Natural Language Generation for Route Description (NLP/GIS)

Presented by

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Advisor

Advisor: Asst. Prof. Dr. Nuttanart Facundes

"I've read and approved the content of this report"

Nuttanart Facundes

(.....)

Advisor

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A Project Submitted in Partial Fulfillment of the Requirements
for the Degree of Bachelor of Engineering

Department of Computer Engineering, Faculty of Engineering
King Mongkut's University of Technology Thonburi
Academic Year 2018

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Project Committee

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Project Title	Natural Language Generation for Route Description (NLP/GIS)
Project Credit	3 credits
Project Participant	Miss Pharewa Phusuwankul
	Miss Amvisa Taphaophong
Advisor	Asst. Prof. Dr. Nuttanart Facundes
Degree of Study	Bachelor's Degree
Department	Computer Engineering
Academic Year	2018

Abstract

Because in nowadays, people have to use map for navigation to reach the correct destination with the least amount of time. And we see that the most popular online map is 'google map' which tells user for the route, distance and the time that user will take to reach for the destination. The problem is after you select for the destination, the navigator might tell the name of road or name of some expressway that we do not know and can be lost easily. Then, we think that it will be easier if the navigator specific for user with something that can be noticed easily by more human language.

Our method is to develop for the navigation system of online maps to be better with more human language by using Natural Language Processing or NLP which is the process that allows us to understand ourselves and understand others through the communication in both verbal and non-verbal communication.

Our application is the navigator with maps application in android platform. The application provides 2 functions which are online and offline functions. If user wants to use the navigation system with high accuracy, user can select the online section to use. If the user has no internet in the mobile device, he or she can select the offline section to use without having the internet. Both online and offline sections have the same functions which are search function for finding the location and navigation function. The offline navigation function is the part that we use natural language processing to generate the human language interface in the form of text for helping user not to confuse and get the easy understanding with easy understand route description.

Our group decides to simulate the map only within KMUTT university area first. This application is useful for everyone who has to travel in the university area especially the one who comes to the KMUTT for the first time.

Acknowledgements

We would like to express our appreciation to our advisor, Asst. Prof. Dr. Nuttanart Facundes for the many guidances during this term of senior project. We are particularly grateful for the assistance and the support. Without her valuable assistance, this project would not have been completed.

We would also like to thank for our friends that always give us the good suggestions about the program for using in this project and the information about the map of KMUTT campus.

Finally, we wish to thank for our parents for their love, support and encouragement throughout our working of this project.

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Introduction

1.1 Problem Statement and Approach

The reason that we choose to do this kind of project because we see that in nowadays, people have to use map for navigation to reach the correct destination with the least amount of time. And we see that the most popular online map is ‘google map’ which tells user for the route, distance and the time that user will take to reach for the destination.

So, the problem is after you select for the destination, the navigator might tell the name of road or name of some expressway that we do not know and can be lost easily. Then, we think that it will be easier if the navigator specific for user with something that can be noticed easily by more human language example like some landmarks such as 7-11 shop or the department store.

This problem is also from our own experience from using online google map, we found that after the user went to the wrong direction, the navigator will generate new navigation that can make user get more confusion and waste their time. So, we want to develop this function for the convenience of the maps user when they meet the complicated route and help the user to reach the correct destination with the most appropriate time.

And for the categories of our project, we decided to be the type of potential commercial product because we will generate the application that develop the navigation maps and also the type of addressing the needs of a specific group of stakeholders, in this case for KMUTT university area.

1.2 Objectives

1. To make the navigation maps with more understanding for the user with more human language.
2. To study about the natural language processing that can accommodate our way of life.
3. To study about the GIS or Geographic Information System.
4. To study about how to make the mobile application.
5. To understand how to use JAVA and the others require language programming.

1.3 Scope

For our project, it is about to use Natural Language Processing or NLP to generate for the route description for the maps users, including by using Geographic Information System or GIS to specify the location of the users. In this project, our map scope is the map of KMUTT that we

did the real exploration and collected the picture to help for providing the correctness of the location. Our application will be divided into 2 sections which are online and offline map. In case that the user are using the application with the internet, they can choose online map system that we will take the Google Maps and the navigation system which can provide for the real time location of the user. However, if the user are using the application without the internet, they can choose the offline map system that we will create our own map and also our navigation system without using Google. For the software program that we will use to develop for the application is 'Android Studio' that support for us to use with available connected between database. And we also did the survey about the usage of online maps to improve and develop our application to be better.

Deliverables for Term 1

- Boundary of project area.
- Information about database and data creation of the route and buildings in the university.
- User Interface design.
- Software design and algorithm.
- Application prototype.

Deliverables for Term 2

- Implement the application.
- Test and improve for the application.

1.4 Tasks and Schedule

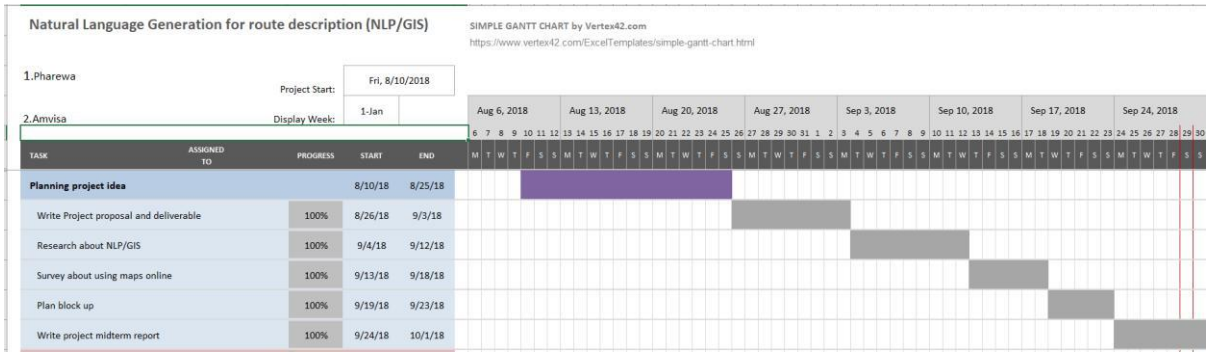


Figure1.4.1: Gantt chart part 1

Natural Language Generation for route description (NLP/GIS)

1.Pharewa

2.Amvisa

Project Start:	Fri, 8/10/2018
Display Week:	1-Jan

TASK	ASSIGNED TO	PROGRESS	START	END
Planning project idea			8/10/18	8/25/18
Write Project proposal and deliverable		100%	8/26/18	9/3/18
Research about NLP/GIS		100%	9/4/18	9/12/18
Survey about using maps online		100%	9/13/18	9/18/18
Plan block up		100%	9/19/18	9/23/18
Write project midterm report		100%	9/24/18	10/1/18

Figure1.4.1.1: Extent from gantt chart part 1

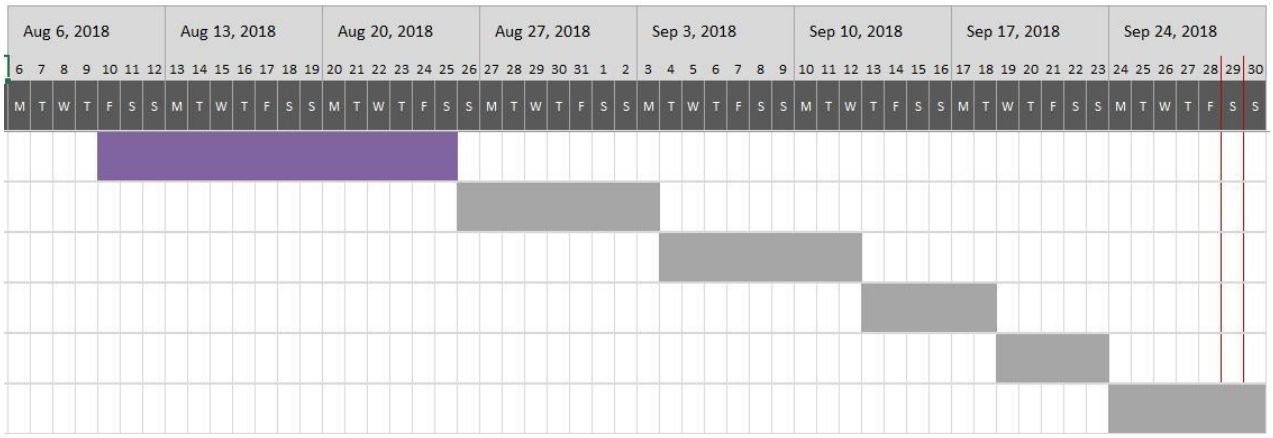


Figure1.4.1.2: Extent from gantt chart part 1

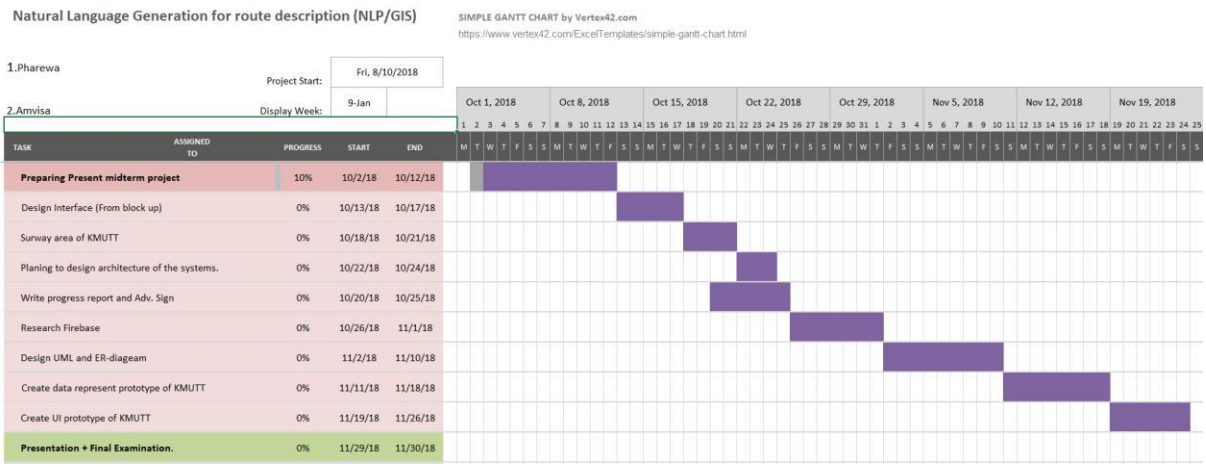
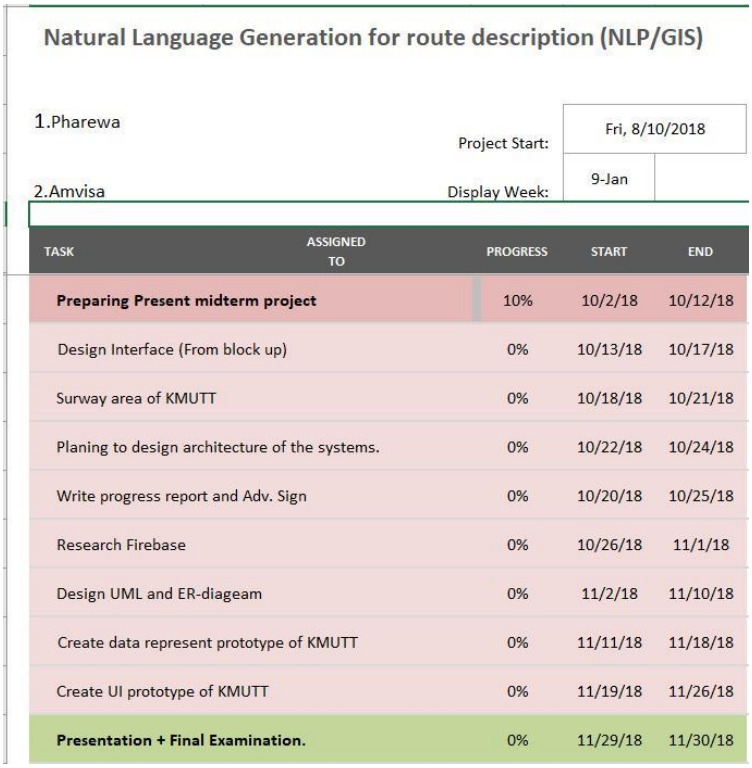


Figure1.4.2: Gantt chart part 2



Natural Language Generation for route description (NLP/GIS)

1.Pharewa

2.Amvisa

Project Start: Fri, 8/10/2018

Display Week: 9-Jan

TASK	ASSIGNED TO	PROGRESS	START	END
Preparing Present midterm project		10%	10/2/18	10/12/18
Design Interface (From block up)		0%	10/13/18	10/17/18
Surway area of KMUTT		0%	10/18/18	10/21/18
Planing to design architecture of the systems.		0%	10/22/18	10/24/18
Write progress report and Adv. Sign		0%	10/20/18	10/25/18
Research Firebase		0%	10/26/18	11/1/18
Design UML and ER-diageam		0%	11/2/18	11/10/18
Create data represent prototype of KMUTT		0%	11/11/18	11/18/18
Create UI prototype of KMUTT		0%	11/19/18	11/26/18
Presentation + Final Examination.		0%	11/29/18	11/30/18

Figure1.4.2.1: Extent from gantt chart part 2

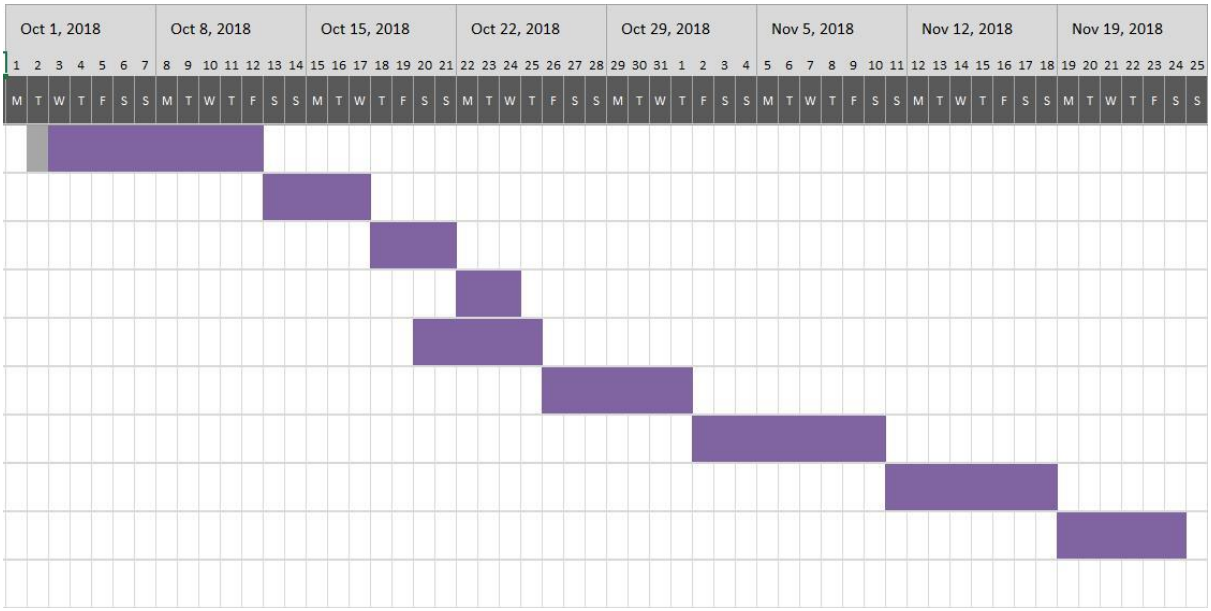


Figure1.4.2.2: Extent from gantt chart part 2

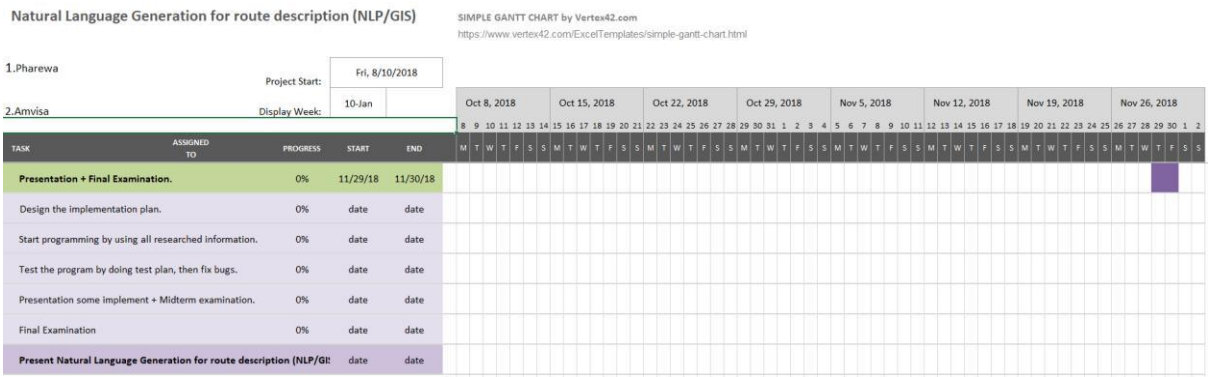


Figure1.4.3: Gantt chart part 3

Natural Language Generation for route description (NLP/GIS)

1.Pharewa

2.Amvisa

Project Start: Fri, 8/10/2018

Display Week: 10-Jan

TASK	ASSIGNED TO	PROGRESS	START	END
Presentation + Final Examination.		0%	11/29/18	11/30/18
Design the implementation plan.		0%	date	date
Start programming by using all researched information.		0%	date	date
Test the program by doing test plan, then fix bugs.		0%	date	date
Presentation some implement + Midterm examination.		0%	date	date
Final Examination		0%	date	date
Present Natural Language Generation for route description (NLP/GI			date	date

Figure1.4.3.1: Extent from gantt chart part 3

Chapter 2
Background, Theory and Related Research
Related theories

2.1 Geographic Information System (GIS)

Geographic Information System or GIS is the systematic space-based system that using geographic information such as address, location, latitude and longitude which are analyzed by computer analysis and data is stored in the form of tables. The results are high accuracy and can be applied in many areas such as mapping, environmental management and relocation with high accuracy results.

GIS is the information system stored on the computer. The condition of the system is related to the proportion of distance and actual area on the map. The data stored in the GIS is spatial data that is displayed in the form of graphics and maps that associated with the Attribute Data or Database. The maps in the GIS system is related to geographic location that is the exact coordinates. In the GIS data, both spatial and attribute data can be referenced both directly and indirectly for the real location that exist on the earth by using the Geocodes system. GIS data that referring to the earth's surface directly means data that has coordinates or has actual location on the earth or in a map, such as location of road, building, etc. GIS data that is referenced to be the indirect is information of the house including house number, alley, district, province and zip code. We can specify where this house is located on the earth because every house has a unique address.

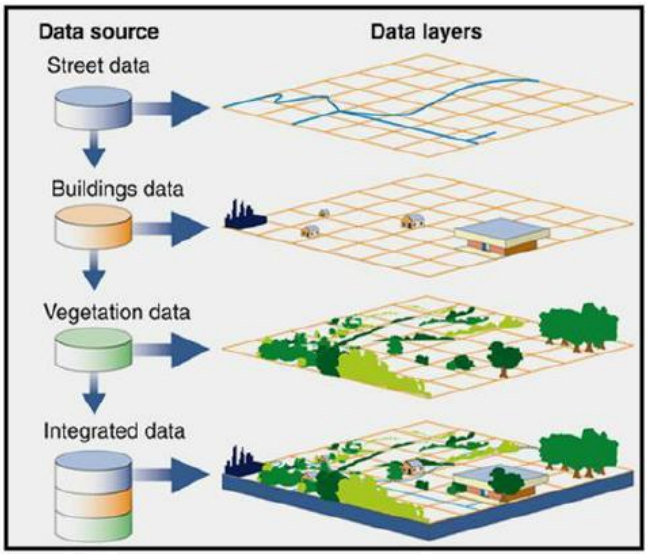


Figure2.1.1: GIS data layers
(https://www.nationalgeographic.org/encyclopedia/geographic-information-system-gis/)

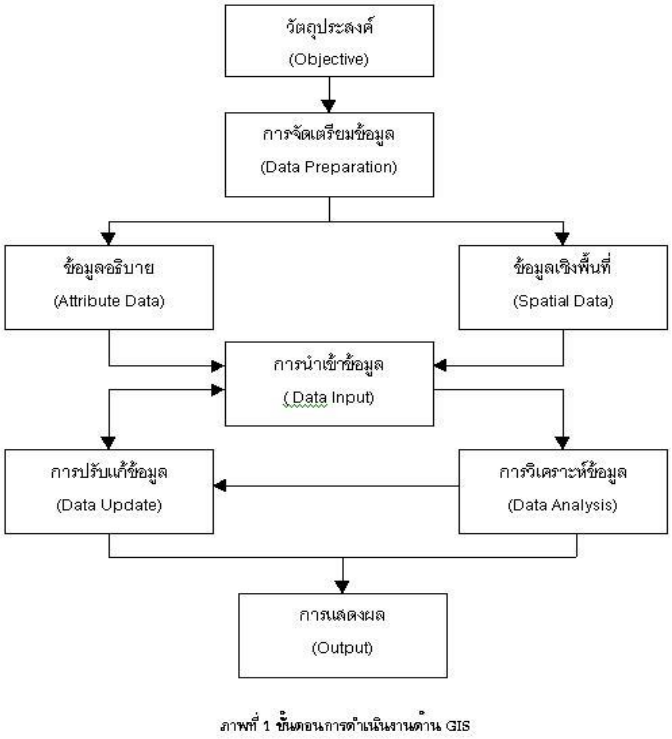


Figure2.1.2: GIS system
(http://www.mahadthai.com/gis/basic_d.htm)

Map is the appearance of the surface of the earth in both natural and man-made, displayed on a flat surface. Reduce to the desired size and use a marker or symbol instead of what appears on the surface of the earth.

Spatial data consists of two parts, first is Graphic data that can be represented in two basic forms which are Vector format and Rastor format.

