ESCAPE

An app to find quiet areas in a busy city

Abstract

This app gathers data using passive microphone sensors that send location data and noise data to a database to gather details on the quietest places around cities. This data is parsed on our app to allow users to see where around them is the quietest at that time.

The Problem

People living in cities are regularly exposed (against their will) to noise above 85 decibels from sources like traffic, subways, industrial activity, and airports. That's enough to cause significant hearing loss over time. [1]

According to a European Union (EU) publication [2]:
- About 40% of the population in EU countries is exposed to road traffic noise at levels exceeding 55 db(A);
- 20% is exposed to levels exceeding 65 dB(A) during the daytime; and
  more than 30% is exposed to levels exceeding 55 dB(A) at night.
- Only limited international figures are available on the health impact of environmental noise in the European Region. WHO/Europe published preliminary estimates in 2011.

The Solution

[3] Under the EU Environmental Noise Directive (END) 2002/49/EC, 'Quiet Areas' (urban or in open country) must be protected against noise. Quiet areas are not areas of complete silence but are ones that are undisturbed by unwanted or harmful outdoor sound created by human activities (i.e. environmental noise).

Article 3 of END defines a quiet area in an agglomeration as:

> *'an area, delimited by the competent authority, for instance which is
> not exposed to a value of Lden or of another appropriate noise
> indicator greater than a certain value set by the Member State, from
> any noise sources.'*

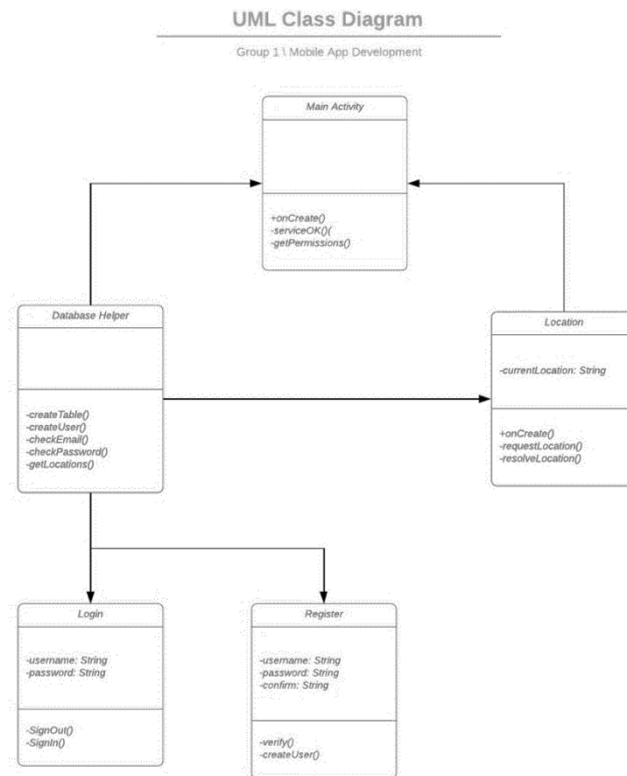and defines a quiet area in open country as:

> *'an area, delimited by the competent authority, that is undisturbed by
> noise from traffic, industry or recreational activities.'*

