matching ID in a source code table. Once it found the ID, the source code is returned to the application.



ID	BitArray

ID	Source_Code

4.3 Requirements Traceability Matrix

Req. #	Requirements	Design Specification	Test Steps	Expected result	Success	Remarks
1	User must be able to accept or decline camera permissions	FR1	1) Create camera permission pop up 2) Do something if user declines, proceed if they accept	Camera permission pop up shows		
2	User must be able to accept or decline GPS permissions	FR2	1) Create GPS permission pop up 2) do something if user declines, proceed if they accept	GPS permission pop up shows		
3	Program must recognize A building by corresponding letter on the building	FR3	1) User points camera at the ”A” letter on the building 2) Program uses GPS and Cloud Database data to discern the building they’re facing is the A building	Program decerns the building in question is the A building		
4	Program must recognize B building by corresponding letter on the building	FR3	1) User points camera at the “B” letter on the building 2) Program uses GPS and Cloud Database data to discern the building they’re facing is the B building	Program decerns the building in question is the B building		
5	Program must recognize C building by corresponding letter on the building	FR3	1) User points camera at the ”C” letter on the building 2) Program uses GPS and Cloud Database data to discern the building they’re facing is the C building	Program decerns the building in question is the C building		
6	Program must	FR3	1) User points camera at	Program		

	recognize D building by corresponding letter on the building		the ”D” letter on the building 2) Program uses GPS and Cloud Database data to discern the building they’re facing is the D building	decerns the building in question is the D building		
7	Program must recognize E building by corresponding letter on the building	FR3	1) User points camera at the ”E” letter on the building 2) Program uses GPS and Cloud Database data to discern the building they’re facing is the E building	Program decerns the building in question is the E building		
8	Program must recognize N building by corresponding letter on the building	FR3	1) User points camera at the ”N” letter on the building 2) Program uses GPS and Cloud Database data to discern the building they’re facing is the N building	Program decerns the building in question is the N building		
9	Program must recognize G building by corresponding letter on the building	FR3	1) User points camera at the ”G” letter on the building 2) Program uses GPS and Cloud Database data to discern the building they’re facing is the G building	Program decerns the building in question is the G building		
10	Program must recognize H (student housing) building by corresponding letter on the building	FR3	1) User points camera at the ”H” letter on the building ((student housing)) 2) Program uses GPS and Cloud Database data to discern the building they’re facing is the H building	Program decerns the building in question is the H building		
11	Program must recognize R building by corresponding	FR3	1) User points camera at the ”R” letter on the building 2) Program uses GPS and	Program decerns the building in question is the		

	letter on the building		Cloud Database data to discern the building they’re facing is the R building	R building		
12	Program must recognize L building by corresponding letter on the building	FR3	1) User points camera at the ”L” letter on the building 2) Program uses GPS and Cloud Database data to discern the building they’re facing is the L building	Program decerns the building in question is the L building		
13	Program must recognize K building by corresponding letter on the building	FR3	1) User points camera at the ”K” letter on the building 2) Program uses GPS and Cloud Database data to discern the building they’re facing is the K building	Program decerns the building in question is the K building		
14	Program must recognize M building by corresponding letter on the building	FR3	1) User points camera at the ”M” letter on the building 2) Program uses GPS and Cloud Database data to discern the building they’re facing is the M building	Program decerns the building in question is the M building		
15	Program must recognize T building by corresponding letter on the building	FR3	1) User points camera at the ”T” letter on the building 2) Program uses GPS and Cloud Database data to discern the building they’re facing is the T building	Program decerns the building in question is the T building		
16	Program must recognize U building by corresponding letter on the building	FR3	1) User points camera at the ”U” letter on the building 2) Program uses GPS and Cloud Database data to discern the building they’re facing is the U building	Program decerns the building in question is the U building		

17	Information must correctly populate the A building's overlay	FR4	1) Parser gets information from website 2) AR displays a layer with the information	Information is correctly displayed		We'll be able to get into deeper specifics once we have the exact activity layout
18	Information must correctly populate the B building's overlay	FR4	1) Parser gets information from website 2) AR displays a layer with the information	Information is correctly displayed		We'll be able to get into deeper specifics once we have the exact activity layout
19	Information must correctly populate the C building's overlay	FR4	1) Parser gets information from website 2) AR displays a layer with the information	Information is correctly displayed		We'll be able to get into deeper specifics once we have the exact activity layout
20	Information must correctly populate the D building's overlay	FR4	1) Parser gets information from website 2) AR displays a layer with the information	Information is correctly displayed		We'll be able to get into deeper specifics once we have the exact activity layout
21	Information must correctly populate the E building's overlay	FR4	1) Parser gets information from website 2) AR displays a layer with the information	Information is correctly displayed		We'll be able to get into deeper specifics once we have the exact activity layout
22	Information must correctly populate the N building's overlay	FR4	1) Parser gets information from website 2) AR displays a layer with the information	Information is correctly displayed		We'll be able to get into deeper specifics once we have the exact activity layout
23	Information must correctly populate the G building's overlay	FR4	1) Parser gets information from website 2) AR displays a layer with the information	Information is correctly displayed		We'll be able to get into deeper specifics once we have the exact activity layout
24	Information must correctly populate the H (student housing) building's overlay	FR4	1) Parser gets information from website 2) AR displays a layer with the information	Information is correctly displayed		We'll be able to get into deeper specifics once we have the exact activity layout
25	Information must correctly	FR4	1) Parser gets information from	Information is correctly		We'll be able to get into deeper specifics

