**Group Project: Project 1**

# MapHidol

**By**

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**Submitted to**
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**A Report Submitted in Partial Fulfillment of**
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**ACKNOWLEDGEMENTS**

We are grateful for supporting the organizing team in this report throughout our research project on the Flutter application, including an excellent chance to project inventive feedback from the expert professor.

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End up with the most effective platform, libraries, package, and convenience application that drive our research project to the achievement we prefer. We are applicated and pleased to gratefulness.

**ABSTRACT**

We are enlargement this project in the practice of the Flutter mobile application developed, which is a part of the ITCS424 Wireless and Mobile Computing. The achievement we observe is the study of writing an application that provides the convenience of traveling to Mahidol University via our features. We administer the location of parking places, restaurants, canteen, cafes, tram stops, and tram routes in the Mahidol University Salaya areas. We aim to give this information to students, especially those unfamiliar with the Mahidol University area. The extension of the project includes APIs of the map using the Flutter language via location awareness studying.

Hopefully, this report will be achieved and provide helpful information to participants and give the organization feedback to improve the application's utility for people who use our service in the future, along with our experience in developing mobile applications.

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# CHAPTER 1

**Introduction**

## 1.1 Motivation

Mahidol University is a renowned institution students aim to achieve at the academy. Along with the COVID-19 situation, the learning activity has changed to online lectures. Another point we observe is that parking at the University is challenging to find. This complication makes the student not familiar with the Mahidol University area. MapHidol is able to cure this pain point by giving the location of an interesting restaurant, canteen, and cafe together with the tram station and route to travel. The application will make it accessible and functional for freshmen and students unfamiliar with the University area. We expect this application to make users more comfortable traveling in the Mahidol University area.

## 1.2 Problem Statement

Navigating a large university campus can be daunting for students, faculty, and visitors. The complex layout of buildings, walkways, and roads, combined with the size of the campus, can make it challenging to locate specific locations and destinations. This often results in wasted time, frustration, and delays in reaching important meetings, classes, or events.

Traveling in the Mahidol University area via tram is a challenge, including the parking place needing help finding where it is available. Therefore, the problem that this application seeks to address is the need for an efficient and effective tool for navigating the university campus. However, most students still need to familiarize themselves with the campus and the information about interesting restaurants, cafes, and canteen.

**1.3 Objectives of the project**

This application aims to provide students, faculty, and visitors with an easy-to-use tool to navigate the complex layout of the university campus and locate the restaurants, canteen, cafe, tram stop, and parking place. The application will utilize map API technology to guide users to their desired destination. By providing a comprehensive and user-friendly platform for campus navigation, this application aims to improve the overall experience of individuals at the University, reduce time spent searching for locations, and enhance safety and security on campus. However, most of the students in the University are still unfamiliar with the university area and tram route.

**1.4 Scope of the Project**

The application must allow a user to access the information friendly via our features by implementing:

1. The map API usage convinces the user to explore the application effectively.
2. User-friendly interface: Designing of the application should be simple and easy to access the features.
3. Cafe location: The application provides the navigator of a specific cafe at Mahidol University where students can choose a place to study or purchase some drinks.
4. Canteen/restaurant location: The application navigates all the canteen and restaurants at Mahidol University, where students can decide where to purchase some meals during lunch break.
5. Tram stop location: The application must display the tram stop, including the tram route, so students can better decide to travel via Mahidol University.
6. Parking place location: The application displays where they can park when they arrive at Mahidol University.

**1.5 Expected Benefits**

The MapHidol is expected to complement the students/visitors/professors/personal experience of traveling and better to know the information, including:

1. Map API usage: A Map API will allow the application to provide accurate and reliable navigation to users, increasing their confidence and encouraging them to explore its features effectively. This will ultimately lead to a better user experience and higher engagement with the application.
2. User-friendly interface: A simple and easy-to-use interface will make it more accessible and reduce the learning curve required to navigate the application. This will result in a more positive user experience and encourage continued application usage.
3. Cafe location: Providing the location of cafes at Mahidol University will allow students to find a comfortable place to study or socialize, increasing their satisfaction with the university experience and improving their academic performance.
4. Canteen/restaurant location: Navigating all the canteen and restaurant locations at Mahidol University will make it easier for students to find a place to eat during lunch breaks, saving them time and reducing the stress associated with finding a meal.
5. Tram stop location: Displaying the tram stops and routes will provide students with a more convenient and affordable transportation option, improving their ability to move around campus and attend classes on time.
6. Parking place location: Displaying the location of parking places will make it easier for students to find a place to park their vehicles when they arrive at Mahidol University, reducing the time and stress associated with finding a parking spot.

**1.6 Organization of the Document**

This document consists of 6 chapters, including:

1. In the introduction, we delve into the depths of the problem statement, generating the idea of the report, elucidating the objectives, outlining the project's scope, and clarifying the expected benefits, all with the motivation to provide a comprehensive understanding of the subject matter.

2. The background part provides a comprehensive summary of the subject matter and a thorough review of the related literature, offering a complete and insightful understanding of the topic.

3. In the section on Analysis and Design, we present the system architecture and system structure chart to provide a clear visualization of the project's technical aspects, facilitating the development of an efficient and effective solution.

4. The Implementation section covers the MapHidol application's development, utilizing the programming languages of Dart and Flutter to create a functional and user-friendly platform for navigation and information on Mahidol University.

5. In the Testing and Evaluation section, we discuss the development of the weather application using Dart and Flutter, followed by an evaluation of its functionality and user experience. Additionally, we analyze the test code results to ensure the application's reliability and accuracy.

6. In conclusion, we evaluate the code and the goal state achieved by the application, demonstrating its effectiveness in meeting the users' needs. Furthermore, we discuss potential improvements and future developments to enhance the application's capabilities and user experience, ensuring its continued success in providing navigation and information on Mahidol University.

**CHAPTER 2**

**Background**

## 2.1 Literature Review

In today's technology-driven world, understanding location has become a crucial element. The study of location awareness has been extensive across several fields, including navigation, tourism, and transportation. The advancements in GPS technology and smartphones have made it easier to offer location-based applications and services. Specifically, for Mahidol University, developing an application that can provide location-based information to users can significantly enhance their on-campus experience.

One of the critical factors in developing such an application is Map API, which has been extensively researched in the literature. Map API allows developers to integrate map functionalities into their applications and provide users with accurate location-based information.

Cafe and canteen/restaurant locations are essential features of the application as they provide students with a comfortable and convenient place to study and eat. Integrating transportation information, such as tram stops and parking locations, can significantly improve students' mobility and accessibility on campus. Location-based transportation services improve efficiency, reduce travel time, and increase user satisfaction.

In conclusion, the literature suggests that developing a location-aware application for Mahidol University can significantly improve students' experience on campus. The application can provide users with accurate and reliable location-based services that meet their needs by integrating features such as Map API, comfortable study spaces, food options, and transportation information. Furthermore, designing a user-friendly interface and conducting user evaluations and testing can ensure the application's success and continued usage.