Our solution would involve implementing a monitoring system with devices placed around areas of our test city, Belfast, in order to monitor noise levels in certain areas. This will give us the data we need to plot back where would be the quietest place at a certain location and at a certain time.
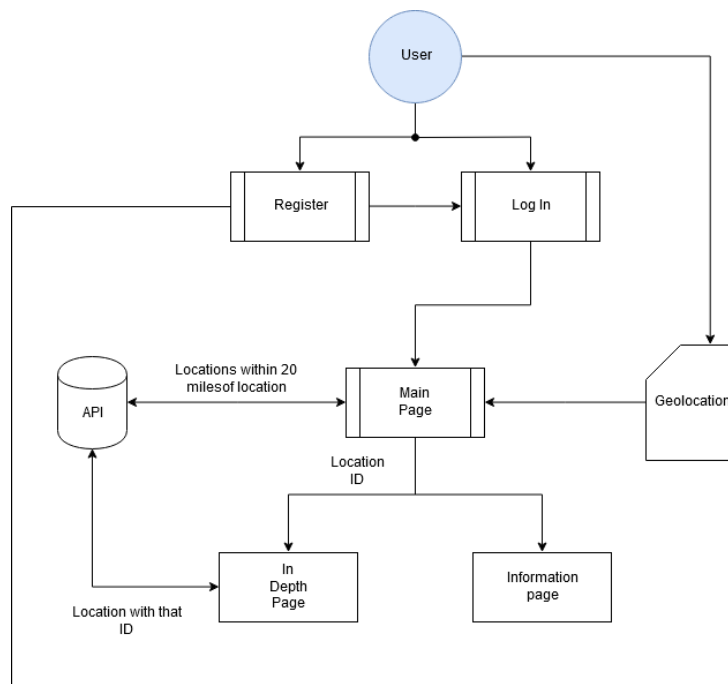
The ethics of placing microphone devices in these areas can be addressed, as we only plan to feedback real time volume levels for plotting as data and are not interested currently