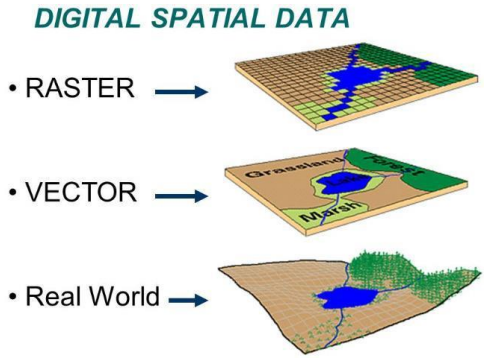


Figure2.1.3: Graphic data of GIS
(https://slideplayer.com/slide/6152526/)

Next is Attribute data that is a descriptive text that relates to visual data, such as street names, surface characteristics, and number of the lanes of each road.

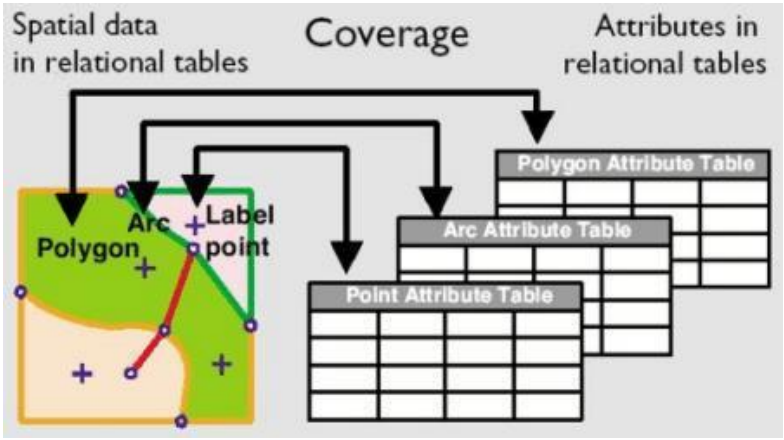


Figure2.1.4: Attribute data of GIS
(http://mjcetce409.blogspot.com/2015/10/diagram-depicting-linkage-between.html)

Our project will use GIS for mapping to determine the location of the user to the destination distance.

2.2 Natural Language Processing (NLP)

Natural language processing (NLP) is one in many sections in artificial intelligence that focus on making computers to understand and process the human language to perform the desired tasks. NLP has the knowledge from many branch, including computer science and computational linguistics, it can reduce the gap between human communication and computer understanding.

NLP systems generate the meaning from an input of words likes sentences or paragraphs to be the vary form of structured output and can be divided into two parts which are Natural Language Understanding and Natural Language Generation that evolves the task to understand and generate the text.

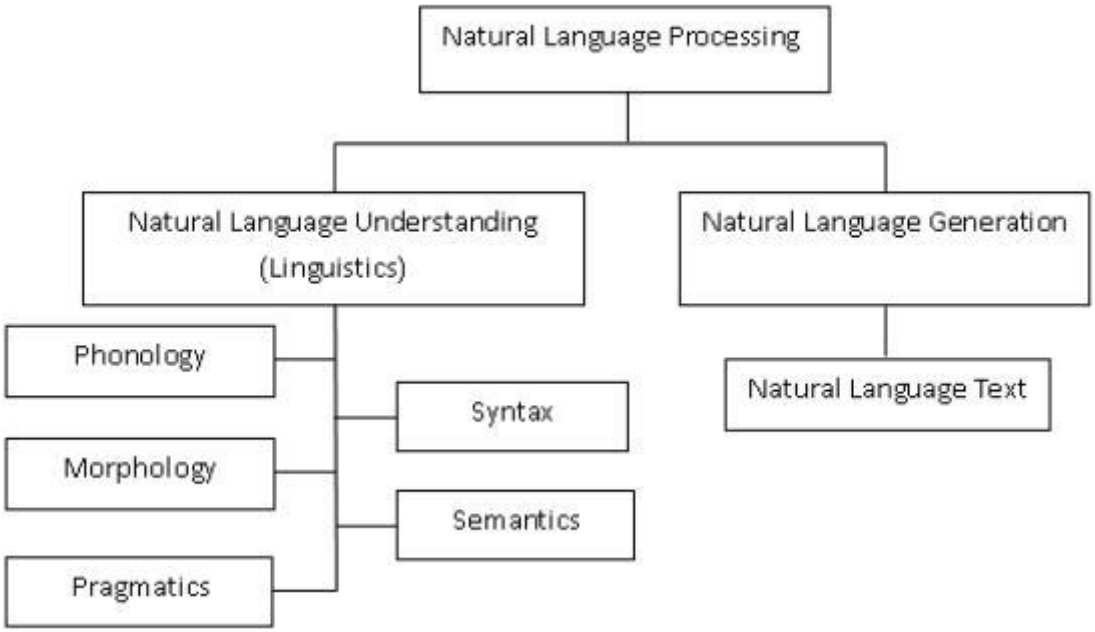


Figure 2.2.1: Broad Classification of NLP

For the section of Natural Language Understanding is about the Linguistics that is "the scientific study of language, and involves an analysis of language form, language meaning, and language in context." which can divided into many types likes Phonology that refers to sound, Morphology for the word formation, Syntax for sentence structure, Semantics syntax and Pragmatics that refers to understanding.

For the section of Natural Language Generation is about the process that producing the text from computer. It is the natural language processing task of generating natural language from a machine representation system.

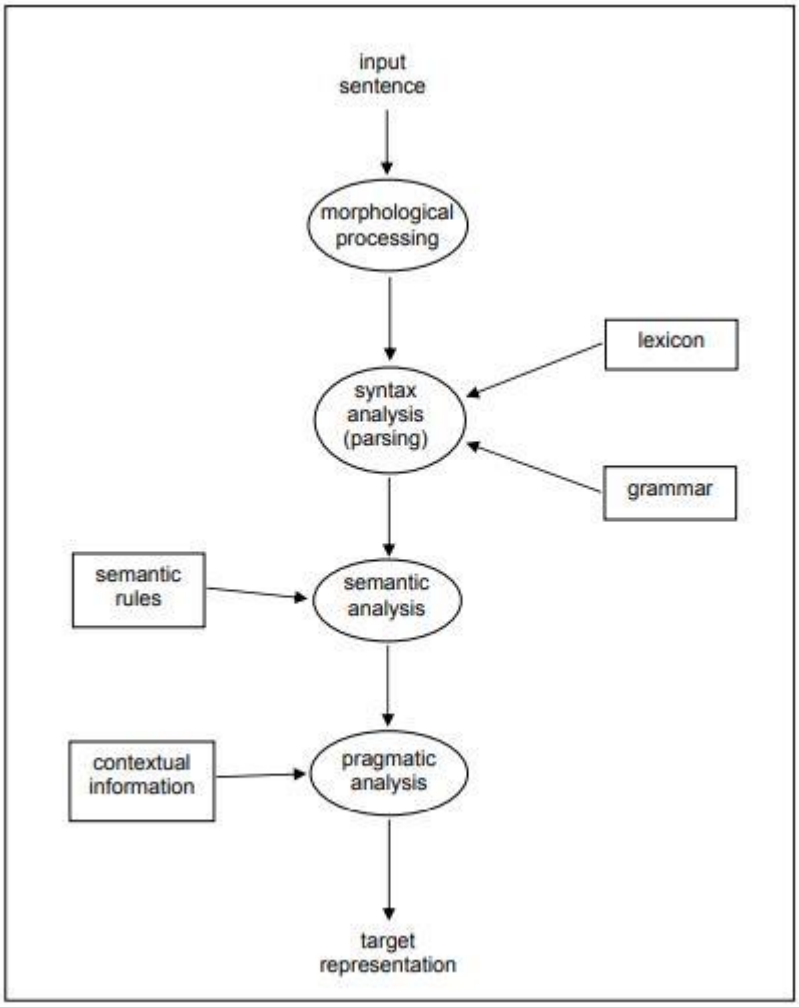


Figure 2.2.2: The logical steps in Natural Language Processing

Level of Natural Language Processing

1. Phonology

Phonology is the part of Linguistics that related to the systematic arrangement of sound. The NLP system take the input sound and analyzed to be the digital signal and do the language process.

2. Morphology

This level deals with morphemes that are the smallest units of meaning in the words and it is the parts that make up word. You can break down an unknown word into each morphemes in order to understand its meaning.

3. Lexical

This level of speech analysis examines how the parts of words (morphemes) combine to make words and interpret the meaning of individual words.

4. Syntactic

This level focuses on text at the sentence level and analyzing the words in a sentence to check for the grammatical structure of the sentence. This requires both a grammar and a parser. The output of this level of processing is the sentence that reveals the structure relationships between the words.

5. Semantic

This level focuses on how the context of words within a sentence helps determine the meaning of words on an individual level.

6. Discourse

This level works with units of text longer than a sentence. How sentences relate to one another. Sentence order and arrangement can affect the meaning of the sentences.

7. Pragmatic

This level is about bases meaning of words or sentences on situational awareness and world knowledge. Basically, what meaning is most likely and would make the most sense.

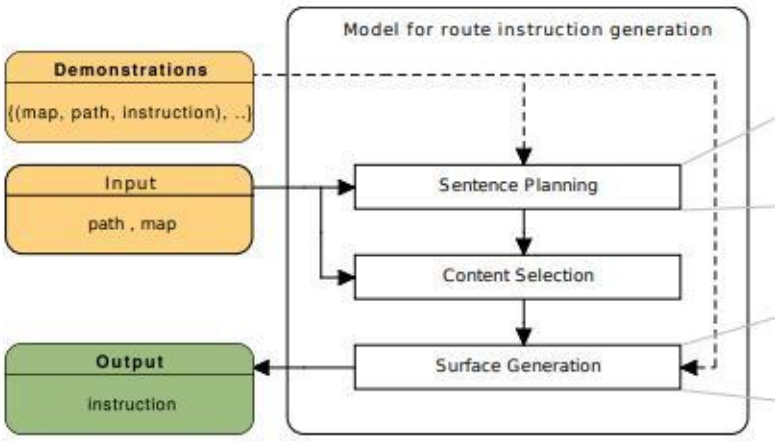


Figure 2.2.3: How NLP works in our system

How NLP works

For our project, after we got the information from the GIS system, we will take the 'map and path' as the input into our model for generate route description which are including by 3 sections in the model,

1) Sentence planning

The step that take path and maps as an input and use parser or parsing that is the process that determine the structure of the input text by analyzing the text based on the grammar of that language.

2) Content Selection

The process of identify the important sentences to extract from the large document of whole input to be in the subset of the information to include in generated output.

3) Surface Generation

The step to generate for the last output which has 'Sentence Generator' and 'Language Model' which is a method to assign probability to the sentences to ensure the correctness and use 'Maximum Entropy' to combine the diverse piece together and generate the route description as an our output.

2.3 Mobile Applications

Because in nowadays, windows applications are getting less and less popular because most of the users always use mobile. Most developers pay more attention to Web applications because they can run on any platform, including Windows, Ubuntu, Android, iOS, Windows Phone, etc. Just have a browser and the internet is accessible. But the web application development also has many limitations, such as the lack of access to the resources of the user directly, the need to access the internet and not as fast as Native Application.

Figure2.3.1: IOS Vs Android
(https://www.wisbar.org/NewsPublications/WisconsinLawyer/Pages/Article.aspx?Volume=90&Issue=5&ArticleID=25605)

The reason that our group choose to develop our application by Android Operating System is because Android is one of the most platform that people use widely and this platform has the tools that can support our application that we are going to implement. In addition, various devices for coding and testing can be easily found with no extra charge. The program that support to use JAVA language with is Android Studio which is the official Android IDE for develop the Android application especially with the InteliJ IDEA concept, similar to the Eclipse or Netbean and Android ADT Plugin. The purpose of Android Studio is to develop IDE tools that can develop Android Application specifically to be more effective

with the GUI design that allows the application to preview different views on the smartphone and can display the preview immediately without running the application on the emulator and also fix the speed of the emulator that still have problems in the present.

Comparison between Android and iOS system.

Android
- The JAVA programming language can be implemented in many platforms more widely than the objective-C to develop.
- Android development tools can be used and tested with windows system.
- Better market share with the open source system.

iOS
- Easier to generate User Interface.
- More stable when using the application.

Figure2.3.2: Android Studio
(https://www.techtalkthai.com/google-releases-android-studio-3-2-beta-1-support-android-app-bundle-and-energy-profiler/)

Basic intstruction of Android Studio

From the tab project, the default of Android Studio displays project files in the Android Project view, which is a bit different from Eclipse or Netbeans, with emphasis on ease of use and speed.

In every Android Project there will be 2 files.

- The app folder: stored source code with 3 internal storage areas:
  - manifests: store the AndroidManifest.xml file.
  - java: store Java source code files, including JUnit test code.
  - res: store non-code resources such as XML layouts, UI strings, and bitmap images.
- Gradle Scripts: Build Android Application.

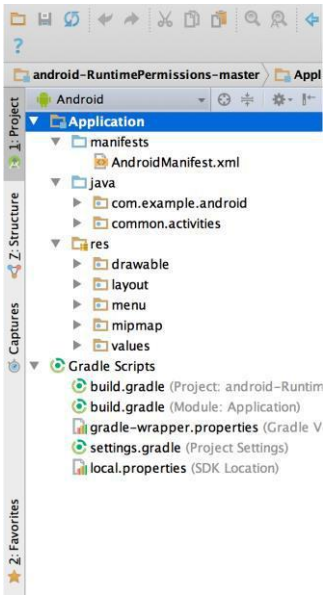


Figure2.3.3: Tab project of android studio
(https://www.arctech.in.th/articles/125)

The User Interface

1) Toolbar: frequently used toolbar.
2) Navigation bar: a toolbar that shows the location of files and makes accessing files easier.
3) Editor window: code and graphics area.
4) Tool window bar: the other window bars that associated which will be placed around the IDE.
5) Tool windows: a window for managing a project, such as displaying a file in a debugging project, showing the various consoles that are placed around the editor.
6) Status bar: show the status of the project such as error or warning.

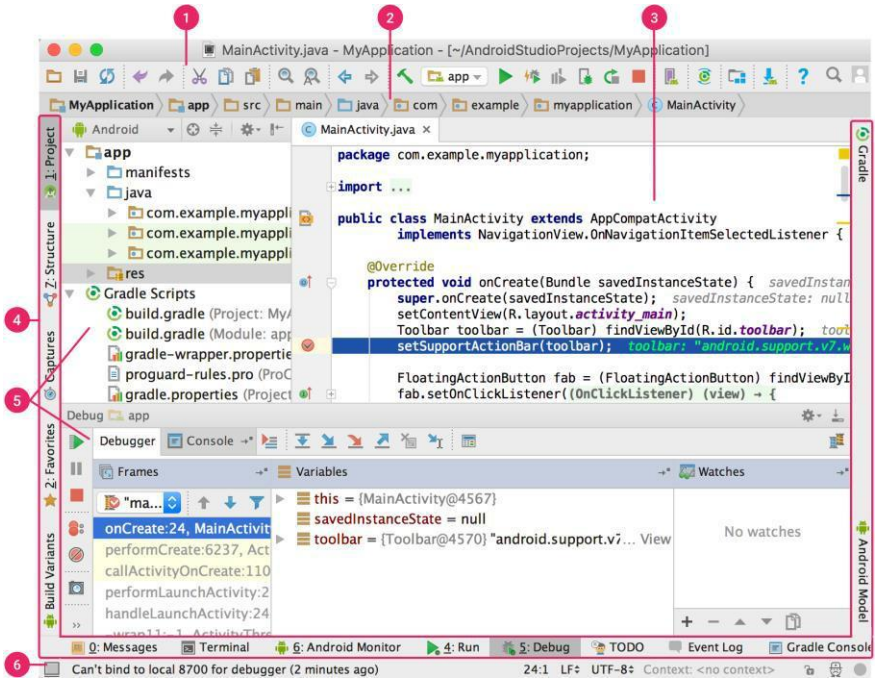


Figure2.3.4: User interface of android studio
(https://www.arctech.in.th/articles/125)

Nox is an Android emulator that popular among the Android developer because the the emulator system is relatively stable and easy to use. Another benefit of using Nox is user can drag the files such as pictures or APKs file to the emulator directly and can also customize various setting in your own way

Figure2.3.5: Nox emulation system
(https://review.thaiware.com/1075.html)

2.4 Graph Structure

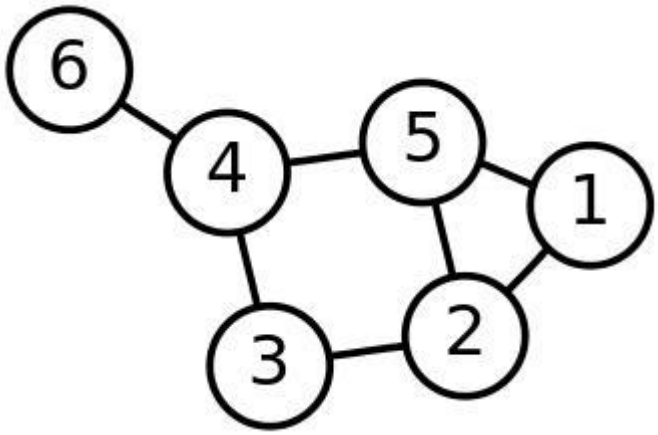


Figure 2.4.1: Example of Graph with nodes and edges (https://medium.freecodecamp.org/a-gentle-introduction-to-data-structures-how-graphs-work-a223d9ef8837)

Graph is the diagram structure that consist of nodes or you can called 'Vertices' and edges which represent the connection between nodes.
We divided the graph into 2 types, undirected graph and directed graph.

1.Undirected Graph has the two ways direction of edges between two nodes.

2.Directed Graph or Di-Graph has the one way direction of edges between two nodes.

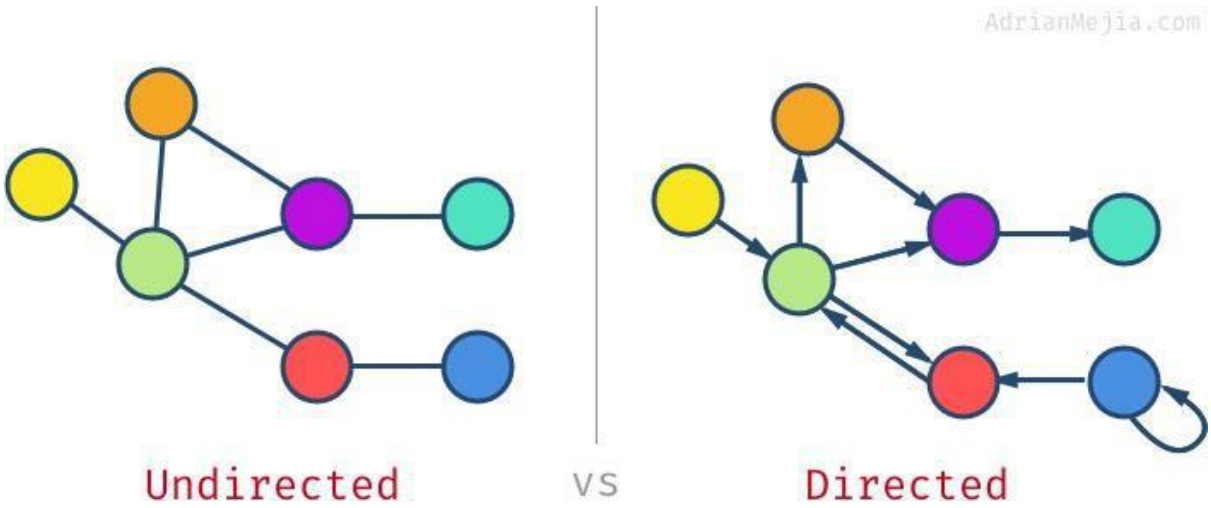


Figure 2.4.2: Example of Undirected and Directed Graph (https://adrianmejia.com/blog/2018/05/14/data-structures-for-beginners-graphs-time-complexity-tutorial/)

Another way to specific type of graph is to focus on cycles which tell that you can go along edges and can get to the same node more than once or not. If the graph has cycles, it will be called 'Cyclic Graph'. If the graph has no cycles, it will be called 'Acyclic Graph'.

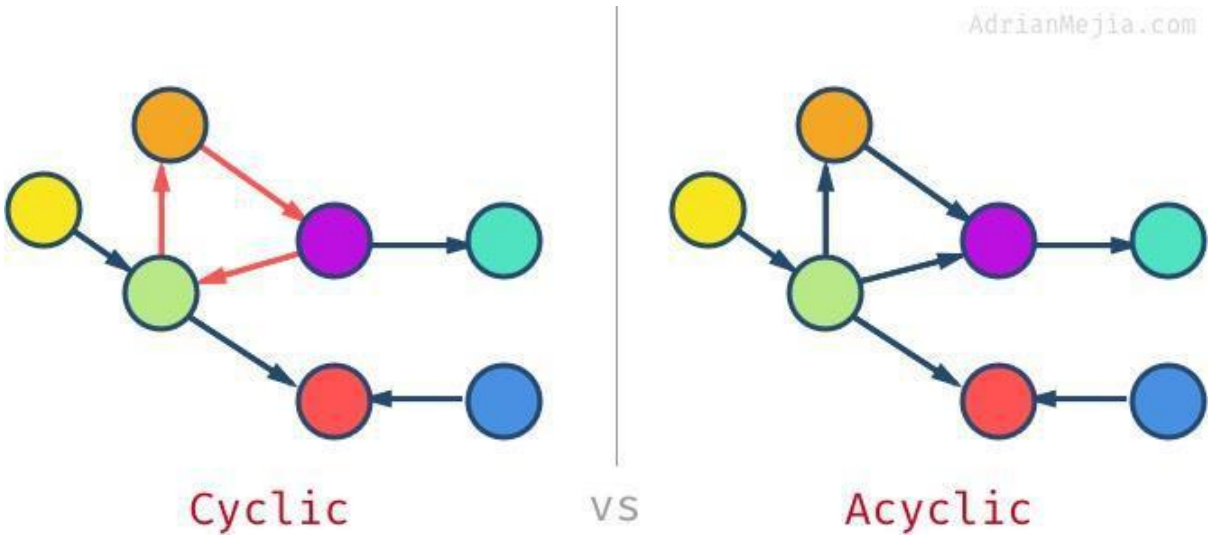
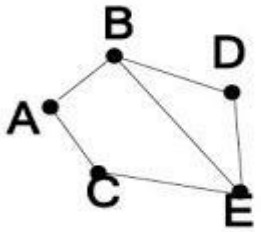


Figure 2.4.3: Example of cyclic and acyclic graph (https://adrianmejia.com/blog/2018/05/14/data-structures-for-beginners-graphs-time-complexity-tutorial/)

Example way to store edges in the database is to store 2 nodes of that edge in the 2 dimensions array if it has no direction.



