

CS 6235-A: Real Time Systems



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TABLE OF CONTENTS

MOTIVATION	2
RELATED WORK	3
RISKS AND CHALLENGES	4
AVAILABLE DATASETS/APIs	7
PROTOTYPE ARCHITECTURE	12
DELIVERABLES	12
WORKPLAN	13
TIMELINE	13
IMPLEMENTATION AND FEATURES	14
DATABASE SCHEMA	25
TECHNOLOGY STACK	26
TEST AND EVALUATION	26
FUTURE SCOPE	27

MOTIVATION:

DILEMMA:

No integrated housing and roommate options for university students

PROBLEM:

No website catering specifically to the student community

SOLUTION:

A one-stop shop for students to find apartments and roommates

EXPLANATION:

As students, we have all gone through the dilemma of finding the right choice of accommodation when relocating across states or continents. While students from the same country could still go and have a look at the area and the nearby amenities before deciding on their apartment, it is a major cause of concern for international students who have to decide on a place to live months before they actually shift base. There are some websites like Zillow, Trulia, and Walk Score that dish out details about apartment communities, and some neighborhood information. However, there is no website that caters specifically to the needs of university students e.g. proximity to the college, budget, etc. Another major concern is the roommate search. Students generally prefer to have preferences for roommates and resort to finding them through messaging apps or in-person meets. **Drawing from personal experience**, we decided to come up with a web solution that will cater solely to the student community for both, apartment search and roommate search.

While existing websites bombard users with hundreds of results and suggestions for apartments, we intend to simplify our web application by spontaneously returning only the apartments within a certain radius of the user's university selection considering the fact that students have to commute daily to the campus. We will allow the users to specify their preferences, as well as view the neighborhood details of the apartment, such as traffic and route information, transit and commutability, and apartment-specific information such as the address, website information and reviews. Simultaneously, the web application will let users create profiles and will showcase roommate suggestions based on their profile details and apartments of interest. Thus we propose to integrate both modules into a single application with help of Google map APIs and other services.

RELATED WORK:

- **RoomSurf**

RoomSurf is an independent resource for students looking for roommates at their particular university. Students can create profiles based on their preferences, and take surveys that

help the application match them to potential roommates. The application then displays the matches, which students can review and decide on the best match.

- **Zillow**

Zillow is a popular resource for looking up houses for buying, selling or renting, and offers several features including aerial views of homes, and prices of comparable homes in the area. It also provides information like cost, the number of days for which the ad has been posted on their website, the square footage and the number of bedrooms and bathrooms in a home. Zillow provides an application programming interface (API) and developer support network.

- **Trulia**

Trulia provides price trend information by using listing and public data which shows how the price of a home has changed over a period of time as well as comparing that house price with other homes in the same ZIP code and the same city. Information on local schools and amenities is provided for each property listed on the company's website. The map shows the driving or commute times, and a visual representation of commute times is projected onto a geographical map.

RISKS AND CHALLENGES:

LACK OF DATA:

- **Apartment data**

PLAN: We planned to source a data-provider for rental apartment information for apartments around universities in the US

CHALLENGE: We found that such specific data is difficult to source. We considered Zillow and Trulia (explained below)

- **Cannot rely on historical data**

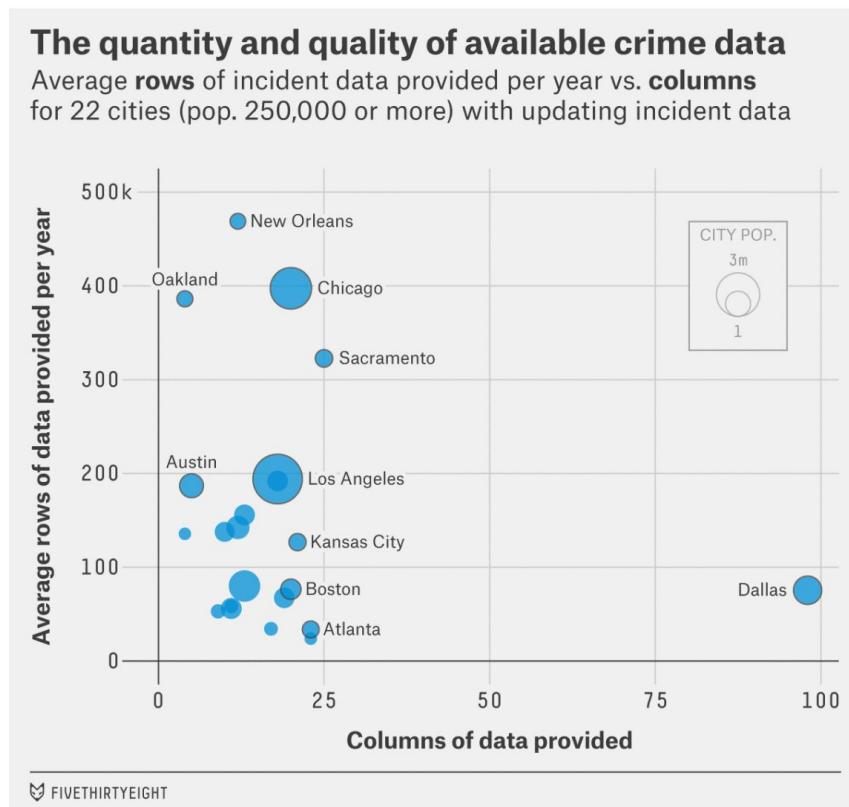
PLAN: We planned to provide a lot of data about apartments for our users

CHALLENGE: We cannot use historical data which is freely available on the web, since ours is a real-time data-driven system. Lack of any publicly available real-time data resource provided by Zillow API and other real-estate websites for the entire US (since we are planned to provide support for all major universities in the USA)

- Safety feature implementation

PLAN: We planned to incorporate heat maps depicting safe regions and crime-prone regions for locations around the universities

CHALLENGE: Statistics on verified public crime data available in US:



(Source: www.fivethirtyeight.com)

LACK OF API SUPPORT:

- No relevant data from Zillow APIs

PLAN: We planned to use the Zillow API, to gather data for verified apartment-specific information such as unit-specific information, real-time pricing data, amenities provided and verified contact information.

CHALLENGE: The Zillow API, in recent times, has cut down on providing all this data freely to developers. The only details provided are the apartment address, its latitude, longitude, specific unit numbers, and link to its listing on Zillow.

The screenshot shows a Microsoft Edge browser window with the following details:

- Title Bar:** Online PHP Script Execut x
- Address Bar:** localhost/rtspoint/searchapt.php
- Bookmarks Bar:** Apps (250 Ivy League courses, Spiels of a Quill, Newsletter Archive | 20 free books to get, Problems - LeetCode, Hello World - GitHub, Students - Google Classroom)
- Content Area:** A large block of text representing the JSON response from the Zillow API. The text is mostly identical, listing various property details for the address 470 16th St NW in Atlanta, GA.
- Bottom Bar:** Type here to search, taskbar icons (File Explorer, OneDrive, Mail, Photos, Edge, Chrome, Etc., Mail, Photos, Edge, Chrome, Etc.), system status (10:21, ENG, 2017-11-29).

The above screenshot shows the result returned by the Zillow API for the address: **470 16th ST NW**. The result returned includes the available unit numbers, Zillow information like Zillow Property ID (ZPID) and date of post creation, and links to that unit on Zillow website.

- **Trulia support unavailable**

PLAN: We planned to use the Trulia API. With the Trulia API, developers can add real estate data to their applications. Available data includes: neighborhoods in a city, cities and counties in a state, and geo-location information. Developers also have access to Trulia traffic statistics and sale listing data.

CHALLENGE: Trulia has since stopped all developer API support (<http://developer.trulia.com/> - redirects to a broken page)

- **Limited support from Walk Score API:**

PLAN: We planned to include the **Travel Time API**, which calculates travel times between places and visualizes travel times on a map. We hoped to showcase user commute time from the university to the selected apartment through this API.

CHALLENGE: API Key was not provided by Walk Score.

NOTE: The Travel Time API can be used to:

- [Easily add a Travel Time Widget](#) to map.

- [Search for apartments](#) or homes by commute time.
- [Calculate travel times](#) on a map

AVAILABLE DATASETS/APIs:

Due to the above mentioned risks that we faced, we decided to use the following as our data sources:

1. Google Maps API

Google Maps lets developers pass a search query and displays the output on the map interface, just the way it would work if one were to manually perform a search on the Google Maps homepage. We exploited this feature to query for apartments near the student's university and used markers to point to the search results on the map. Being a vast data source in itself, the map also outlines the travel network, the restaurants, hospitals and many other amenities which gets incorporated when we use the Google Maps API. Another star feature is that Google Maps provides three different views to the user- Roadmap view, Satellite view and Street View.

Roadmap view is the default one where one can view all the roads and nearby amenities in a very easy way. Satellite view is one constructed using Google Earth satellite images. With street view, one can explore the streets and maybe step-inside certain places for all supported locations. We have incorporated all these features of Google Maps in our project to enhance user experience.

Another feature is that Google Maps lets users add layers over it. These may be custom layers or the ones that are already supported by Google Maps. The layers may be bike routes, traffic, heat map, etc.

