

Personal Finance Management Mobile Application with Chatbot

BY

Mah Pei Tong

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Pei Tong

(Author's signature)

Su Lee

(Supervisor's signature)

Address:

238, Persiaran Pengkalan Timur 11,

Medan Pengkalan Indah,

31650 Ipoh, Perak.

Mr Su Lee Seng

Supervisor's name

Date: 18/4/2022

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It is hereby certified that **Mah Pei Tong** (ID No: **18ACB03609**) has completed this final year project/ dissertation/ thesis* entitled “ *Personal Finance Mobile Application with Chatbot* ” under the supervision of Mr Su Lee Seng (Supervisor) from the Department of Digital Economy Technology , Faculty/Institute* of Information and Communication , and Encik Syed Muhammad Bin Syed Omar (Co-Supervisor)* from the Department of Information Systems, Faculty/Institute* of Information and Communication.

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ABSTRACT

The proposed project is a personal finance application with chatbot as my final year project in UTAR for academic purposes. Traditional budgeting and planning methods have been widely used as one of the fundamental management techniques across different types of organizations. In order to let user manage their daily expenses in a more coherent and manageable way, I developed a mobile application that integrates the knowledge of Fintech to help shape the wealth management of the user. Fintech is the integration of technology into the financial service to improve the services delivery in finance. Personal Finance Management Mobile Application with Chatbots is an android based application. This application allows the user to maintain a computerized diary that will record the expenses of a user on a day-to-day basis. Users are able to track their daily, weekly, monthly or even annually expenses with a wise distribution of categories. With the help of this application, users are able to view reports on a weekly, monthly or annually basis via graphical representation to get an overview insight of their current financing status. This can help them to stay on budget as well as be in control of their financial affairs effectively. I have reviewed these five existing finance applications, Mint, YNAB, Bluecoins, DollarBird, Goodbudget before building my system. A finding that has been found is that these five finance apps have not utilised technology like Chatbot and smart reminder in their application. Therefore, some innovative components like Chatbot and reminder are added to my application to make it stand out from the crowd of competitors. The methodology used in this project is the prototyping model which the prototype will be tested and reworked until the outcome is accepted by the customer. While the technology adoption that I used to build this application is Android studio software. All the data will be stored in the Real-time firebase for CRUD response. At the same time, IBM Watson Assistant Chatbot will be integrated into my application to serve as a virtual financing agent with automation replies. To make user feel secure when using my application, users' credential information will be identified and verified by Firebase Authentication first before one can enter into the account

Table of Contents

REPORT STATUS DECLARATION FORM	i
SUBMISSION OF FINAL YEAR PROJECT /DISSERTATION/THESIS	ii
DECLARATION OF ORIGINALITY	iii
ACKNOWLEDGEMENTS	iv
ABSTRACT	v
LIST OF FIGURES	iv
LIST OF TABLES	vii
LIST OF SYMBOLS	viii
LIST OF ABBREVIATIONS	ix
CHAPTER 1: INTRODUCTION	1
1.1 Background Study.....	1
1.2 Project Introduction	2
1.3 Problem Statement and Motivation.....	4
1.4 Objectives	6
1.5 Project Scope	8
1.6 Contribution	10
1.7 Report Organization.....	11
CHAPTER 2: LITERATURE REVIEW	9
2.1 Review of the Existing Systems/ Applications	9
2.1.1 Mint.....	9
2.2.3 Bluecoins.....	13
2.2.4 DollarBird	15
2.1.5 Goodbudget.....	17
2.2 Comparison between the Existing system and Proposed system.....	19
CHAPTER 3: SYSTEM METHODOLOGY/APPROACH	20
3.1 System Design Diagram/ Overview.....	20
3.1.1 System Architecture Diagram	20

3.1.2 Use Case Diagram and Description	22
3.1.3 Activity Diagram.....	28
CHAPTER 4: SYSTEM DESIGN	34
4.1. System Block Diagram	34
4.2 System Flowchart Diagram.....	36
4.3 System Components Specifications	39
4.4 System Components Interaction Operations.....	47
CHAPTER 5: SYSTEM IMPLEMENTATION	67
5.1 System Methodology	67
5.2 Project Timeline.....	69
5.3 Review of the Technologies.....	71
5.3.1 Hardware Platform.....	71
5.3.2 Software Platform	71
5.3.3 OS / Database.....	72
5.3.4 Programming Language.....	72
5.3 Technologies and Tools Involved.....	73
5.4 Summary of Technology Review	75
5.5 Project Implementation Issues and Challenges.....	76
CHAPTER 6: SYSTEM EVALUATION AND DISCUSSION	56
6.1 System Testing and Performance Metrics.....	56
6.2 Testing Result	57
6.2.1 General Question.....	58
6.2.2 User Interface Design Feedback	60
6.2.3 System Requirement Feedback.....	63
6.4 Objectives Evaluation	68
CHAPTER 7: CONCLUSION AND RECOMMENDATION	69
7.1 Conclusion	69
7.2 Recommendation	70
REFERENCES.....	71
APPENDIX.....	73