N_1	N_2
A	B
A	C
B	A
B	D
B	E
C	A
C	E
D	B
D	E
E	B
E	C
E	D

การแทนกราฟด้วยแถวลำดับ 2 มิติ กรณีกราฟไม่มีทิศทาง

Figure 2.4.4: How to store edges in 2 dimensional array (http://piyapan-aod.blogspot.com/2009/03/graph.html)

So, we can represent and store the graph in 2 ways.

Adjacency Matrix

Adjacency Matrix represent the graph by using 2 dimensional array which will focus on the intersection of nodes. If the node is connected, the weight will be 1. But if the node is not connected, the weight will be 0 or -.

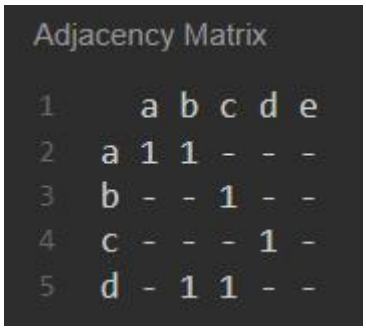


Figure 2.4.5: How to store edge in Adjacency Matrix (https://adrianmejia.com/blog/2018/05/14/data-structures-for-beginners-graphstime-complexity-tutorial/)

Adjacency List

Adjacency List also represent the graph using array or Hashmap. The array will contain the list of nodes that connect to the other nodes.

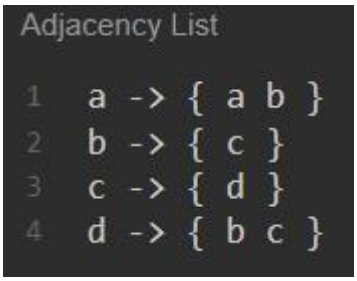


Figure 2.4.6: How to store edge in Adjacency List (https://adrianmejia.com/blog/2018/05/14/data-structures-for-beginners-graphs-time-complexity-tutorial/)

The graph is also using to represent network. So, the applications of graph are various. It can use for the social network system and also can use for generating the maps by node represent the intersection or point and edge represent the path between two nodes.

OpenStreetMap (OSM)

Figure 2.4.7: OpenStreetMap Logo
(https://en.wikipedia.org/wiki/OpenStreetMap)

OpenStreetMap is the geographic information system database that you can edit the maps of the world for free with just few limitations and can use for many objectives. There are many ready-made online maps with the various type of maps in the OpenStreetMap that use OpenStreetMap as the source example likes

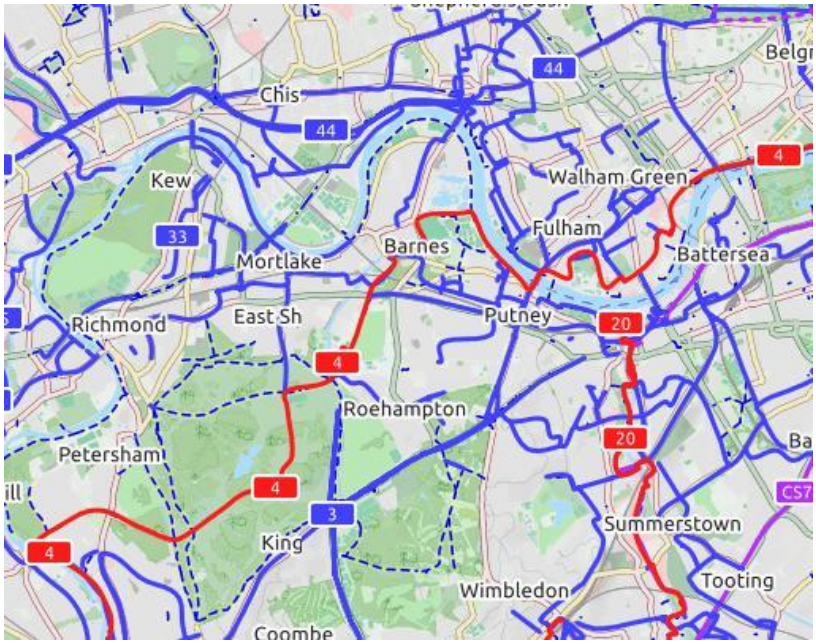


Figure 2.4.8: Bicycle map
(https://wiki.openstreetmap.org/wiki/File:CycleLayer2.png)

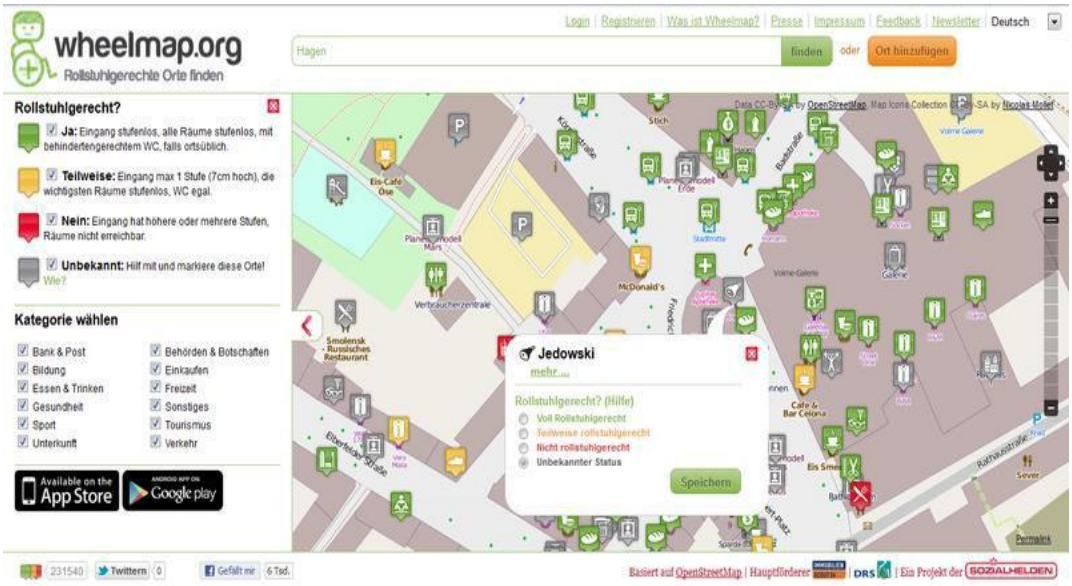


Figure 2.4.9: Wheelchair user map
(https://wiki.openstreetmap.org/wiki/File:Wheelmap_screenshot.png)

2.5 Database

phpMyAdmin is a program developed by using PHP language to manage MySQL database instead of using command line. Because if we use a MySQL database, it will be difficult to use sometimes. Therefore, phpMyAdmin is a tool to manage MySQL databases in order to be able to manage the MySQL DBMS easily with more convenient for user.
phpMyAdmin is a MySQL client program that directly used to manage MySQL data via a web browser. This phpMyAdmin will work on a web server as a php application that controls MySQL server.

The ability of phpMyAdmin is

1. Create and delete database.
2. Create and manage tables such as insert, delete and edit record, delete table, edit field.
3. Load text files into the table.
4. Find results with SQL statements

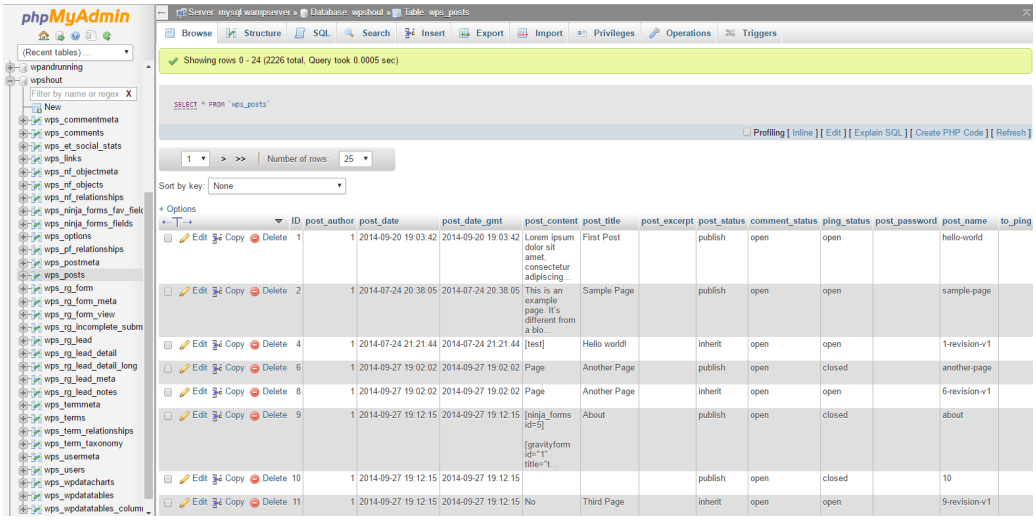


Figure2.5.1: phpMyAdmin system
(https://wpshout.com/mysql-basics-writing-custom-select-statements-phpmyadmin/)

Data dictionary can be said to be a file that records the details about the data stored in the database which can be a tool that helps to store data into categories and can find the details you need

So, the mapping application database should be a firebase that will easy to pull up the API from Google which is support with the Android application. We also have a data dictionary to store the type of sentence to use for generate the route description by using NLP to compose speech for easy access.

Sheet_1

Show rows with cells including:

Variable	Variable name	Mesaurement unit	Allowed values	Description
Participant ID number	ID	Numeric	001-999	ID number assigned to participant in sequential order
Group number	GROUP	Numeric	1-30	Group assigned to participant based on ID number
Age in years	AGE	Numeric	18.0-65.0	Age of participant in years
Date of birth	DOB	mm/dd/yyyy	1-12/1-31/1951-1998	Participant's date of birth
Gender	SEX	Numeric	1 = male 2 = female	Participant's gender
Date of survey	SURVEY	mm/dd/yyyy	01/01/2015 – 01/01/2016	When the participant completed the survey
Self-reported consumer spending	SPEND	Numeric	0-100,000,000	Self-reported average yearly expenditure
Market sentiment	SENTIMENT	Numeric	1 = negative 2 = neutral 3 = positive	Sentiment towards US domestic economy
Actual GDP growth	GDP	Numeric	-5.0-5.0	Average US yearly GDP growth

Figure2.5.2: Data dictionary
(http://help.osf.io/m/bestpractices/l/618767-how-to-make-a-data-dictionary)

2.6 Programming

There are many software programs available for development, but our group choose the Android Studio because it has a fast assist. Some may prefer Eclipse because it is faster when you open it and it use less RAM memories. The performance is the same but for the Android Studio, it will support for the JAVA language.

Advantages of Java Language

- Java language is a language that supports complete object-oriented programming. This is ideal for developing sophisticated systems. Object-oriented programming allows us to use the words or names that are available in the system to be used in program design. Make it easier to understand.
- There are many IDEs, application servers, and libraries for Java that we can use without charge. So we can reduce the cost to buy tools and s / w various.

Disadvantages of Java Language

- Works much slower than native code (programs that compile into machine language) or programs written in other languages such as C or C ++. This is because programs written in Java will be converted to a native language. When the program runs, the command for this intermediate language is changed to machine language. The command (or group of commands) at runtime is slower than the native code, which is in the machine language from when you compile the programs. If you want to speed up the work, you should not written in Java.

Highlights of Java

- Simple
- Object Oriented Language.
- Distributed
- Robustness
- Secure
- Architecture neutral
- Portable
- Interpreted
- High performance
- Multithreaded
- Dynamic

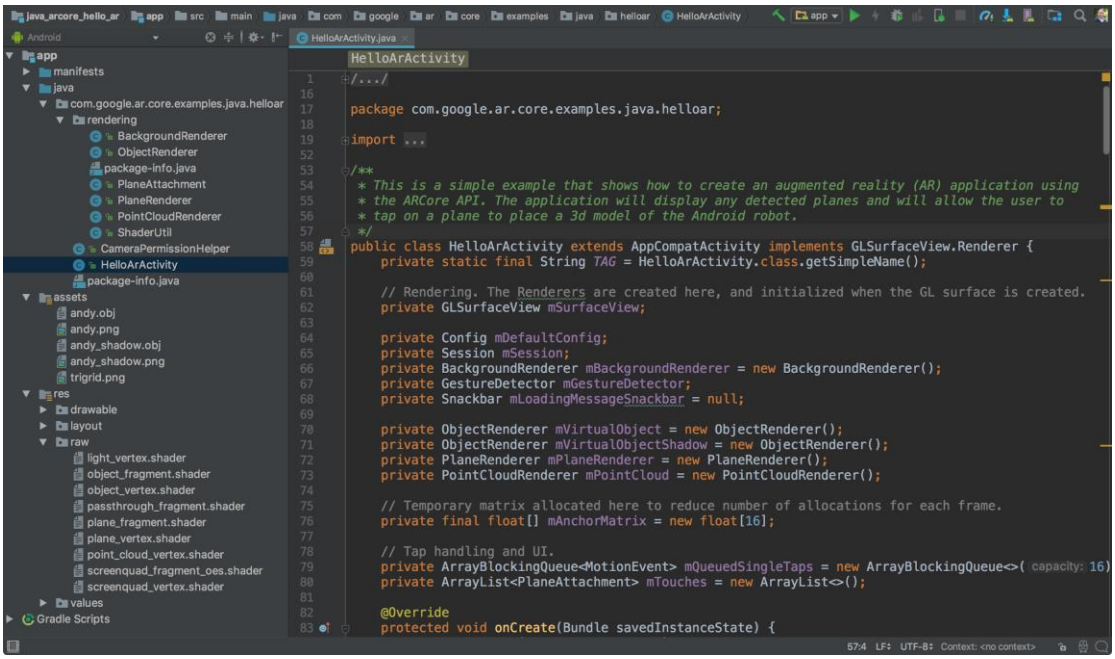


Figure2.6.1: Java language in android studio (https://developers.google.com/ar/develop/java/quickstart)

JSON

JSON or JavaScript Object Notation is a form of data that is used for small data interchange. People can easily understand and it can easily be created and read by the machine. It is a completely independent text format but similar with C, C++, C#, Java, Javascript, Perl, Python, and so on. These features make JSON a perfect data exchange language.

Figure2.6.2: Android json
(https://www.thaicreate.com/mobile/android-json-from-url.html)

2.7 Area survey in KMUTT

The survey is a major factor in creating a map so that you know where each campus is located.

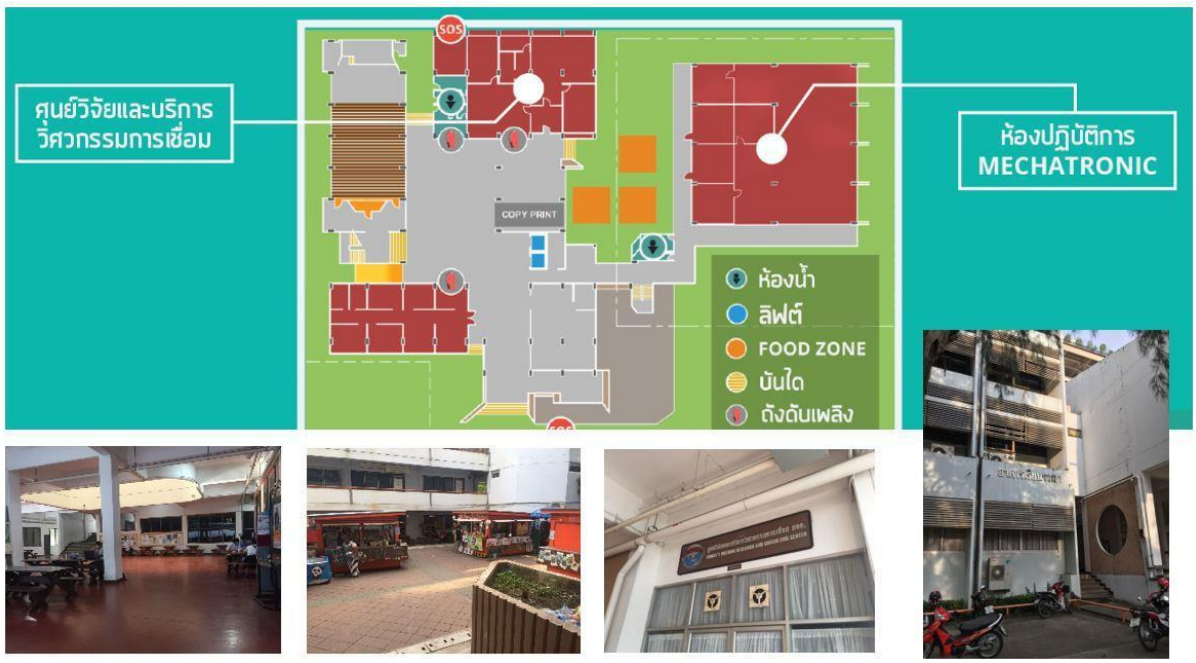


Figure2.7.1: CB1 Building

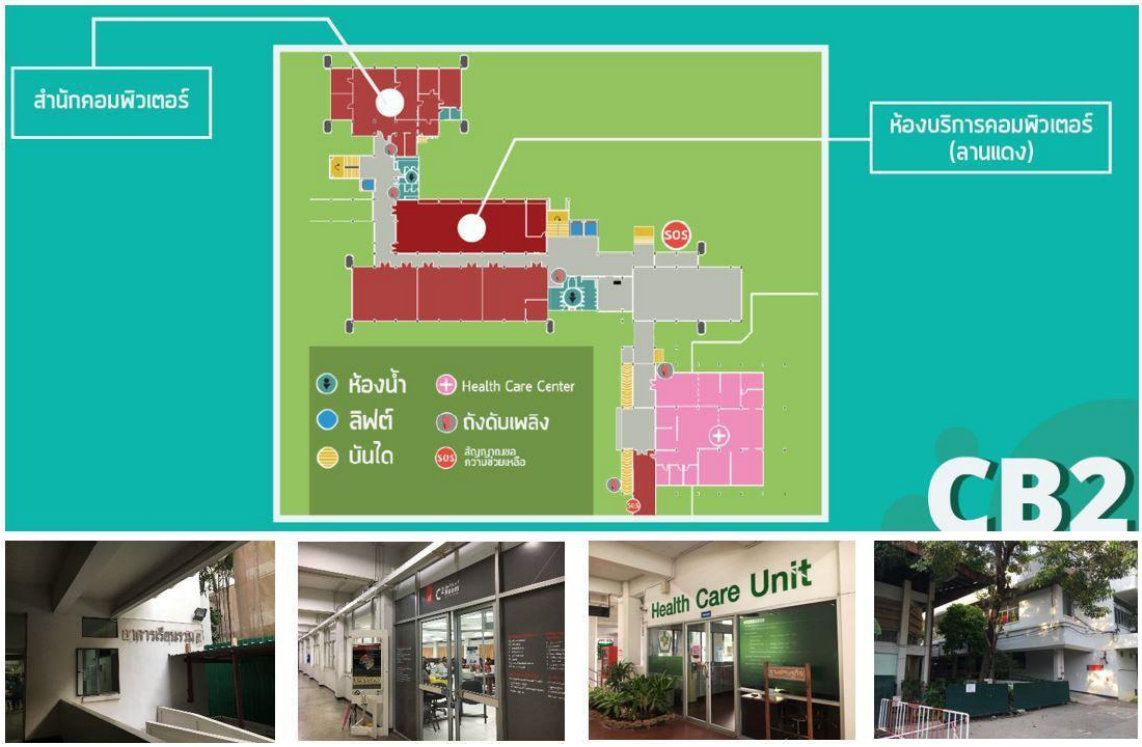


Figure2.7.2: CB2 Building

Figure2.7.3: Car park building Ground floor

Figure2.7.4: Car park building Underground floor

2.8 Online survey

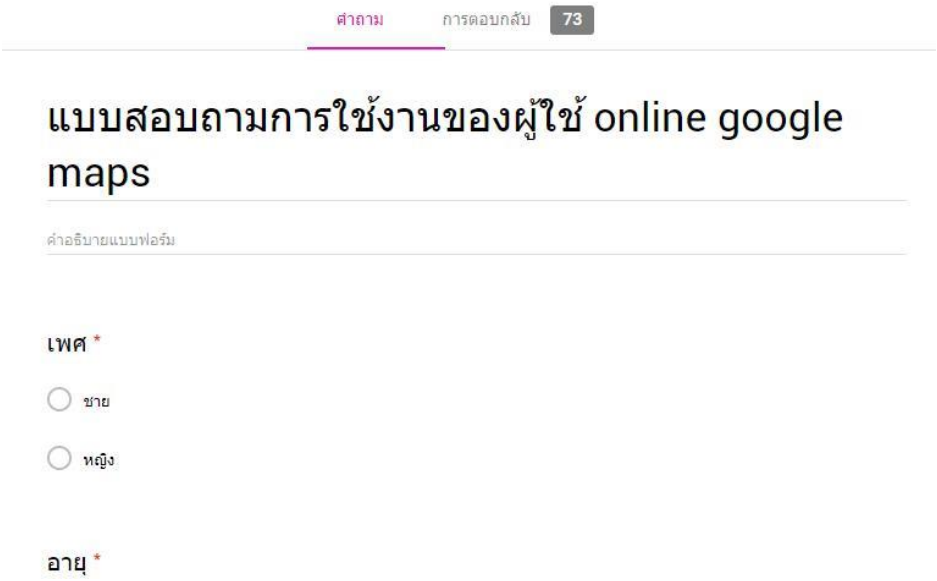


Figure2.8.1: Google maps user survey result

To observe and collect the usage, opinion and problems from the real user of google maps, we created the online survey and got the following results, From the 73 result answers, we got 64.4% of man and 35.6% of woman for this survey.