in the content of the audio to help protect the public from the surveillance capabilities of the devices.
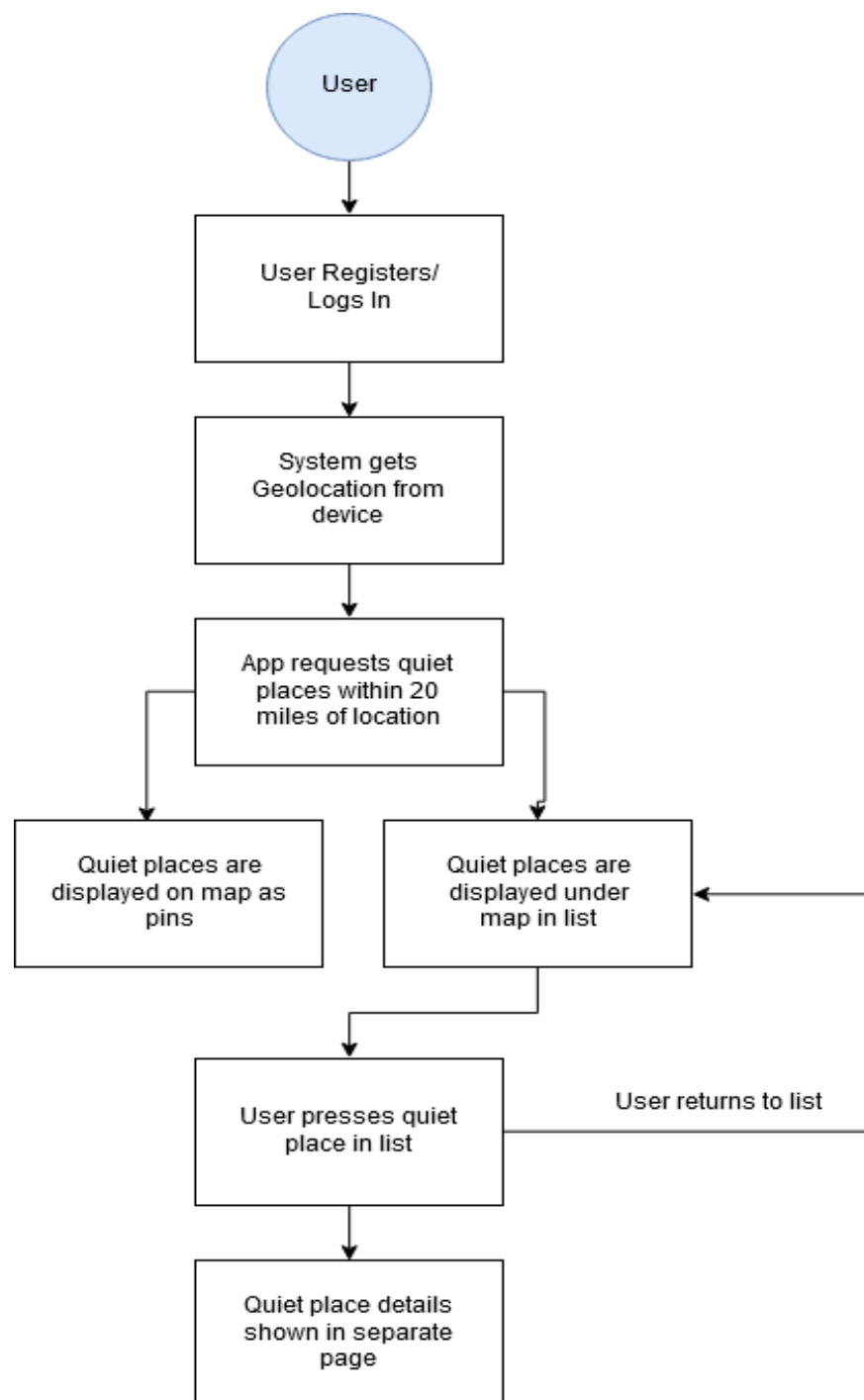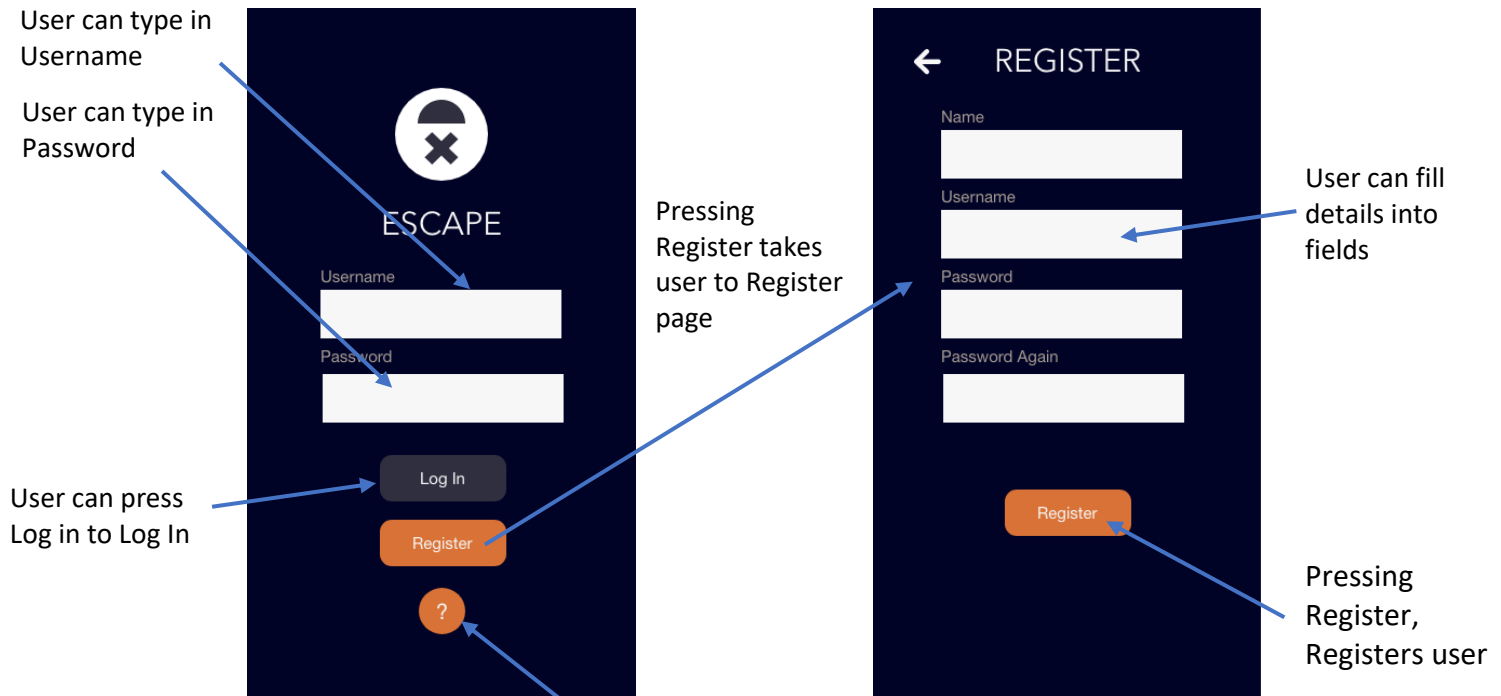
Our Concept
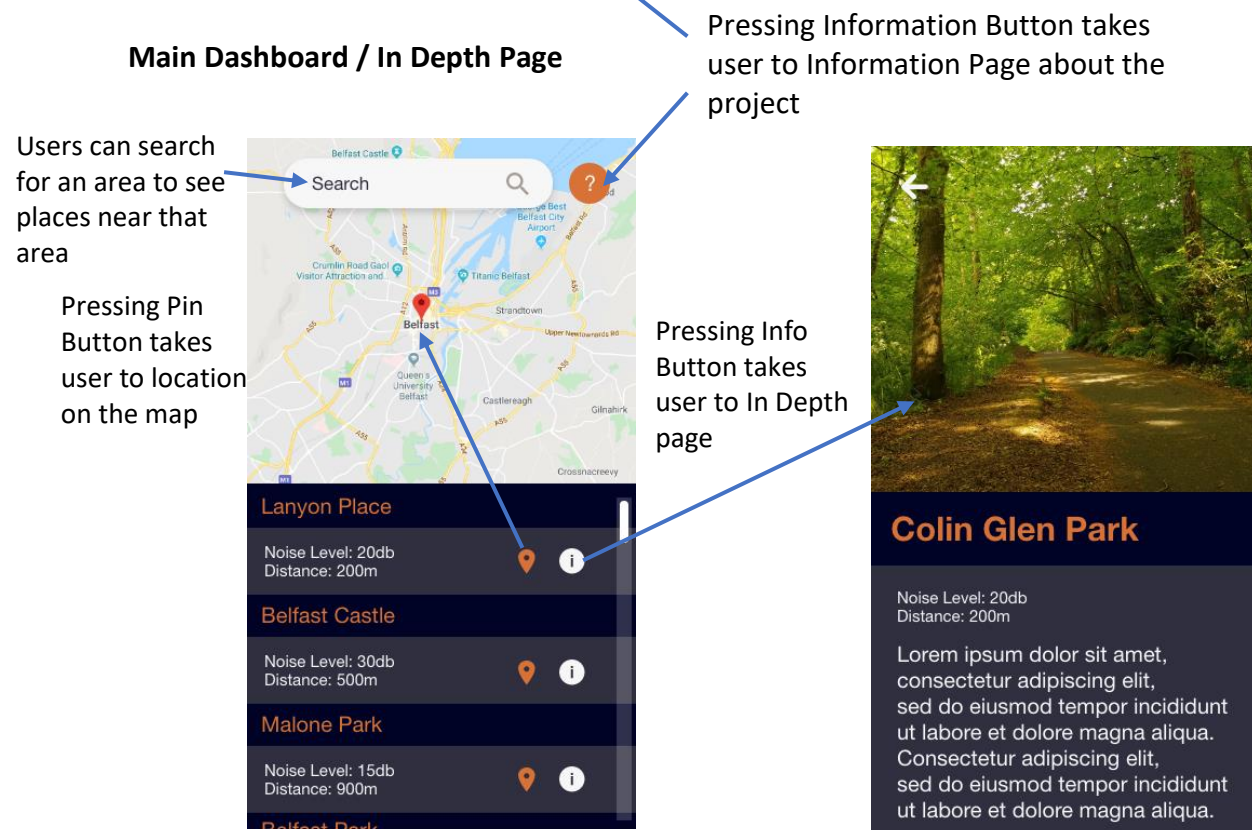
UML Class Diagram:

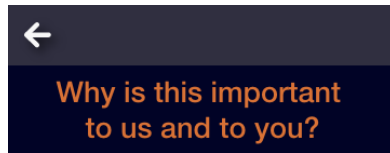User Data Flow:

User Walkthrough:

Storyboards:

Login/Register

User can type in Username

User can type in Password

Pressing Register takes user to Register page

User can fill details into fields

ESCAPE

Username

Password

Log In

Register

?

User can press Log in to Log In

REGISTER

Name

Username

Password

Password Again

Register

Pressing Register, Registers user

Pressing Information Button takes user to Information Page about the project

Main Dashboard / In Depth Page

Users can search for an area to see places near that area

Pressing Pin Button takes user to location on the map

Search

Lanyon Place

Noise Level: 20db
Distance: 200m

Belfast Castle

Noise Level: 30db
Distance: 500m

Malone Park

Noise Level: 15db
Distance: 900m

Pressing Info Button takes user to In Depth page

Colin Glen Park

Noise Level: 20db
Distance: 200m

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Information Page:

This shows information about the project, including why it should be used

Technology:

We chose to develop this app for the Android framework as this is the area, we had most experience in and would allow the biggest reach in terms of user base, being the most popular mobile operating system in terms of users.

For our database, we chose to use SQLite as it is bundled with Android phones and allowed us to have relational tables of data and easy access for efficiency. Ideally for scale, we would transfer this to Firebase or another cloud platform in future.
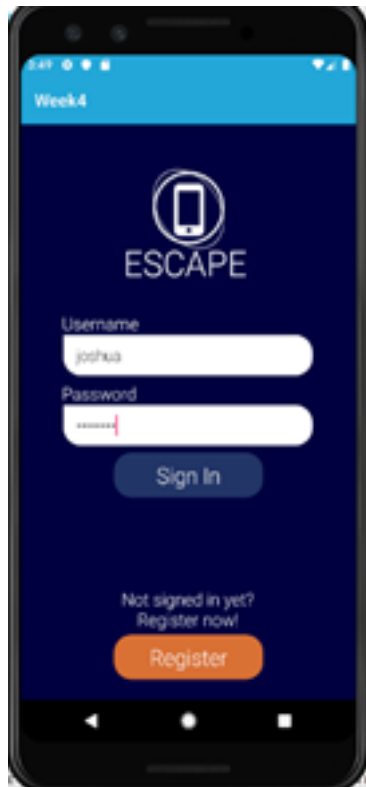
In terms of our proposed IoT device for this project, it would resemble this noise monitor. Including a GSM chip and geolocation module to allow uplink to an API service, reporting back a geolocation and noise level in the area.
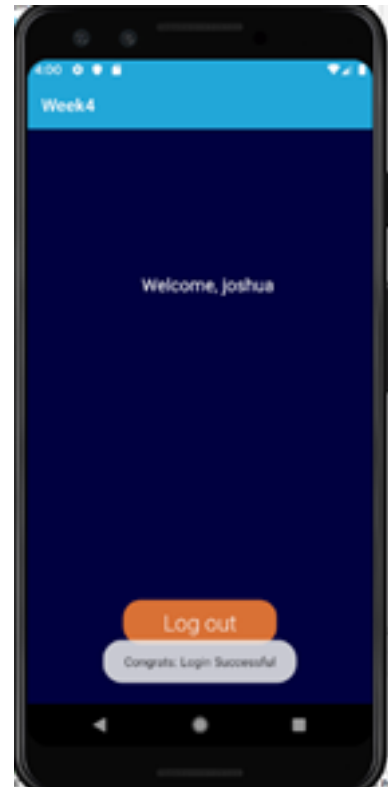
Technical Development

Login/Register development:

Each element of the app will be shown below using an emulator:

This shows the Log In flow for users

This shows successful Log In page which users are then redirected away from

This shows Sign Up flow on the app where users enter their details and can create an account

Data Pages:

First page loads Belfast quiet places, as our app is aimed at Belfast, it displays Belfast Airport as a mock current location. These coordinates are set manually because current location would display Google Plex Centre in San Francisco, and we have no quiet places for this area. We display a list below the current location button to display Quiet Places around you with the closest first.