FYP POSTER.....	73
FINAL YEAR PROJECT WEEKLY REPORT.....	74
TURNITIN CHECK RESULT	86
PLAGIARISM CHECK RESULT	90
FYP 2 CHECKLIST	91
FYP 2 SYSTEM TESTING QUESTIONNAIRE.....	92

LIST OF FIGURES

Figure Number	Title	Page
Figure 1.2.1	Percentages of Malaysian have smartphones	2
Figure 2.2.1	Mint Mobile application	12
Figure 2.2.2	You Need a Budget mobile application	13
Figure 2.2.3	Bluecoins mobile application	15
Figure 2.2.4	DollarBird mobile application	16
Figure 2.2.5	Goodbudget mobile application	17
Figure 1.1.1	System Architecture Diagram	20
Figure 3.1.2	Use Case Diagram	22
Figure 3.1.3	Login Activity Diagram	28
Figure 3.1.4	Transaction Activity Diagram	29
Figure 3.1.5	Budget Activity Diagram	31
Figure 3.1.6	Report Activity Diagram	32
Figure 3.1.7	Chatbot Activity Diagram	33
Figure 4.1	System Block Diagram	34
Figure 4.2	System Flowchart Diagram	36
Figure 4.3	Report Activity Class Diagram	39
Figure 4.4	Budget Activity Class Diagram	41
Figure 4.5	Transaction Activity Class Diagram	43
Figure 4.6	Chatbot Activity Class Diagram	45
Figure 4.4.1	Splash Screen	47

Figure 4.4.2	User Login	47
Figure 4.4.3	New User Register	47
Figure 4.4.4	Reset Password	48
Figure 4.4.5	Reset Link	48
Figure 4.4.6	About Page-1	49
Figure 4.4.7	About Page-2	49
Figure 4.4.8	About Page-3	49
Figure 4.4.9	About Page-4	49
Figure 4.4.10	About Page-5	49
Figure 4.4.11	Homepage	50
Figure 4.4.12	Add Transaction	50
Figure 4.4.13	Calculator	50
Figure 4.4.14	Expenses category	52
Figure 4.4.15	Navigate to income category	52
Figure 4.4.16	Income Category	52
Figure 4.4.17	Date picker	53
Figure 4.4.18	Fill in full details	53
Figure 4.4.19	Add Transaction successfully	53
Figure 4.4.20	Firebase	53
Figure 4.4.21	Expand transaction	54
Figure 4.4.22	update details	54
Figure 4.4.23	Updated Transaction successfully	54
Figure 4.4.24	Updated Firebase	54

Figure 4.4.25	Click Transaction	55
Figure 4.4.26	Delete button	55
Figure 4.4.27	Confirmation dialog	55
Figure 4.4.28	Updated List	55
Figure 4.4.29	Deleted Firebase	55
Figure 4.4.30	Transaction list	56
Figure 4.4.31	Select a date	56
Figure 4.4.32	Filtered list	56
Figure 5.1.7	Prototype Model Phase	65

LIST OF TABLES

Table Number	Title	Page
Table 2.3	Comparison between similar application	19
Table 3.1.2.1	Register activity use case description	22
Table 3.1.2.2	Login activity use case description	23
Table 3.1.2.3	Add Transaction activity use case description	23
Table 3.1.2.4	Filter Transaction activity use case description	24
Table 3.1.2.5	Edit Transaction activity use case description	24
Table 3.1.2.6	Delete Transaction activity use case description	24
Table 3.1.2.7	Add Budget activity use case description	25
Table 3.1.2.8	Delete Budget activity use case description	25
Table 3.1.2.9	Filter Budget activity use case description	26
Table 3.1.2.10	Category Report activity use case description	26
Table 3.1.2.11	Pie Chart Report activity use case description	26
Table 3.1.2.12	Chatbots activity use case description	27
Table 3.1.2.13	Log in reminder activity use case description	27
Table 5.2.1	Hardware Requirements	71
Table 5.2.2	Software Requirements	71
Table 5.2.3	OS / Database Requirements	71

LIST OF SYMBOLS

% Percentages

LIST OF ABBREVIATIONS

AI	Artificial Intelligence
APK	Android Package
CASE	Computer-aided software engineering
EEBA	Easy Envelope Budget Aid
FAQ	Frequently Asked Questions
FinTech	Financial Technology
GB	Gigabyte
GHz	Gigahertz
iOS	iPhone operating system
PFM	Personal Financial Management
SDLC	Software Development Life Cycle
UI	User Interface

CHAPTER 1 INTRODUCTION

CHAPTER 1: INTRODUCTION

1.1 Background Study

Planning and budgeting are concerns by most people nowadays regarding their regularity of daily expenses. Despite the fact that the limitations of traditional and alternative budgeting systems have been known for over a decade, still have a minority of people prefer to use conventional methods. As different people used different methods, it depends. For a common user, they prefer to use conventional methods like using sticky notes and notebooks. For proficient people, they will use a spreadsheet and ledger to make an account and record the expenses. Traditional budgeting methods are very often criticized for their inflexibility especially in budgeting. This is because budgets are a lot to keep an eye on. There are chances of crucial inputs can be missed and manual errors may sneak in. It could be a very hectic and troublesome process to have an overview of expenses. On the other hand, more and more people are discovering the benefits of budgeting tools because budgeting applications are able to simplify people's life by helping them to take control of their financial affairs effectively. It is not only helping people with budgeting but also enables them to manage their money effortlessly on a solitary stage. Therefore, I believe that a handy design and handy mobile application can tackle all of these troubles. Moreover, it is able to sum up, and give a broad view of the dashboard of the interface, but it can also be integrated with other intelligent technologies that we cannot experience in traditional methods of planning and budgeting.