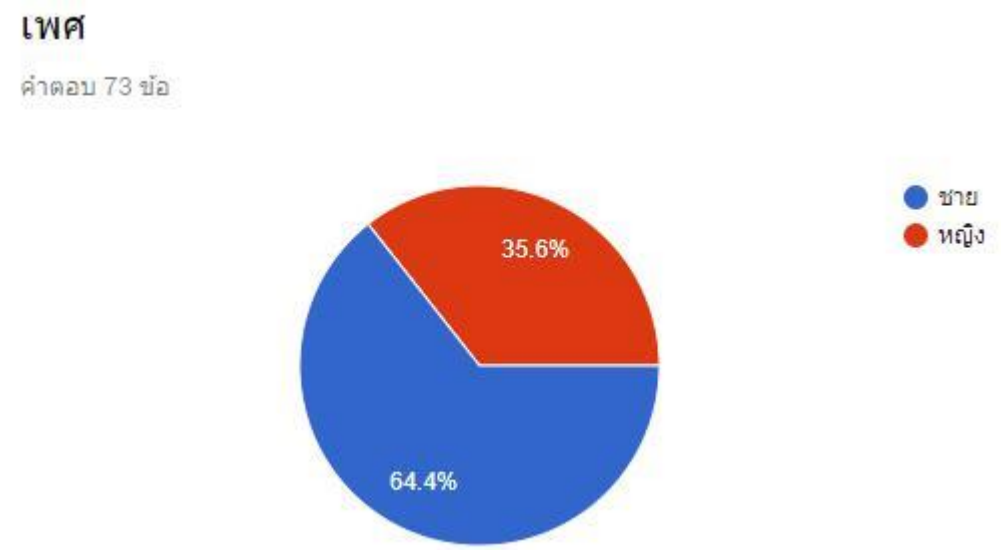


Figure2.8.2: Gender of google maps user survey result

We asked the user if they used it before and we got that 93.2% of user used to use the online google maps to navigate for the route description.

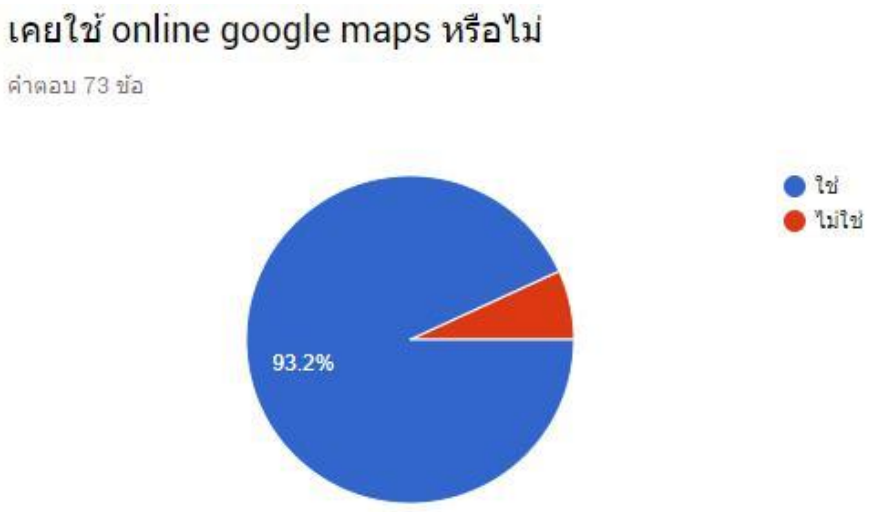


Figure2.8.3: Using online google map

We asked for the understanding of using google maps and divided the level into 4 levels which are not understand, quite understand, understand, and very understand. 47.9% of user can understand for the navigation, 34.2% are quite understand, 9.6% are very understand and 8.2% are not understand for the navigation.

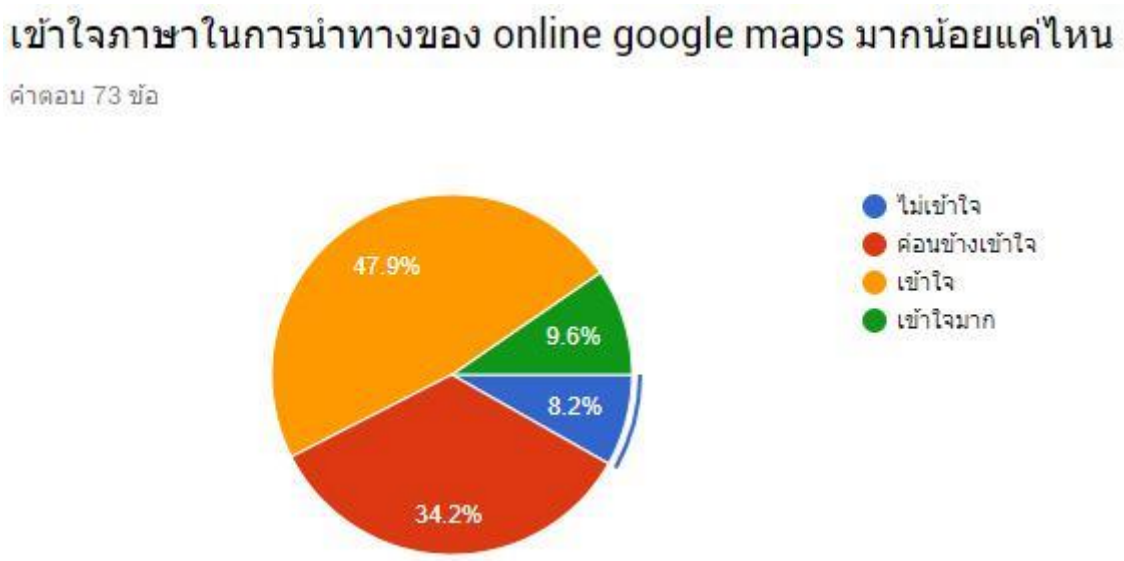


Figure2.8.4: Understanding the language of navigation by google map

But 58.9% of user had ever lost in their ways using online google maps.

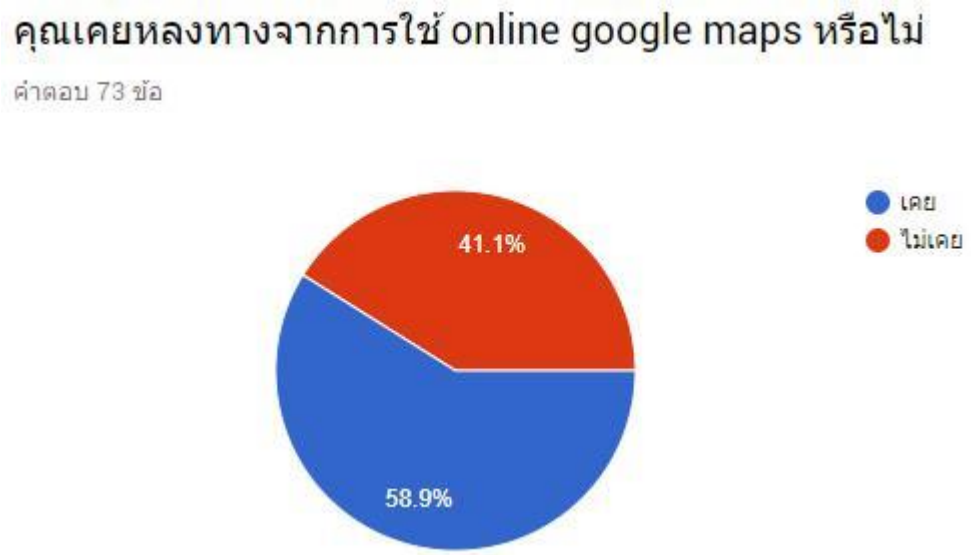


Figure2.8.5: Getting lost from using google map

And for the reason that make user lost and confuse with the navigation system of google maps are something likes the map is not detailed enough or the map is not up to date with the recently changes. They also said that it will get more confuse if they did not know around that location before, the alley is too tiny and they always looking through to the main street and get lost. Some of them said that the maps in google maps are not the same with real location maps, the navigator is sometime generated the wrong direction with more complicated route description more than usual.

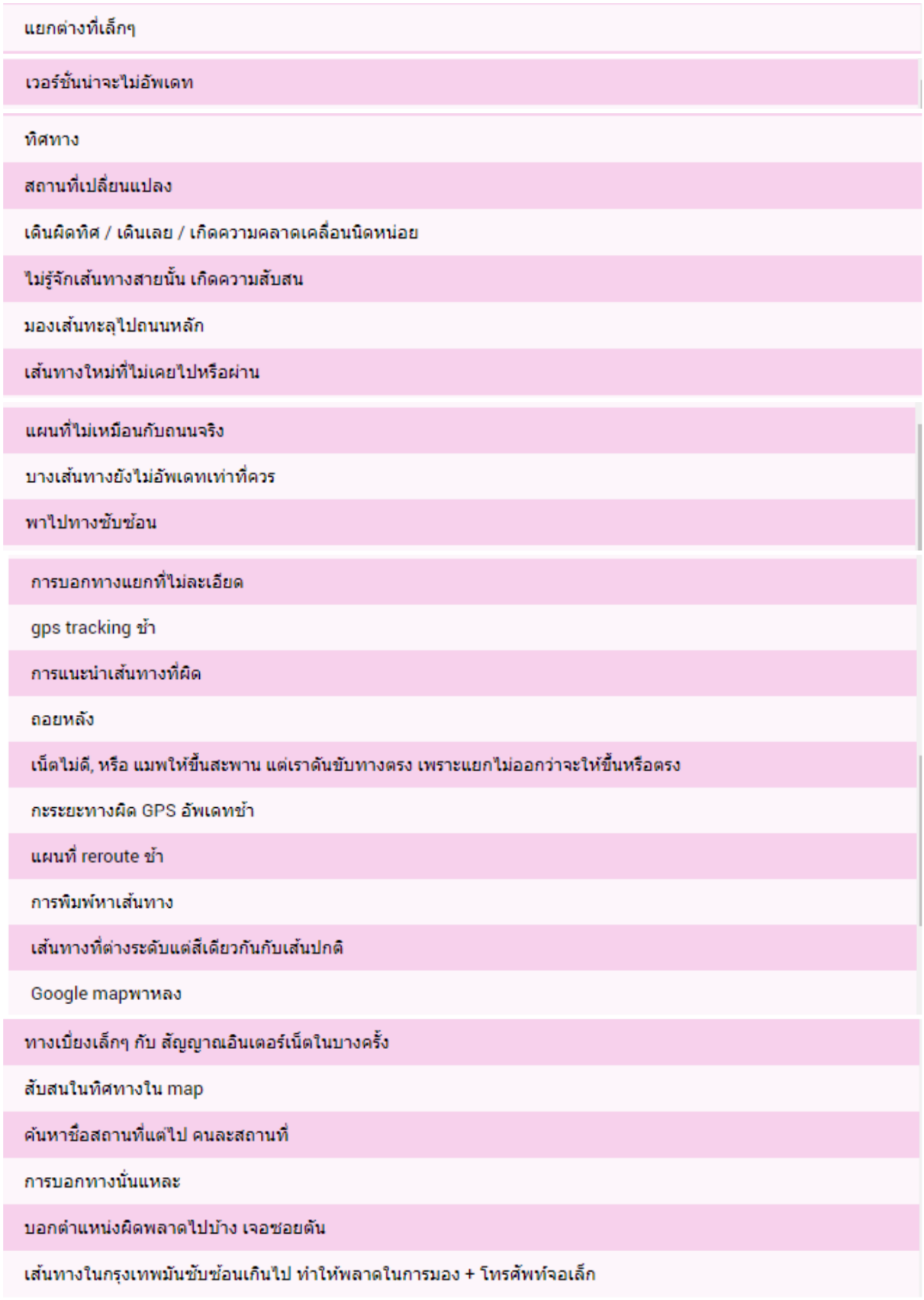


Figure2.8.6: The result why getting lost from using google map.

2.9 Client Side technology (Google APIs)

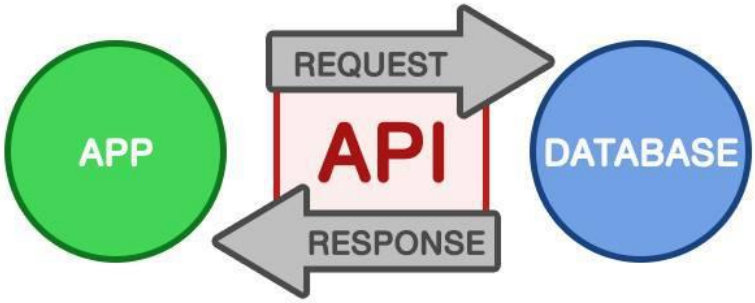


Figure2.9.1: API system
(https://www.codebee.co.th/labs/api-คืออะไร-ทำความรู้จักกัน/)

API stands for Application Programming Interface that is one way to connect to an API provider site from another and makes the application connect to another application or connect to the operating system. For example, the Google Maps API is a Google service that we can use Google Maps data that Google offers to apply to the website of the company or the shop or the store to make customer know the location.

Google API Client Libraries

Google APIs give you programmatic access to Google Maps, Google Drive, YouTube, and many other Google products. To make coding against these APIs easier, Google provides client libraries that can reduce the amount of code you need to write and make your code more robust.

You will see that we choose to use the program that can develop as an Android Studio, which is subordinate to the Java language, so we use the API of the google APIs that support for android and can help make the mapping easier from the database of google.

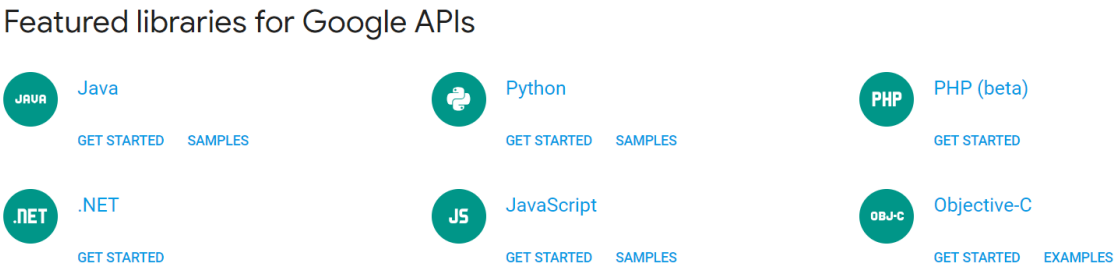


Figure2.9.2: Featured libraries for Google APIs
(https://developers.google.com/api-client-library/?hl=th)

Permission of the android application

To make a map application, the most popular way is to use Google's existing Map Engine API, which is open for developers to run. The API is called Google Maps Android API. Google Maps can not run on the AVD Emulator because it does not have Google Apps, so it should be tested on real machines or Genymotion with Google Apps installed.

What to do to get started with Google Maps:

• Remove the SHA1 code from the Keystore to request API Key for Google Maps at the Google Developer Console to designate the application.
• Add Google Play Services Dependencies to your application project.
• Set XML Layout to display Google Maps.
• Run with Google Maps commands to use as needed.

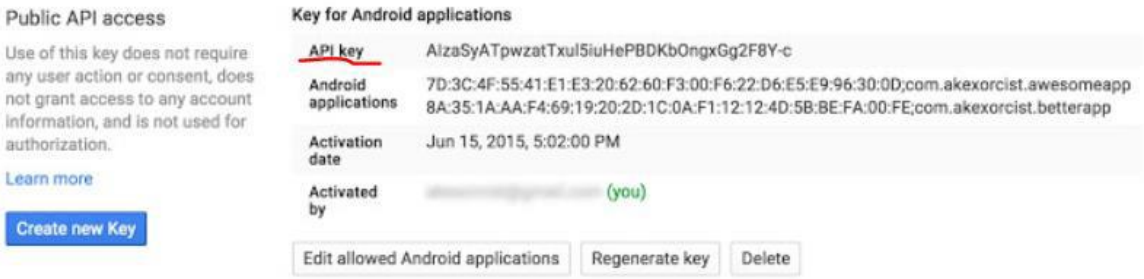


Figure2.9.3: Example permission Google APIs
(https://developers.google.com/tasks/oauth-authorization-callback-handler)

Chapter 3
Design and Methodology

How the application works

The process of project work is start from press the application, it will enter to the homepage of the application that user can select to use online or offline map section. If user select the online map section, it will show all locations in the university for selecting. After user choose the destination, the page with location detail and map will show up. User can push the navigate button in this page for generating the navigation but user must already have the Google Map application before push on the navigate button. User can search to find each location in the university and also can display the overview of our map.

For the user that select the offline map section, this section also provided 2 sub-functions. User can also search for the location, the selected location will show up with red marked in the map. The most important of the application is the offline navigation function, user can select the start point and the destination point to generate the route description.

3.1 General Requirement

3.1.1 The application can use only in Android platform.
3.1.2 The user can display for the map of KMUTT.
3.1.3 The user can search for the location.
3.1.4 The user can click on to see details of each location.
3.1.5 The user can click on to display the real picture of each location.
3.1.6 The user can use the navigation online system.
3.1.7 The user can select for the start location.
3.1.8 The user can select for the destination location.
3.1.9 The user can use the current location to be the start location.
3.1.10 The user can select between using online or offline map section.

3.2 Use Case Analysis

3.2.1 Use Case Diagram

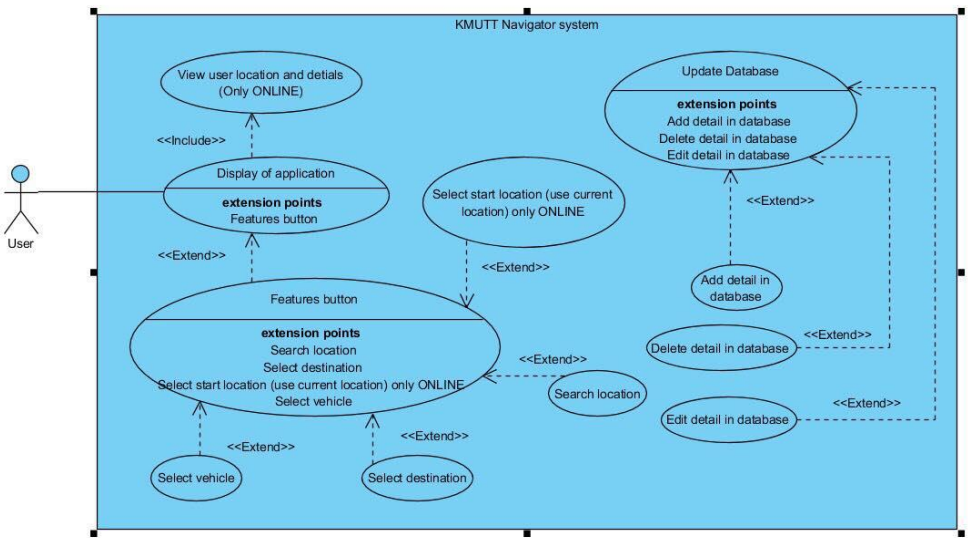


Figure 3.2: Use cases for system

3.2.2 Use Case Narrative

Scenario 1 : To download and open the application.
Actor: User
Goal: To open the application for use.
Precondition: The platform of your mobile must be Android.
Main success scenario:
1. User download the application from the store.
2. User click on to the application.
3. The logo of the application will appear and redirect to the homepage of the application.

Scenario 2 : Select online or offline map section.
Actor: User
Goal: To choose the type of map that user want to use.
Precondition: The homepage is displayed on the screen.
Main success scenario:
1. The homepage of the application show the button the choose type of map.
2. User push on the button to select type of map.
3. If user select the online map section, the application will redirect to the page with all locations in the university. If the user select the offline map section, the application will redirect to the page with overview of our own map.

Scenario 3 : Select the destination location in the online map section.
Actor: User
Goal: To show all the detail for each location.
Precondition: The list of all locations in the university are shown on the screen.
Main success scenario:
1. User select one location from the location list.
2. The application will redirect to the detail page of that location.

Scenario 4 : Use the navigation system in the online map section.
Actor: User
Goal: Start navigating to the destination for user.
Precondition: The map section is displayed on the detail page.
Main success scenario:
1. User click on the navigate button to start the navigation.
2. The application will start navigating for user.

Scenario 5 : Search for the location in the offline map section.
Actor: User
Goal: To find out the destination in the overall map.
Precondition: The overview of the map is shown up on the screen.
Main success scenario:
1. User search for the location by the name of buildings.
2. The application will highlight on the right location on the overview map.

Scenario 6 : Select the start and destination point in offline map section.
Actor: User
Goal: To generate the route description for user.
Precondition: The search page is displayed on the screen.
Main success scenario:

1. User type the start and destination point on the search page.
2. User push the navigate button.
3. The application will generate the route description for user.