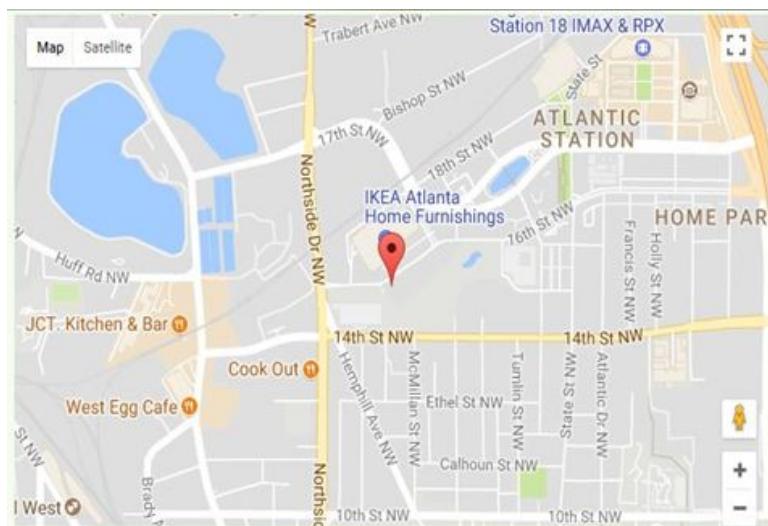


Fig.: Google Maps Roadmap view

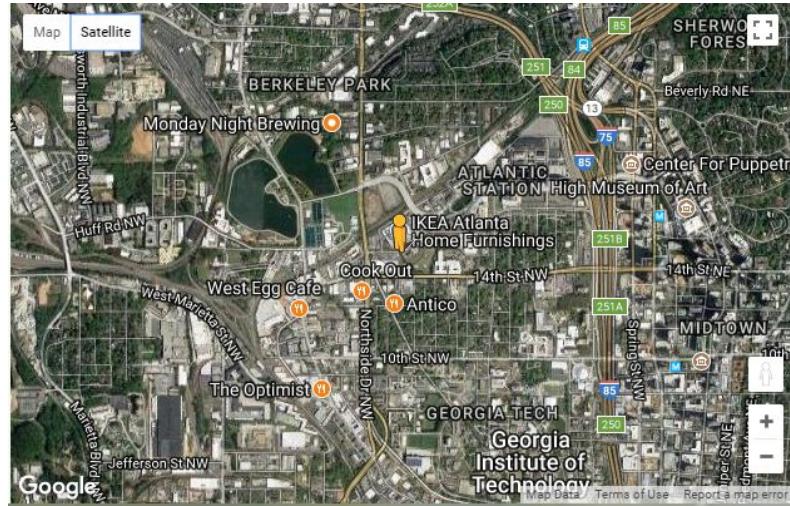


Fig. Google Maps Satellite view

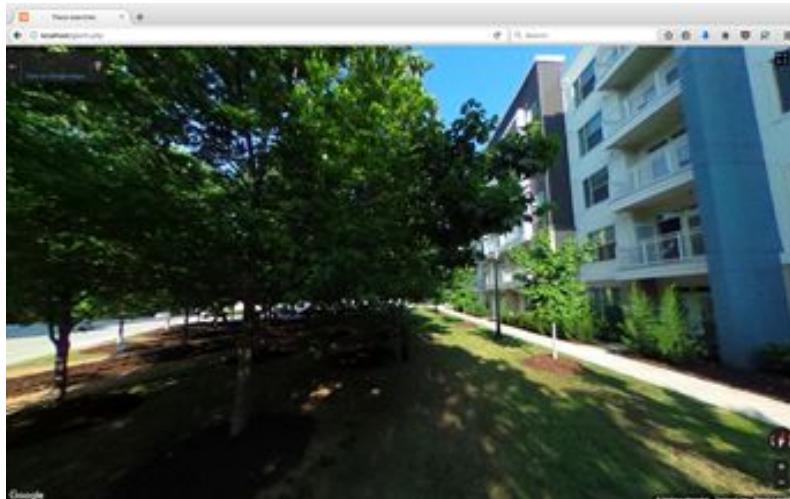


Fig.: Google Maps Street view

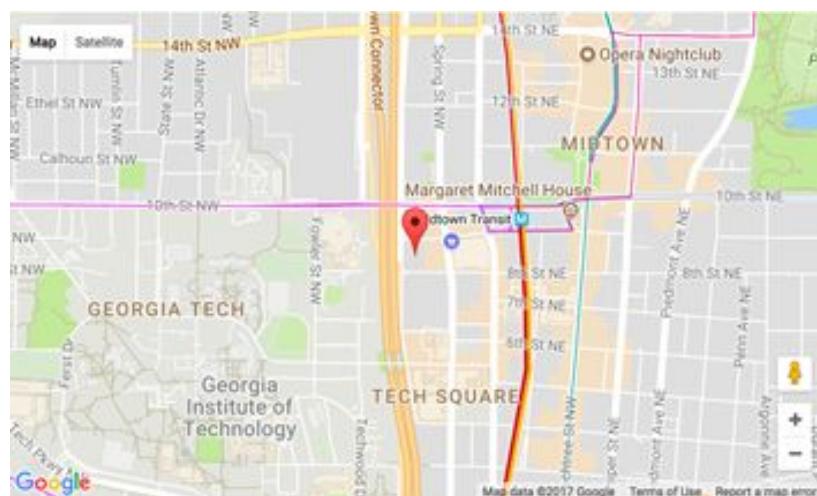


Fig.: Google Maps Transit Layer

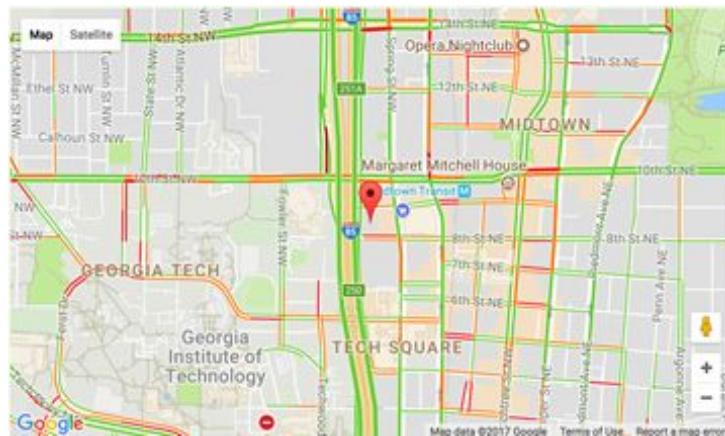


Fig.: Google Maps Traffic Layer

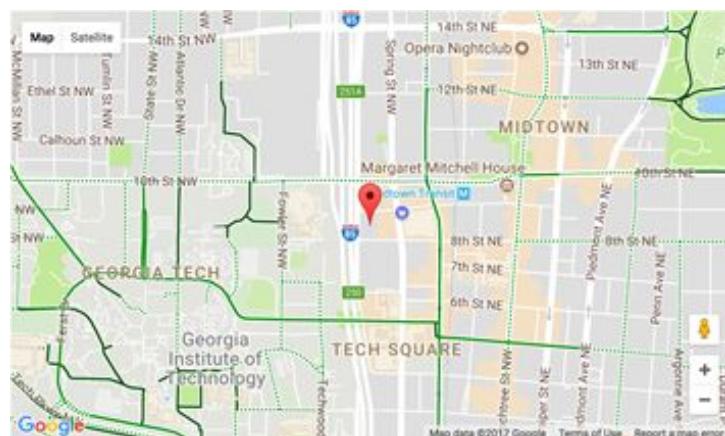


Fig.: Google Maps Biking Layer

Why use Google Maps for our application?

- Provides informative interface
- Provides local information (e.g. address, latitude, longitude)
- View of nearby amenities
- Layers on Google Maps (e.g. Traffic, Public transit and biking routes)

2. APIs from WalkScore

Walk Score is an apartment finder website that has many features and APIs to support the same. The Walk Score APIs that we have used returns the following information:

- **Walk Score**

Walk Score measures the walkability of any address using a patented system. For each address, Walk Score analyzes hundreds of walking routes to nearby amenities. Points are awarded based on the distance to amenities in each category. Amenities within a 5 minute walk (.25 miles) are given maximum points. Walk Score also measures pedestrian friendliness by analyzing population density and road metrics such as block length and intersection density. Data sources include Google, Education.com, Open Street Map, the U.S. Census, Localeze, and places added by the Walk Score user community.

- **Transit Score**

Transit Score is a patented measure of how well a location is served by public transit on a scale from 0 to 100. The Transit Score algorithm calculates a score for a specific point by summing the relative "usefulness" of nearby routes. They define usefulness as the distance to the nearest stop on the route, the frequency of the route, and type of route.

- **Bike Score**

Bike Score measures whether a location is good for biking on a scale from 0 - 100 based on four equally weighted components: Bike lanes, Hills, Destinations and road connectivity, and Bike commuting mode share. The goal with Bike Score is to provide an easy way to evaluate bikeability at a specific location. Bike Score can be used by the student community, majority of whom rely on bikes for local commute.

- **Graphical visualization of nearby amenities**

A bar graph displays the percentage of amenities available by categories. These categories include dining & drinking, groceries, shopping, errands, parks, schools, and culture & entertainment.