CHAPTER 1 INTRODUCTION

1.2 Project Introduction

Finance Technology also known as FinTech, is growing with the transformation of individuals' life and is currently dominated by users of technology innovation at a rapid pace. Fintech utilises Personal Financial Management (PFM) to provide personal financial analysis, and health evaluation to monitor and control the financing usage based on users' financial planning goals.

The proposed project for this proposal will be a Personal Finance Management mobile application with Chatbot in Android-based. The purpose of this application is to help users to keep track of their flow of cash, and provide them better visibility into their financial status in a way of computerised diary. This application is able to help us to reduce the hectic process caused by using the traditional methods of planning and budgeting. Sometimes it may lead to problems like wrong calculations, and data loss. Thus, we are trying to satisfy the user's requirements by building a mobile application that will help them reduces their burdens.

In addition to the fact that smartphones are the backbone of media interactions, the smartphone penetration rate is expected to increase year by year starting from Year 2015 to 2022 as statistic shown below (Statista 2020). The percentage is getting higher and close to 93.96% in the Year 2020. We can expect that smartphones will play a very important part in people's life as it is getting higher demand in the future.

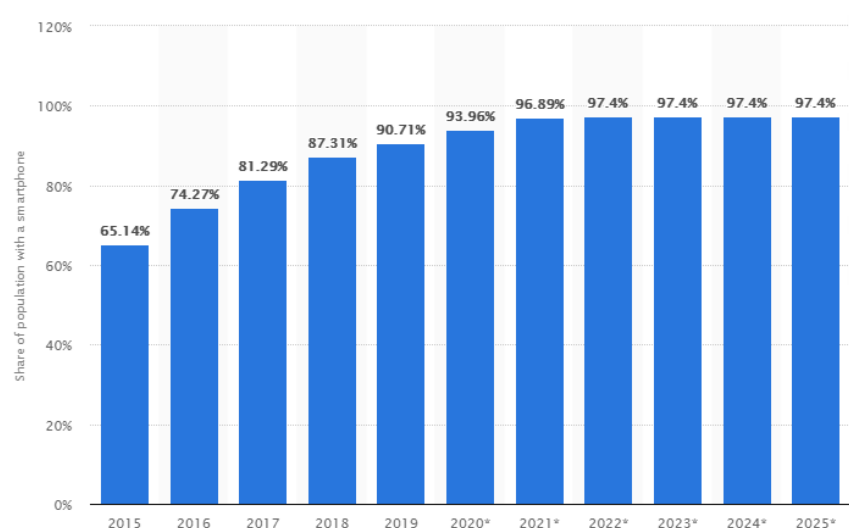


Figure 2.2.1 Percentages of Malaysian have smartphones Source: (Statista 2020)

CHAPTER 1 INTRODUCTION

According to (O'Connell, 2019), “63% of smartphone users have at least one financial app on the device, and the app data tracking site App Annie estimated approximately 200 billion personal budgeting app sessions globally across iOS and Android alone, in 2017.” This shows that the budgeting app is now trending in the market and at least one budgeting app is on their phone. The enhancement of mobile app technology made financial planning applications have expanded users’ financial wings to let them learn to fly correctly, on a personal budgetary basis. Users can have comfortable planning on their spending with a suitable income per month. The proposed financial management application will provide services like recording income and expenses, tracking expenses, filtering expenses based on weekly/monthly/year and category basis, setting budgets to avoid overspending, view the monthly statement through a visualization graph to support users’ needs.

Besides, my proposed project has eye-catcher features which is the implementation of Chatbot. From the day of its invention until now, Chatbot has been widely deployed in financial services to facilitate the financing process in many spheres with the rising bars of customer expectations. According to (Business Insider 2021), around 80% of the bank have been aware of the potential benefit of using Chatbot in their management. A Chatbot is a personal virtual intelligent assistant, which is only one message away and has the potential to be the most preferred way to provide human-like customer service like an interactive FAQ, answering questions based on their recognition of certain keywords. Besides, to make my application more unique, I added a push notification to remind user to login into the application if the system detected the user’s login expired 2 days ago. This is more advanced than the traditional method since it will trigger notifications to alert users if they forget to record their expenses within a period. It ensures consistency between real-life expenses and in-app expenses. These features ultimately contribute to effective money management and the consistency of expense amounts. I believe it will increase value in the financial services marketplace as well as compete with the other existing financing applications in the market.