3.3 System Architecture

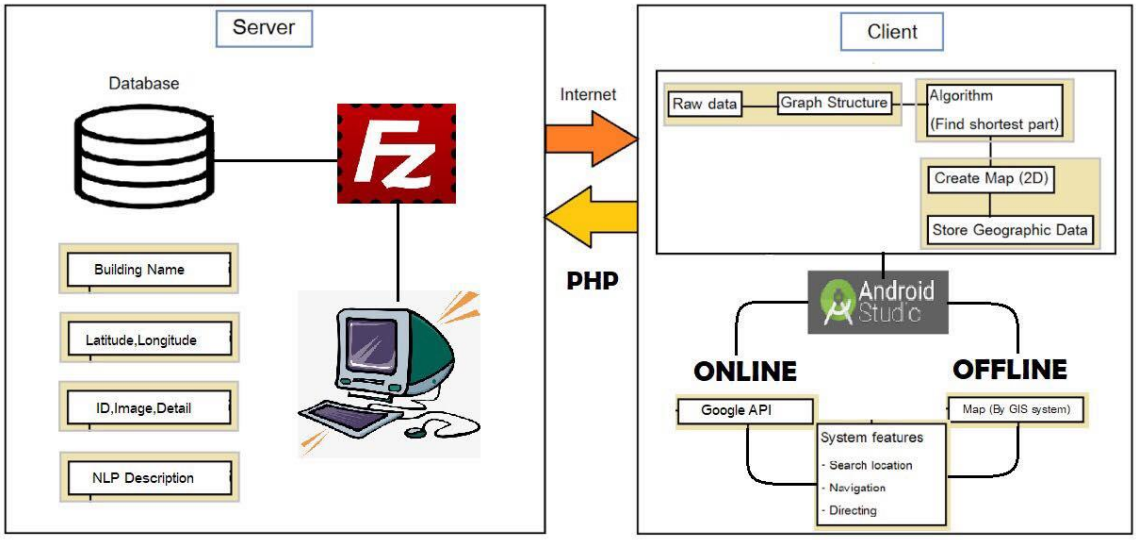


Figure 3.3: Navigation system architecture

We divided the system to be connected between server and client(user).

For the server side, it contains all about the database for the online map section. All the details of each location such as building name, latitude, longitude and image were stored in the database with phpMyAdmin and also Filezilla to connect with the client side.

For the client side, we are using Android Studio to implement the front-end module by JAVA and also using JS and CSS to manage the application displays.

We divided the application into 2 modules.

1. Online map module
   - This module will relate with the online database access and the Google maps API to show all the details for user.
   - Internet is required.
2. Offline map module

   - Compilation between raw data and graph structure.

   - For the raw data section, we got the raw data both from real exploration and OpenStreetMap database and take it into the Graph Structure algorithm to generate the path between location.

   - Algorithm to find shortest path using Dijkstra's algorithm which has nodes and edges represent for the location and path in KMUTT.

   - To create MAP 2D layers after we got the result from using OpenStreetMap with Android Studio and then to store geographic data to be used by Front-End Module.

All of the information will be shown in this mobile application displays for user to use and send information back to communicate with server.

3.4 Graph Structure and Possible Path

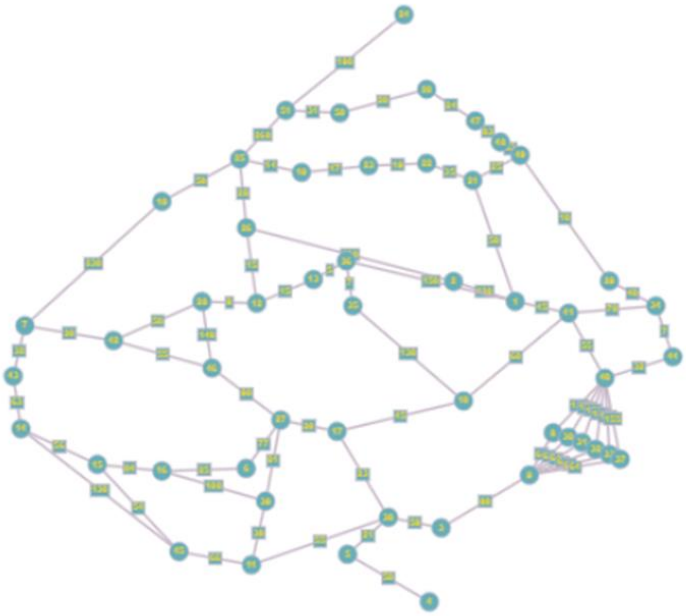


Figure 3.4.1: Nodes and Edges in graph structure.

We have 51 nodes within our KMUTT map and can be added more in the future to develop by using Graph Structure refer to OSM in the way to create map and specify nodes and edges both with computer-write and hand-write of human.

In the case that we have to specify one path with no choice for user, the one path have to be the path that best and shortest for traveling. So, we will use Dijkstra's algorithm to find the shortest path for user likes the following picture that node 42 (football field) and want to go to the node 19 (Library KMUTT).

Shortest path length is 116: 42⇒28⇒12⇒26⇒25⇒19 (For main part)
(สนามบอล , football field) ----> (หอสมุด, Library kmutt)

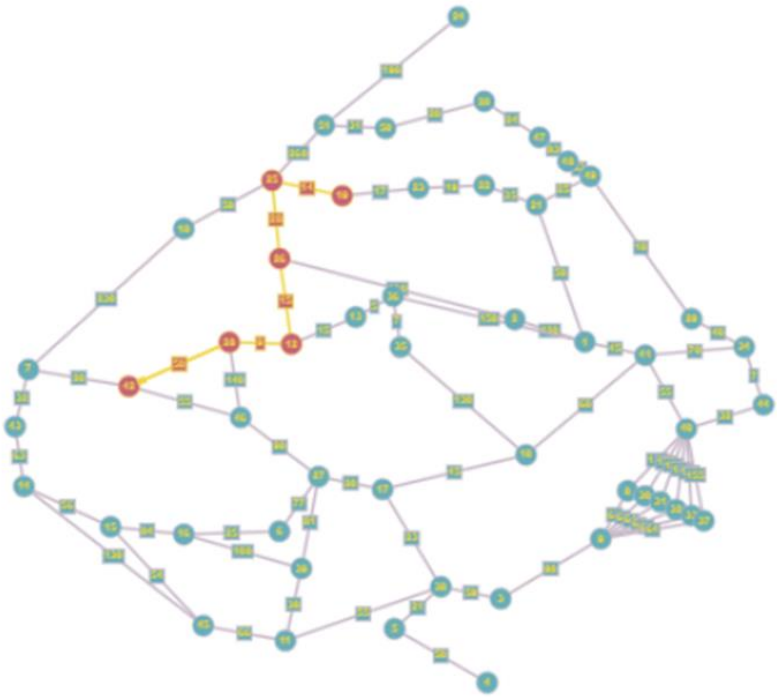


Figure 3.4.2: Shortest path length.

3.5 OSM Open Street Maps Structure of KMUTT

We choose the OpenStreetMap or OSM to do the map layers because it convenient and the open free source. Start from finding the location that we will deal with it which is the KMUTT map that we also add more detail from our real exploration to modify the updated location likes added more point and area.

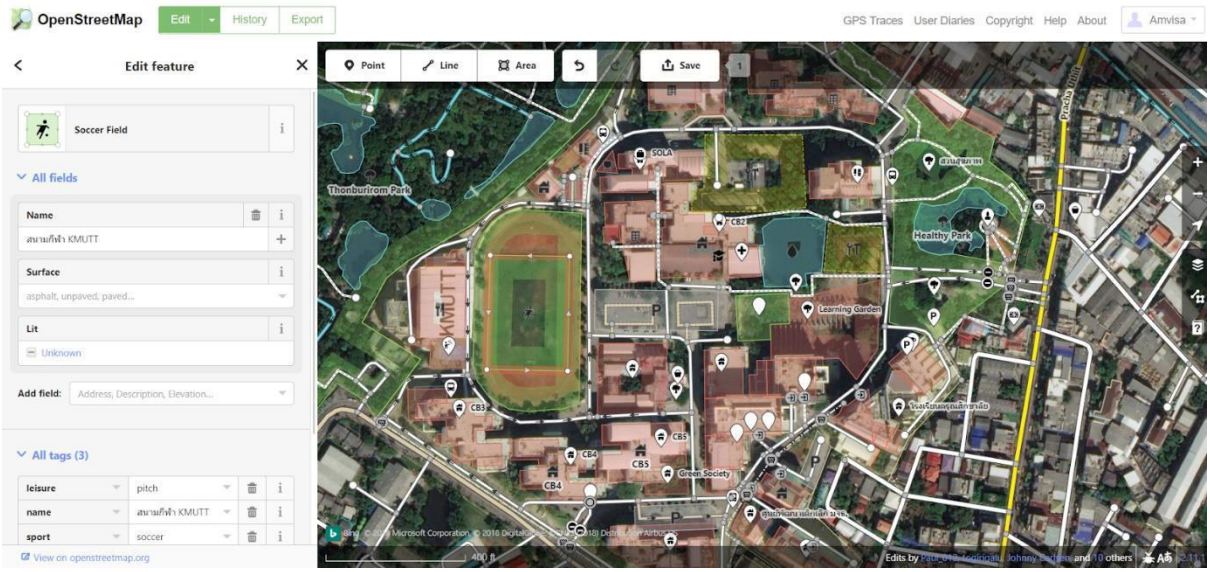


Figure 3.5.1: Open Street Maps at KMUTT
(https://www.openstreetmap.org/edit#map=17/13.65161/100.49464)

After we saved all the edited data, we can export all the map layers to use in the next step (But when updated, the data still has some problems in the way that we update the map detail but it not be shown in the export file.

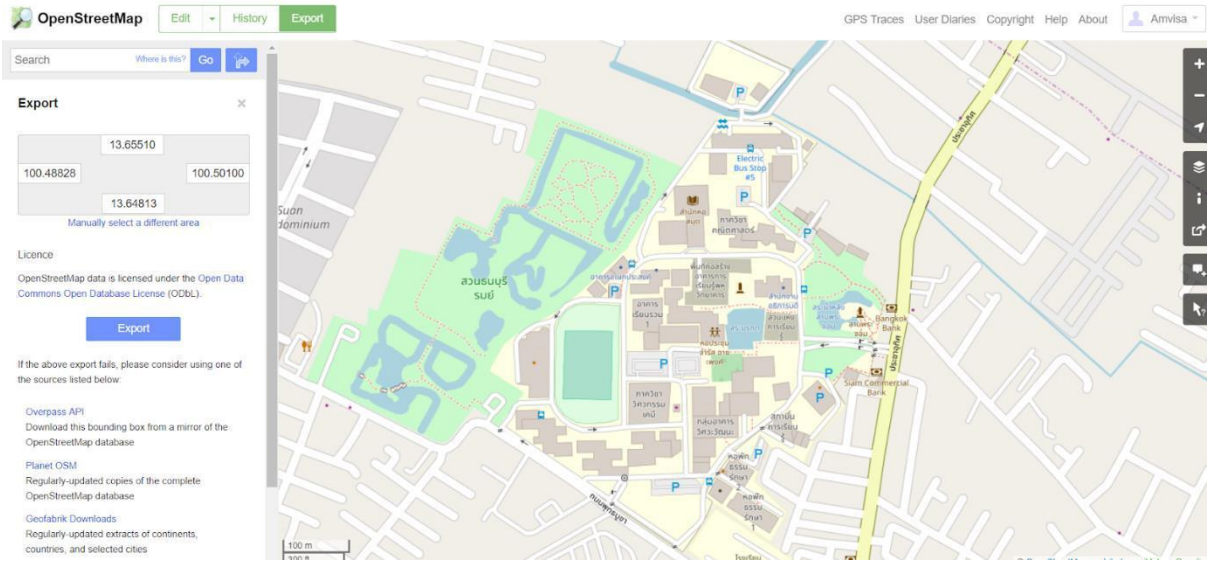


Figure 3.5.2: Export Open Street Maps (https://www.openstreetmap.org/export#map=17/13.65174/100.49580)

When we got the information from the OSM, we use the export file to import in QGIS to look into the information and modify to be better. So, we import the points, polylines and polygons data from OSM and we will get the first draft of KMUTT map.

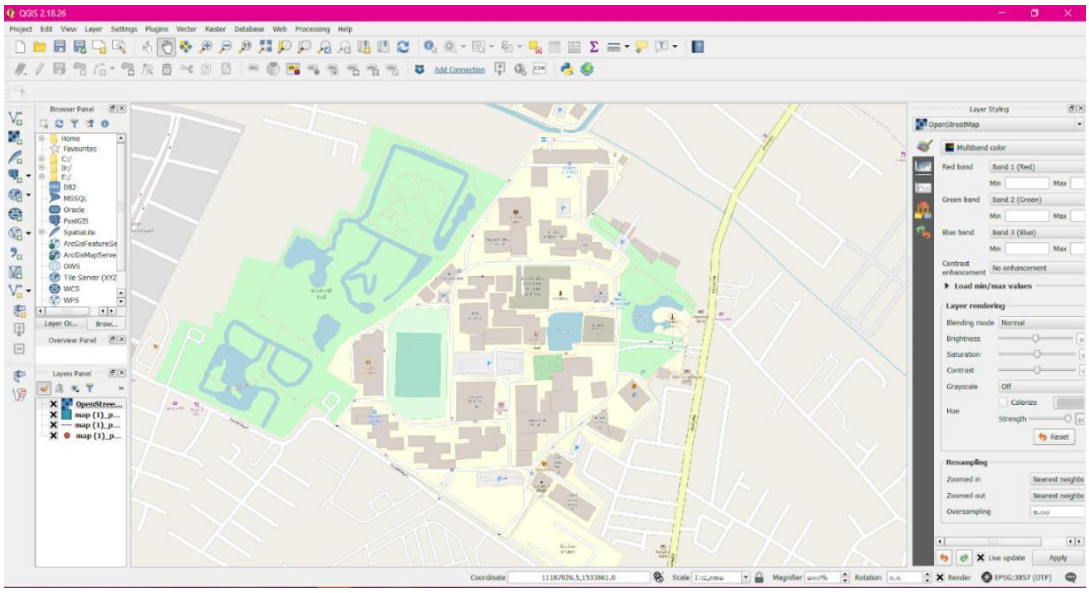


Figure 3.5.3: Import Open Street Maps in Qgis

This is the map that specify the nodes to use the graph structure algorithm.

Figure 3.5.4: Maps Example in OSM

Figure 3.5.5: Location Maps Example

3.6 Database Design

This ER diagram describes the structure for storing data in the online database system. It consist only one table.

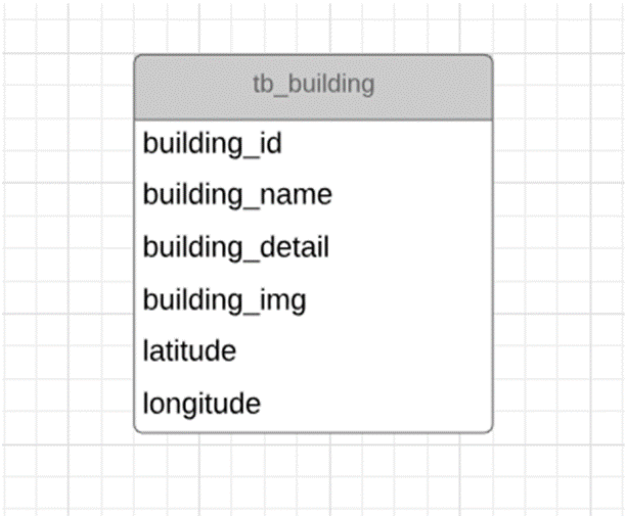


Figure 3.6: ER diagram

The tb_building table store information of each location in the university, the table includes 6 fields and these fields have data types as shown by following

Attribute	Description	Type	Length
building_id	Identify ID of each building.	int	5
building_name	Identify name of each building.	varchar	100
building_detail	Identify detail of each building.	text	-
building_img	Identify image of each building.	text	-
latitude	Identify latitude of each building.	text	-
longitude	Identify longitude of each building.	text	-

3.7 User Interface Design (Mock-up)

For the old UI design, we designed all the 7 pages of the application.

1.Logo page

The page when user cilck on the application to start using application.

2.Main page

The page after logo page with 4 components that are

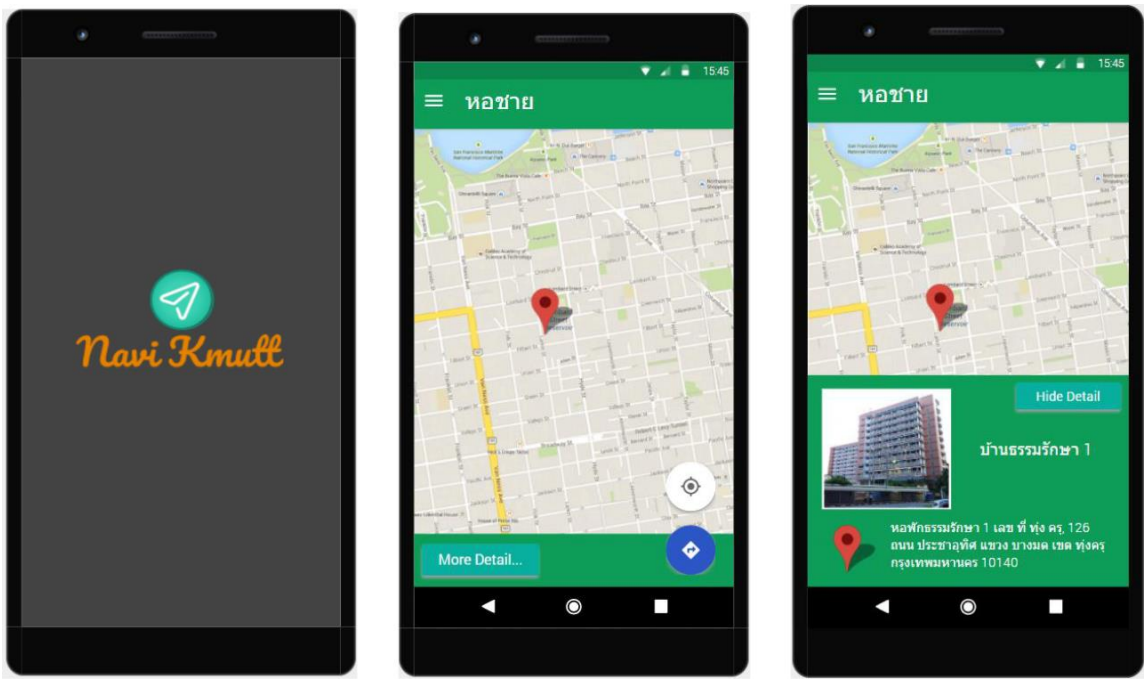
2.1.1 lines icon is the icon that user can click to redirect to the system features and it called “Select features page”.

2.2.2 The headline character of the top is the current location or pinned location of the user.

2.2.3 Pinned icon is the icon location of the location that user select or it can be the current location of the user.

2.2.4 More Detail Button is the button for link to the Detail Page.

3. **Detail Page** is after you clicked on more detail button to show more detail about that location which are picture, name and address.



Logo page Main page Detail page (Click more detail)

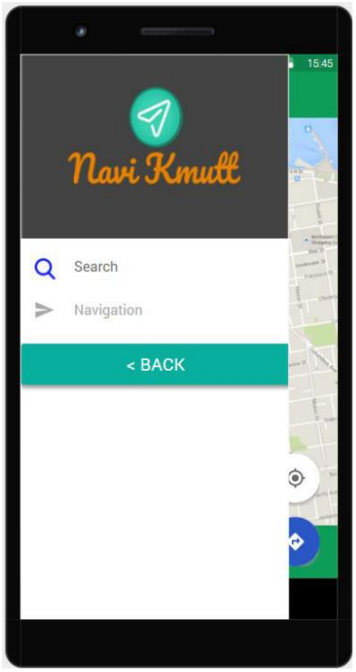
Figure 3.7.1: Mock up (part1)

4. **Select features page** is the page to show all feature in the application which are search and navigation.

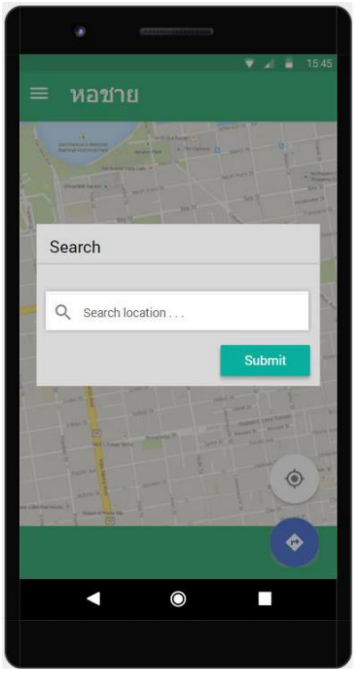
5. **Search Page** is the page when user select search function in the features, the blank index will appear for user to type some location.

6. **Navigation Page** is the page when user select navigation function in the features, the blank index of start and destination location will appear for user to fill and the system will do the navigation.

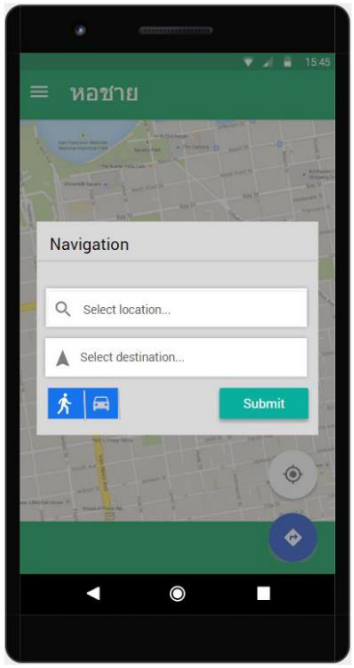
7.**Routing page** is the page that display the route after user select start and destination in the Navigation Page, it will show all the detail and the best route with the description for the user.