This shows the ability to scroll through suggested areas underneath
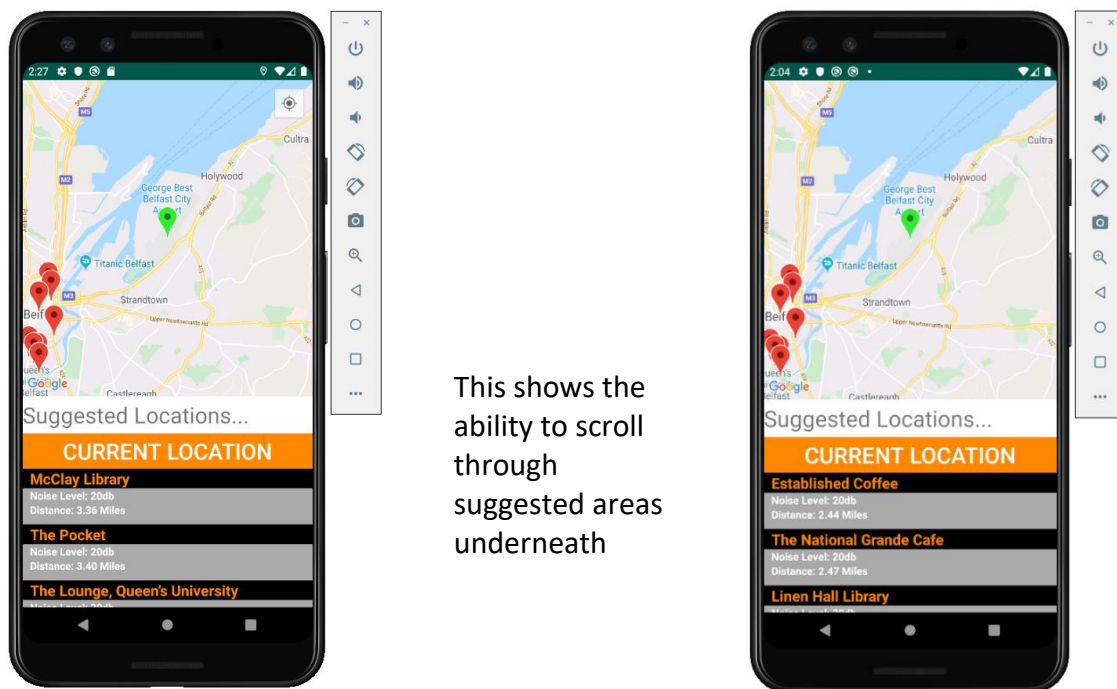
Suggested Location-

Suggested Location is added to show that the result of current Location would actually update within the map with a real device using current location and display Quiet Places around you. However, for the purposes of the assignment and needing to use an emulator it currently uses the coordinates of the train station or the bus station within that city as your location. It would display new Quiet Places within the area you have selected. Also, it could be used in final design as it allows the user to view Quiet Places outside of their area in different cities if they wanted -see below

Suggested Derry/Londonderry
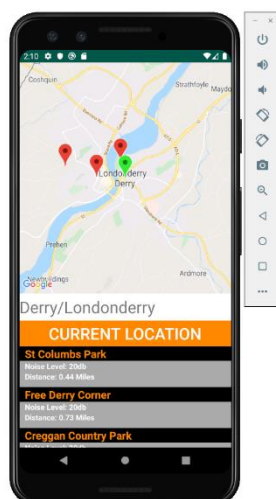
Suggested Belfast
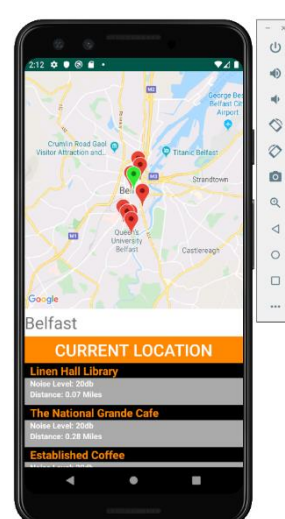
Current Location button-