# CHAPTER 3

# Analysis and Design

## 3.1 System Architecture Overview

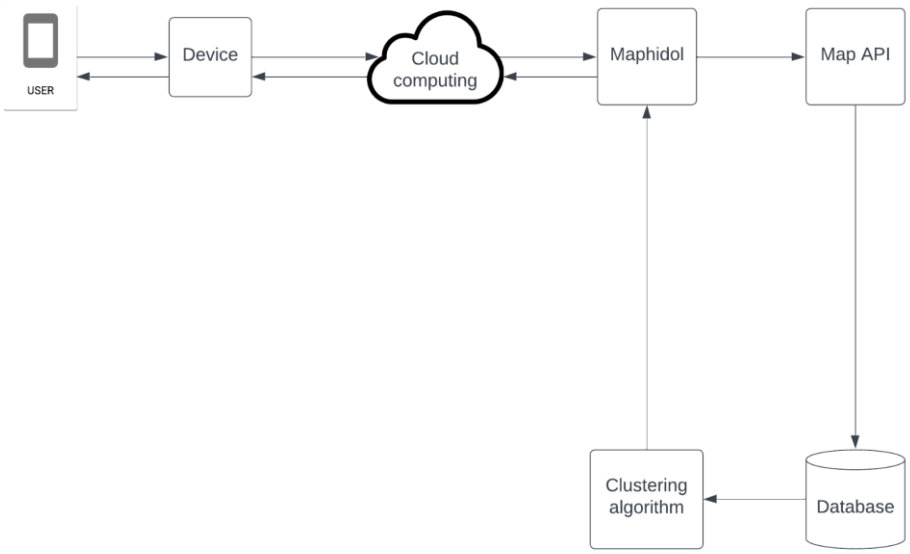



**Figure 1: System Architecture Overview**

## 3.2 System Structure Chart

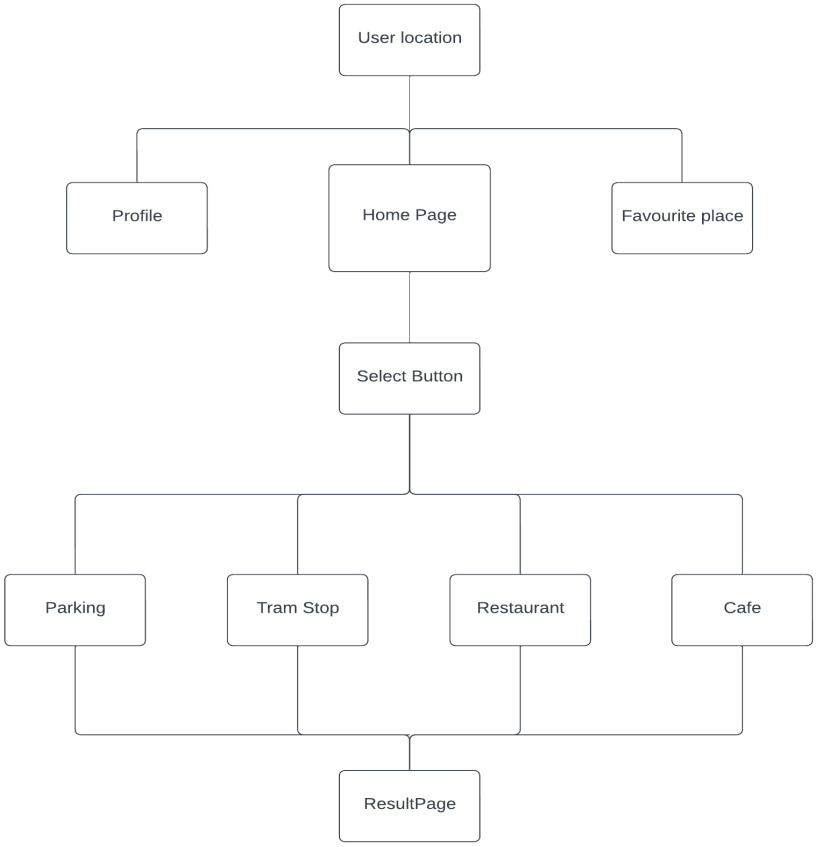



**Figure 2: System Structure Chart**

## I/O Design

### Interface Design

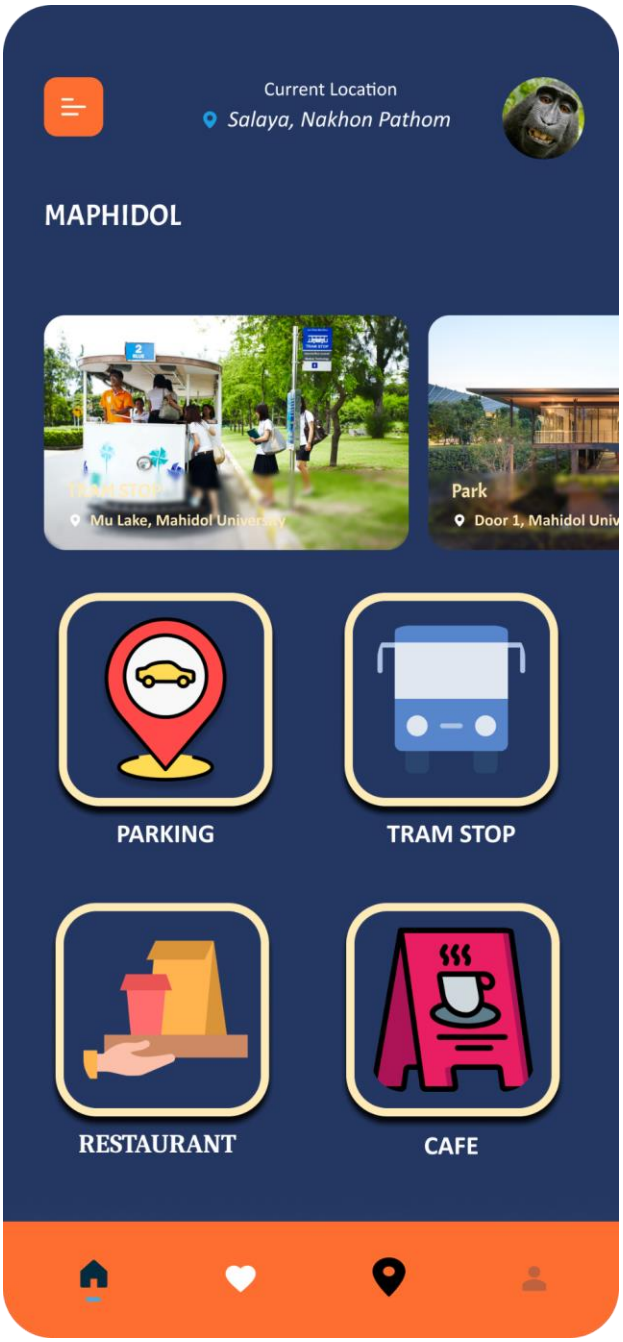



**Figure 3: Home Screen Page**

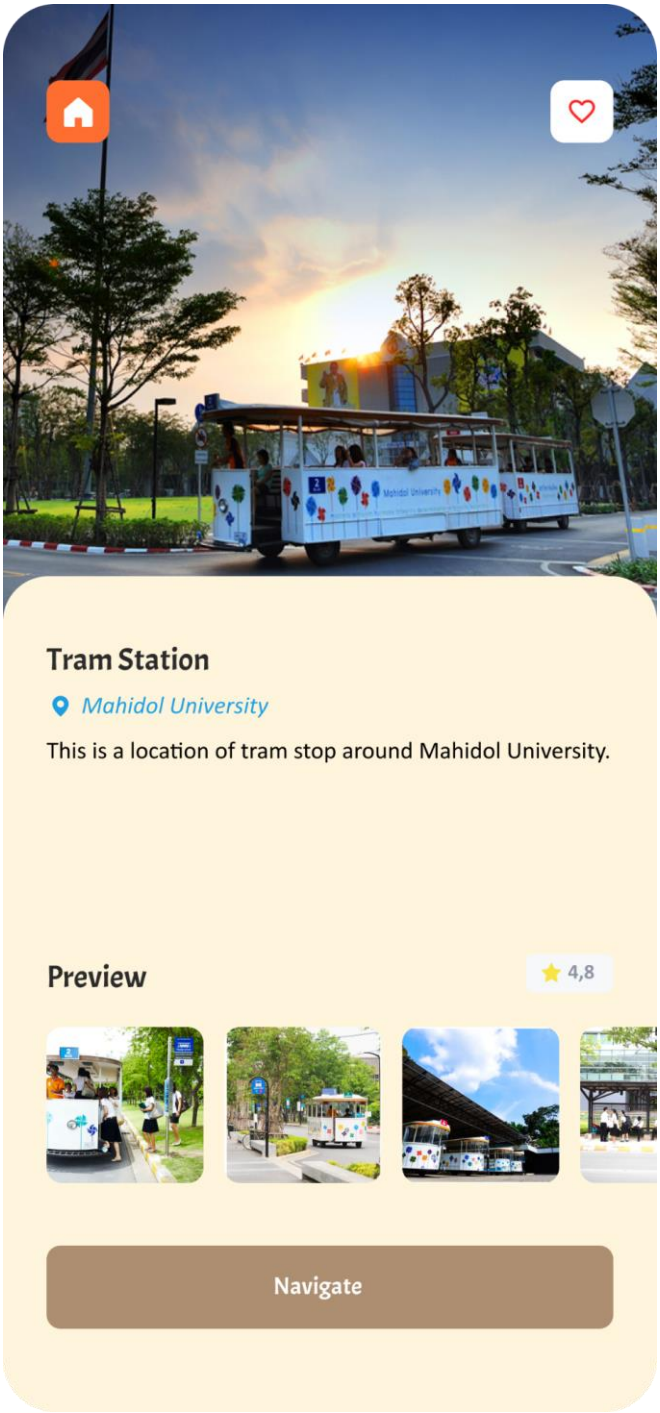



**Figure 4: Tram Station Page**

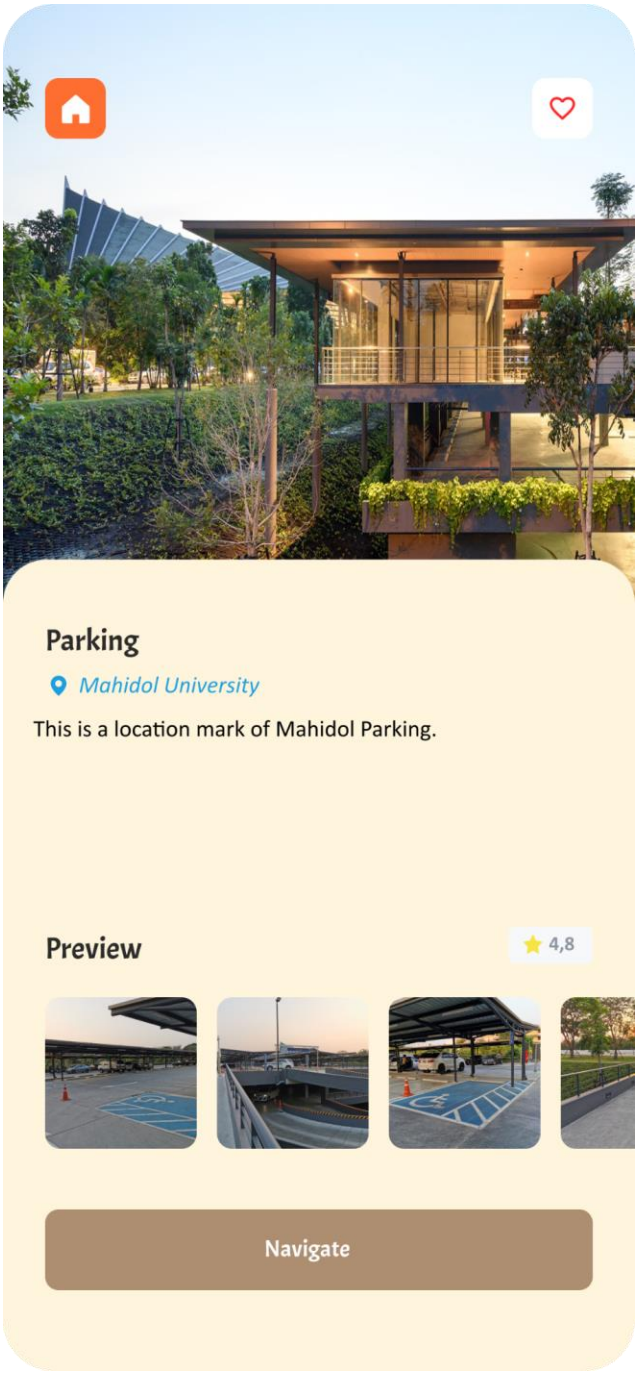



**Figure 5: Parking Page**

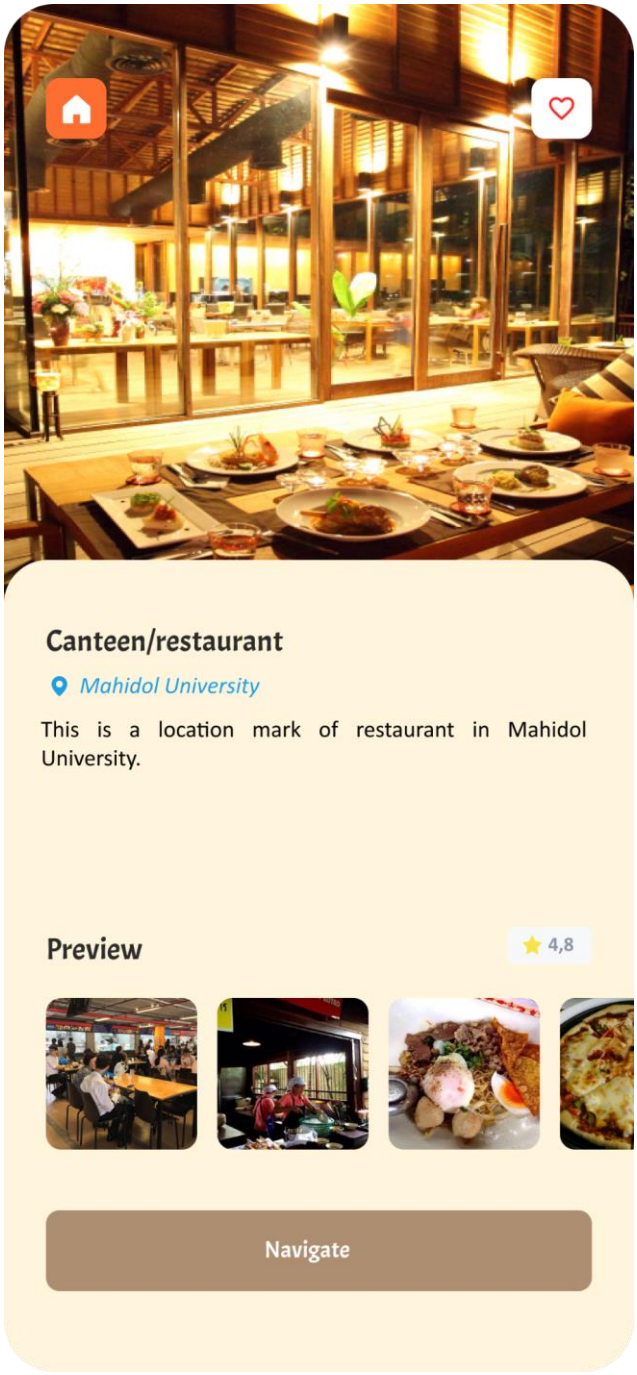



**Figure 6: Canteen / Restaurant Page**

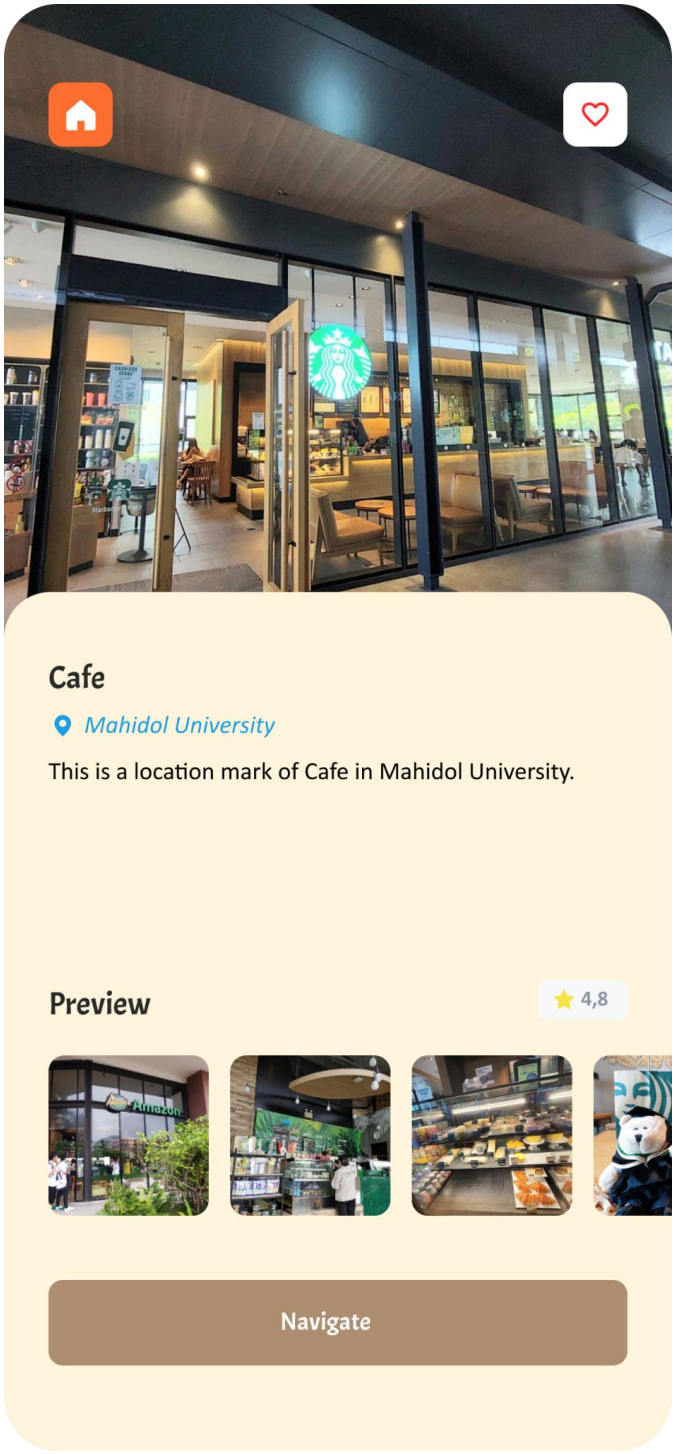



**Figure 7: Cafe Page**

**Transition Diagram**

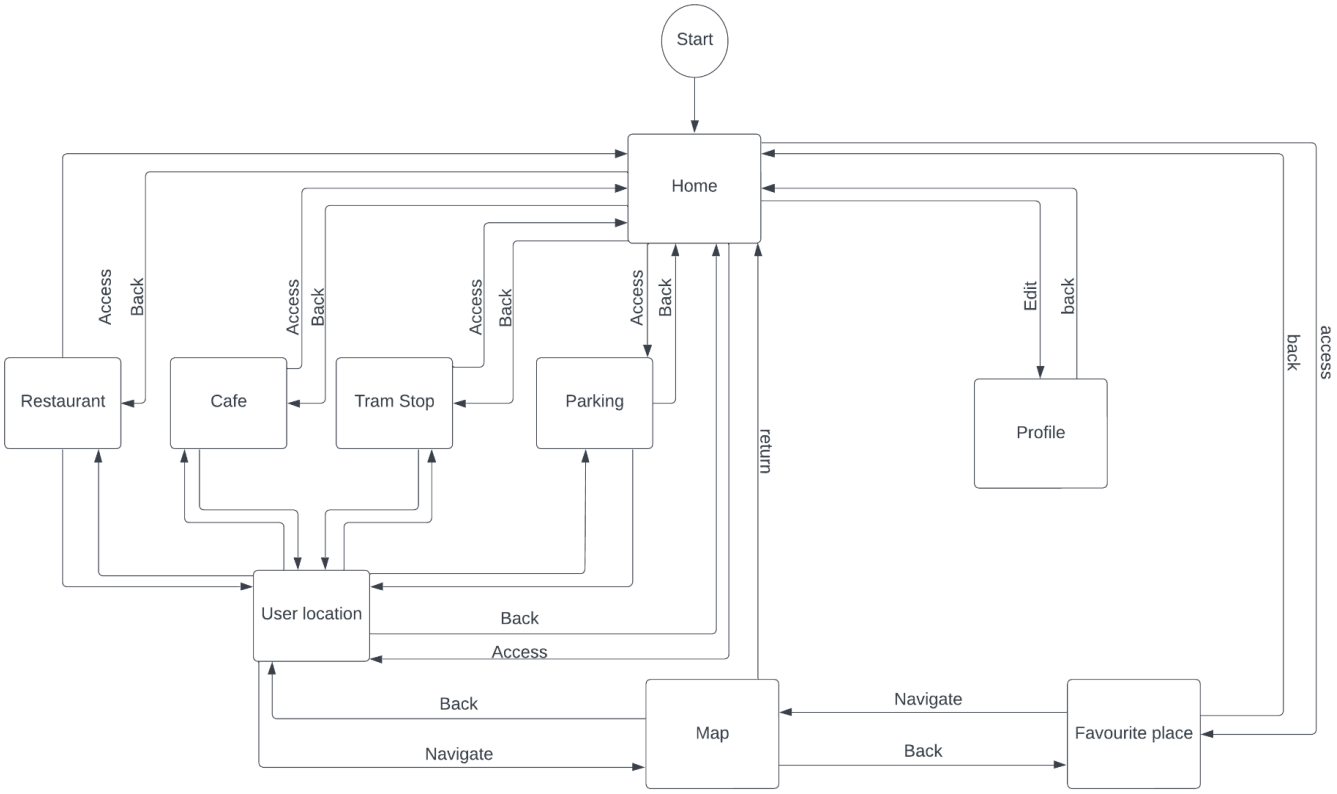



**Figure 8: Transition Diagram**

# CHAPTER 4

# IMPLEMENTATION

This chapter is the discussion about the environment of the hardware and software, also the implementation guide and techniques of our system.

## 4.1 Hardware and System Environment

- Operating System and Utilities Application
    - Hardware
        - Laptop hardware 1: MSI GF75 Thin, Intel(R) Core(TM) i7-10750H CPU @ 2.60GHz  2.59 GHz, RAM 16 GB, Storage 1.5 TB
        - Laptop hardware 2: Acer Nitro 5, AMD Ryzen 7 5800H with Radeon Graphics 3.20 GHz, RAM 32 GB, Storage 512 GB
    - Software
        - Operating System: Microsoft Windows 11 Home Single Language
        - Visual Studio, Microsoft Word, Android Studio, Google Chrome, Flutter, Firebase

- Web Server Software
    - Firebase

        Firebase is a comprehensive and scalable mobile and web application development platform that offers a suite of tools and services to help developers build, grow, and manage their apps with ease.