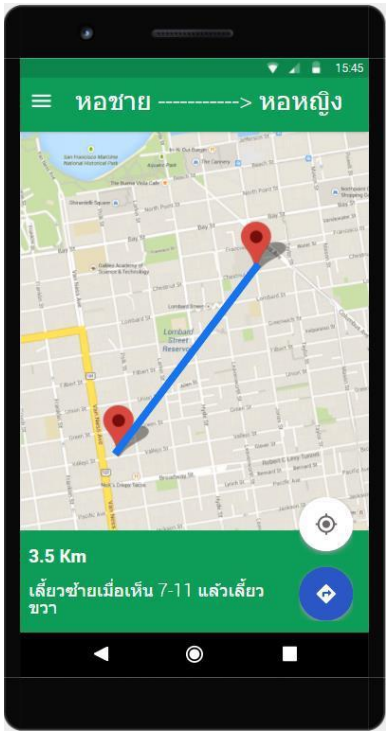
Select features page



Search page (Click search)



Navigation page (Click navigation)



Routing page

Figure 3.7.2: Mock up (part2)

3.8 Route description generator

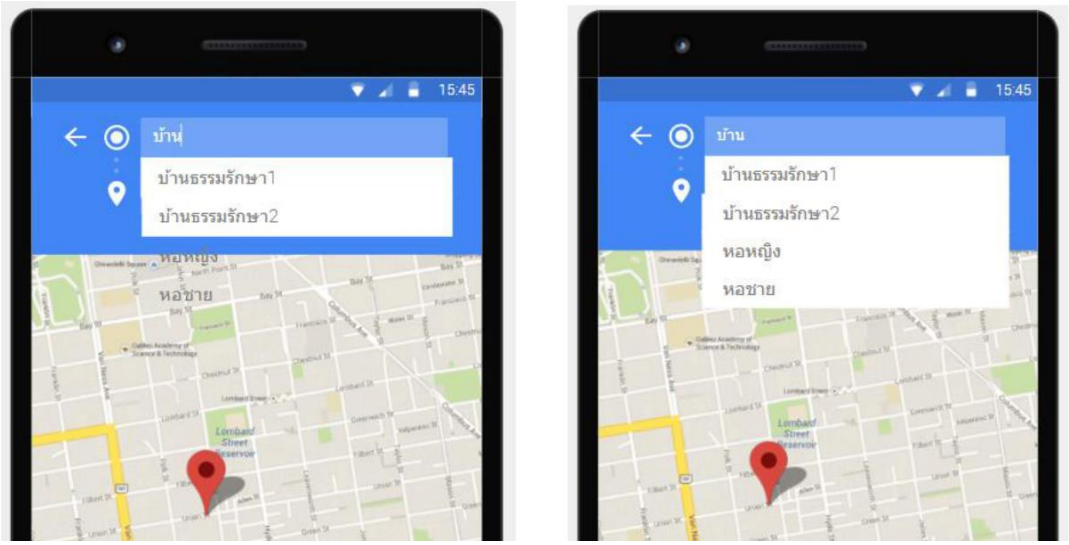


Figure 3.8.1: Design between normal select auto list and NLP select auto list.

The use of NLP after select the location and map direction.

From the left picture, you will see that the choice of Location or Direction will match the word as auto list. There are some words that close to, such as when typing the word 'home', the word match is 'Baan Thammaraksa 1' or 'Baan Thammaraksa 2'. So, the use of NLP is very important for direct mapping. For example, the right picture, when typing 'house'. Not only the word match, but also converts into NLP words from the spoken languages. Normally, ‘Baan Thammaraksa 1’ is the official language of the place, which are the woman dormitory that is the spoken and understandable. So, the use of NLP will help to process the location and direction conveniently.

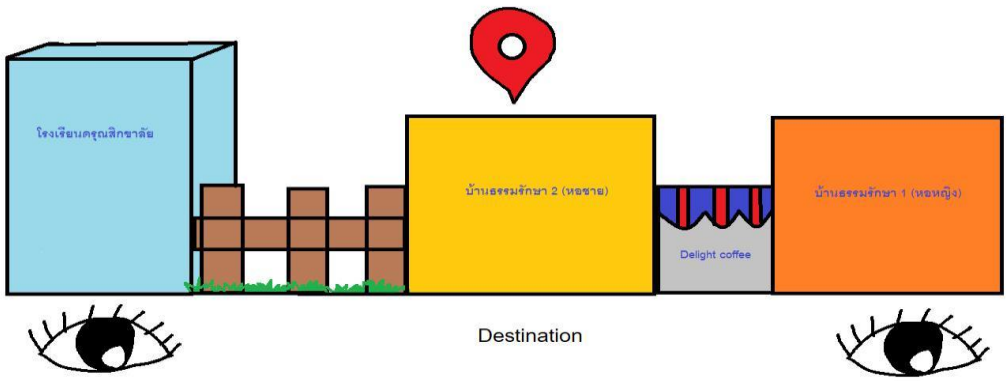


Figure 3.8.2: Using NLP for generate route description from observation 1.

The use of NLP for generate route description from observation.

From the picture above, if you are traveling from the front of the university, you will need to go through the ‘Darunsikkhalai’ school and the detail in the route description will refer to that place.

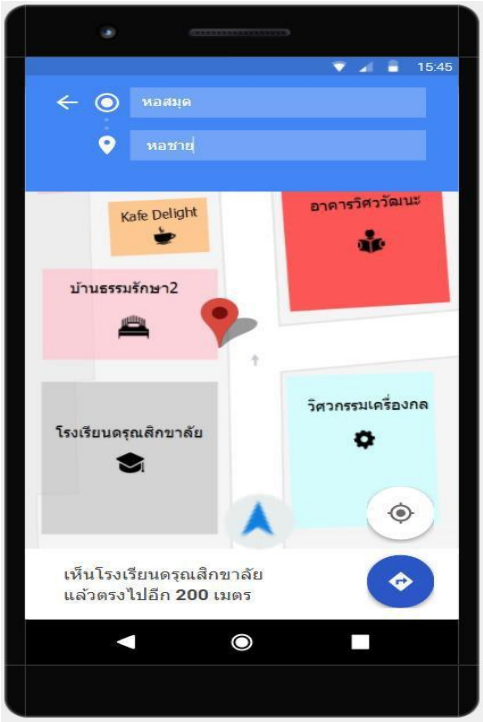


Figure 3.8.3: Using NLP for generate route description from observation 2.

It can be seen that the ‘Darunsikkhalai’ school is the location before you reach the destination. When you get close to the destination, the details of the route will use NLP which will notice for the school first and then notify to the user. But if the destination is ‘Kafe Delight’, so it will say 'When you see the man dormitory, go another 50 meters' which change from the word 'Baan Thammaraksa 2' into ‘Man Dormitory’ based on NLP that makes the user more understandable.

So, we can conclude that the use of NLP is divided into two categories in our project. First is use to search for the destination or location and the use of detail to navigate by the navigator, which will tell the location before the user will reach the destination.

3.9 Using of NLP in this project

We use NLP for directions to improve navigation to destinations without confusing them with unknown directions, such as navigating in the image below. Normally, humans will notice from the surroundings first. From the language that is not that human language, such as "Turn left into Sukhumvit road" means that users must know Sukhumvit Road. Otherwise, it may be lost, but if you say "When you see Lotus, then turn left", the user will

easily notice and not lost in their ways. Therefore, using NLP will reduce the user's misbehavior by using more human-like language.

"**Turn left into Sukhumvit road**" -----> "**When you see Lotus, then turn left**"

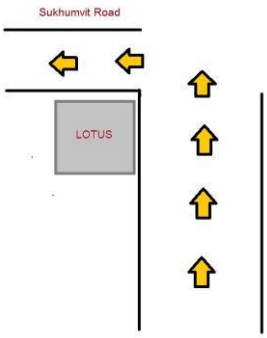


Figure 3.9 : Example NLP for routing

3.10 NLP Data Dictionary

Example of NLP location

No.	Building	Name1	Name2	Name3
1.	อาคารส านักงานอธิการบดี	ตึกอธิการ	-	-
2.	อาคารการเรียนรู้พหุวิทยาการ(LX)	ตึกสร้างใหม่	-	-
3.	อาคารหอพักนักศึกษาชาย	หอชาย	หอธรรมรักษา2	หอพักชาย
4.	อาคารหอพักนักศึกษาหญิง	หอหญิง	หอธรรมรักษา1	หอพักหญิง
5.	อาคารพัฒนาเด็กเล็กมจธ.	เนอเซอรี่	ศูนย์เด็กเล็ก	-
6.	อาคารวิศวกรรมเคมี	ตึกเคมี	ภาคเคมี	คณะเคมี
7.	อาคารพระจอมเกล้าราชานุสรณ์190 ปี	เคเอฟซี	KFC	โรงอาหาร
8.	อาคารจอดรถ 14 ชั้น	ตึกดิโอโร่	ตึกจอดรถ	-
9.	โรงเรียนครุณสิกขาลัย	โรงเรียนครุณ	ครุณ	-
10.	อาคารคณะพลังงานสิ่งแวดล้อมและวัสดุ	ตึกพลังงาน	ภาคพลังงานและสิ่งแวดล้อม	-
11.	อุทยาการเรียนรู้(LG)	Learning Garden	-	-
12.	อาคารเรี ยนรวม1	CB1	-	-

13.	อาคารเรี ยนรวม2	CB2	-	-
14.	อาคารเรี ยนรวม3	CB3	ตึกครุ	-
15.	อาคารเรี ยนรวม4	CB4	ตึกICE	-
16.	อาคารเรี ยนรวม5	CB5	-	-
17.	อาคารวิศววัฒนะ	ตึกแดง	-	-
18.	อาคารอเนกประสงค์	-	-	-
19.	อาคารส าหนักหอสมุด	หอสมุด	-	-
20.	อาคารปฏิบัติการทางวิทยาศาสตร์	สโลป	-	-
21.	อาคารภาควิชาเคมี	ตึกเคมี	ภาคเคมี	-
22.	อาคารภาควิชาคณิตศาสตร์	ตึกคณิต	ภาคคณิตศาสตร์	-
23.	อาคารภาควิชาฟิ สิกส์	ตึกฟิ สิกส์	ภาคฟิ	ภาคฟิ สิกส์
24.	อาคารสถาบันวิทยาการหุ่นยนต์ภาคสนาม	ตึกฟิ โบ้	FIBO	-
25.	อาคารคณะเทคโนโลยีสารสนเทศ	ตึกIT	ภาค IT	-
26.	อาคารคณะศิลปศาสตร์	ตึกโซล่า	Sola	-
27.	Seven-Eleven	7-11	เซเวนตึกแดง่	เซเวน่
28.	ลุงหนุ่ม Square	ลุงหนุ่ม	ร้านลุงหนุ่ม	-
29.	สวนสุขภาพ	-	-	-
30.	ไปรษณีย์ไทยkmutt	ไปรษณีย์	-	-
31.	ศูนย์หนังสือพระจอมเกล้าธนบุรี	ศูนย์หนังสือKMUTT	ศูนย์หนังสือ	-
32.	U-store	-	-	-
33.	ร้านกาแฟD’oro	D’oro	-	-
34.	อนุสาวรีย์สมเด็จพระจอมเกล้าเจ้าอยูหัว่	อนุสาวรีย์หน้ามอ	-	-
35.	ห้องพยาบาล	-	-	-
36.	ห้องปฏิบัติการคอมพิวเตอร์	ห้องคอม	ห้องคอมพิวเตอร์CB1	-
37.	Heliconia	โรงแรม 14 ชั้น	-	-

38.	ร้านกาแฟKafe Delight	Kafe Delight	-	-
39.	Green Society	ตึกกรีน	-	-
40.	สวนเฉลิมพระเกียรติ	-	-	-
41.	Car Rental Agency Haupcar	ที่เช่ารถ	haucar	-
42.	สนามฟุตบอลมจธ.	สนามบอล	สนามกีฬา	-
43.	สหกรณ์มจธ.	สหกรณ์	-	-
44.	ป้อมยามหน้าkmutt	ป้อมยามหน้ามอ	-	-
45.	ป้อมยามหลังkmutt	ป้อมยามหลังมอ	-	-
46.	ลานจอดรถ	ที่จอดรถลานแดง	-	-
47.	Learning Space	-	-	-
48.	สนามเปตอง	เปตอง	-	-
49.	Electric Bus Charging Station	รถบัสชาร์จไฟ	-	-
50.	อาคารภาควิชาจุลชีววิทยา	ตึกจุล	-	-
51.	สนามบาธ มจธ.	สนามบาธ	-	-

Example of NLP table

No.	Action	Name1	Name2	Name3
1.	ซ้าย	เลี้ยวซ้าย	ไปทางซ้าย	ข้างซ้าย
2.	ขวา	เลี้ยวขวา	ไปทางขวา	ข้างขวา
3.	ตรง	ตรงไปข้างหน้า	ไปข้างหน้า	ข้างหน้า
4.	เห็น	มองเห็น	เมื่อเห็น	ถ้าเห็น

Example of route description using NLP

Location : อาคารสำนักงานอธิการบดี
Destination : อาคารหอพักนักศึกษาชาย

เส้นทาง : จากตึกอธิการ ตรงไปข้างหน้าผ่าน Car Rental และเดินทะลุผ่าน Learning Garden เพื่อเดินทะลุผ่านตึกแดง จะมองเห็นหอชายอยู่ด้านหน้า

Chapter 4

Results and Discussion

We start to implement our project from creating the online map module which including by using Google Maps API of Google to be our base and create the online access database with phpMyAdmin that can connect all the information between server and client using PHP language as the transition. We also using FileZilla for the other raw data such as picture of each building in the university from the computer to upload into the database.

For the raw data section, we already added the information of each building which are Building ID, Building Name, Building Detail, Latitude, Longitude and also the image of the location for connecting with the application.

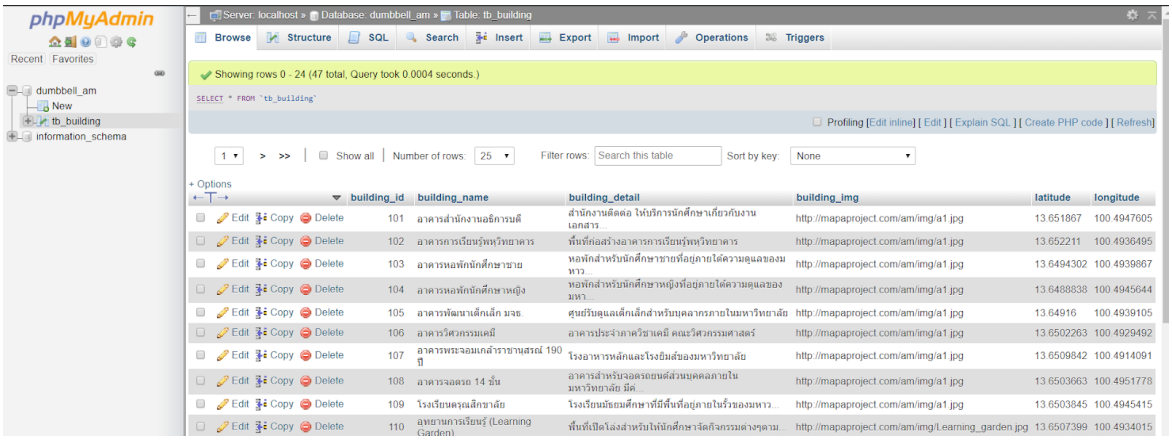


Figure 4.1 : Using phpMyAdmin to access for the online database.

```php
<?
$objConnect = mysql_connect("localhost","navimapkmu_ammy","Ammy123");
mysql_query("SET NAMES 'utf8' COLLATE 'utf8_general_ci';");
$objDB = mysql_select_db("navimapkmu_project13");

("SET NAMES 'utf8' COLLATE 'utf8_general_ci';");
date_default_timezone_set('Asia/Bangkok');
$CreateDate=date("Y-m-d H:i:s");

$str_ID = $_GET['id'];
$strSQL = "SELECT * FROM tb_building WHERE 1 AND building_id = '".$str_ID."'  ";


$objQuery = mysql_query($strSQL);
$obResult = mysql_fetch_array($objQuery);
if($obResult)
{
      $arr["building_id"]   = $obResult["building_id"];
      $arr["building_name"]    = $obResult["building_name"];
       $arr["building_detail"]    = $obResult["building_detail"];
        $arr["building_img"]    = $obResult["building_img"];
       $arr["latitude"]    = $obResult["latitude"];
       $arr["longitude"]    = $obResult["longitude"];

}

mysql_close($objConnect);

echo json_encode($arr);
?>
```

Figure 4.2: Example of php file that use to display on the application

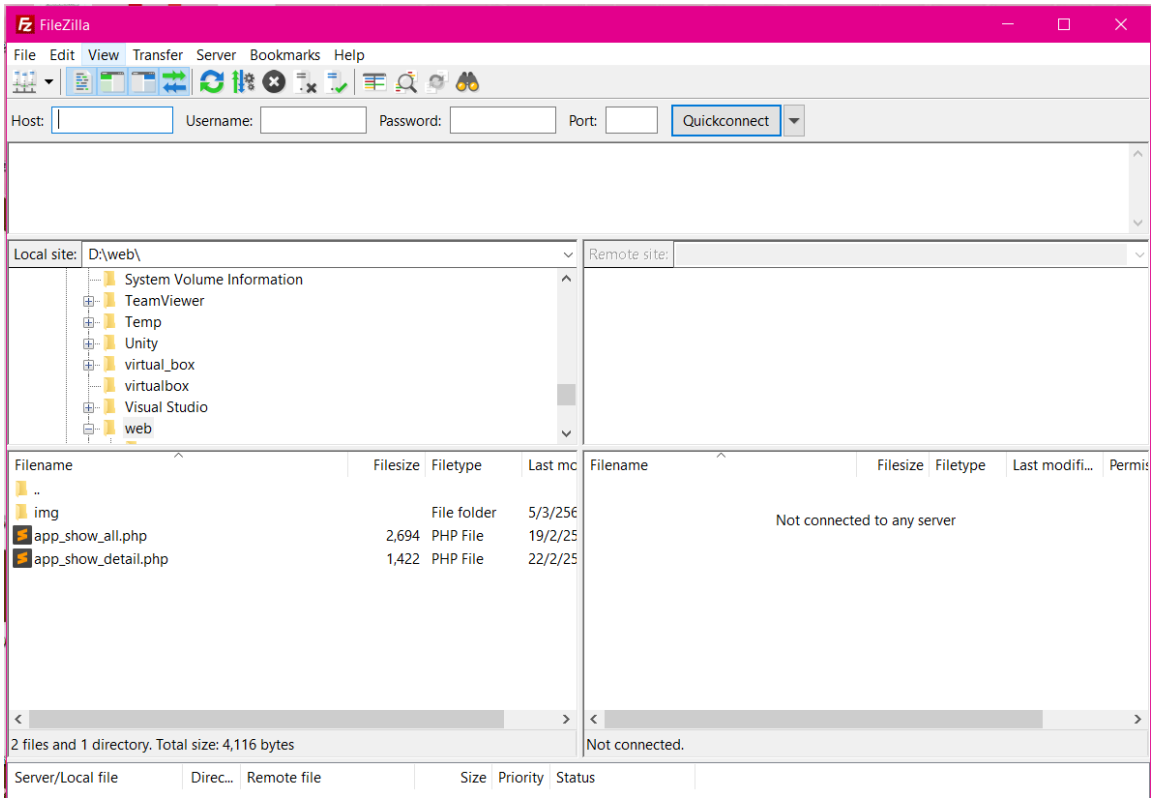


Figure 4.3: Using filezilla to upload the raw data to the database.

We used the Android Studio program implement with Java language start from creating the structure of the application.

The first page is our **main homepage** that allow user to select between

- Online navigation system
- Offline navigation system

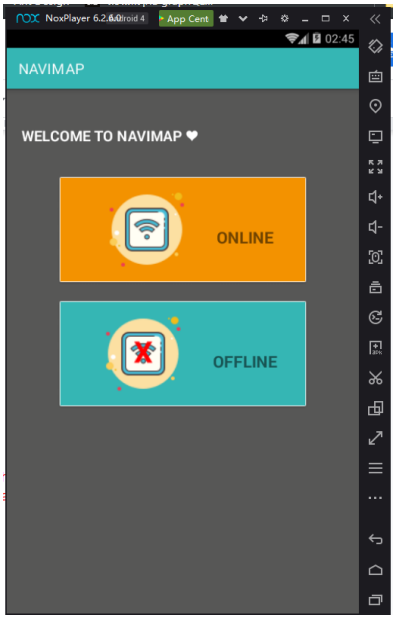


Figure 4.4 : The main homepage menu to select between online and offline

ONLINE SECTION

The first section is the online part with another menu page including by

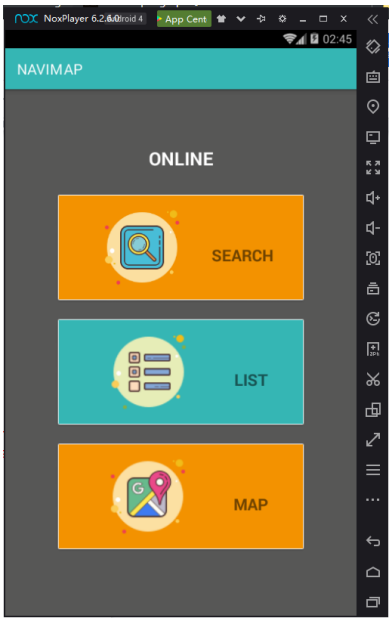


Figure 4.5 : The menu page for each function in online system

- Online Search Page
- Building List Page : user can select each location to show all the details and map that connect with the Google maps and can also navigate by the Google Maps which can automatically select from the building lists and navigate from the user location.

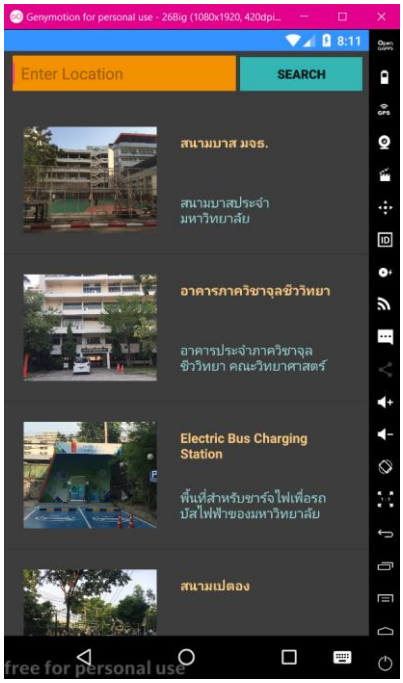


Figure 4.6: The page that display all building in KMUTT as a list view

User can also search for the location by typing the name of each location, the program will display for the selected location. Example from the picture, if user type “Sanam” and push on the search button, all the location that their name has the word “Sanam” will all appear as a result.