Displays current location on map, but the view beneath button current location is empty as there are no Quiet Places saved within the database in this area. The current location button does pinpoint the current location with a green marker and also sets a blue dot as the current location. If location was set within an area within the north then quiet places would appear.
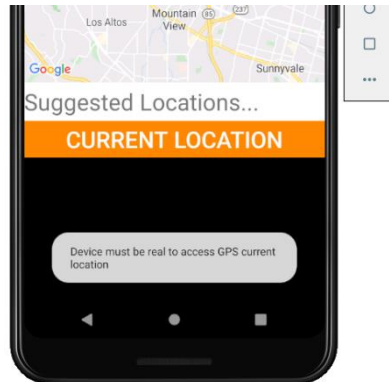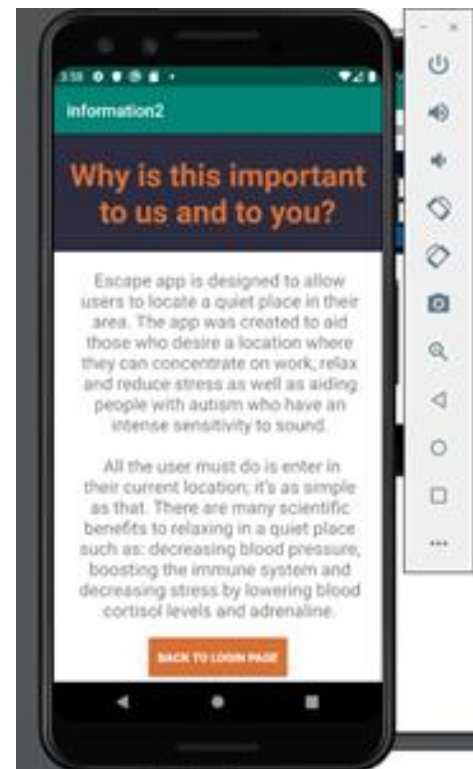

Marks when clicked display the name of the quiet place, and if your current location marker is clicked it displays your location.
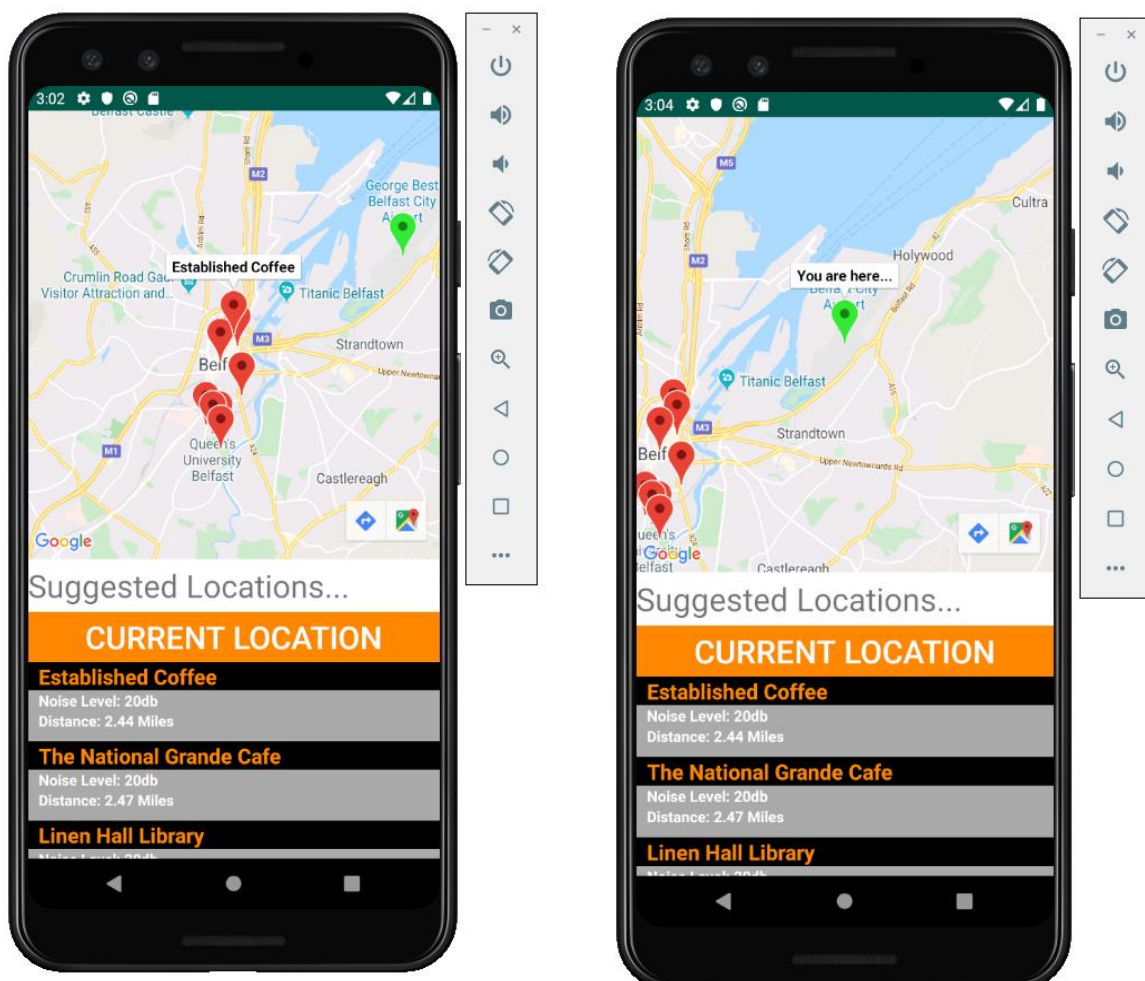
Information Page