Walk Score®	Description
90-100	Walker's Paradise Daily errands do not require a car.
70-89	Very Walkable Most errands can be accomplished on foot.
50-69	Somewhat Walkable Some errands can be accomplished on foot.
25-49	Car-Dependent Most errands require a car.
0-24	Car-Dependent Almost all errands require a car.

Fig.: Walk Score

Transit Score®	Description
90-100	Rider's Paradise World-class public transportation.
70-89	Excellent Transit Transit is convenient for most trips.
50-69	Good Transit Many nearby public transportation options.
25-49	Some Transit A few nearby public transportation options.
0-24	Minimal Transit It is possible to get on a bus.

Fig.: Transit Score

Bike Score	Description
90-100	Biker's Paradise Daily errands can be accomplished on a bike.
70-89	Very Bikeable Biking is convenient for most trips.
50-69	Bikeable Some bike infrastructure.
0-49	Somewhat Bikeable Minimal bike infrastructure.

Fig.: Bike Score

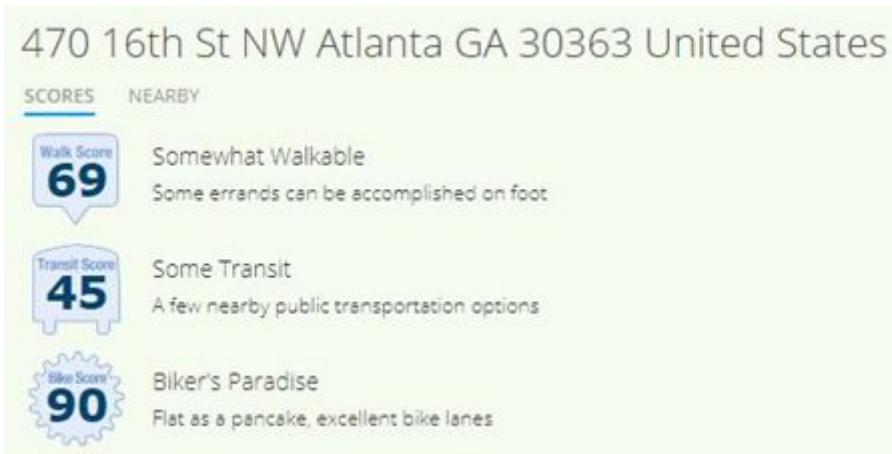


Fig.: Scores provided by WalkScore



Fig.: Nearby amenities by categories

Why use WalkScore for our application?

- WalkScore measures walkability of location, availability of public transit and feasibility for biking
- Analyzes hundreds of routes to calculate scores
- A general overview about nearby amenities making decisions easier for the user

PROTOTYPE ARCHITECTURE:

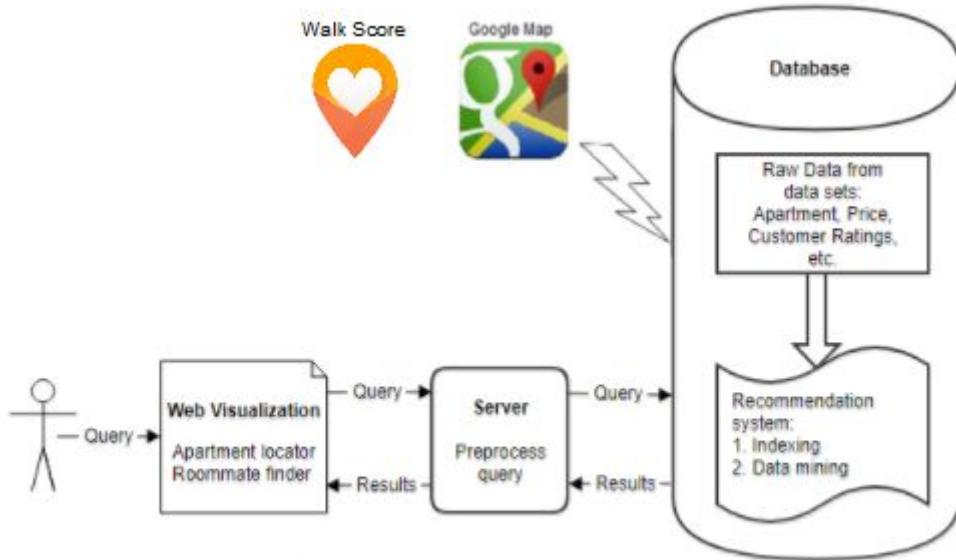


Fig.: Prototype Architecture

The figure above depicts our prototype architecture. There are two main modules in our application:

- **Apartment locator**

A user is expected to enter his/her university name while creating the profile. Using this information, we query the Google Maps API in the apartment finder module. This query goes to their server and retrieves real-time data (nearby apartments) which are then displayed to the user via the Google Maps interface. Our module will also have other data like walk score, bike score, transit score, traffic data, etc. After reviewing all these details, the user can mark his/her interest in apartments that he likes from the ones that our application displays.

- **Roommate finder**

The user can edit their preferences for a roommate anytime in the application. Once they mark their interested apartments, they can also view other people from the same university who have expressed an interest in those very apartments. On clicking their usernames, the user will be redirected to their respective profiles where he/she can see what the other person's preferences are for their potential roommate. This simplifies the process of roommate search.

DELIVERABLES:

- Source code of the application
- Presentation of implementation
- Final report

WORK PLAN:

Sneha:

- Requirement Analysis and Design
- Implementation of Google Maps API
- Database implementation
- Profile updation
- Testing

Nidhi:

- Technology Research and Familiarization
- Implementation of Walk Score API
- User interface implementation
- Miscellaneous features (eg: Feedback)
- Evaluation

TIMELINE:

The timeline followed for our project pipeline is as shown in the color-coded chart below:

Milestone \ Time	Sep 24	Oct 1	Oct 8	Oct 15	Oct 22	Oct 29	Nov 5	Nov 12	Nov 19	Nov 26	Dec 3
Requirement Analysis and Design											
Technology Research and Familiarization											
Implementation of API for part A*											
Implementation of database for part B**											
Implementation of dashboard											
Testing and Evaluation											
Miscellaneous features											
Project Deliverables											

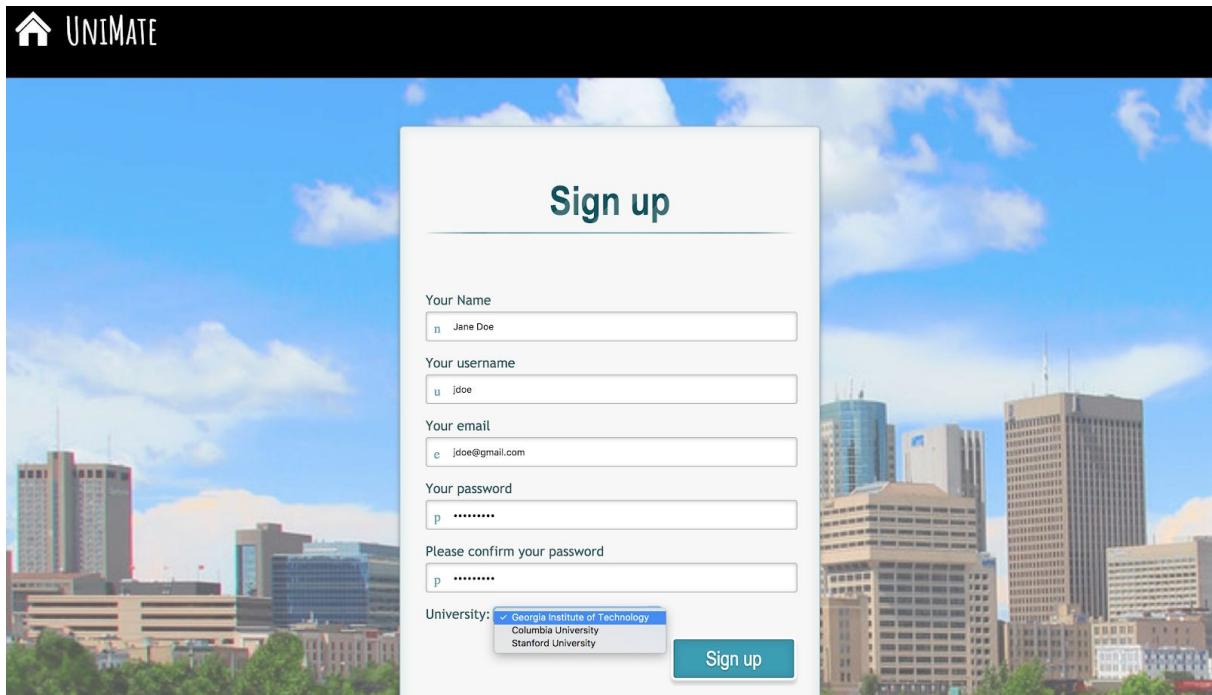
*Part A: Apartment locator

**Part B: Roommate finder

Figure: Time distribution for project (Each unit represents 7 days)

IMPLEMENTATION AND FEATURES:

1. SignUp and Login (using PHP sessions):

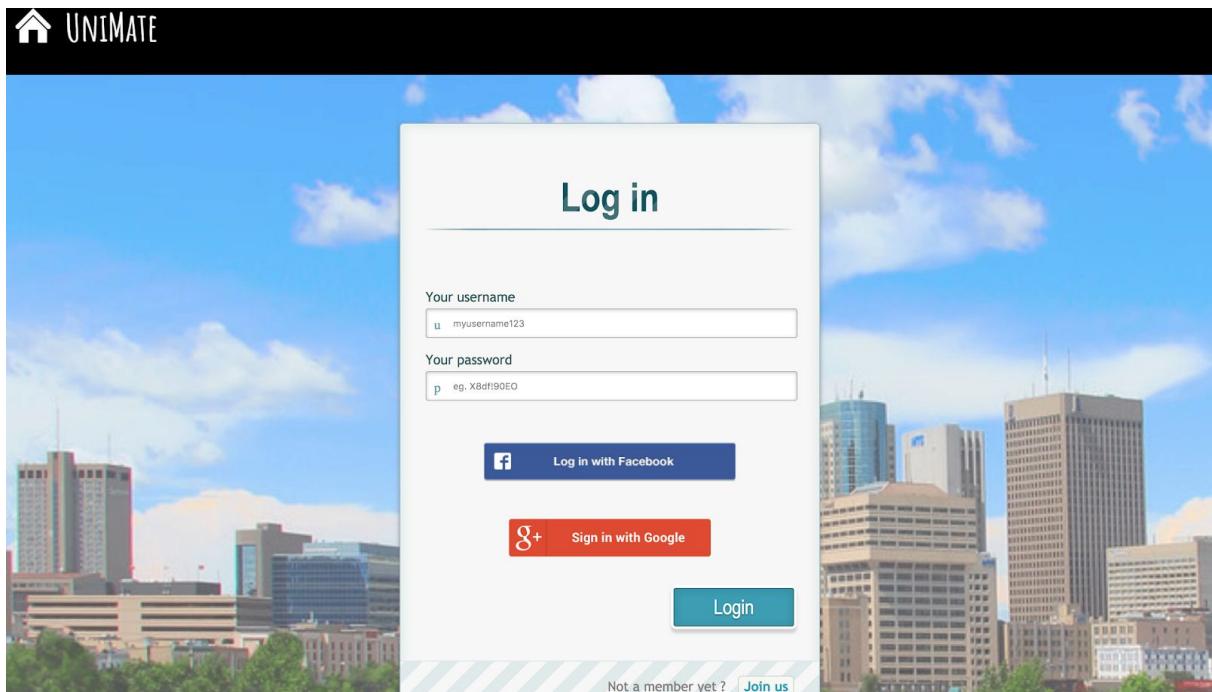


The screenshot shows a 'Sign up' form overlaid on a background image of a city skyline under a blue sky with white clouds. The form has a light gray header with the word 'Sign up' in bold. Below it are five input fields: 'Your Name' (with placeholder 'Jane Doe'), 'Your username' (with placeholder 'jdoe'), 'Your email' (with placeholder 'jdoe@gmail.com'), 'Your password' (with placeholder '*****'), and 'Please confirm your password' (with placeholder '*****'). A dropdown menu labeled 'University:' is open, showing three options: 'Georgia Institute of Technology' (selected), 'Columbia University', and 'Stanford University'. A teal 'Sign up' button is located at the bottom right of the form.

We decided to create a Sign Up form in order to obtain University information from the user.

The features of this form are:

- Email validation
- Password matching
- Drop-down menu to select the student's university from the list



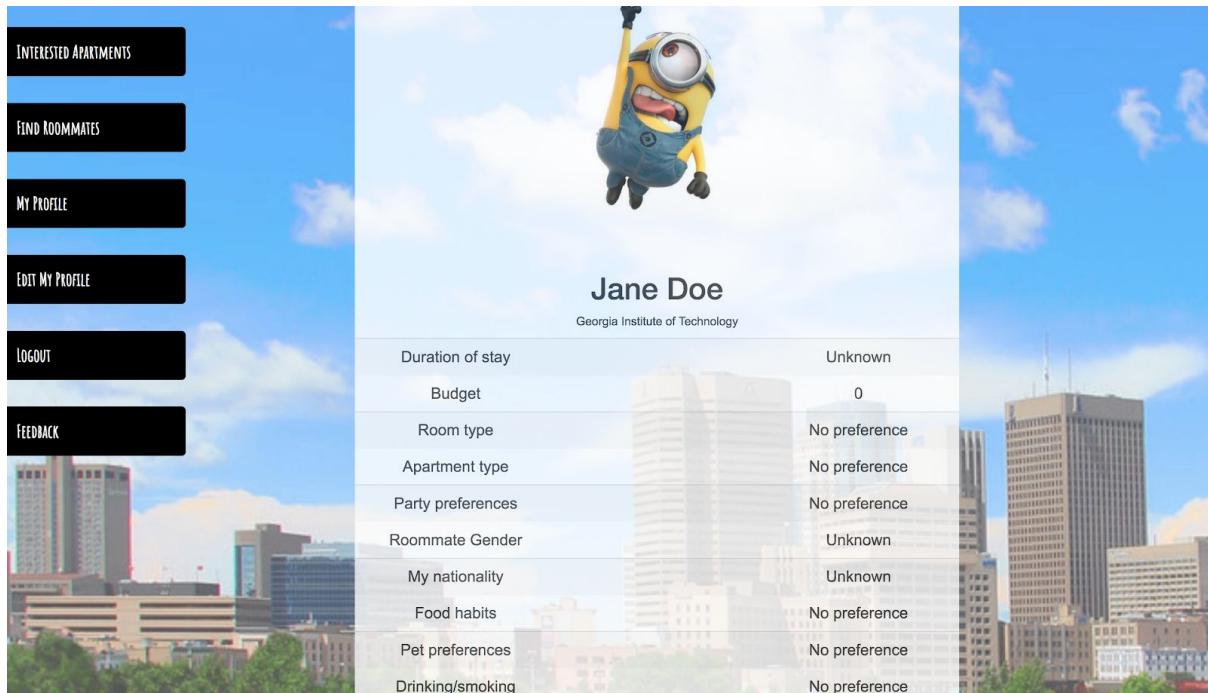
The screenshot shows a 'Log in' form overlaid on a background image of a city skyline under a blue sky with white clouds. The form has a light gray header with the word 'Log in' in bold. Below it are two input fields: 'Your username' (with placeholder 'myusername123') and 'Your password' (with placeholder 'eg. X8df190EO'). At the bottom of the form are three login options: a blue 'Log in with Facebook' button with a small 'f' icon, a red 'Sign in with Google' button with a 'g+' icon, and a teal 'Login' button. A small note at the bottom left says 'Not a member yet? [Join us](#)'.

The Login form has the following features:

- Detects existing/new username
- Password validation
- Google/Facebook login buttons

We plan to incorporate the option of using information from the user's profiles in Google and Facebook in the future.

2. Profile

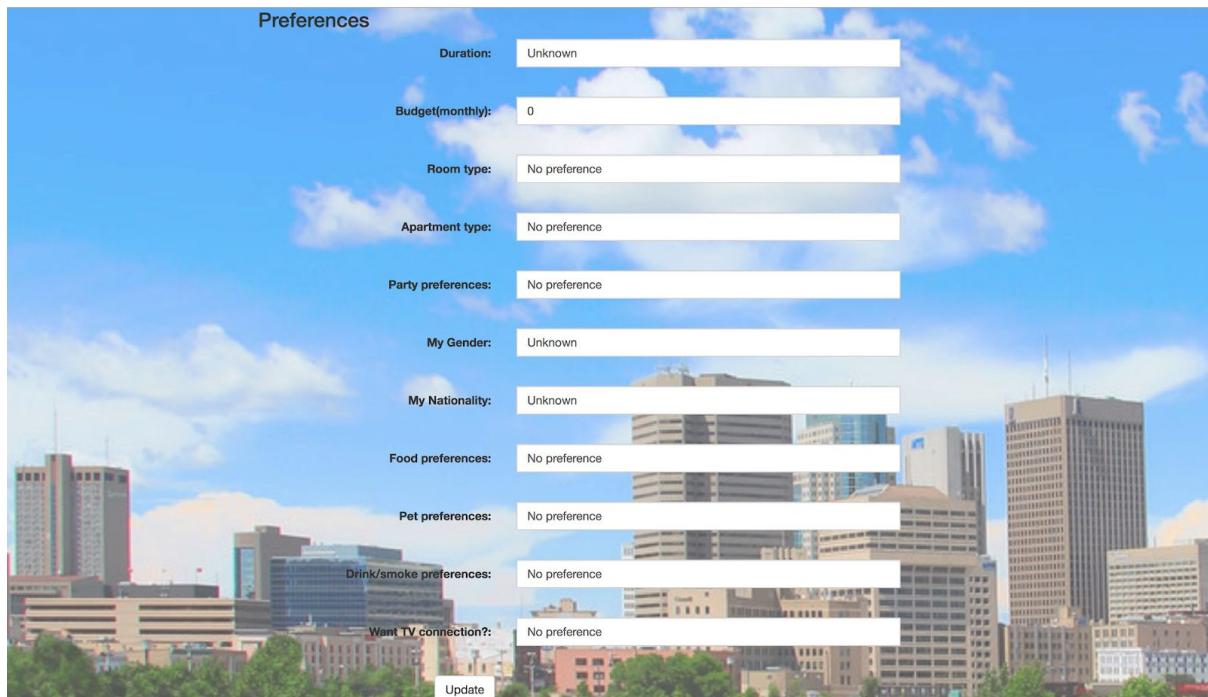


The profile page contains a Profile Card displaying 11 user preferences. On a new user's sign up, the preferences are automatically set to default values (as shown).