        Firebase provides a real-time database, user authentication, hosting, cloud storage, push notifications, machine learning, analytics, and other features that allow developers to develop high-quality, responsive, and reliable applications quickly and easily.

        With Firebase, developers can easily integrate multiple functionalities into their app, such as allowing users to sign in using their social media accounts, storing, and syncing data in real-time, running A/B testing, sending personalized notifications, and much more.

Firebase also offers an easy-to-use web console and API that allows developers to monitor and manage their apps in real-time, making it easier to debug and troubleshoot issues. It's an ideal platform for small and large-scale app development projects alike, with flexible pricing plans that cater to various needs and budgets. Overall, Firebase is an excellent choice for developers who want to create high-quality apps quickly and efficiently while reducing development costs and time-to-market.

Firebase provides a range of services that enable efficient management of data. In the following section, we will explore these services in detail.

## Build Better Apps

- Cloud Firestore

Cloud Firestore is a cloud-based NoSQL database service that enables users to store and synchronize data across devices and users worldwide. The service offers real-time synchronization and offline support, ensuring that data is always up-to-date and accessible even when the device is not connected to the internet. Cloud Firestore also provides powerful data retrieval capabilities, making it easy to search and retrieve data. Additionally, Cloud Firestore can be integrated with other Firebase products, allowing developers to build serverless applications with ease.

