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Section 1 Introduction

1.1 Abstract

Our project is Travel Northern Taiwan - GIS, an Android travel App that introduces Northern Taiwan. We will collect information about food, clothing, housing, travel, music, etc. in Northern Taiwan. For these feature, we will attach a label to allow users to filter the travel information they want to know through specific labels. We use Google's API to tag popular attraction information on the map and provide the ability to save places of interest, so that users will be able to plan a variety of travel itineraries.

Key words： REST API， data visualization， real-time database， NoSQL， JSON， GPS (Global Position System)， GIS (Geographic Information System).

1.2 Motivation

Every time we think about travelling in Taiwan, Taipei is the first thing that comes to our mind because it's the capital city or maybe because it's Taiwan's most famous region. However, other regions in Taiwan are worth visiting as well, so one of our motivations could be to promote tourism to other regions in the North of Taiwan, since it's near Taipei.

Additionally, travelling might get slightly stressful, especially if we are planning the trip by ourselves, so we intend to offer a travel guide that also has useful tools such as budget planning, weather information, and a to-do list, so the user won't have to download several apps because all the necessary tools are in the same application.

1.3 Project description

Our project can be considered an all-in-one travel guide, where the user can organize day trips according to any region in Northern Taiwan that could be of interest. The user is able to save up to ten places per day trip, and to organize how much money they have planned to spend and to record their expenses, while showing a more detailed graph showing which type of expenses have been done, how much money has been spent, and how much money is left.

Section 2 System requirements

2.1 Scenario

Backpacker:

      Daniel is a college student. He is currently studying at the Taipei University of Science and Technology. Although he has a heavy day-to-day class, he likes to take a trip in his spare time! In the past, he always checked the information in advance and recorded the information of the tourist attractions on his laptop for easy access during the trip. However, he recently began to get tired of taking a notebook with every trip. Therefore, on the Android Play Store, he searched for several popular travel apps, but found out that when he wanted to check the travel information, the annoying advertisements kept jumping out, and even the intent to check the attractions could not be done. Later, he found the Travel Northern Taiwan app. When he consulted the information, the annoying advertisement no longer interfered when browsing of travel information. What is even better is that the app also combined with the function of querying the weather and planning the travel budget, so that he would not have to download other apps.

2.2 System introduction

      The users have to sign up with their e-mail to the App in order to be able to use all the functionalities. Our system is a travel itinerary system, which main function is to allow registered users to search for places of interest, display their location on a map, and let the users save them for their trip, while additional functions include manage trip budget per trip and display weather. We used the following tools:


Google Maps API : Display places' location on a map

Google Places API: Retrieve places information according their category

Firebase: Firebase Auth is used to manage users' credentials. Firebase real-time database is used to store data.

Dark Sky API: Retrieve weather data of any location.

MPAndroidChart: Tool used for data visualization in Android Apps

2.3 System use case

  As mentioned above, users cannot make use of most of the functionalities unless they sign up with their e-mail. The information remains confidential in the Firebase real-time database.

- Sign up:

      Sign up > Input e-mail and input a new password twice

- Sign in:
      Sign in > Input e-mail and password

- Create trip:
      Sign in > Input e-mail and password > Press add floating bottom > Select region > Input information

- Add places to the trip:
      Sign in > Input e-mail and password > Press add floating bottom > Select region > Input information > Select category > Swipe up to check the places > Press checkbox to save

- Filter places by category:
      Sign in > Input e-mail and password > Press add floating bottom > Select region > Input information > Select category

- Edit trip's basic information:
      Sign in > Input e-mail and password > Select trip > Input new information > Save

- Manage trip's itinerary:

      Sign in > Input e-mail and password > Select trip > Press map bottom > check / uncheck places to add or remove

- Manage trip budget:
      Sign in > Input e-mail and password > Select trip > Press manage budget bottom > Select expense category > Input amount > Submit

- Check weather:
      Sign in > Input e-mail and password > Open navigation drawer > Weather