This shows the
information page
displaying some
info about our
app concept, this
can be accessed
from our main
page

Database:


```
1     package com.example.myapplication;
2
3     import ...
16
17    class DatabaseHelper extends SQLiteOpenHelper {
18        public DatabaseHelper(@Nullable Context context) { super(context, name: "Login.db", factory: null, version: 1); }
21
22        @Override
23        public void onCreate(SQLiteDatabase db) {
24            db.execSQL("Create table user (email text primary key, password text) ");
25            db.execSQL("Create table location (locationID int primary key, locationName text, locationLongitude int, locationLatitude int )");
26            db.execSQL("Create table quietPlaces (quietPlaceID int primary key, " +
27                "quietPlaceName text, " +
28                "quietPlaceDescription text, " +
29                "quietPlaceSoundLevel int, " +
30                "locationID text, " +
31                "quietPlaceLongitude int, " +
32                "quietPlaceLatitude int, " +
33                "foreign key (locationID) references location(locationID) )");
34        }
35
36        @Override
37        public void onUpgrade(SQLiteDatabase db, int oldVersion, int newVersion) {
38            db.execSQL("drop table if exists user");
39            db.execSQL("drop table if exists location");
40            db.execSQL("drop table if exists quietPlaces");
41        }
42
43        //insert into database
44        public boolean insertUser(String email, String password) {
45            SQLiteDatabase db = this.getWritableDatabase();
46            ContentValues contentValues = new ContentValues();
47            contentValues.put("email", email);
48            contentValues.put("password", password);
49            Long user = db.insert( table: "user", nullColumnHack: null, contentValues);
50            if (user == 1) return false;
51            else return true;
52
53        }
54
55        public Boolean checkEmail(String email) {
56            SQLiteDatabase db = this.getReadableDatabase();
57            Cursor cursor = db.rawQuery( sql: "Select * from user where email = ?", new String[]{email});
58            if (cursor.getCount() > 0) return false;
59            else return true;
60        }
61
```

This shows our
database being
created with
relevant tables

A Breakdown of Contribution to the Project

References

[1] Wagner, K. (2018). *City Noise Might Be Making You Sick*. [online] The Atlantic. Available at: https://www.theatlantic.com/technology/archive/2018/02/city-noise-might-be-making-you-sick/553385/ [Accessed 16 Nov. 2019].

[2] Data and statistics. (2019). *Who.int*. [online] Available at: http://www.euro.who.int/en/health-topics/environment-and-health/noise/data-and-statistics [Accessed 16 Nov. 2019].

[3] Cities at a Glance. (n.d.). [online] Available at: https://webgate.ec.europa.eu/greencitytool/resources/docs/best_practices/GPFS_QuietAreas_A01.pdf [Accessed 16 Nov. 2019].

A Breakdown of Contribution to the Project