The following preference information is displayed on the Profile Card:

- User display image (default for new user)
- Duration of Stay
- Budget
- Room type
- Apartment type
- Party preferences
- Roommate Gender
- My nationality
- Food habits
- Pet preferences
- Drinking/smoking preferences
- TV connection needed

3. Edit Profile



This functionality is used by users to edit and set their profile information and preferences. They are first populated with default values. Features include:

- Profile information: Change email id, name and password. Unchangeable parameters are username (unique) and university name.
- Preference information: Users can view their last modified preference, and can modify each preference accordingly.

4. Go To Map

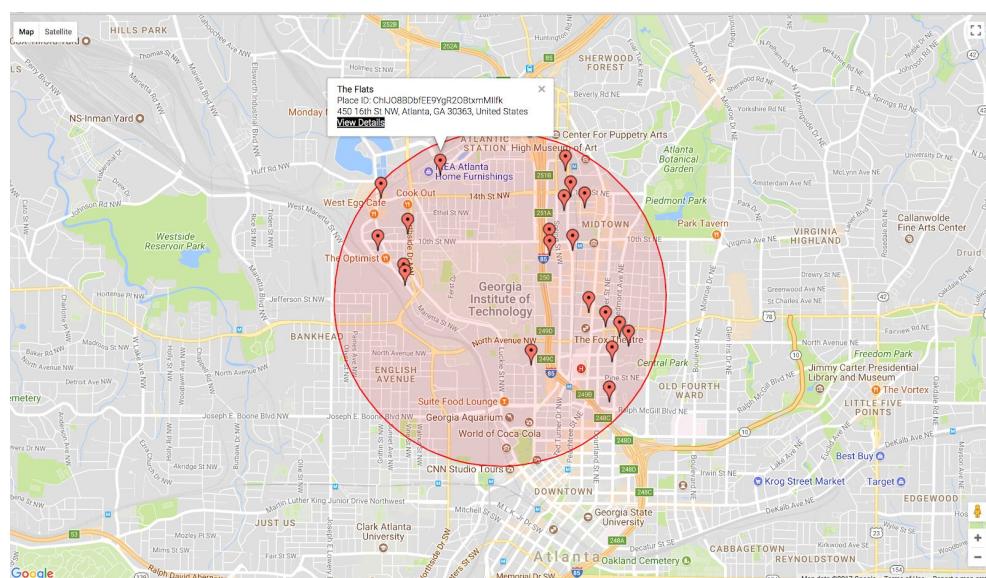


Fig.: Regular map view

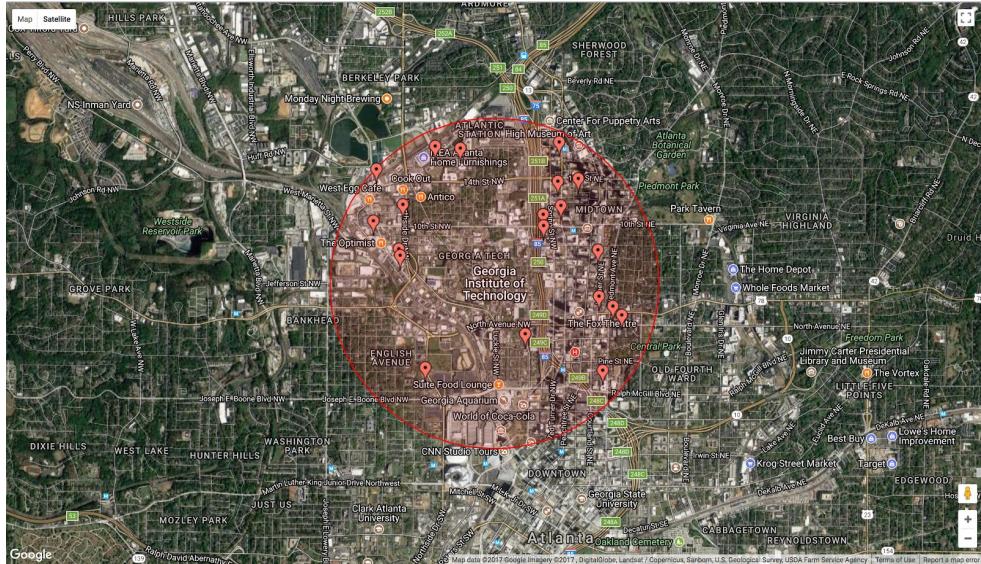


Fig.: Satellite view

Clicking on the ‘Go To Map’ option takes us to a page which displays a Google Map interface consisting of the following features:

- Centered on the user’s university
- Markers around the university display nearby apartments for rent
- Proximity circle displays apartments within a specific radius
- Nearby restaurants and other amenities are displayed
- Clicking on an apartment’s marker displays additional information in the form of an ‘info-window’: Apartment name, Place ID, and full address.
- The info-window also contains a ‘View Details’ link that redirects the user to a page containing additional useful details about the specific apartment
- Regular and satellite views are displayed
- Ability to zoom and Street views

5. Apartment

This web page is dynamically populated for the apartment that the user clicked on, in the previous page. It has the name of the apartment as the title. We have provided a small button on the UI called “Know More”. On clicking this button, a side bar slides out from the right side of the web-page with a sub-menu. The sub-menu helps the user in garnering more information about that particular apartment. The user can navigate through this menu and the results are displayed on the same webpage in a target frame.

The sub-menu options are:

- About
- Walkscore
- Public Transport
- Traffic
- Transit
- Bike Trails

A] About

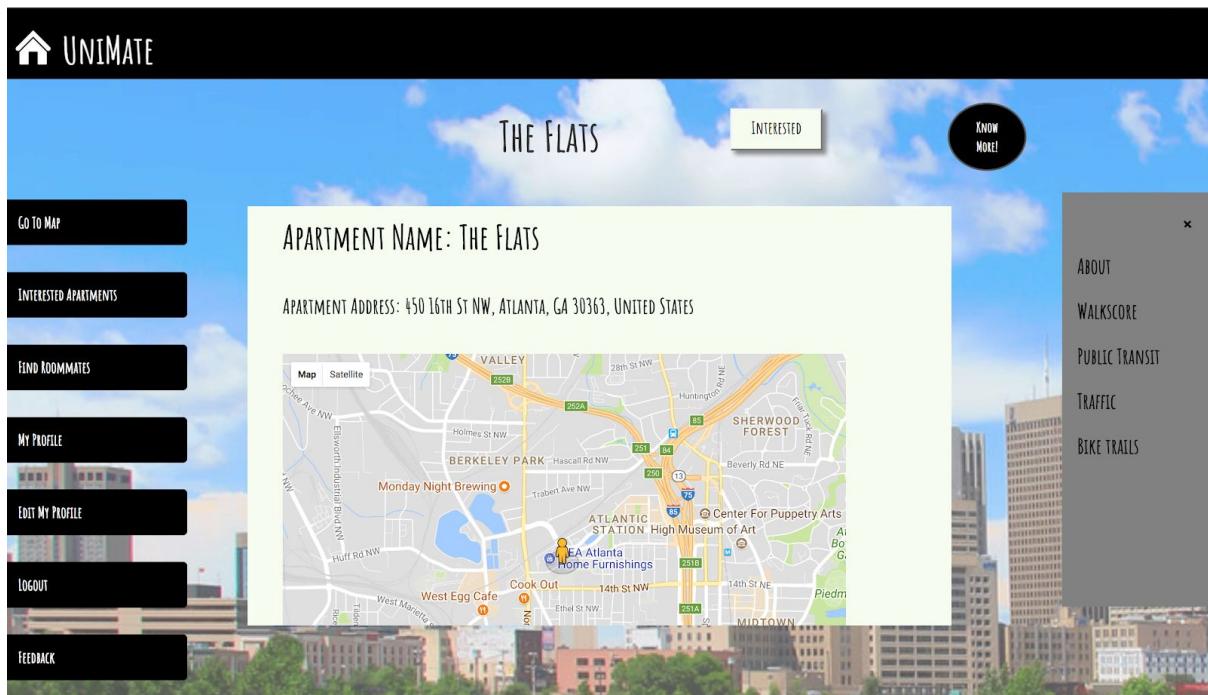


Fig.: Map of the apartment and nearby area and amenities

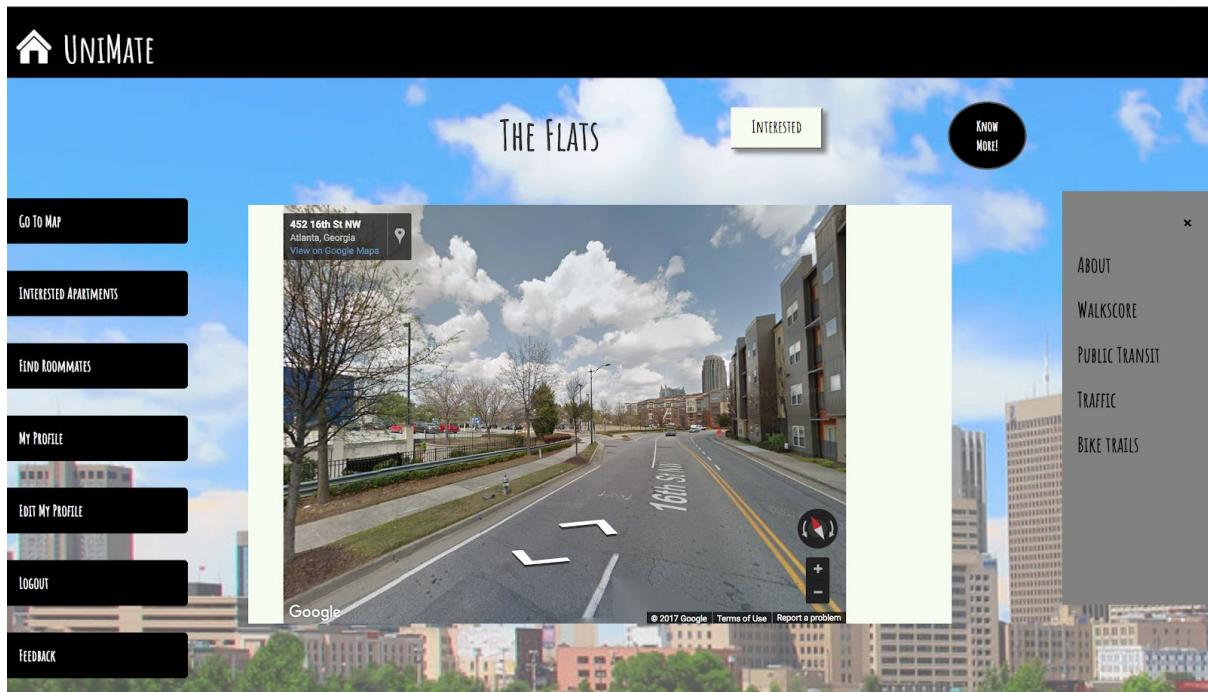


Fig.: Street view

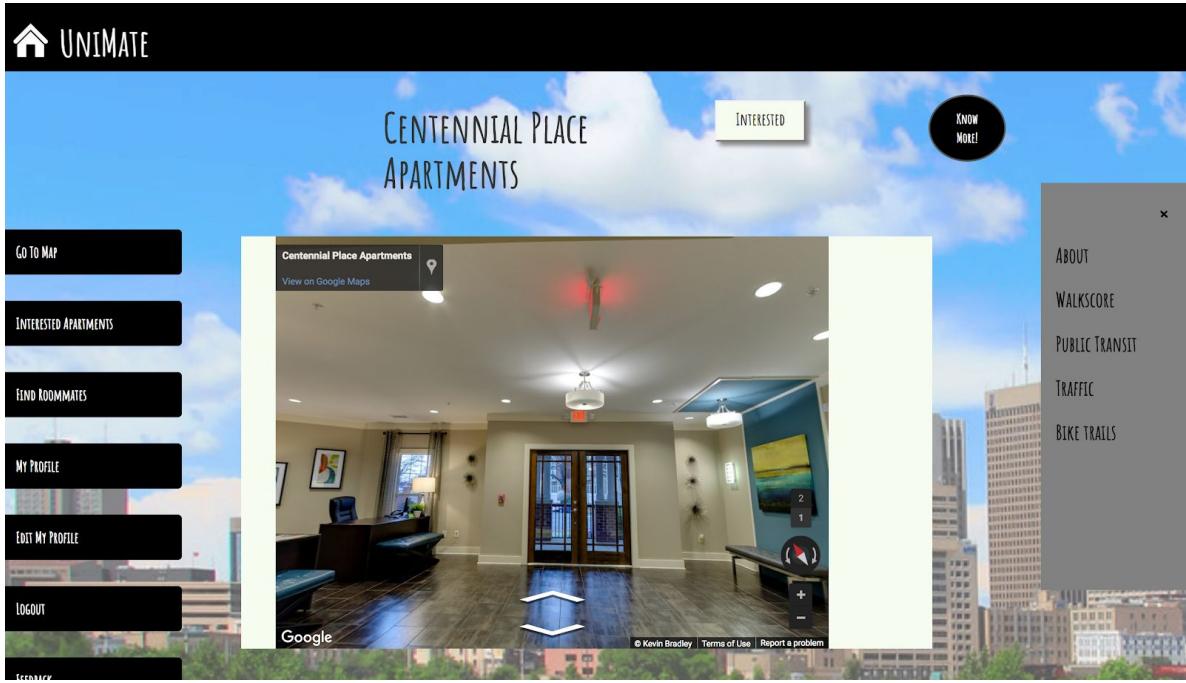
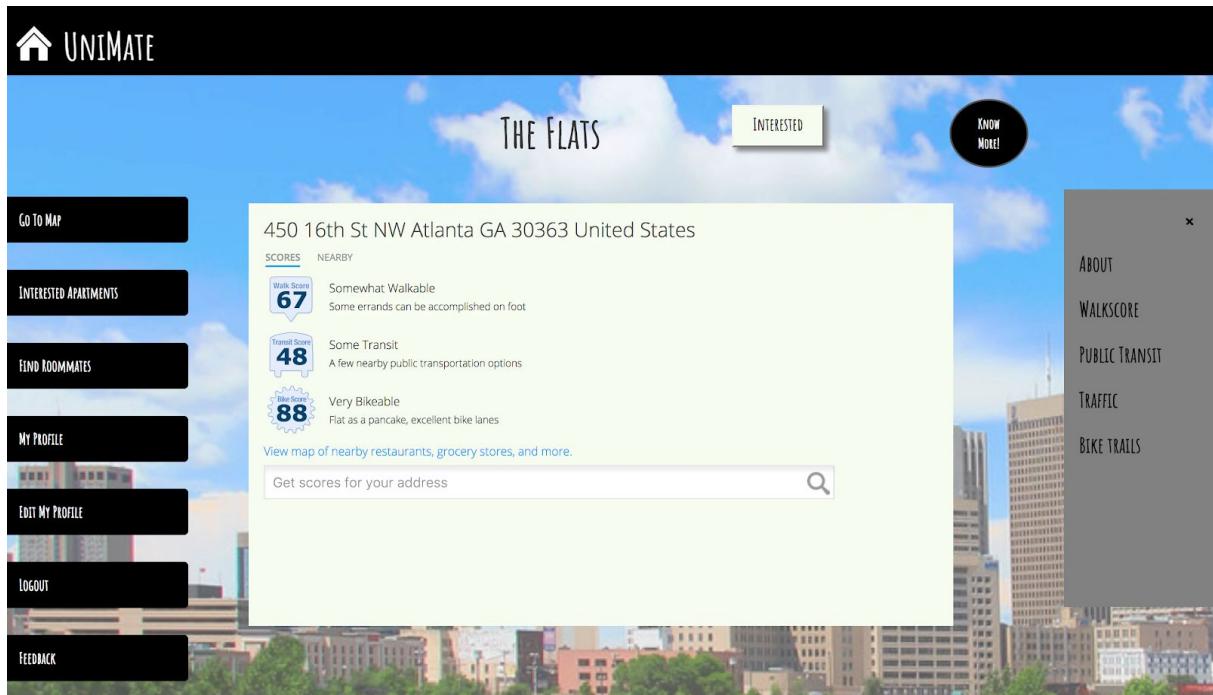


Fig.: Indoor view

- It includes the apartment name, apartment address, Google Maps roadmap view and Google Maps street view.
- The maps show the nearby amenities very clearly, thus facilitating the user in deciding if he/she is interested in an apartment.
- At locations where it is supported, Google Maps also lets user explore indoor scenes.

B] WalkScore

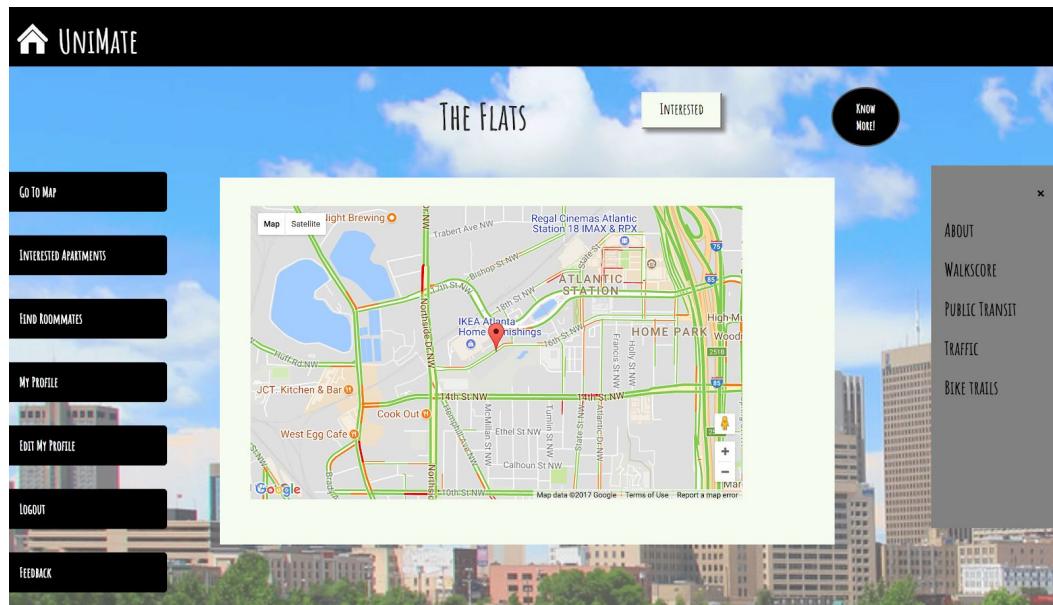


- In the first tab titled 'Scores' we display the walk score, transit score and bike score
- In the second tab titled 'Nearby' we display a graphical comparison of nearby amenities classified into multiple categories