- Sign out:
      Open navigation drawer > Sign out

Section 3 System Design

3.1 System structure design
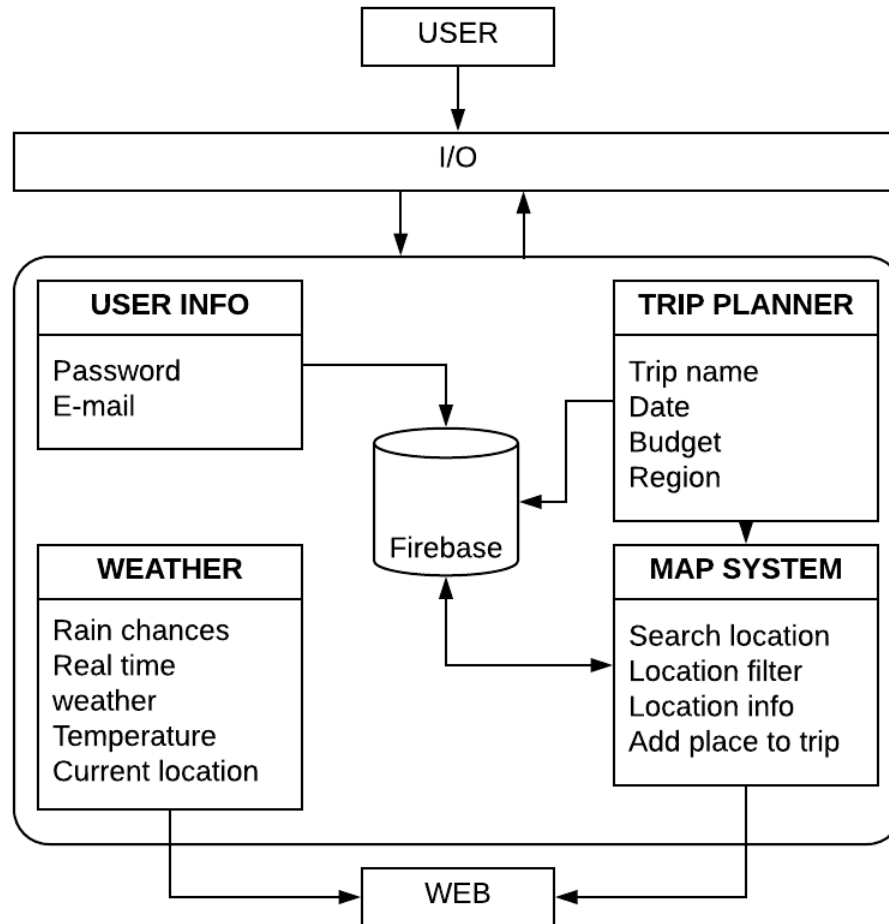
Fig. 1. System structure

This project is based on Android and consists of four different systems:

- User information system: Saves the user information, such as e-mail and password, in the Firebase real-time database.
- Weather: Displays the weather forecast of the user's current location and Northern regions of Taiwan as well.
- Trip Planner: Sends the basic trip information input by the user to Firebase real-time database, and generates a random trip key to be sent to the map system.
- Map system: Displays places according to their category in the map, displays the places' information, and allows the user to bookmark up to ten places of interest.
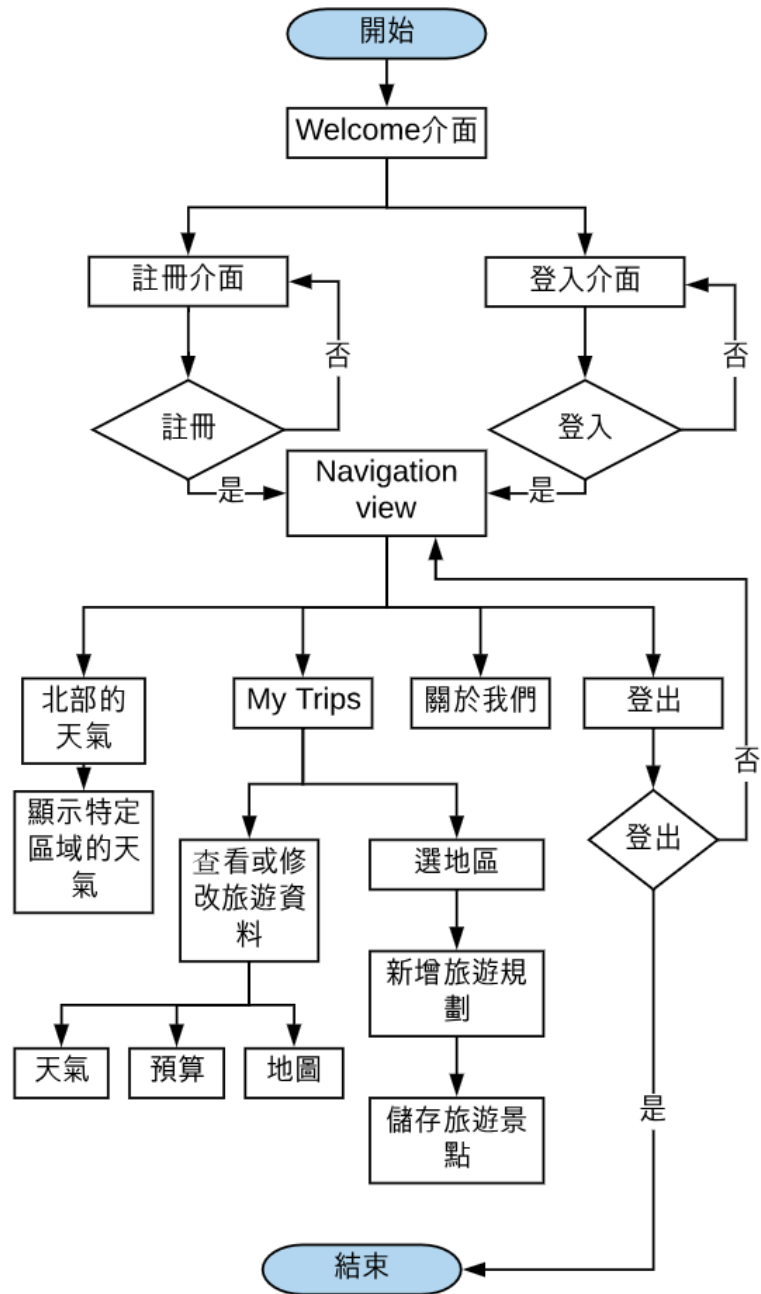
3.2 Structure flow chart