- Firebase Authentication

Firebase Auth is a simple and secure user management service that enables developers to manage their users with ease. The service offers multiple authentication methods, such as email and password authentication, third-party authentication providers like Google and Facebook, and direct integration with existing account systems. With Firebase Auth, developers can either build their own user interface or take advantage of the fully customizable open-source user interface to provide a seamless authentication experience for their users.

- Firebase Hosting

Firebase Hosting provides a simplified web hosting solution designed specifically for modern web applications. Uploading your web content to Firebase Hosting automatically sends them to our global content delivery network (CDN), ensuring a low-latency and reliable experience for your users, no matter where they are located. Firebase Hosting also provides free SSL certificates to enhance the security of your website, giving your users a secure browsing experience.

- Firebase Database

  Firebase Database is a cloud-based NoSQL database service provided by Firebase that enables developers to store and sync data in real time between their applications and backend servers. It uses JSON data format and can be accessed directly from the client-side code. Firebase Database provides a scalable, secure, and reliable solution for managing data, making it easier for developers to build real-time applications with minimal server-side code.

**Improve app quality**

- Crashlytics

  Firebase Crashlytics helps developers reduce troubleshooting time by transforming avalanche crashes into a manageable list of issues. The service provides actionable insights on which issues need to be addressed first by analyzing user impact in the Crashlytics dashboard. With real-time alerts, developers can stay informed of crashes while on the go, ensuring their apps remain stable. Firebase Crashlytics is the primary crash reporting tool for Firebase, offering an efficient and reliable solution for identifying and resolving application crashes.

- Performance

  Firebase Performance enables developers to diagnose app performance issues that occur on user devices. With Performance tracing, developers can monitor the performance of specific areas of their app and view a summary of their app's startup time and HTTP request monitoring, without the need for any additional code. This allows developers to identify and address performance issues in their applications quickly and efficiently. With Firebase Performance, developers can stay on top of app performance, ensuring their users have a smooth and efficient experience.

- Test Lab

  Firebase Test Lab enables developers to run automated and custom tests for their applications on Google-hosted virtual and physical devices. The service can be used throughout the development cycle to identify bugs and inconsistencies, helping developers deliver a high-quality app experience. With Firebase Test Lab, developers can test their applications on a wide range of devices, ensuring their app is optimized for all users. The service provides a reliable and efficient solution for app testing, making it easier for developers to identify and fix issues in their applications.