C] Public Transit

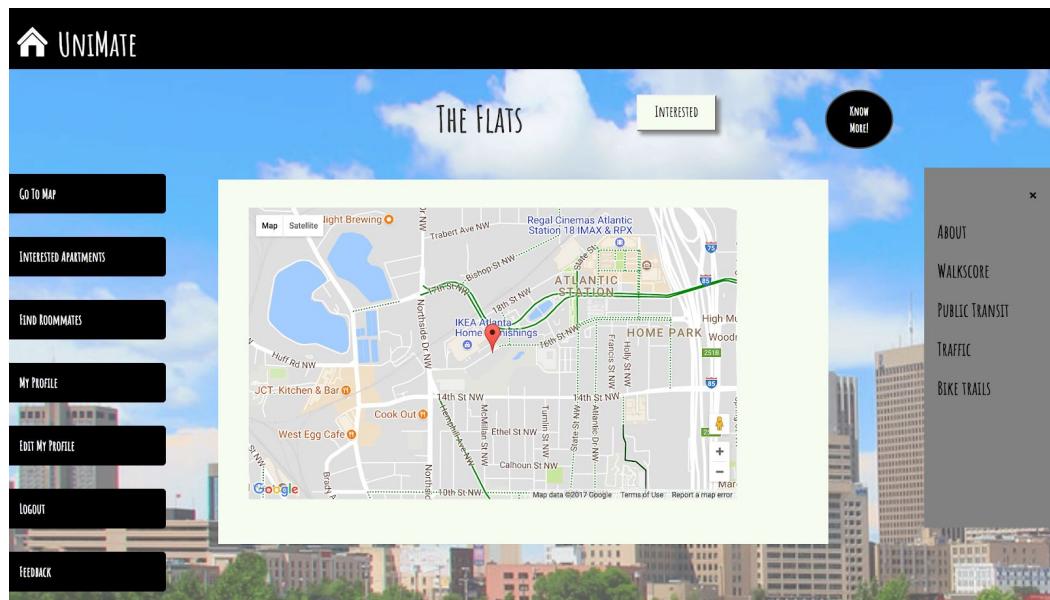
This web page displays a Google map with a Transit Layer. This will help our user to understand how good the transit is in the area around the apartment.

D] Traffic



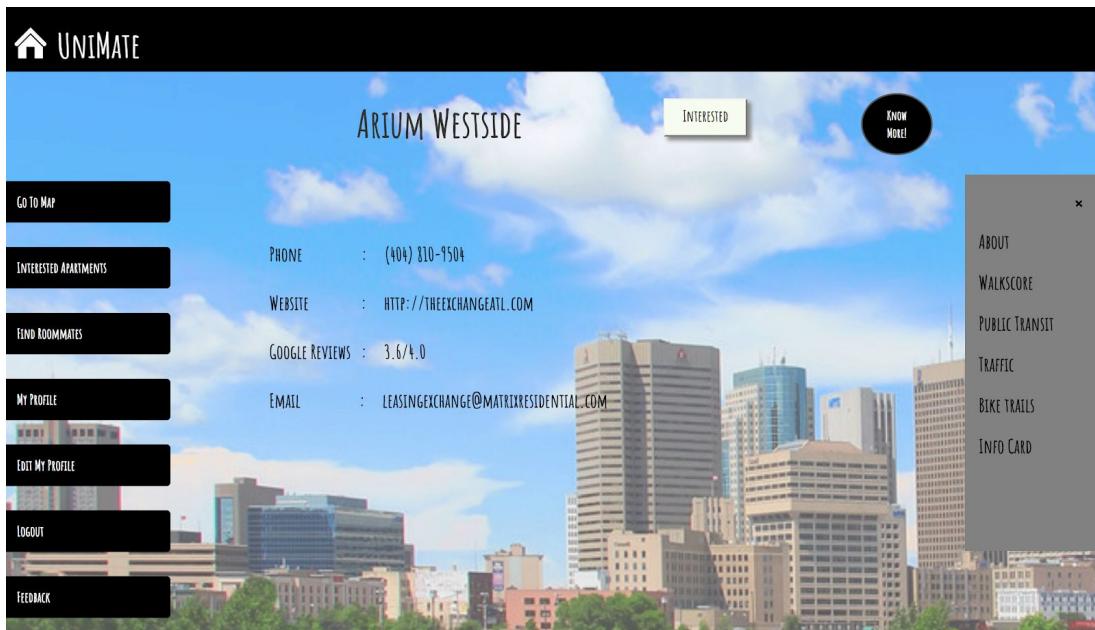
- This web page displays a Google map with a Transit Layer.
- This will help our user to understand how much traffic can be estimated in the area around the apartment.
- Since it is real-time data, the user can analyze traffic during normal hours and peak hours.

E] Bike Trails



This web page displays a Google map with a Bike Layer. This will help our user to understand the bike trails and their connectivity in the area around the apartment.

F] Info Card

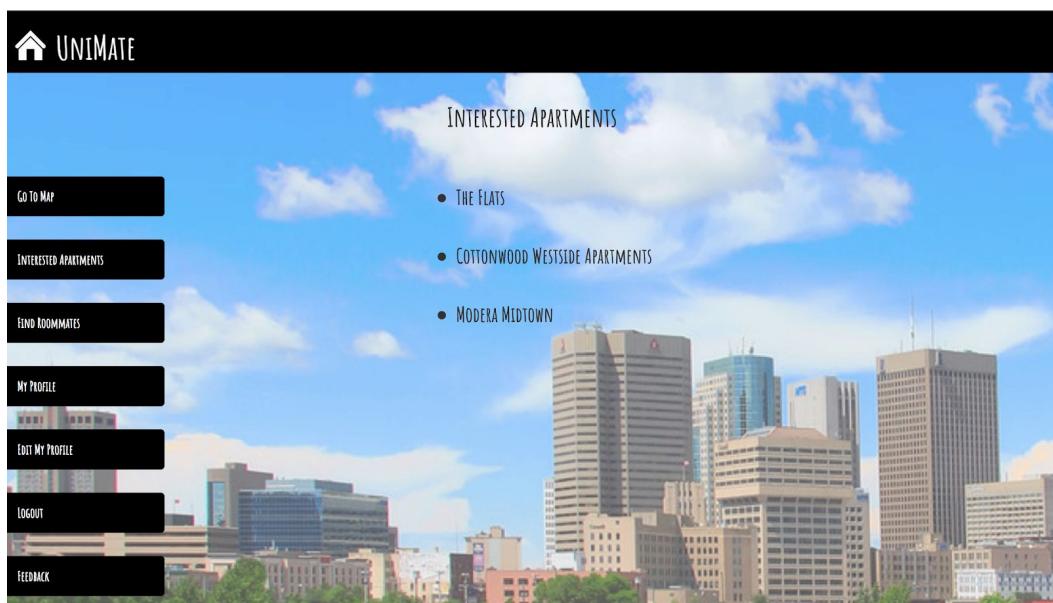


This is our information card that has information about the apartment that the user viewing. This information is sourced from the web and hence its availability is conditional. The data displayed includes the following parameters:

- Contact Information
 1. Phone Number
 2. Website URL
 3. Email ID
- Google Reviews ratings

This displays the Google Reviews ratings for the particular apartment on a 4.0 scale.

6. Interested Apartments



- This webpage lists the apartments that the user has marked his interest in.
- Then the records for interested apartments for the logged in user is retrieved from the database and the apartment names are displayed on the webpage.