Fig. 2. Structure flow chart

3.3 System front-end design

For the front end design, we completely used XML to design all our layouts. We mainly used the Android framework to create our views, but in addition to the Android framework, we also made use of some third party libraries such as:

- Sequence layout. This library provides a progress bar with animations which will mark the current step of the progress.
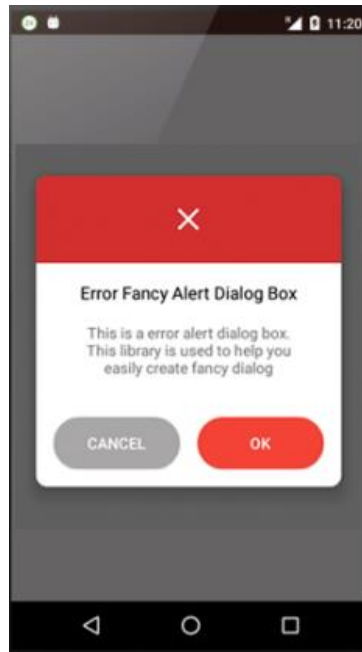

Fig. 3. Sequence layout sample

- MPAndroidChart. This library provides a tool that enables the developer to visualize data in a simpler and appealing way.
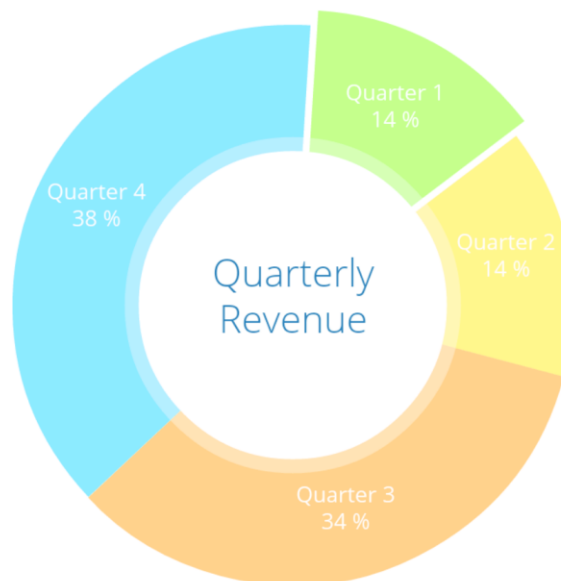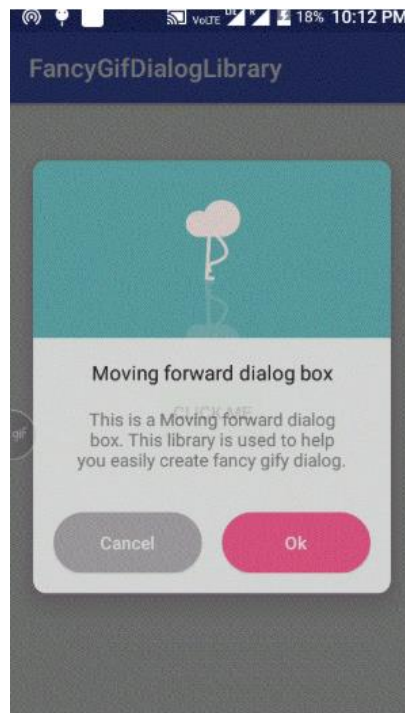

Fig. 4. Android data visualization sample

- Arsenal Fancy Alert Dialog. This library provides better looking alert dialogs.