	populate the R building’s overlay		website 2) AR displays a layer with the information	displayed		once we have the exact activity layout
26	Information must correctly populate the L building’s overlay	FR4	1) Parser gets information from website 2) AR displays a layer with the information	Information is correctly displayed		We’ll be able to get into deeper specifics once we have the exact activity layout
27	Information must correctly populate the K building’s overlay	FR4	1) Parser gets information from website 2) AR displays a layer with the information	Information is correctly displayed		We’ll be able to get into deeper specifics once we have the exact activity layout
28	Information must correctly populate the M building’s overlay	FR4	1) Parser gets information from website 2) AR displays a layer with the information	Information is correctly displayed		We’ll be able to get into deeper specifics once we have the exact activity layout
29	Information must correctly populate the T building’s overlay	FR4	1) Parser gets information from website 2) AR displays a layer with the information	Information is correctly displayed		We’ll be able to get into deeper specifics once we have the exact activity layout
30	Information must correctly populate the U building’s overlay	FR4	1) Parser gets information from website 2) AR displays a layer with the information	Information is correctly displayed		We’ll be able to get into deeper specifics once we have the exact activity layout
31	The A building’s information must be overlaid on the A building in AR	FR5	1) A building is recognized 2) AR displays a layer with the information	The overlay gathered the information correctly and the correct one is displayed		
32	The B building’s information must be overlaid on the B building in AR	FR5	1) B building is recognized 2) AR displays a layer with the information	The overlay gathered the information correctly and the correct one is displayed		

33	The C building's information must be overlaid on the C building in AR	FR5	1) C building is recognized 2) AR displays a layer with the information	The overlay gathered the information correctly and the correct one is displayed		
34	The D building's information must be overlaid on the D building in AR	FR5	1) D building is recognized 2) AR displays a layer with the information	The overlay gathered the information correctly and the correct one is displayed		
35	The E building's information must be overlaid on the E building in AR	FR5	1) E building is recognized 2) AR displays a layer with the information	The overlay gathered the information correctly and the correct one is displayed		
36	The N building's information must be overlaid on the N building in AR	FR5	1) N building is recognized 2) AR displays a layer with the information	The overlay gathered the information correctly and the correct one is displayed		
37	The G building's information must be overlaid on the G building in AR	FR5	1) G building is recognized 2) AR displays a layer with the information	The overlay gathered the information correctly and the correct one is displayed		
38	The H (student housing) building's information must be overlaid on the H building in AR	FR5	1) H building is recognized 2) AR displays a layer with the information	The overlay gathered the information correctly and the correct one is displayed		
39	The R building's information must	FR5	1) R building is recognized	The overlay gathered the		

	be overlaid on the R building in AR		2) AR displays a layer with the information	information correctly and the correct one is displayed		
40	The L building's information must be overlaid on the L building in AR	FR5	1) L building is recognized 2) AR displays a layer with the information	The overlay gathered the information correctly and the correct one is displayed		
41	The K building's information must be overlaid on the K building in AR	FR5	1) K building is recognized 2) AR displays a layer with the information	The overlay gathered the information correctly and the correct one is displayed		
42	The M building's information must be overlaid on the M building in AR	FR5	1) M building is recognized 2) AR displays a layer with the information	The overlay gathered the information correctly and the correct one is displayed		
43	The T building's information must be overlaid on the T building in AR	FR5	1) T building is recognized 2) AR displays a layer with the information	The overlay gathered the information correctly and the correct one is displayed		
44	The U building's information must be overlaid on the U building in AR	FR5	1) U building is recognized 2) AR displays a layer with the information	The overlay gathered the information correctly and the correct one is displayed		
45	Help menus are operational	FR7	1) User clicks on "help menu" icon 2) A fragment or activity pops up containing the	Help menu correctly displays		

			help information			
47	Parse the BC webpage	FR9	1) App utilizes the parser	Parser returns the needed information		
48	Confirm Location Button	FR10	2) User looks at map 3) If user likes the current location, they press the button.	Button sends location information and opens next activity		