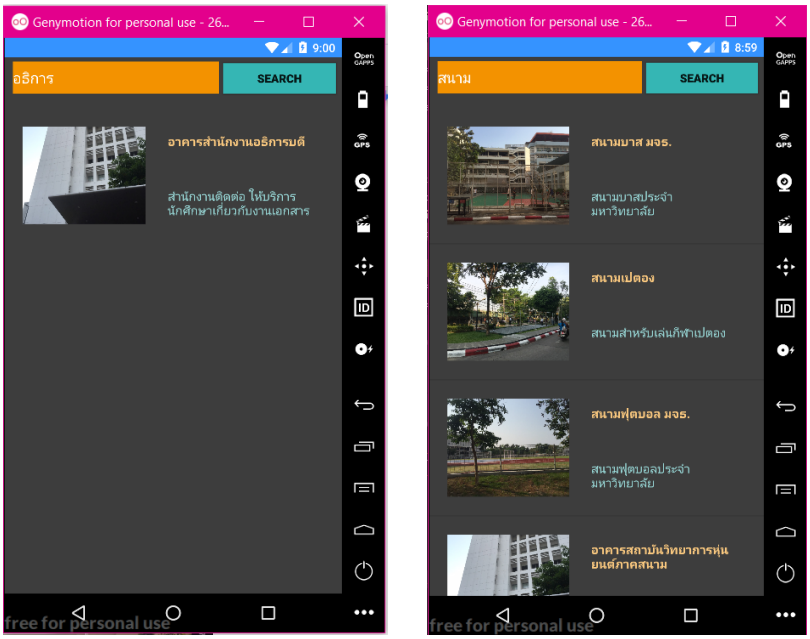


Figure 4.7: Search function in the list view page

After user select one location from online list view, the detail page of that location will appear to show all detail which are name of the building, detail of the building and the image of the building.

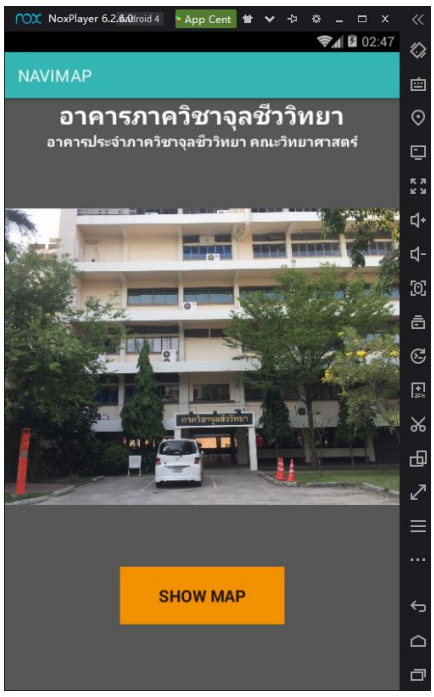


Figure 4.8: List detail result page

From the detail page, it also has the “SHOW MAP” button to push for showing the online map location of that building. If user push on the “SHOW MAP” button, the application will redirect to the map page with marked location.

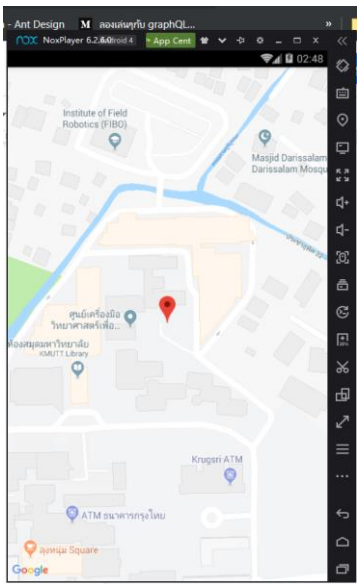


Figure 4.9: Button pushed result

If user push on the red marked in the online map, the pop up will appear and show the name of that location.

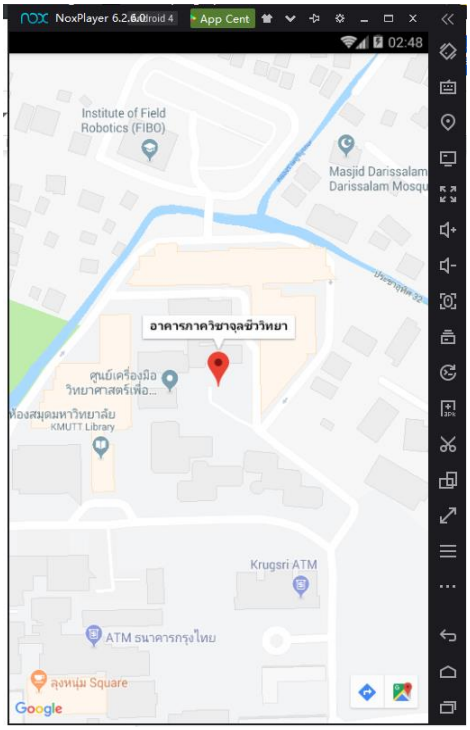


Figure 4.10: Popup pushed result

After user push the navigate button, the application will enter Google maps application automatically. In this case, user must have the Google maps application in the android device before push on the navigate button.

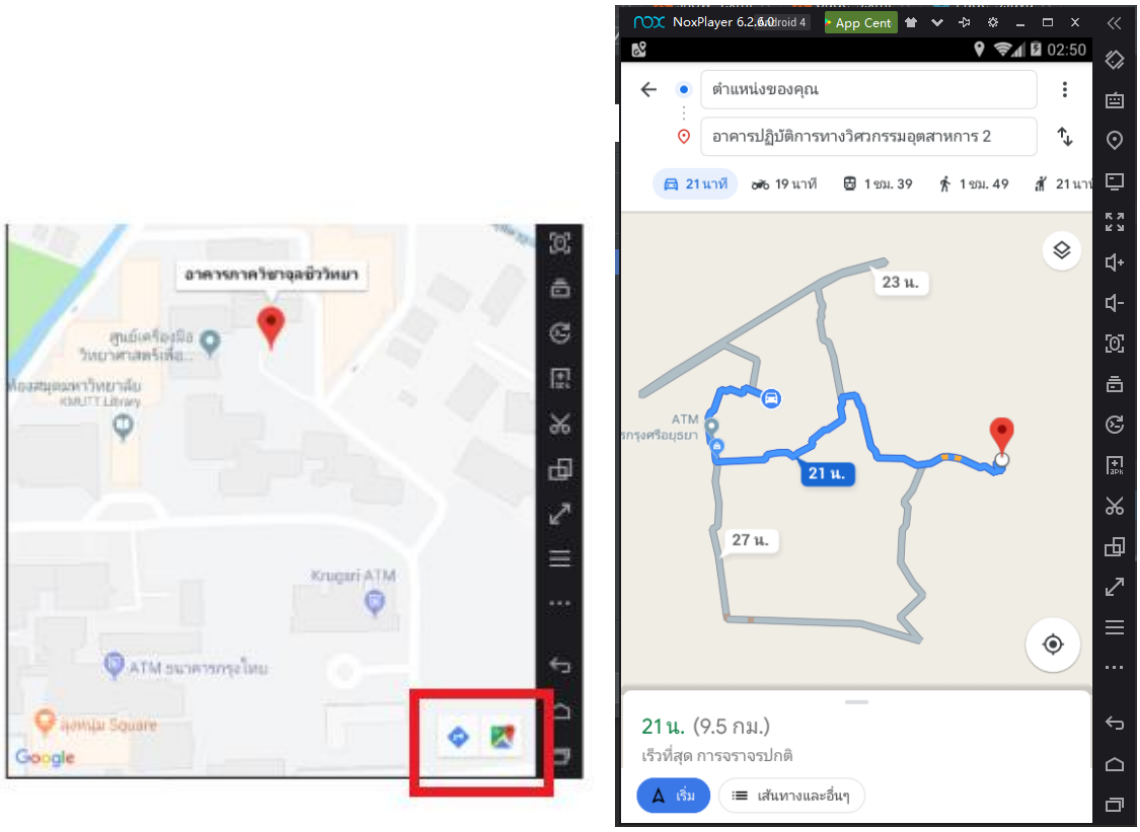


Figure 4.11: Navigate button pushed result

- Overview Map Page : display the map from Google.

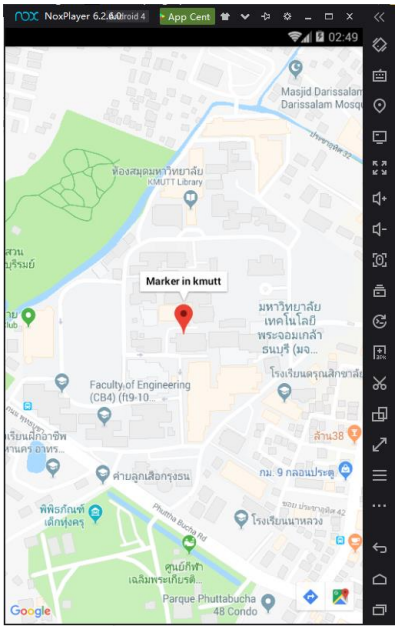


Figure 4.12: Overview of KMUTT map from Google

OFFLINE SECTION

The second section is the offline part with the last menu page including by

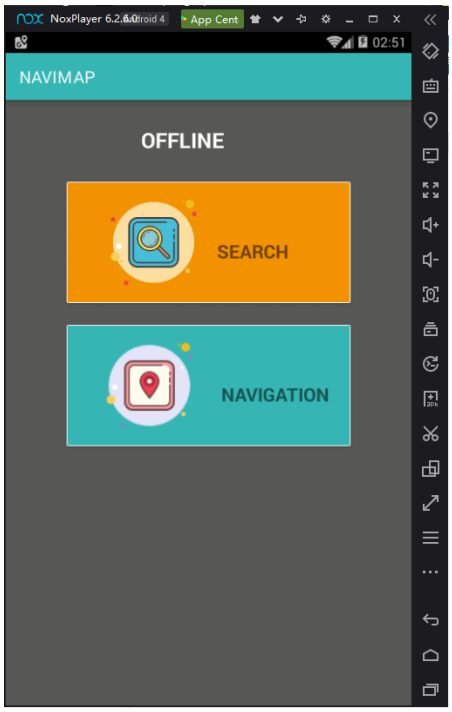


Figure 4.13: Offline function menu page

- **Offline search page** : search function in offline map that user can use without using the internet.

After user selected for the offline search function, the new page will appear and show overview of our own map. If user push on the search button, the popup will show up and allow user to fill in the name of the location.

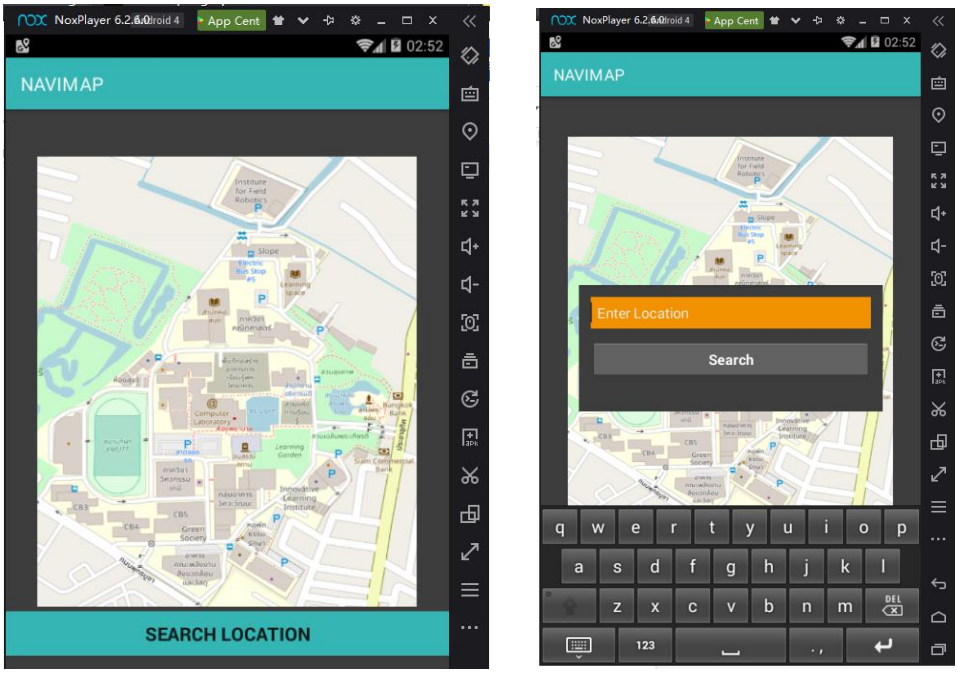


Figure 4.14: Example of offline search page

After user filled in the name of the location and pushed the search button, the result page will appear and show the location of that building with red marked.

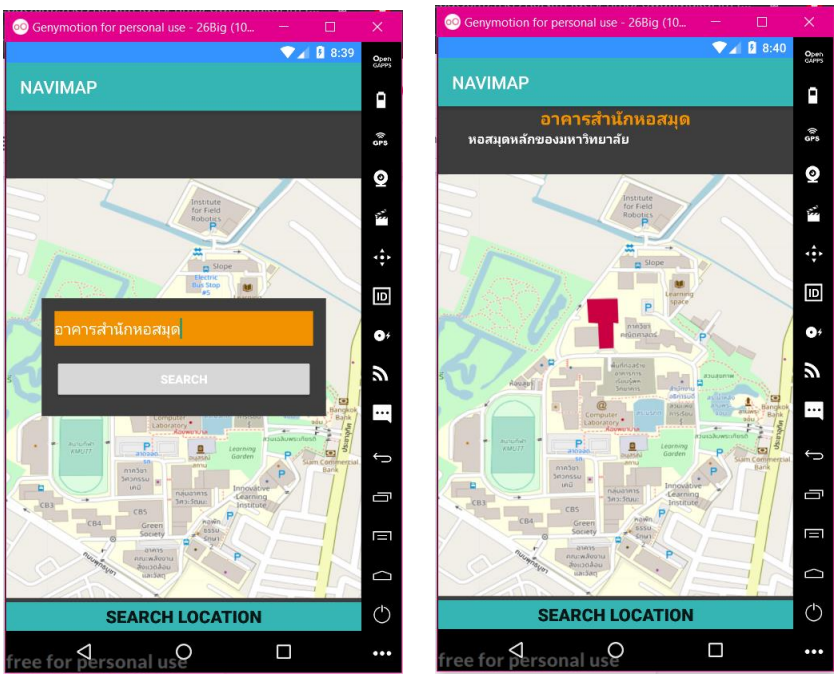


Figure 4.15: Example after user search one location

We studied and used the concept of NLP about to help user to search one location with different names.

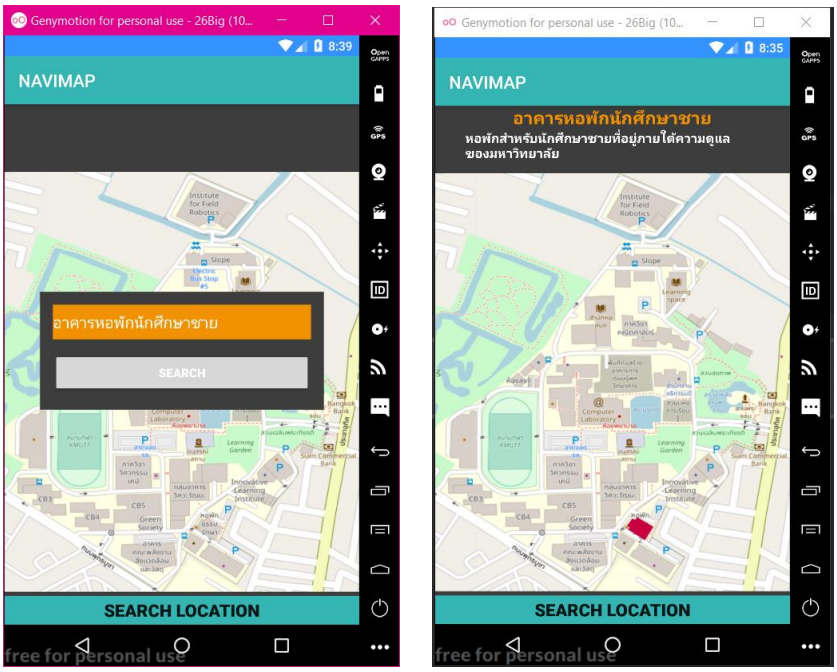


Figure 4.16: First example after user search with multiple names

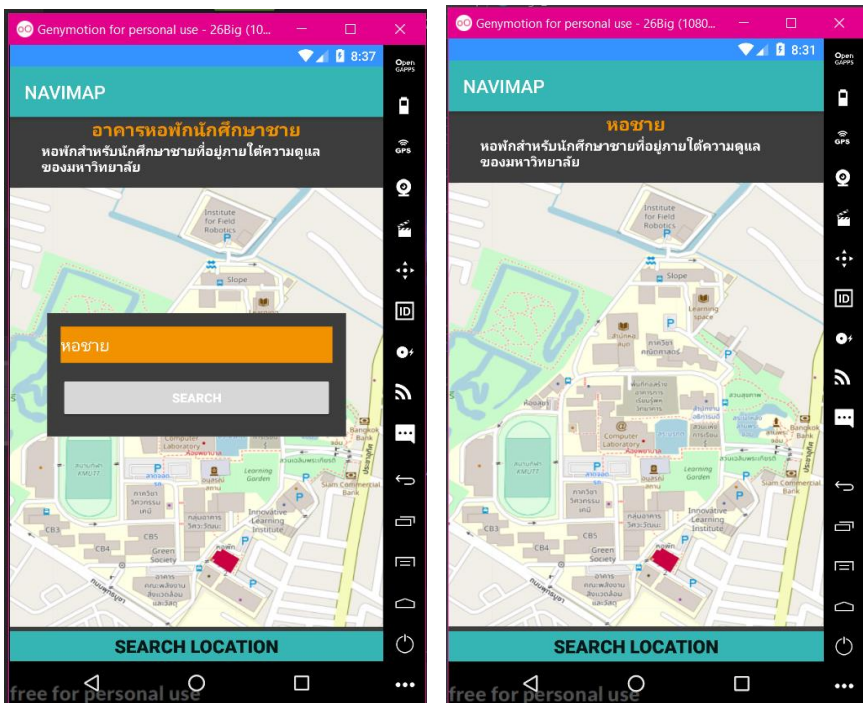


Figure 4.17: Second example after user search with multiple names

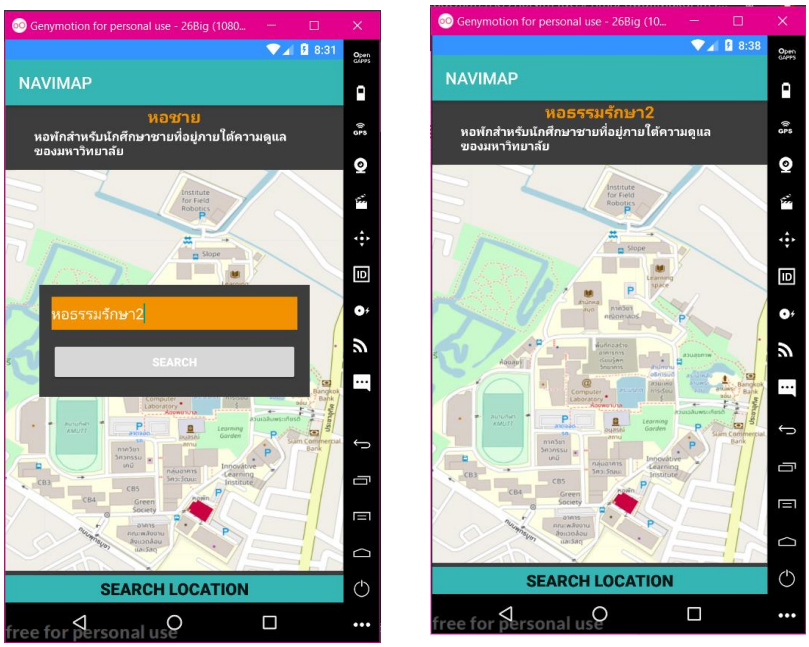


Figure 4.18: Thrid example after user search with multiple names

- **Offline navigation page** : our own offline navigation system from using Dijkstra's algorithm to find the shortest path from start location to destination location.

This page allow user to select the start location from the box that have all 51 locations in the university.

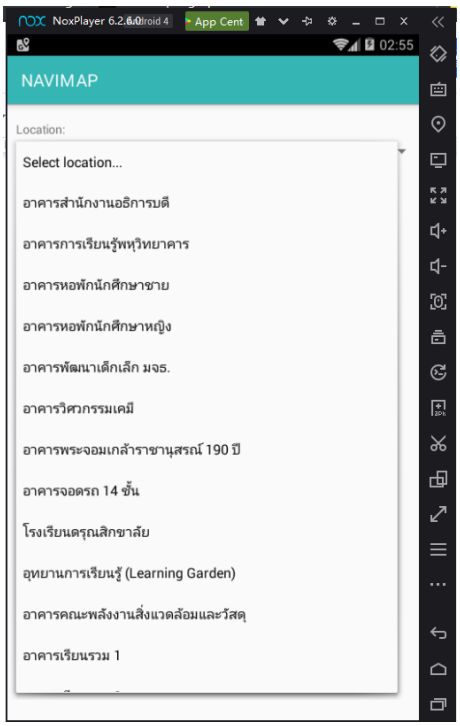


Figure 4.19: Drop down box of start location

This page allow user to select the destination location from the box that have all 50 locations in the university except the first location that you selected before as a start location.