CHAPTER 1 INTRODUCTION

1.3 Problem Statement and Motivation

According to a recent report, it stated that almost 45,000 individuals around thirty-five-year-old and below in Malaysia declared as bankrupt' for the past three years back around 2009 because of the burden of credit card payments, medical fees, hire purchases and debt loan sharks (Kosmo, 2012). They noticed most people failed at financial planning because of lack of self-restraint and getting more addicted using credit card to overstretch themselves to buy on credit, with no means to pay off the debt. The other reason that motivates me to build an expense tracker mobile application is that most people still using traditional methods of budgeting. As traditional methods of budgeting and planning, they maintain the Excel sheets, sticky notes and use a ledger to record their large amount of data where human errors may sneak in. This is a monotonous process to always keep the logs in this way. Meanwhile, developing a handy design and handy mobile application can help to tackle these problems, with many advantages that can be seen.

- **Inefficiencies and mistakes in using manual method to perform financial planning**

Some people choose to keep their expenses records using this traditional method of budgeting planning. Manual calculation sometimes may result in mistakes leading to incorrect and inconsistent figures at the end of the month. Therefore, the chances to have a human error on calculation are very high, especially with a huge number of data entries. Besides, it is extremely difficult to track back past expenses through paper documentation. It is time-consuming and monotonous process to track back the past expenses manually without digital help. Moreover, paper documentation can lead to losses easily, because the data is not maintained perfectly.

- **Difficult and inconvenient using Excel to plan and budget**

From my perspective, not every person knows how to use Excel. It is especially true for many elders because Excel requires formulas starting from transforming input data to output data. There is a lot of work spent on modifying and correcting Excel spreadsheets. Moreover, it does not provide enough user portable device management level, Excel is mostly used on desktop software so we are unable to update anywhere expenses as they happen. Theoretically, you

CHAPTER 1 INTRODUCTION

could use a mobile spreadsheet, but that might be a lot more tedious than using an app. There are many complications in areas like there are chances if crucial inputs can be missed when inputting data into the spreadsheet row by row with limited screen size on a mobile device. Excel is outdated now especially use in budgeting and planning.

- **A slow customer service response time in the existing system**

Existing financial management mobile applications lack advanced features that can improve the two ways of communication between user and system. Currently, the expense tracker application that is implemented with a financial virtual assistant is hard to find in the market. Even though I have reviewed 5 existing applications, none of them includes this type of technology in their applications. Many negative reviews complain about their services since they are still using the email method to support the communication process. It is hard to build a relationship to sustain users' interest and loyalty. Besides, a system without a financial virtual assistant makes the process slower and inefficient when assisting with the users.

CHAPTER 1 INTRODUCTION

1.4 Objectives

- **To develop a user-friendly personal finance management mobile application with auto precise calculation.**

In this proposed project, the system will calculate the net balance automatically. The amount spent and income will show on the home screen to let users notice how much they spent and how much is left, all in one glance. With auto-count, it can lower the human error, and reduce the workload of summing up all the data manually by using traditional methods, especially dealing with a huge number of transaction entries. A calculator feature is added to the application to help users solve math problems. Therefore, this proposed system was able to ensure the figure's accuracy. Besides, the proposed system also allows users to filter the transactions through the date which totally fastens the searching process compared to manually searching. Additionally, no worry about data loss or data damage because all the data will store in the Realtime Firebase which is easy to retrieve.

- **To develop a personal finance management mobile application that is portable enough to let user add in transactions whenever they make transactions immediately.**

The proposed system is more extensive and accessible than a laptop because it can carry all the time anywhere to record the transaction. It provides much convenience and efficiency to a user in recording transactions into their phone if compared to the Desktop version of Excel. Moreover, user with no basic knowledge of excel can easily use this application. Here we provide an environment where in a few clicks can add their expenses. No formula is needed to type, they just need to enter a figure into the finance application. This application is best used for every level of society due to its user-friendliness of the application.

CHAPTER 1 INTRODUCTION

- **To develop a expense tracker application with automated Chatbot that provides fast reply when assisting customer.**

The proposed system will be more interactive due to the implementation of Chatbot. Chatbot is able to imitate a real conversation and respond in an exact manner that they want it to within seconds because Chatbot is available for users around the clock. This will help to solve most of the problems that are faced with human customer support, including difficulty in providing 24/7 support. I believe it will provide a differentiated value-add experience and customer satisfaction to users. More users will be attracted and switch their current used application to my proposed application.

CHAPTER 1 INTRODUCTION

1.5 Project Scope

At the end of this project, this financial application based on mobile android platform would be an application that helps to guide users in planning and give a better financial decisions in their daily spending. As the saying goes ‘A smart move could bring one to achieve better in future.’, therefore this application will benefit lots of people since it can update users on their current financial status from time to time.

The basic functionalities in this application are users can perform tasks like set budgets, and add incoming and outgoing transactions into customizing categories in an easier way to make user lives less complicated. To facilitate the process of tracking back, a filter feature is added to the application to allow user filters the transactions through a specific date. Moreover, a calculator will be added to the application to solve the math problems that they might encounter. It brings the next level of convenience to the user because they can perform a calculation before they key in the amount spent.