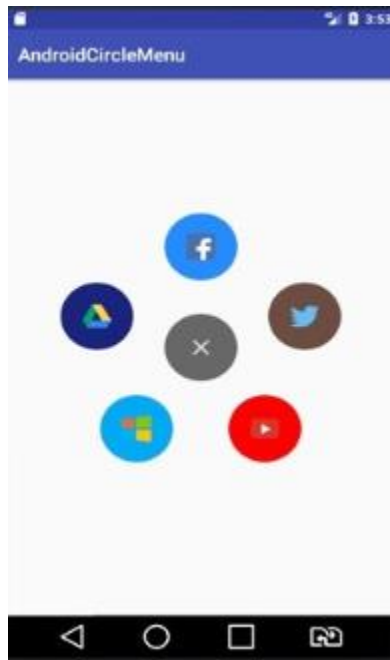*Fig. 5. Fancy alert sample*

- Android Fancy Alert Gif Dialog. This library provides a way to implement .gif file in our alert dialogs.

Fig. 6. Fancy alert gif dialog example

- Circle Menu Button. this is a simple, elegant UI menu with a circular layout and material design animations.

Fig. 7. Circle menu button sample

The colors used in our layouts are the following so they could match with our app logo:
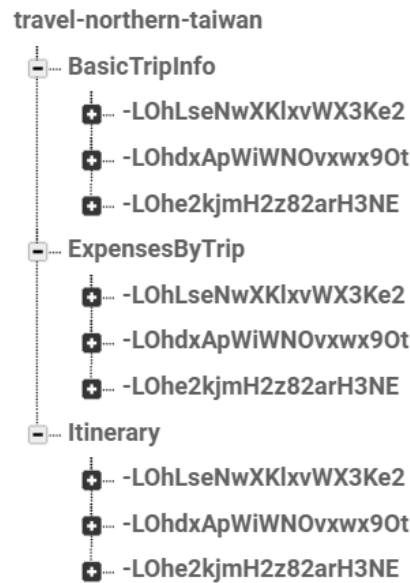

Fig. 8. Interface theme colors

Fig. 8. App logo

3.4 System back-end design

We originally planned to use MySQL as database, but we decided to use Firebase instead because its services. Firebase Auth service that offers a user management system where developers can enable user authentication with email and password login stored with Firebase; and Firebase real-time database that provides NoSQL database as a service and allows the data to be synchronized across clients and stored on its cloud. Additionally, NoSQL databases are more scalable and provide superior performance than the relational databases.

| Identificador	Proveedores	Creado	Accediste a tu cuenta	UID de usuario ↑
ahm14725@gmail.com	✉	4 sep. 2018	4 sep. 2018	46uvt9ZYz0Qwf43kMv8cuySSlwK2
genesisyau@hotmail.com	✉	26 ago. 2018	13 oct. 2018	4iPACklUjxYtkH0Enkl44rcK5cu2
www@gmail.com	✉	11 ago. 2018	11 ago. 2018	5xLUgLPiRoZlw1Ya6M5dpRH7Ljh2
davidrosas29@hotmail.com	✉	5 sep. 2018	2 oct. 2018	K2cN1ZlBHJQ70EW1oexcJOVAz3...
david@david.com	✉	26 jul. 2018	26 jul. 2018	UF66tvG8zRbvnHwqS287Li04rq23
ahm12345@gmail.com	✉	28 jul. 2018	16 sep. 2018	gh9KJfFRsPW9OvPQSMia1Cn9zhk2
gyauxd@gmail.com	✉	28 jul. 2018	13 oct. 2018	iPKEFNze7ndmkBoLx9MkMv8C4c...
test@test.com	✉	27 jul. 2018	28 jul. 2018	slkKetpSYphTJ5mu6uoWDzuSVHk1

Fig. 9. Firebase user management

```
travel-northern-taiwan
  ┣━ BasicTripInfo
  ┃    ┣━ -LOhLseNwXKlxvWX3Ke2
  ┃    ┣━ -LOhdxApWiWNOvxwx9Ot
  ┃    ┗━ -LOhe2kjmH2z82arH3NE
  ┣━ ExpensesByTrip
  ┃    ┣━ -LOhLseNwXKlxvWX3Ke2
  ┃    ┣━ -LOhdxApWiWNOvxwx9Ot
  ┃    ┗━ -LOhe2kjmH2z82arH3NE
  ┗━ Itinerary
       ┣━ -LOhLseNwXKlxvWX3Ke2
       ┣━ -LOhdxApWiWNOvxwx9Ot
       ┗━ -LOhe2kjmH2z82arH3NE
```

Fig. 10. Firebase real-time database

We saved all the trips-related data using a random key generated by Firebase that we call TripKey, and we created three tables that will contain different data:

- TripBasicInfo: contains the trip's basic information such as trip name, total budget, and date.
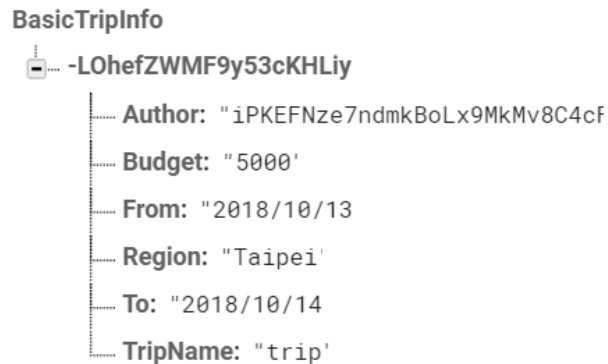

Fig. 11. Basic Trip Info table

- ExpensesByTrip: contains the trip's expenses, including budget, in a more detailed way by categorizing the expenses into accommodation, food, souvenirs, etc.
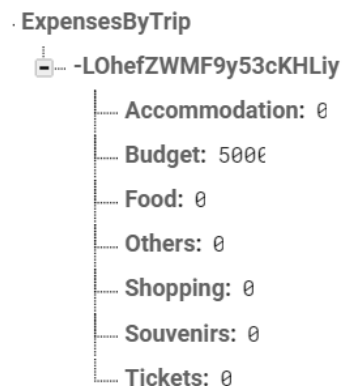
Fig. 12. Expenses by Trip table

- Itinerary: contains a list of the places saved by the user. The places' ID from the Google Maps API are saved instead of their coordinates, making it easier to locate in the map later.
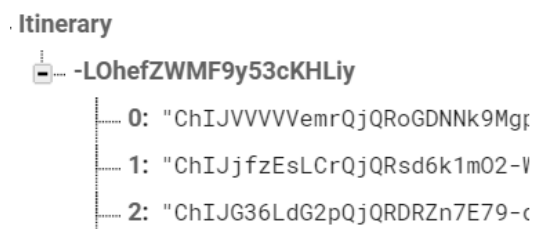
Fig. 13. Itinerary table

We originally planned to save the data by using the user ID provided by the Firebase Auth service, but the structure was nested, making it tedious to iterate over it, so we decided to separate the data into parts and using the randomly generated TripKey instead in order to make it look more simple.

Other backend services we used in our project was RESTful APIs. We used RESTful APIs of two different organizations, Google, and Dark Sky. For Dark Sky, we used the following HTTP request to get information about the destinations:

- GET: https://api.darksky.net/forecast/[key]/[latitude],[longitude],[time]

In addition, for Google, we used the following APIs to get information about the destinations:

- GET: https://maps.googleapis.com/maps/api/place/nearbysearch/output?parameters
- GET: https://maps.googleapis.com/maps/api/place/details/output?parameters

Section 4 Problems encountered and solutions

One of the problems we had in the project was with the calls of the RESTful APIs. Calling APIs in android is often a process done in the background. This method forces us to use threads, which we weren't really familiarized with. Luckily, we found a library that suits perfectly for our needs. We used android's Volley library, which is a library used to make HTTP calls. The library will automatically manage the worker threads for running the network operations, reading from and writing to cache, and parsing responses.

In the process of developing the Travel Northern Taiwan app, one of the most troublesome issue for us was the life cycle and layout issues of Activity and Fragment. At the time of development, we ignored the life cycle characteristics of Activity and Fragment, so it took us a lot of time to debug in this part. In addition, when designing the layout, we were not familiar with the layout of Android components, so it took a little time to adjust the layout and get used to how things work in Android.

A problem that one of our teammates encountered was that her Android Studio wouldn't compile anything and the problem persisted for two weeks straight, since it was a problem that wasn't encountered very often by other people. We found out that Android Studio could only work with directories which path does not contain special characters. In order to solve this issue, a symbolic link was created in order to avoid the special character in the user folder and we switched the gradle version to the alpha version.

Section 5 Results and future prospects

5.1 Conclusion

Travel Northern Taiwan was a challenge for us because we started this project without previous experience in Android. However, even though it was a hard task for us to finish, we learned a lot. We couldn't add all the features we were planning because of time constraints, but we are satisfied with our result because we know we did our best. We think we can add more features in the future to let the user have a better experience.

Comparison with other APPs

	Travel Northern Taiwan	Google Trips
Budget management	✓	X
Itinerary planning	✓	✓
Discounts offered to users	X	✓
Bookings management	X	✓
Weather forecast	✓	X
Download offline itinerary	X	✓

- **Budget management：**

One of the advantages in functionalities that we have over applications like Google Trips is the budget management. Our app can plan trip budget and record the expense of the trip.

- **Itinerary planning：**

Both Google Trips and our application are going to be able to plan itineraries. When planning the trip, all the points of interest are going to be marked on the map. The user will be able to see information about each place of interest and add it to their itinerary if they wish to.