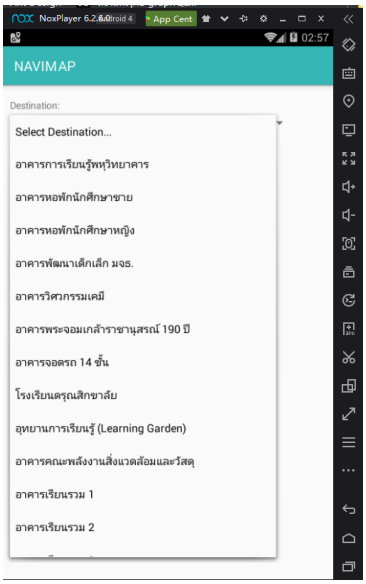


Figure 4.20: Drop down box of destination location

After user selected both start and destination location, the result page will appear with the image that display how to go from one location to one location. This page also repeats what user selected and generate for the most appropriated route description.

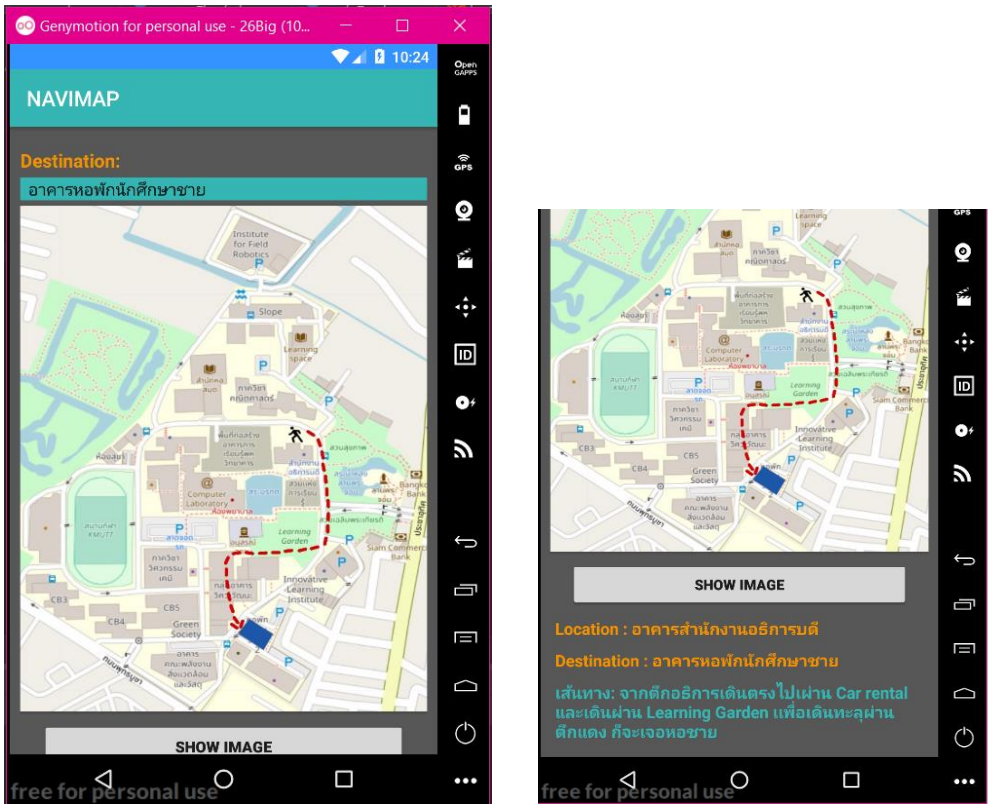


Figure 4.21: Result of navigation page

In this page also have the “SHOW IMAGE” button to display the real image of that location.

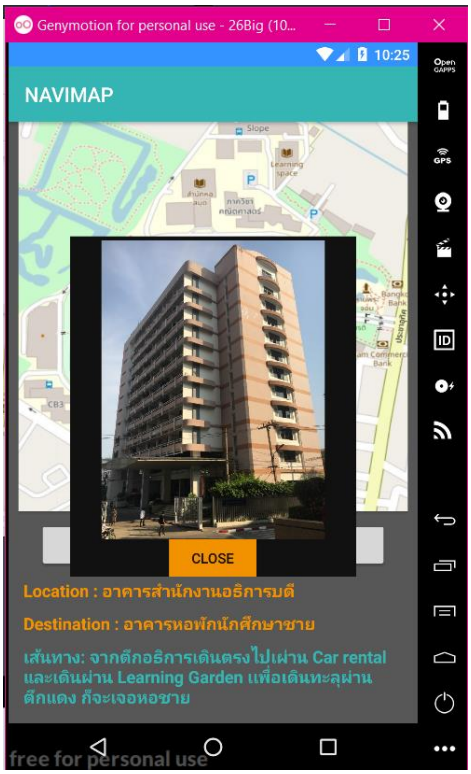


Figure 4.22: Button of image result

The result of using NLP generate more human language route description.

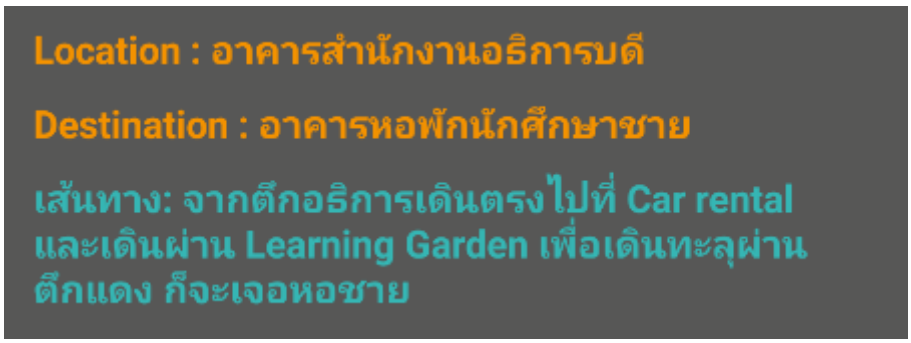


Figure 4.23: More human language route description

Splash Screen Page

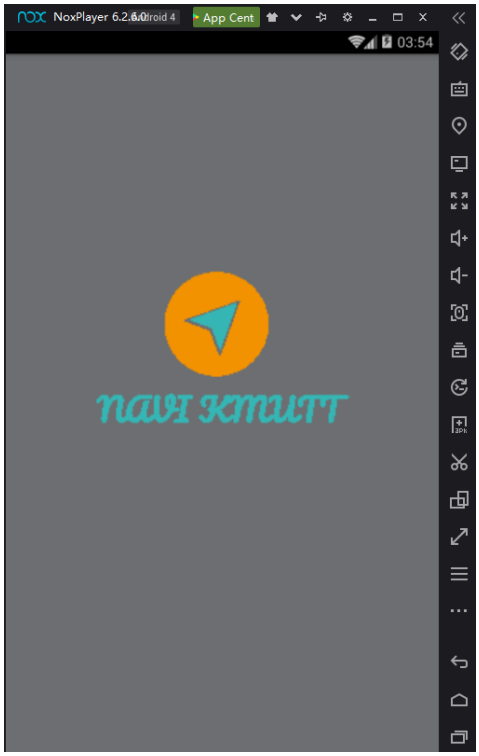


Figure 4.24: The splash screen page display

Application ICON

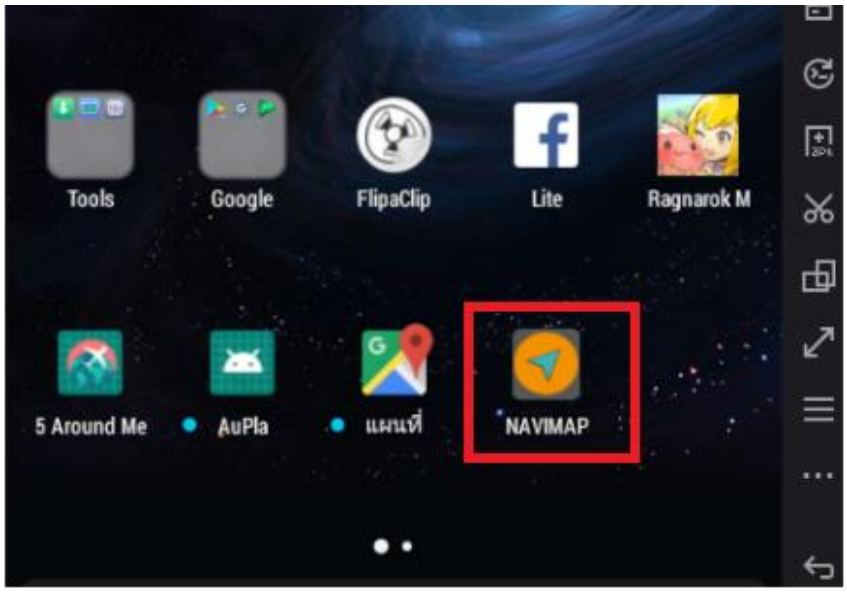


Figure 4.25: The application icon on the android device

For all of the result, we used both NOX and Genymotion to simulate to display and check for the completeness of our application. After all the nox simulation are all work, we take the real android mobile application to test our application.

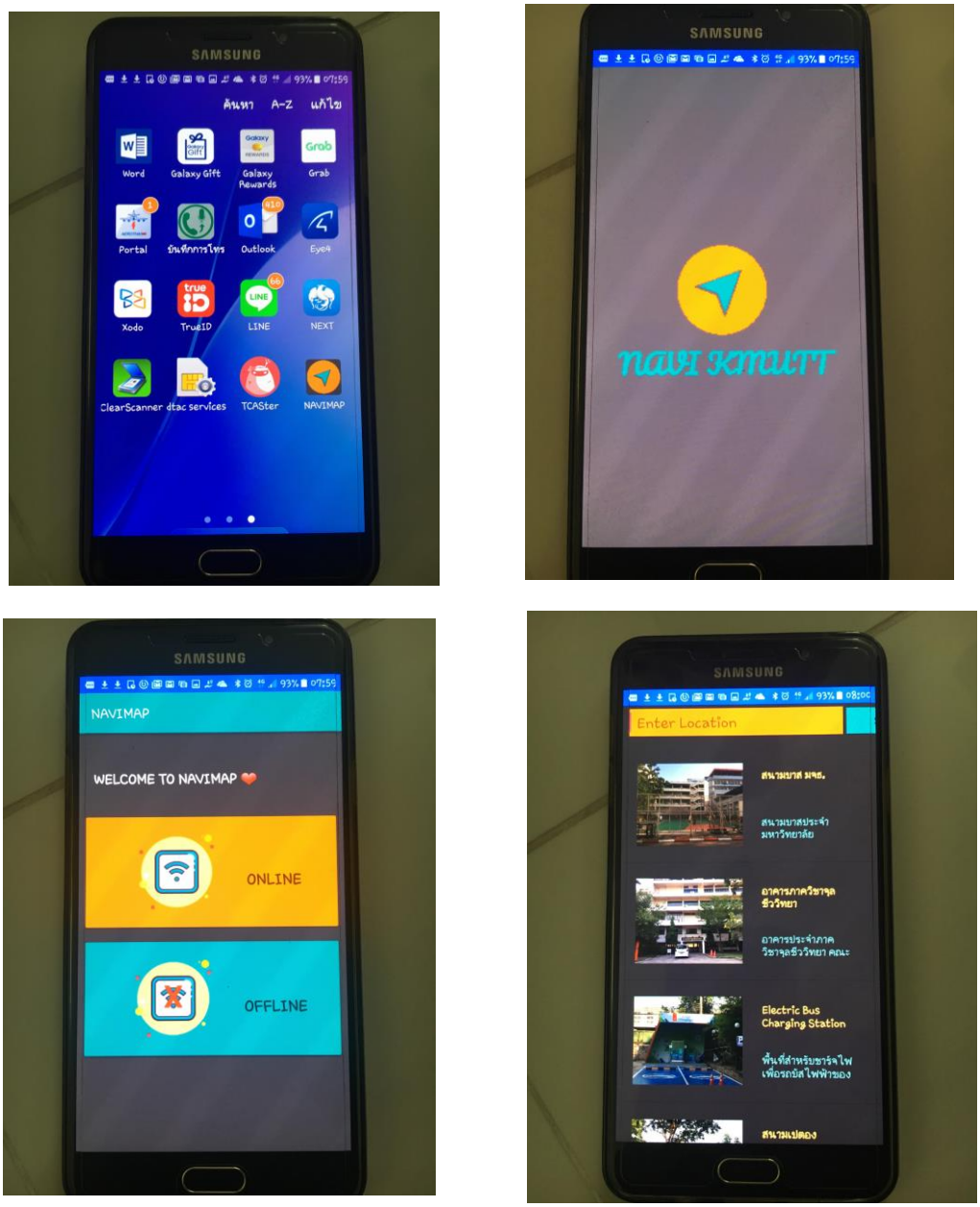


Figure 4.26: Example in some pages on real android mobile device

Chapter 5

Conclusion

For the summary of our project, our project objective is to create the android application that can generate more human language route description by using both map system with natural language processing to make more understanding for using map application in real life. We decided to implement only within university area to test first, so we start to generate the application using Android Studio to implement, we divided our application into 2 section which are online and offline function. Online function is useful when user can use the internet in the mobile devices that is better for accuracy unless user can choose the offline function if they have the mobile devices without the internet.

5.1 The achievement

Figure 5.1: Application logo

From our objectives, our application can be generated successfully.

- Be able to generate the android mobile application by using Java , PHP and also JSON language programming.
- Both online and offline function can completely use with the android application. The offline function can correctly generate the easy understanding route description with the shortest path direction from using Dijkstra's algorithm and we also provide the online function for the user who more convenient to use google online map.
-

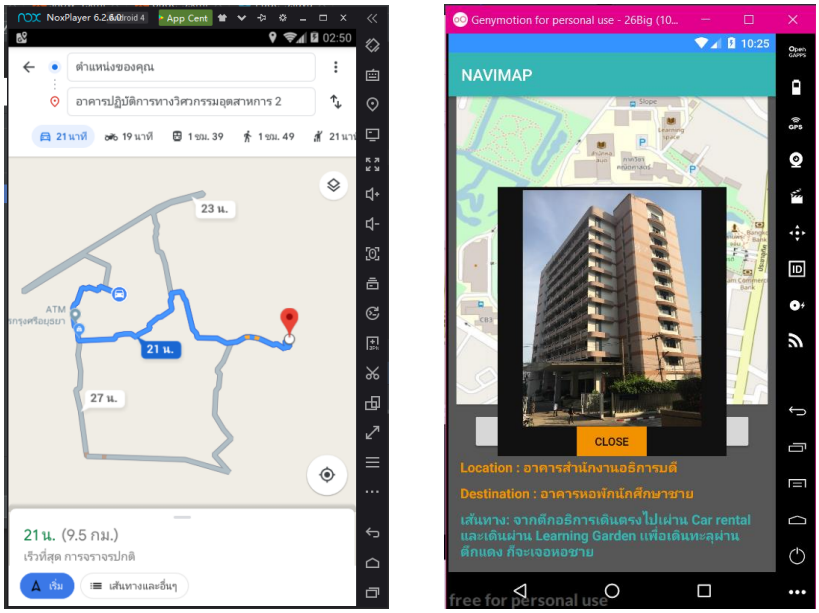


Figure 5.2: Different between online and offline navigation system

- Be able to use the concept of natural language processing to provide the route description which more like human language. Some example of the advantage of using NLP is when user type different name of one building and application can

search correctly. Also for the navigation page that will generate the route description which user will get more understanding and do not confuse from the complicated route description.

3.	อาคารหอพักนักศึกษาชาย	หอชาย	หอธรรมรักษา2	หอพักชาย

Figure 5.3: Different names of one location

5.2 Problem and how to solve

From doing our own project, we got many problems start from designing to implement and testing.

- When we started to implement the application, the application system did not follow the designed application architecture. We solved this problem by study more about android system architecture and adjust our application to be appropriated for user to use.
- We decided to use Firebase as our database at first but after we tried to use it, we found that it did not suitable with our project. So we solved this problem by using phpmyAdmin as our online database instead.
- Because we have the offline section, so we have to handle many raw data for generating the offline map section.
- The problem about the version of each Android device, some version of Android API cannot run the application correctly. So we solved this problem by studying and searching some examples from the internet and fixed the problem.

5.3 What we get from this project

From implementing for this project, we have learned many kinds of knowledge to use in our project. We get the new programming language that is Java to use with Android Studio program, now we can be able to generate and develop the android application.

We have also learned to manage our project with the amount of time. We learned how to work in group and work until the project can be completed successfully.

References

1. การเขียน Android App แสดงแผนที่Google Map ขั้นพื้นฐาน [online], available: https://www.youtube.com/watch?v=7Jdejwzj L5k [2016, May 12].
2. Maps SDK for Android [online], available: https://developers.google.com/maps/documentation/android-sdk/intro [2018, September 25].
3. Android Google MapV2 and Location Tracking Workshop [online], available: https://www.youtube.com/watch?v=od4cVKkeHt8 [2015, January 8].
4. Thomas J. Lampoltshammer and Thomas Heistracher. *"Natural Language Processing in Geographic Information Systems"*.
5. Learning GIS [online], available: http://www.gisthai.org/about-gis/input-gis.html
6. การใช้งานGoogle Maps Android API บน Android Studio เบื้องต้น [online], available: http://www.akexorcist.com/2015/06/google-maps-basic-on-android-studio.html [2015, June 16].
7. การเก็บข้อมูลภาคสนามเพื่อนำเข้าเป็นฐานข้อมูลภูมิสารสนเทศ [online], available: https://www.alro.go.th/it/ewt_dl_link.php?nid=247
8. การดึงข้อมูลจากJSON มาแสดงในแผนที่[online], available: https://www.youtube.com/watch?v=YBdstGQDSGg [2017, August 7].
9. Firebase คืออะไร และมีข้อดีอย่างไรบ้าง่ [online], available: https://www.softmelt.com/article.php?id=588
10. เริ่มต้นสร้าง Android Application พื้นฐานด้วย Android Studio [online], available: https://medium.com/@palmz/เริ่มต้นสร้าง-android-application-พื้นฐานด้วย-android-studio-lab-3sb04-3fda43b07a1 [2018, February 19].
11. ประวัติความเป็ นมาภาษาJAVA [online], available: https://nongtha57.wordpress.com/ความเป็ นมา-java/
12. โครงสร้างของระบบแอนดรอยด์เบื้องต้น [online], available: https://medium.com/@PongPloyAppDev/บทที่-1-สถาปัตยกรรมของระบบแอนดรอยด์-โครงสร้างของระบบแอนดรอยด์-เบื้องต้น-75481fcadbd8 [2017, October 1].
13. What is Geographic Information Systems (GIS) [online], available: https://gisgeography.com/what-gis-geographic-information-systems/ [2018, February 15].
14. GIS (geographic information system [online], available: https://www.nationalgeographic.org/encyclopedia/geographic-information-system-gis/
15. Abhimanyu Chopra, Abhinav Prashar and Chandresh Sain. *"Natural Language Processing"*.
16. Elizabeth D. Liddy. *"Natural Language Processing"*

17. What is Natural Language Processing [online], available: https://www.expertsystem.com/natural-language-processing/ [2016, July 26]
18. Lkit: A Toolkit for Natuaral Language Interface Construction [offline], available: https://www.scm.tees.ac.uk/isg/aia/nlp/NLP-overview.pdf
19. Gobinda G. Chowdhury. *"Natural Language Processing*".
20. Diksha Khurana, Aditya Koli, Kiran Khatter and Sukhdev Singh. *"Natural Language Processing: State of The Art, Current Trends and Challenges"*.
21. Natural Language Processing [online], available: https://www.sas.com/en_us/insights/analytics/what-is-natural-language-processing-nlp.html
22. Natural Language Processing is Fun! [online], available: https://medium.com/@ageitgey/natural-language-processing-is-fun-9a0bff37854e [2018, July 18].
23. The Ultimate Guide to Natural Language Generation [online], available: https://medium.com/@AutomatedInsights/the-ultimate-guide-to-natural-language-generation-bdcb457423d6 [2018, January 31].
24. Artificial Intelligence | Natural Language Generation [online], available: https://www.geeksforgeeks.org/artificial-intelligence-natural-language-generation/
25. Find a route with ArcGIS Runtime SDK [online], available: https://developers.arcgis.com/android/latest/guide/find-a-route.htm
26. การใช้โปรแกรมArc GIS สร้างแผนที่โครงการ[offline], available: http://kmcenter.rid.go.th/kmc10/data/pr/2555/chongkae.pdf
27. Basics of ArcGIS [online], available: http://www.dnp.go.th/Intranet/arcgis/ls02/011.htm
28. Basic Vector Styling [online], available: http://www.qgistutorials.com/th/docs/basic_vector_styling.html
29. Create my own navigation routing system [online], available: http://www.qgistutorials.com/th/docs/basic_vector_styling.html
30. Graph [online], available: http://piyapan-aod.blogspot.com/2009/03/graph.html [2009, March 18]
31. Using OSM Data in QGIS [online], available: https://learnosm.org/en/osm-data/osm-in-qgis/
32. คู่มือการใช้โปรแกรม Quantum GIS [offline], available: http://gis.pwa.co.th/manual/1290764142.pdf
33. Leaflet [online], available: https://leafletjs.com/
34. Leaflet(software) [online], available: https://en.wikipedia.org/wiki/Leaflet_(software)
35. OpenStreetMap [online], available: https://en.wikipedia.org/wiki/OpenStreetMap
36. Using OpenStreetMap [online], available: https://wiki.openstreetmap.org/wiki/Th:Using_OpenStreetMap
37. Mod-Maps KMUTT [online], available: https://drive.google.com/drive/folders/0Bz9yFZ60ZFgJaFNRYkpKUy1mdzA

38. Graph Data Structures for Beginners [online], available: https://adrianmejia.com/blog/2018/05/14/data-structures-for-beginners-graphs-time-complexity-tutorial/
39. Graph and its representtations [online], available: https://www.geeksforgeeks.org/graph-and-its-representations/
40. A Gentle Introduction to Data Structures: How Graphs Work [online], available: https://medium.freecodecamp.org/a-gentle-introduction-to-data-structures-how-graphs-work-a223d9ef8837 [2016, Dec 7]
41. Akinwol Agnes Kikelomo, Yekini Nureni Asafe, Adelokun Paul and Lawal Olawale N. “Design and Implementation of Mobile Map Application for Finding Shortest Direction between Two Pair Locations Using Shortest Path Al