The analytic functionality like visualization graph will be provided. Users are able to view their expenses all in a visual graph in the application. The system will analyze the input data and transform it into a financial graph like Pie Chart. User is able to view the spending in Pie Chart form which categorised in different colour. Besides, a summary report in category form will be added into the system. It will shows all the main category amount spent in a list, where user can click the main category to view the subcategory expenses. It more like an account type of report since it will show the total category expense, total category income and net balance in a page. By having these feature, users are able to track liquidity, expenses and cash flow over a given period on a monthly and yearly basis.

This application is added Chatbot features to improve the interaction with users since it is a lot like an interactive FAQ method. This Chatbots provide them with wanted information within a second instead of waiting for a reply from the customer service centre for the whole day. The message sent by the sender will match with the question bank to look for the matching keyword. After that, the system retrieves back the sentences from Question Bank and replies to the sender.

CHAPTER 1 INTRODUCTION

A reminder is added to the system to remind users to perform add transactions activity if no login records were detected within the past two days. A push notification will be triggered and sent the notification to the notification bar of the mobile device. Last but not least, this application is free of charge, no additional fees will be charged. Each user will have their own account and account authentication will be checked before users log in and log out. We want users to feel more secure and safe when using the application.

CHAPTER 1 INTRODUCTION

1.6 Contribution

This project will bring a huge impact on society as this proposed application is suitable for all levels of society to help them get to manage their money properly. This application will guide them to meet their life financial planning goals by providing step-by-step guidance. Essentially, it helps user to be in control of spending, credit card debt, and investments to maximize the benefits obtained by individuals and enhance their living standards.

Besides, an effective financial system will have a massive contribution to the growth of a country. This is because if all citizens of the country have the basic effective personal finance skills with them, it will definitely help them to ensure they are financing well and propelling them into a brilliant financial future. With financial planning, an individual would have a better mindset to archive their goal because it was able to let people gain visibility into finance in the future. When they have a comfortable and stable life, the crime rate will dramatically decrease too because there is a strong linear relationship between the crime rate and the stable life of a citizen in that country. Therefore, financial literacy helps improve the quality of financial services and contributes to a nation's economic growth and development.

Besides, financial planning system is able to help people to save money for a rainy day when it might be needed unexpectedly. Some uncertainty can happen out of a sudden just like Covid 19. The outbreaks of Covid-19 become a serious threat to the economy, leading to the raising in the unemployment rate. People who do not have savings in their accounts could be suffered from this pandemic compared to those who have proper financial planning. With financial planning system, it can help users to build the basic financial skills to better manage their finance for unexpected incidents.

CHAPTER 1 INTRODUCTION

1.7 Report Organization

Chapter 1 Introduction, Chapter 2 Literature Review, Chapter 3 System Methodology, Chapter 4 System Design, Chapter 5 System Implementation, Chapter 6 System Evaluation and Discussion, Chapter 7 conclusion and recommendation. The **first chapter** is the introduction of this project which includes the problem statement and motivation, project objectives, project scope, project contribution and report organisation. The **second chapter** is the literature review carried out on technologies including hardware platform, firmware, database, and programming language. Besides, several existing expense tracker applications in the market evaluate the strengths and weaknesses of each product. A comparison table is formed to compare all the expense tracker applications with the proposed system. The **third chapter** is discussing the system methodology followed by the system design diagram such as system architecture diagram, use case diagram and description and activity diagram is used to better explain the general work of the procedure. The **fourth chapter** is regarding the deeper details of the system design with the necessary information on how the project is developed. A top-down system block diagram, system components specification and system components interaction operations are used to explain the system design. Furthermore, the **fifth chapter** is regarding the details on system implementation by providing the information on the technology and tool used over the developing period. A system operation with screenshots is included to present the complete mobile app operation from start to end. A concluding remark is the last topic to wrap the Chapter 6. The **sixth chapter** reports the system evaluation after performing system testing by distributing the questionnaire to gather feedback from the respondents about the system reviewed. In this chapter, project challenge and objectives evaluation will also be discussed. The last chapter, **Chapter 7** is a wrap-up conclusion paragraph that summarizes the entire project including the recommendations that can further improve the application.

CHAPTER 2 LITERATURE REVIEW

CHAPTER 2: LITERATURE REVIEW

2.1 Review of the Existing Systems/ Applications

There are few of similar personal finance management mobile applications that can be found in Google Store. I have reviewed on few similar mobile applications as stated below:

2.1.1 Mint

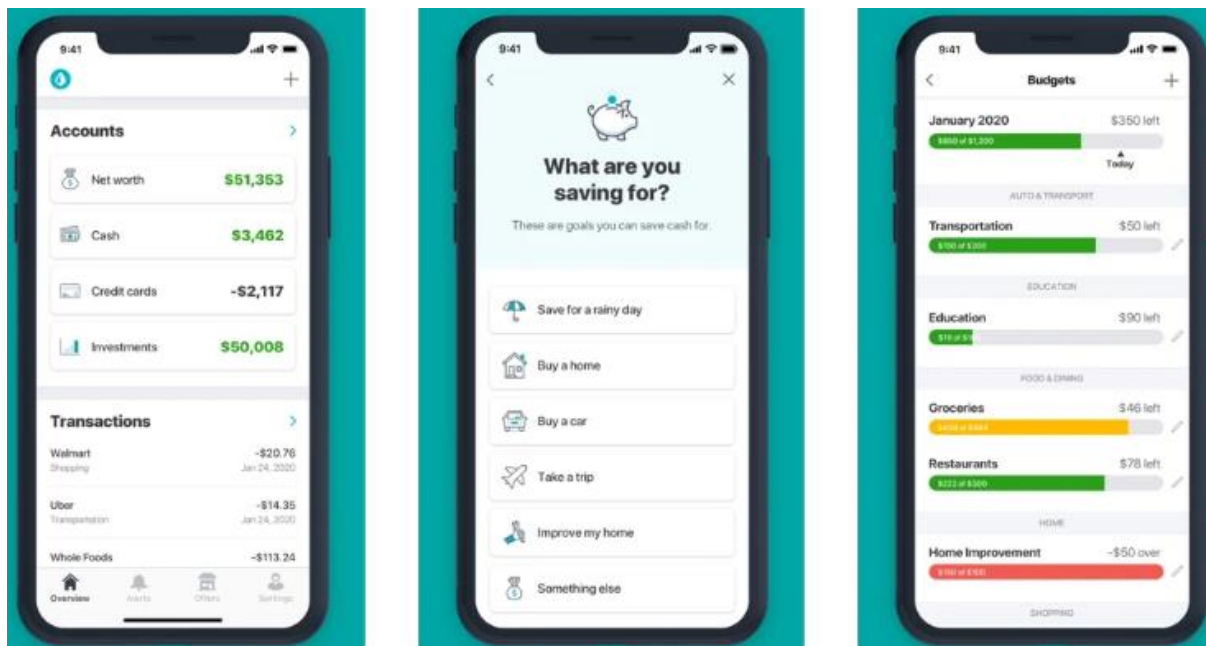


Figure 3.1.1 Mint Mobile Application

Source: (App Store, n.d.a)

Mint application is one of the oldest and well-known applications launched in 2007. This application is available for download in App Store and Google Play Store, where Mint is rated at 4.6 stars out of 5. Mint is not only in budgeting but also a great personal finance application that brings all finances together into one place from balances and budgets to credit health and financial goals.

Mint has a clean and nice overview of UI design so users can easily hand-on. Mint can link multiple users' financial accounts like saving or checking, investing accounts and credit cards to track the incoming and outgoing money. Users are able to add their daily incoming and outgoing expenses by automatically allocates expense categories. The Mint Dashboard

CHAPTER 2 LITERATURE REVIEW

gives a brief overview of a user's personal finances at a glance so users can have a full understanding of their financial picture in a chart at any time user needs.

Mint allows users to set a reminder to remind users when the bill due date is approaching, or user is overspending money. “Mint also includes a feature for setting and tracking short- and long-term goals like building an emergency fund or paying off debt. These, too, are displayed as bar graphs and are linked to specific financial accounts”(PCWorld 2018). Mint provides budgeting tips and advice to help users achieve their financial goals. Moreover, users can track their investment accounts by using the portfolio and investment tracking tool in the application. Mint even helps in reporting user's credit score on an ongoing basis with its free Credit Score Monitoring service. Most importantly, Mint is 100% free charge to install on a smartphone. Mint provides account security to secure the users' private data. It allows users to set a pin code or activate TouchID to prevent unauthorised person access.

Mint has a weakness in always showing annoying intrusive advertisements in the application. This can make users frustrated and pissed off when they try to enter the transaction but are disrupted by the advertisement. Besides, Mint does not support multiple currencies which is quite a huge glitch in this application. Mint has a rather limited customer support and is not able to filter transactions through a specific date range.