- **Weather forecast：**

Weather forecast is another functionality of our application that Google Trips lacks. We will display the hourly and weekly weather forecast of all the regions that are covered by our application and the user's current location. The user may also check the weather of the day that a certain trip is happening by going to the trips information view.

5.2 Future prospects

As mentioned above, we couldn't add all the features planned. We hope that we can add those features in the future, such as social media sharing, recommendations, notifications, allow longer trips, etc. Additionally, we would like to add the rest of the regions of Taiwan, making the guide more complete, thus being more useful for anyone who is interested on visiting Taiwan.

We are also interested on creating a similar guide based on Travel Northern Taiwan, but for Panama instead, since the Panama travel guide Apps seem outdated and we think it might give a good impact to the tourism.

5.3 About the experience

陳立窖:

In the process of developing our app, we encountered many difficulties, because we didn't write Android programs at all, and even didn't have experience in Java. Therefore, when I first started to contact, I spent a little time getting familiar with Android. However, I feel that good team communication is more important than personal program skills in the development process. When designing the interface, we all had our own ideas. After several weeks of discussions and discussions, we decided to determine the current design interface of our app. In addition, I encountered some bottlenecks when developing the app. For example, every activity of Android has its own life cycle, so when my current activity wants to receive the data of the previous activity, I need to pay special attention to which state of the activity should be operated. In the process of our development, more and more activities were built, and sometimes the state of the activity was wrong, causing the App to crash. Finally, I have benefited a lot from the development process. I believe this experience will definitely help the team development in the future.

邱嘉香:

This project has been one of the biggest challenges that I've had to pass through during my college life because I had to learn everything from scratch, since I've got no experience with Android or Java. However, I learned a lot during the time we made this project and even though we didn't make all the features we were planning to make before, I'm proud of what we could create from scratch. In addition, I've realized how important it is to write clean code following a coding standard and writing everything in order with comments, because it makes it easier to understand the code and modify the code in case it is needed. I also learned how to explain things related to my major better because we had to communicate mainly in Chinese. I hope we can create a similar app for Panama because all their travel guides in the PlayStore are outdated and don't have a very friendly user interface.

林大衛：

      This project was the biggest project I've done until now. Before starting the project, I had never done any android applications in my life, so, during the whole duration of the project, I had been learning and doing at the same time. After finishing the project, I now have much more respect to code quality. As the project got bigger, I was more and more finding myself digging through the files trying to find a specific function. Most of this frustration could've been avoided have I had better coding standards and principles. Another thing I've learned in this project is how important the organization of the team is. I now understand in a better way how should a team coordinate and organize themselves in order to develop a piece of software. In conclusion, although we could not include every functionality we wanted inside our application, I think that I have really learned a lot from these past few months.

References

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[5] Philipp Jahoda, "MPAndroidChart", github.com/PhilJay/MPAndroidChart

[6] Transferwise, "Sequence Layout", https://github.com/transferwise/sequence-layout.

[7] Shashank02051997, "Android Fancy Alert Dialog", https://github.com/Shashank02051997/FancyAlertDialog-Android.

[8] RamotionDev, "Circle Menu Button", https://github.com/Ramotion/circle-menu-android.