7. Find Roommates

100 Midtown Apartments	jbish
100 Midtown Apartments	bjohn
100 Midtown Apartments	jdoe
Arium Westside	bjohn
Centennial Place Apartments	sneha
Cottonwood Westside Apartments	jbish
Cottonwood Westside Apartments	jdoe
M Street	jdoe
Modera Midtown	jdoe
The Flats	jdoe
The Flats	sneha

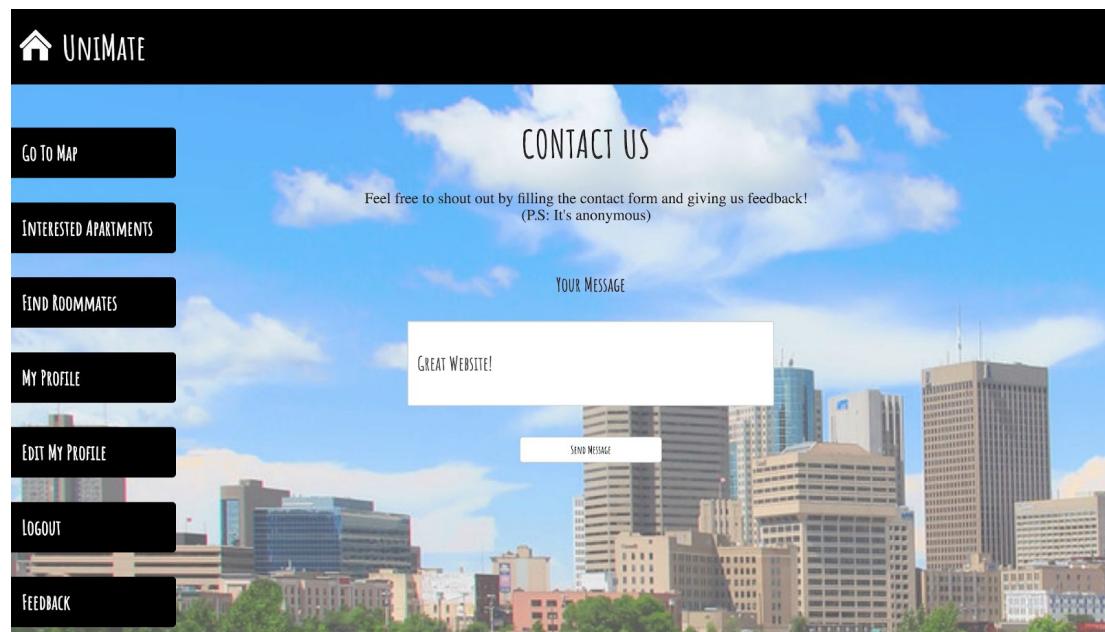
Here, we do university-specific matching where we display other students from the same university who have marked interests in nearby apartments as potential roommates.

8. Roommate Profile

Name	John Bishop
Email	jbish@gmail.com
Duration of stay	1 year
Budget	1500
Room type	No preference

- This page directs to the potential roommate's user profile, the data of which is retrieved from the Profile database.
- The Email ID of the potential roommate's profile is displayed, which allows the user to contact the potential roommate by shooting out an email.

9. Feedback

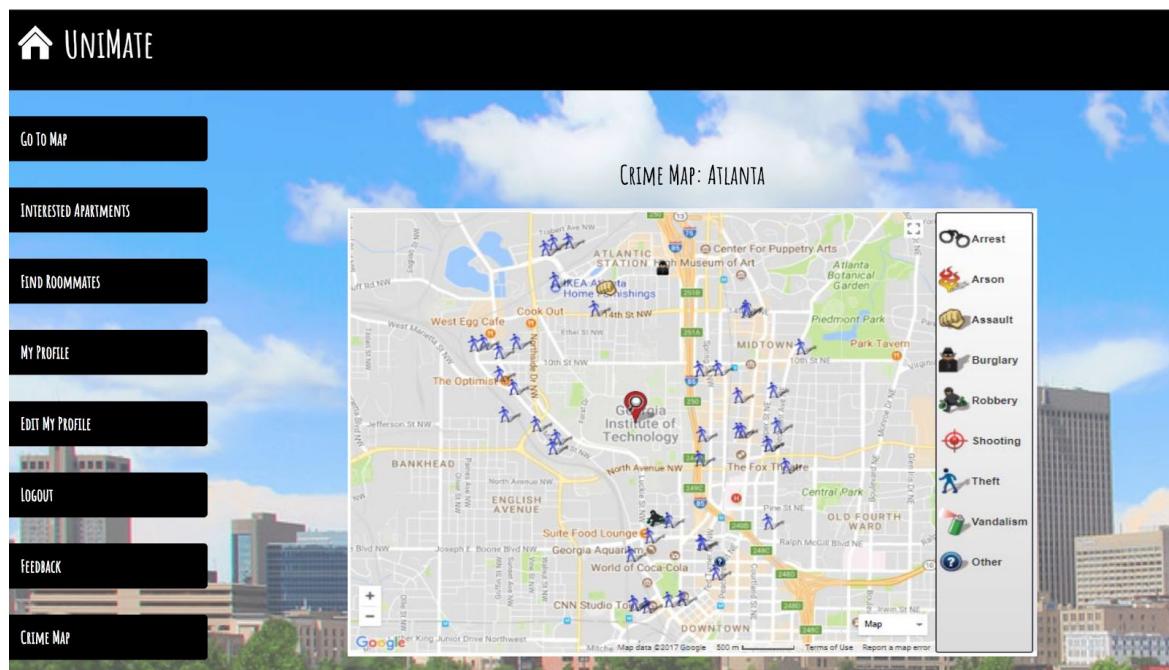


The feedback form is designed to input anonymous feedback from the user.

10. Logout

Clicking on the Logout tab redirects to the Login page, after ending the PHP session of the current user.

11. Crime Map



(Source: www.spotcrime.com)

We include a view of the **Atlanta** crime map around Georgia Institute of Technology, that displays the areas prone to the following crimes:

- Arrest
- Robbery
- Arson
- Assault
- Shooting
- Theft
- Vandalism
- Burglary

DATABASE SCHEMA:

● Profile:

username	password	name	email
bjohn	blahblah	Bishop John	bjohn@gmail.com
jbish	blahblah	John Bishop	jbish@gmail.com
jdoe	password	Jane Doe	jdoe@gmail.com
nidhi	home	Nidhi	nmenon@gmail.com
sneha	blahblah	Sneha Venkat	sneha.venkat21@gmail.com

● Preferences:

duration	budget	room_type	apt_type	party	gender	nationality	food	pets	drink_smoke	tv_conn	username
1 year	1500	individual	one bed one bath	i love to party	male	american	vegan	i love pets	No preference	yes	bjohn
1 year	1500	No preference	studio	i hate parties	male	american	No preference	i love pets	No preference	yes	jbish
10 months	2000	sharing	dont care	i prefer solitude	female	american	dont care	hate	no	no	jdoe
1 year	1000	individual	No preference	bring it on	female	indian	all cuisines	hate cats	No preference	yes	nidhi
2 years	1500	individual	one bed bath	yes	female	Hi I am from India!	any food	i love pets	no	no	sneha

● Interests:

uname	apt
sneha	The Flats
sneha	Centennial Place Apartments
nidhi	Cottonwood Westside Apartments
nidhi	The Flats
nidhi	M Street
nidhi	935M Apartments
jdoe	The Flats
jdoe	Cottonwood Westside Apartments
jdoe	Modera Midtown
jdoe	M Street
jdoe	100 Midtown Apartments
bjohn	Arium Westside
bjohn	100 Midtown Apartments
jbish	Cottonwood Westside Apartments
jbish	100 Midtown Apartments

- **Feedback:**

message ▲ 1

Hi this is a very GREAT WEBSITE!

Love this website!

TECHNOLOGY STACK:

BACKEND:

- **XAMPP:**

Open source cross-platform web server solution stack package developed by Apache Friends.

- **InnoDB:**

InnoDB is a storage engine for the database management system MySQL.

MIDDLEWARE:

PHP

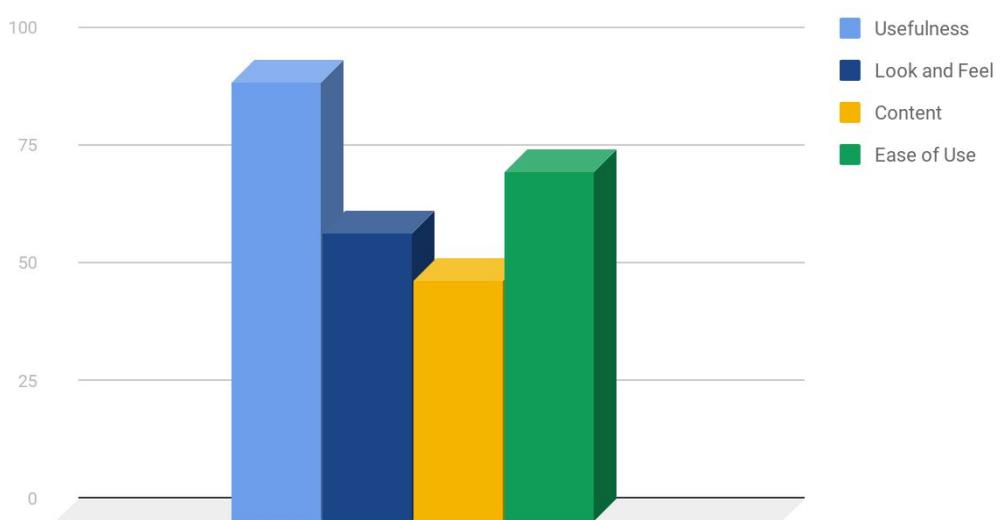
FRONT-END:

HTML, CSS, JavaScript

TEST & EVALUATION:

The evaluation data was collected through surveying. As the application is interactive as well as informative, we reached out to friends and acquaintances to collect feedback of user experience and analyze the effectiveness of our application. The analysis was performed to demonstrate the effectiveness of our application both quantitatively and qualitatively.

User ratings and reviews of UniMate



FUTURE SCOPE:

- Expand the scope of the project to include all major universities across USA
- Improvise on existing features and user-interface
- Integrate a heat map for all university regions, depicting safe and unsafe areas based on crime data in the areas around the universities
- Implement an in-app. roommate chat functionality
- Include verified apartment information and price analysis
- Implement a roommate recommendation (using Machine Learning techniques)