CHAPTER 2 LITERATURE REVIEW

2.2.2 YNAB

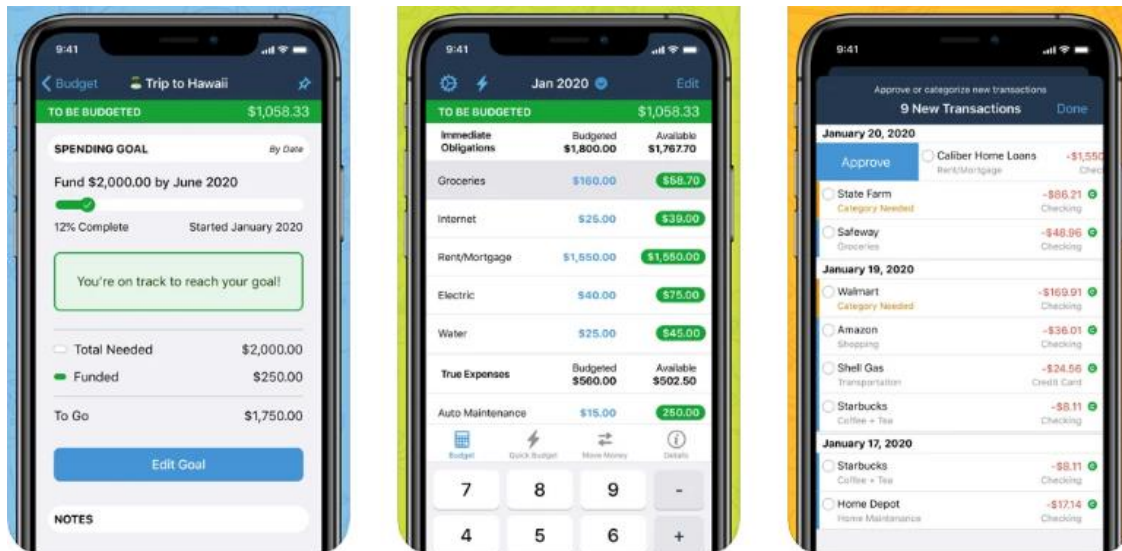


Figure 2.1.2 You Need a Budget Mobile Application

Source: (App Store, n.d.b)

YNAB stands for “You Need a Budget.” YNAB is a powerful app, which is highly rated with a near-perfect 4.8 stars out of 5 in the App Store and Google Play Store. The company was founded in 2004 by a husband-and-wife team Julie and Jesse that offers personal budgeting software. To be clear, YNAB is all about helping you save money and budget better.

YNAB provides users with visual illustration charts of their finances as a whole. “YNAB provides three ways to reach specific goals, including monthly funding goals so you can break your long-term goals down into more manageable monthly increments” (The Dough Roller 2020). In addition, target tracking features allow the users to set fiscal targets such as saving a certain amount of money or getting out of credit card debt. One of the strengths of YNAB is cloud sync which allows users to backup budget files to the cloud and transaction entries are always up to date. The users can secure their account and budgetary information by setting a PIN code. The key features include reporting bliss which will provide detailed, visual spending and trend reports help to measure financial progress. Customer Support is available through a very advanced and user-friendly self-help platform. YNAB provides a smart reminder to fire a notification when overspending.

CHAPTER 2 LITERATURE REVIEW

The weakness of YNAB application is it only offers 34 days of free trial. This absolutely will be a burden to students as highly costs \$11.99 per month and \$84 annually. “YNAB takes a much simpler, but also less intuitive approach to setting goals. Because YNAB’s goal features are so bare-bones, users need to do the mathematical legwork themselves. For example, if they want to pay off a credit card, they need to calculate how the interest will affect their payments themselves”(Lifehacker 2016). Client service is a glaring shortcoming of YNAB because there is no phone number and email contact provided in the application.

CHAPTER 2 LITERATURE REVIEW

2.2.3 Bluecoins

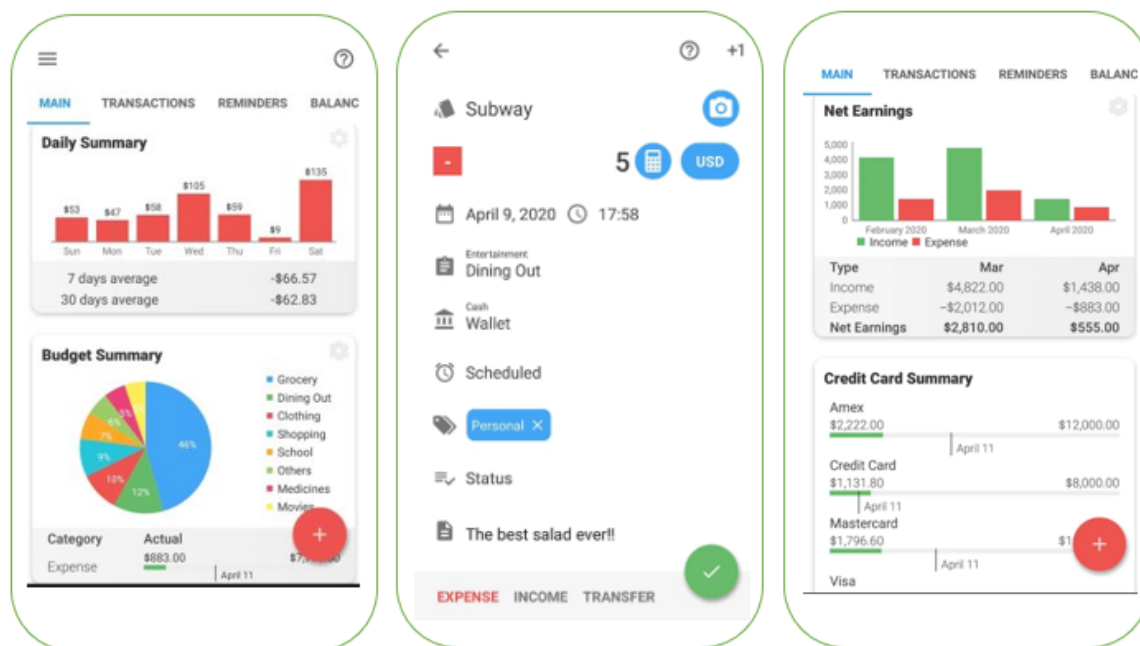


Figure 2.1.3 Bluecoins Mobile Application

Source: (Bluecoins App Review,2020)

Bluecoins is an Android-based mobile application created by Mabuhay Software. It is officially available for free on Android with lots of cool features and visual representation to make budgeting easy and fun. Blue coin provides an intuitive user interface with clean material design and visual control thoughtfully designed. This application is incredibly powerful for monitoring, planning and budgeting.