## Example of Cloud Firestore

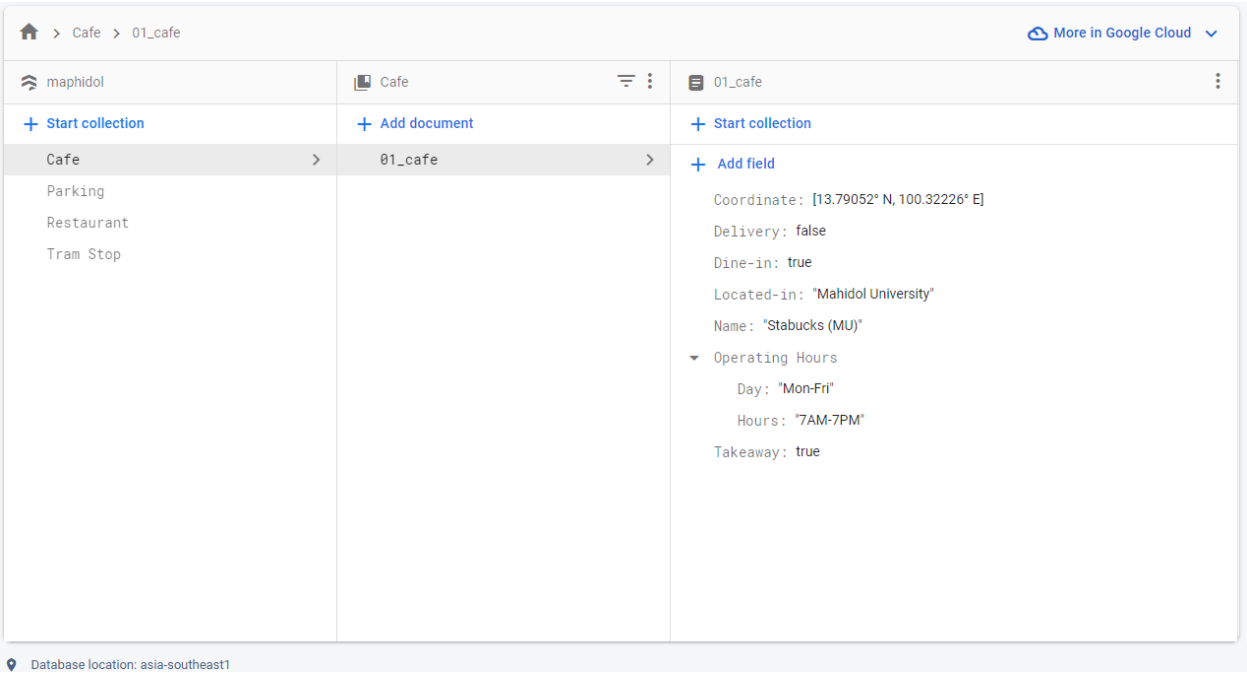



Figure 9 Cloud Firestore: Café

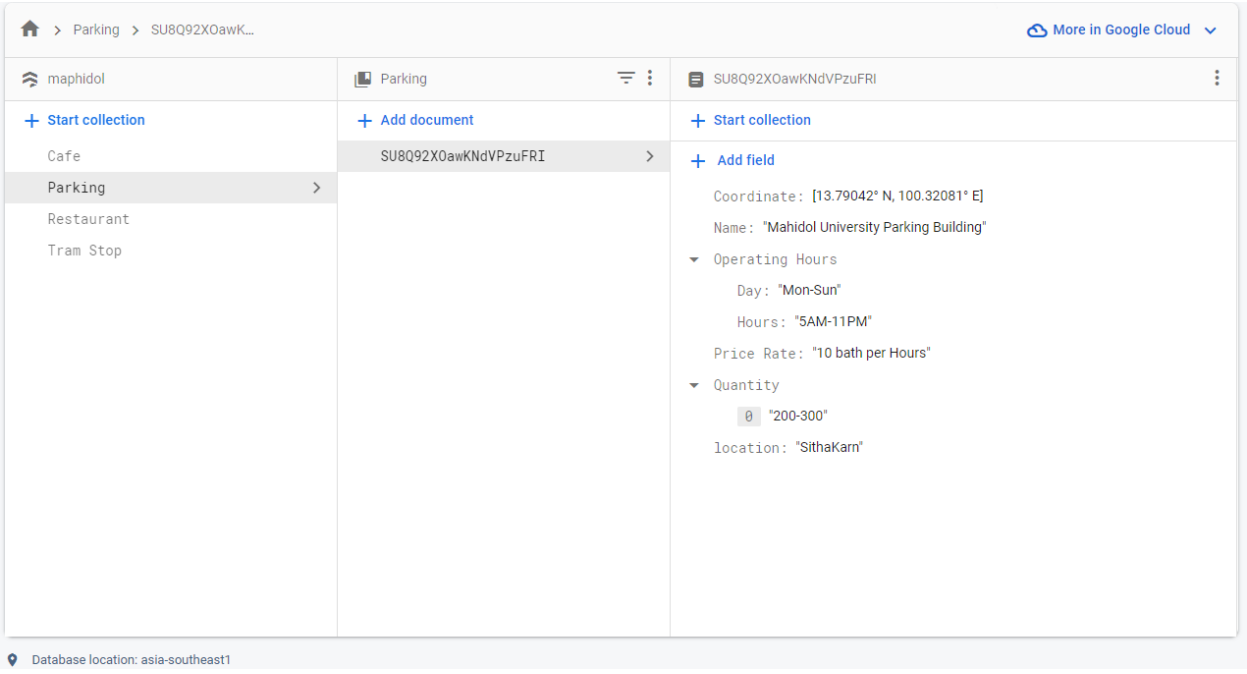


Figure 10 Cloud Firestore: Parking

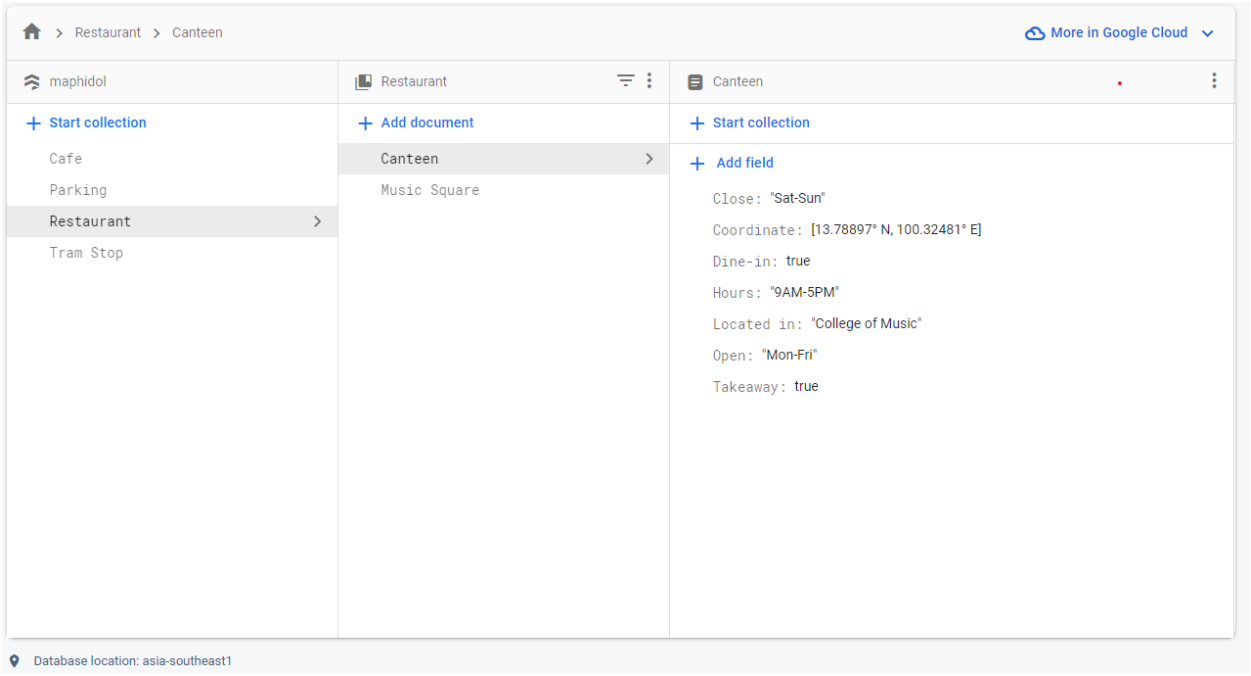



Figure 11 Cloud Firestore: Restaurant

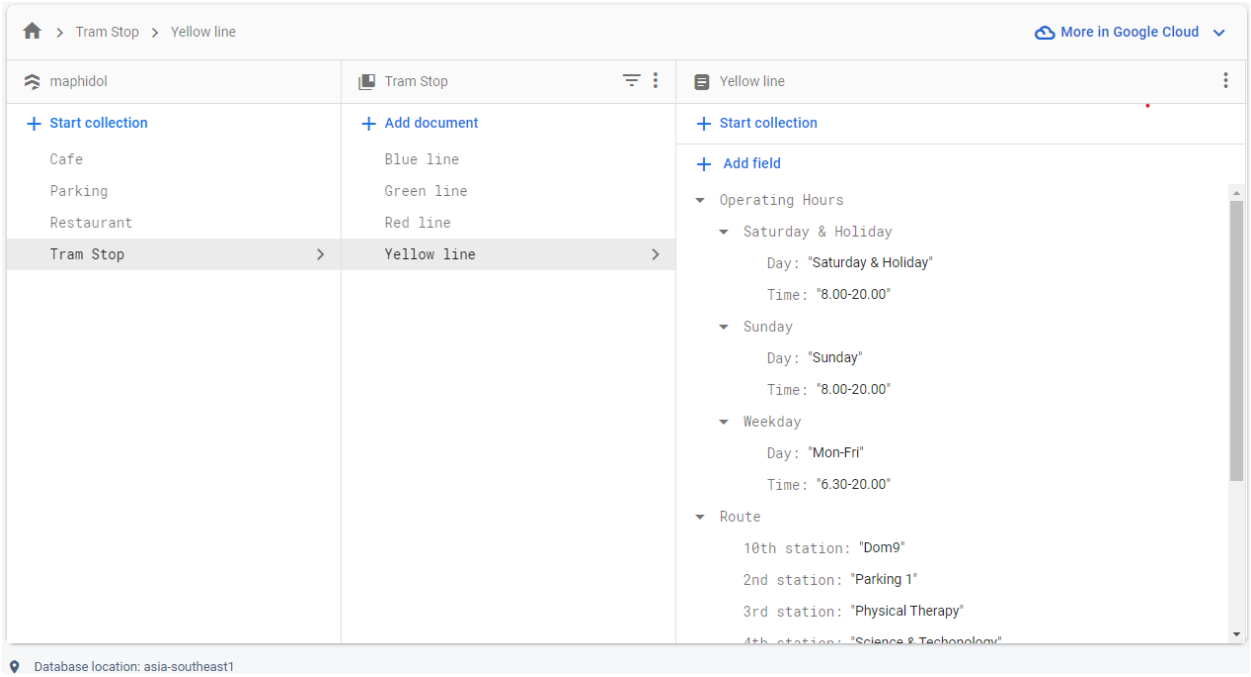


Figure 12 Cloud Firestore: Tram Stop

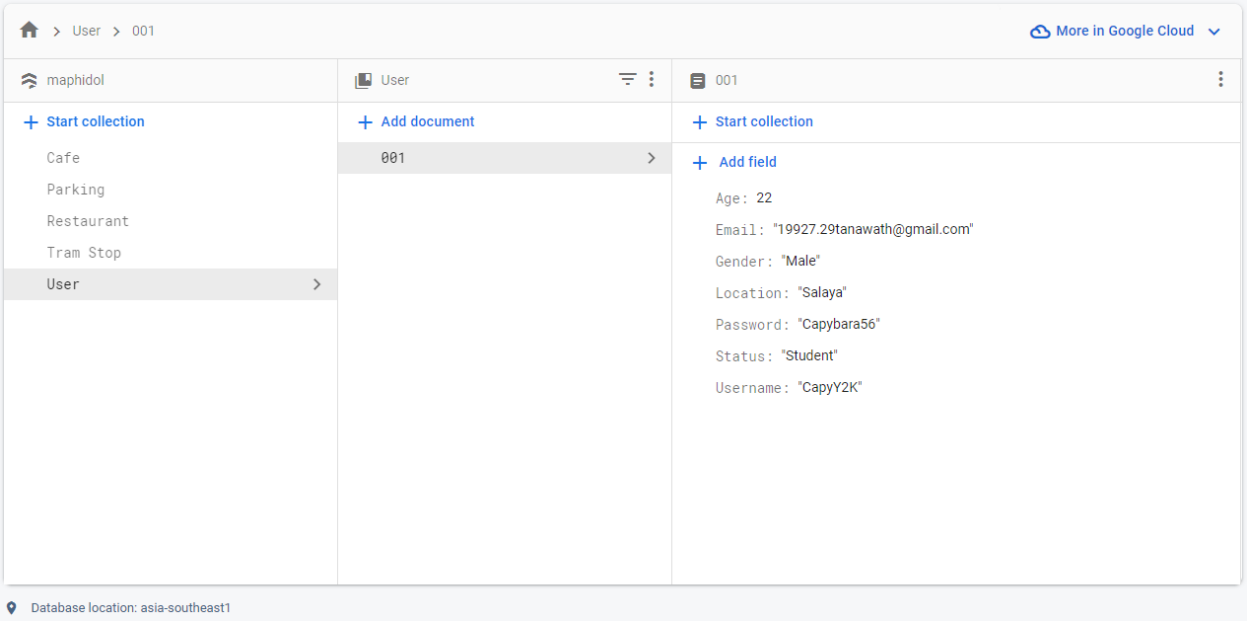



Figure 14 Cloud Firebase: User

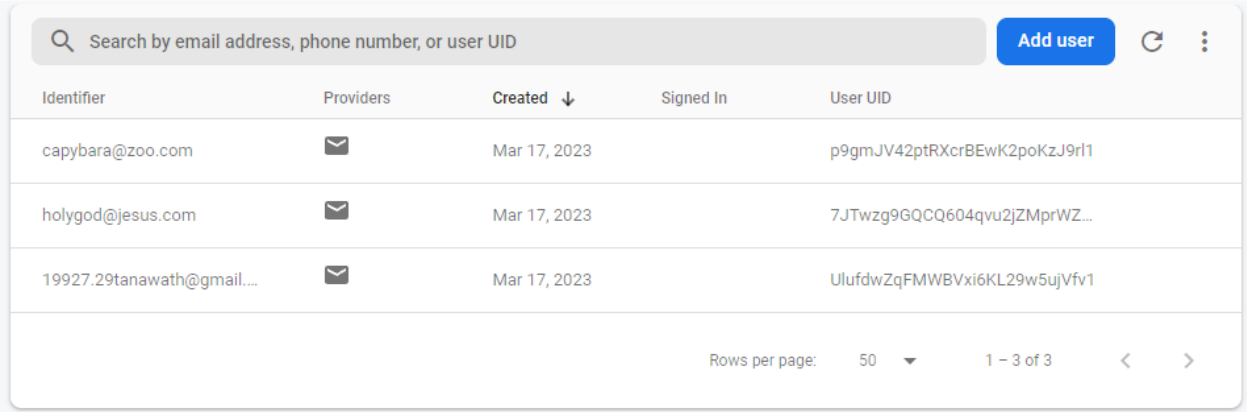



Figure 15 Firebase Authentication: User

**Programming and Scripting Tools**

- Flutter

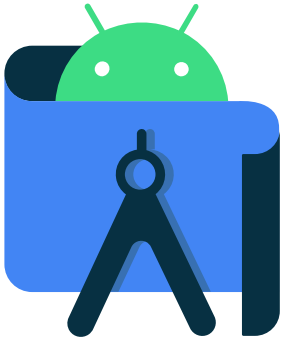
Flutter is an open-source mobile application development framework created by Google that enables developers to build high-quality, natively compiled mobile apps for iOS, Android, and the web, from a single codebase. Flutter uses Dart programming language, which provides a robust set of features such as a reactive programming model, a rich set of pre-built widgets, and tools for