Appendix

Steps to create a trip:
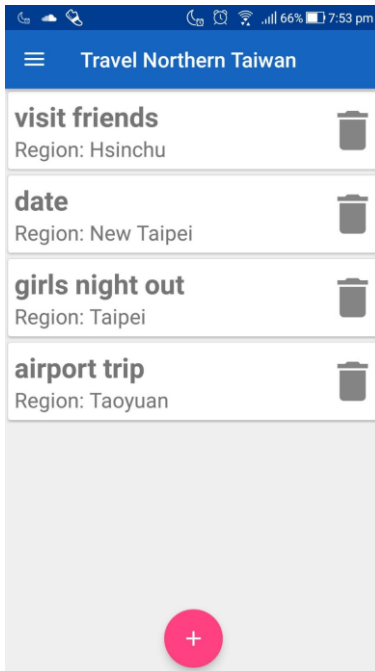
1. Press the add button on the trips view
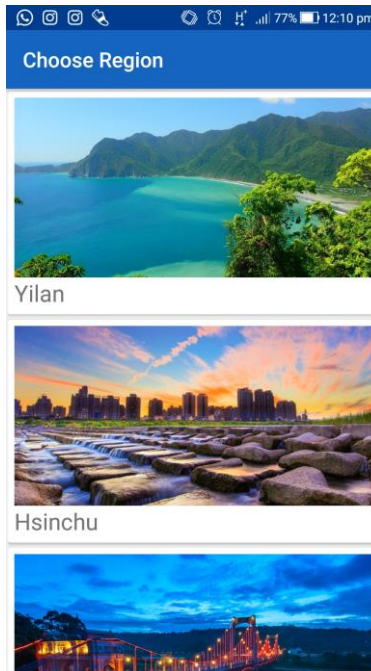
2. Choose the region of interest
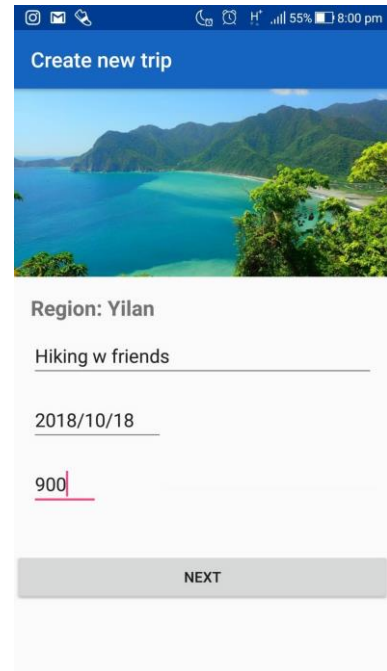
3. Fill out the trip's basic information such as name, date, and budget (if any)
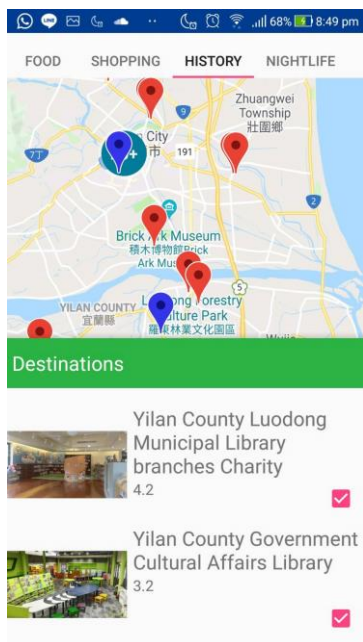
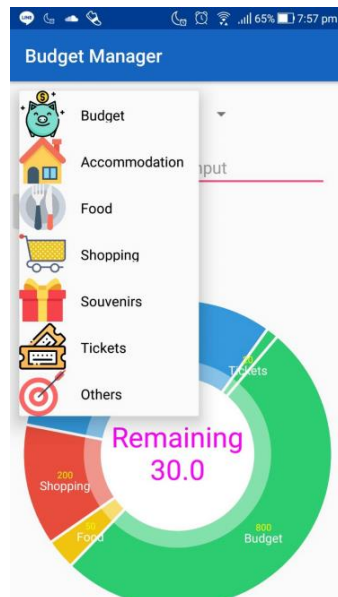4. Bookmark the places of interest by pressing the checkbox
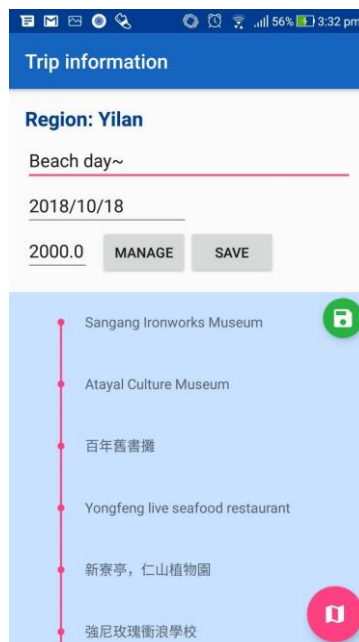
5. Check the saved places and trip's information and click manage to check budget
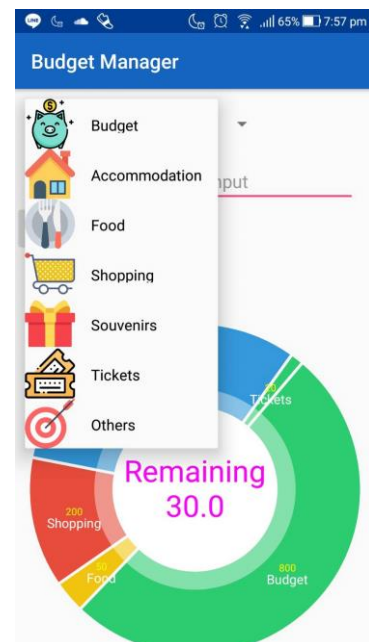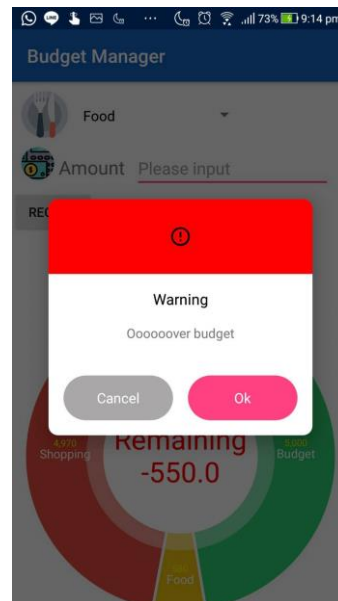