debugging and testing. Flutter allows developers to create beautiful and responsive user interfaces, fast app performance, and a hot reload feature that enables them to make changes and see them instantly. With Flutter, developers can build visually stunning and high-performing applications with ease.

- Dart Programming Language


Dart is a client-optimized programming language developed by Google that is used for building web, desktop, and mobile applications. Dart is an object-oriented language that features a powerful type system, garbage collection, and a just-in-time (JIT) compiler that provides fast development cycles. It also has a robust set of libraries, tools, and packages that make it easier for developers to build applications. Dart is used extensively in the development of Flutter

applications, but can also be used as a standalone language. With its modern features, powerful tooling, and growing community, Dart provides an excellent platform for building robust and performant applications.

- Android Studio



Android Studio is the official integrated development environment (IDE) for Android app development, created by Google. It provides a comprehensive set of tools and features for developing, testing, and debugging Android applications. The IDE is built on top of IntelliJ IDEA and includes features such as code completion, refactoring, and version control support. Android Studio also includes the Android Emulator, which allows developers to test their apps on a wide range of virtual devices. The IDE supports multiple languages such as Java and Kotlin, and it also provides templates and wizards that make it easier to create new projects. With its robust features and ease of use, Android Studio is an essential tool for building high-quality Android applications.

## Components

This section describes about the components of the application “Maphidol”

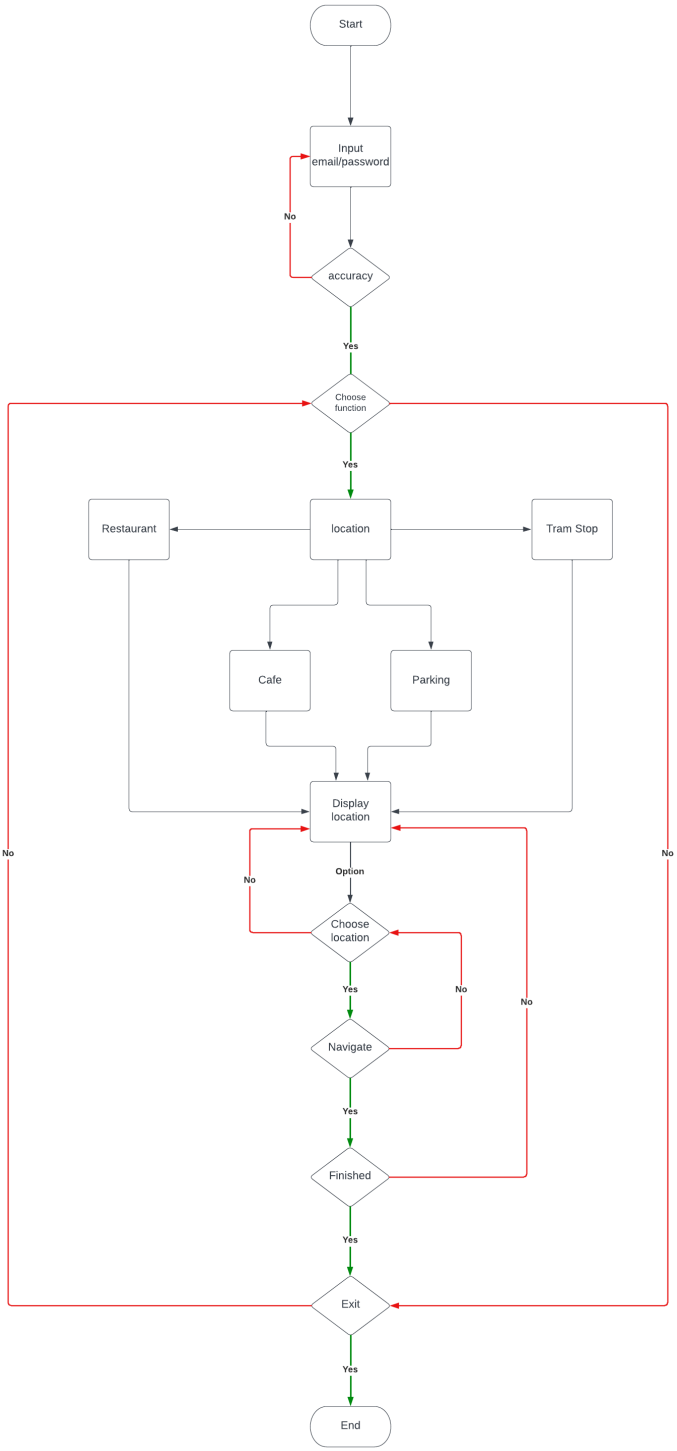



Figure 16 Flowchart of system