6. Manage you budget by recording your expenses or and even more budget

Other features:

Budget manager

1. Add more expenses by selecting the expense category and submitting

2. A pop-up notification will appear if the user has exceeded their budget
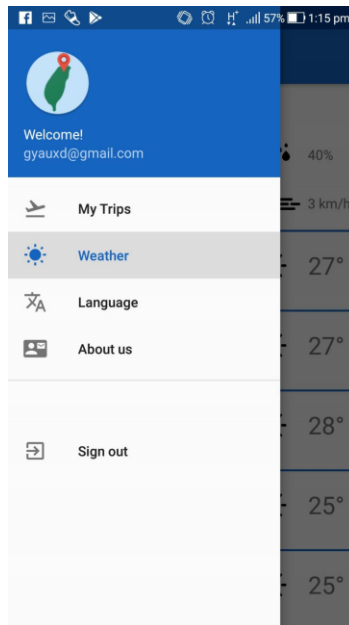
Weather

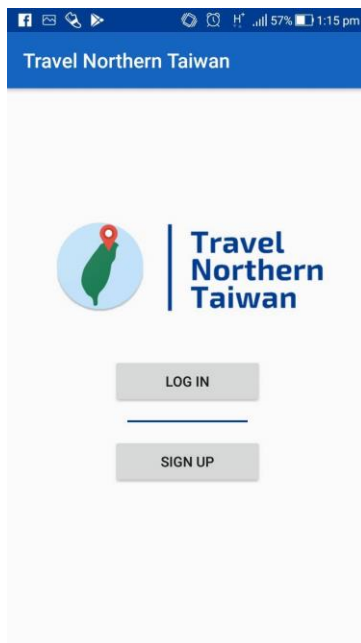1. Check the weather by region or the weather of the current location
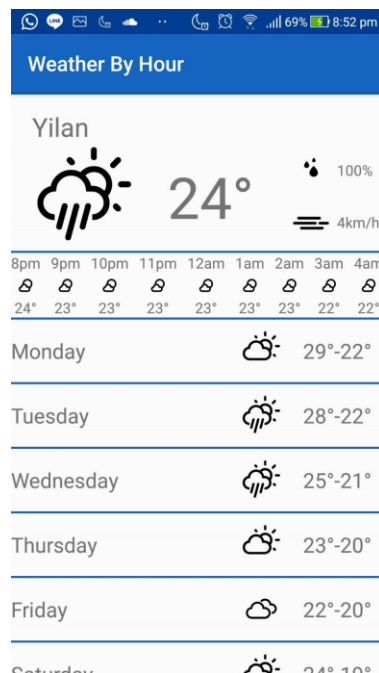
2. Check the weather of a specific region

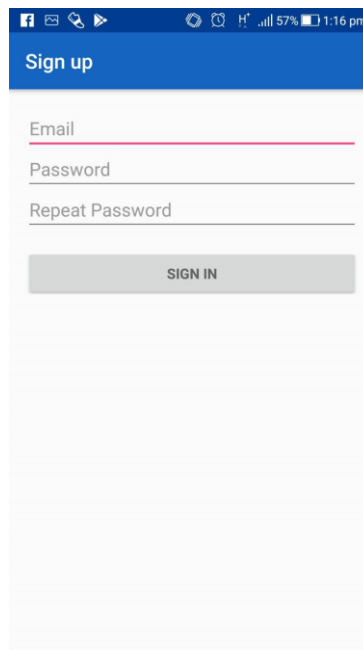## Navigation drawer

The navigation drawer will
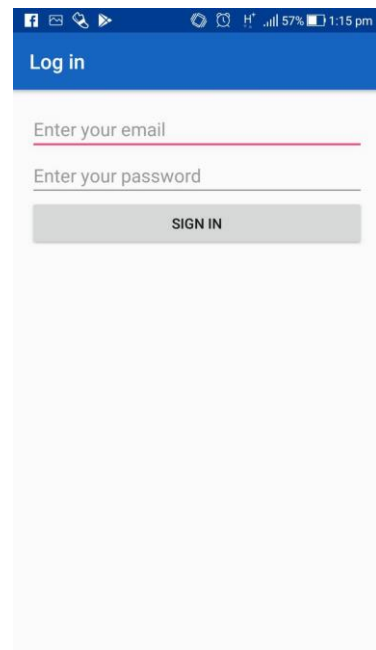display the user's email and
the App's logo

Sign up and Log in

Main view when opening the
app for the first time

1. Sign up with your email

2. Log in with the email you
signed up with