This application supports multi-currency so it is easier for users to record their transactions based on their currency. The key features of Bluecoins is able to attach photos and receipts to any transaction and able to allocate several categories of spending. There is a built-in calculator so that users do not need to exit the application and find the local calculator on their devices. In addition, the budget tool in the application can show the budget remaining or above a given period. Moreover, this application provides strong personal finance control like the current account balances and net worth can be compared at any time and graph account balances can be viewed over time. It can be a very intuitive workflow to create transactions and generate incredible financial and budget graphs and reports. For application security, users can set

CHAPTER 2 LITERATURE REVIEW

passwords or fingerprints from unauthorised access. Bluecoins allow to export of data in pdf or excel and allow customization money spent & budget categories. The weakness of this application is no debt management capability and savings tracking features.

CHAPTER 2 LITERATURE REVIEW

2.2.4 DollarBird

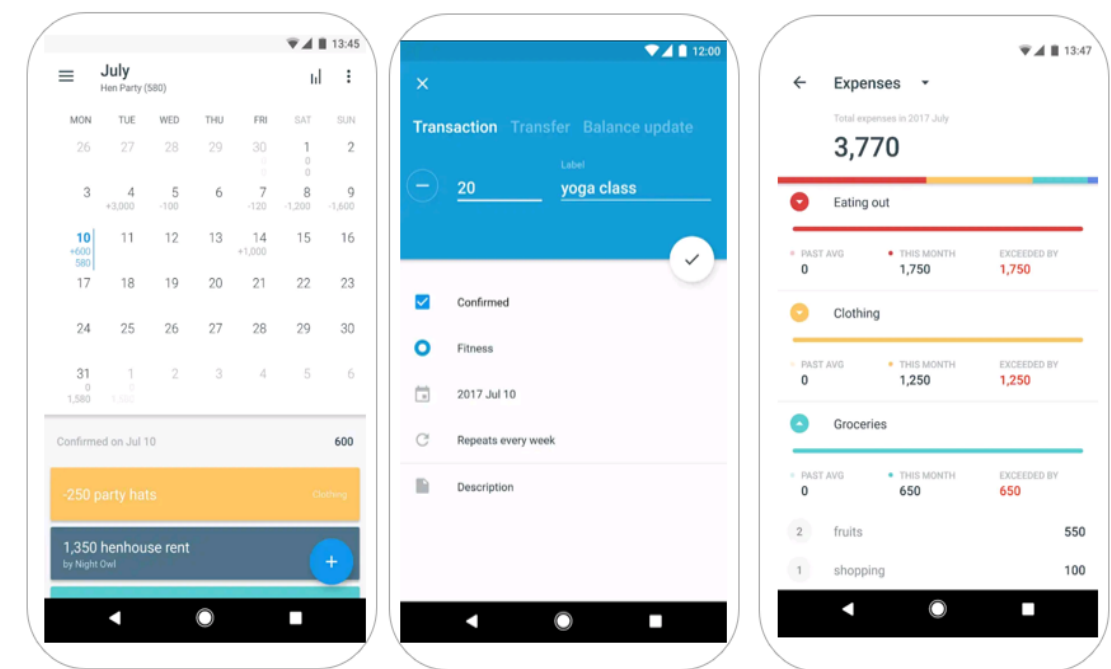


Figure 2.1.4 DollarBird Mobile Application

Source: (App Store, n.d.c)

DollarBird is a cloud-based budgeting application that is available for iOS, Android and website. The core concept behind Dollar Bird is daily cash management. It allows users to track income and expenses, as well as forecast cash flow. DollarBird mainly uses a calendar system to track users' spending and users need manual input. Dollar Bird is significantly different from other budgetary applications that track expenditures by category. Users are able to select a date from calendar and view records immediately in a-glance view of upcoming expenses.

This application is suitable for small businesses because team members can share and access calendars. This would be a helpful tool to help small businesses in tracking their financial status. The strength of this app is the features imply auto-categorization with a hint of AI to classify the entries and sort the expenses into categories. Users can always override the automatic system if they wish to change or delete the categories. Dollar Bird also lets the users export data into a CSV file which will be sent to the user via email. "They're also a reminder or alarm function, which will ping up a message whenever users are due to pay

CHAPTER 2 LITERATURE REVIEW

something. This can be set for up to four days prior to it coming out of users' account" (Paul Sawers 2013). DollarBird has a free version with a limited capacity, but even the paid version is at a reasonable price which is \$2 a month.

The weakness of DollarBird is missing budget capability, so no budget view is provided for users to view how much they spent in a category. In addition, the customer service seems to be extremely limited since there is limited contact information is given on the website itself and the Help Center page did not load any information concerning. Moreover, "all transactions have to be added and confirmed manually. There is no capacity for automatic populating of transaction activity, so this app appears to be a bit labor-intensive" (The Dough Roller 2020)

CHAPTER 2 LITERATURE REVIEW

2.1.5 Goodbudget

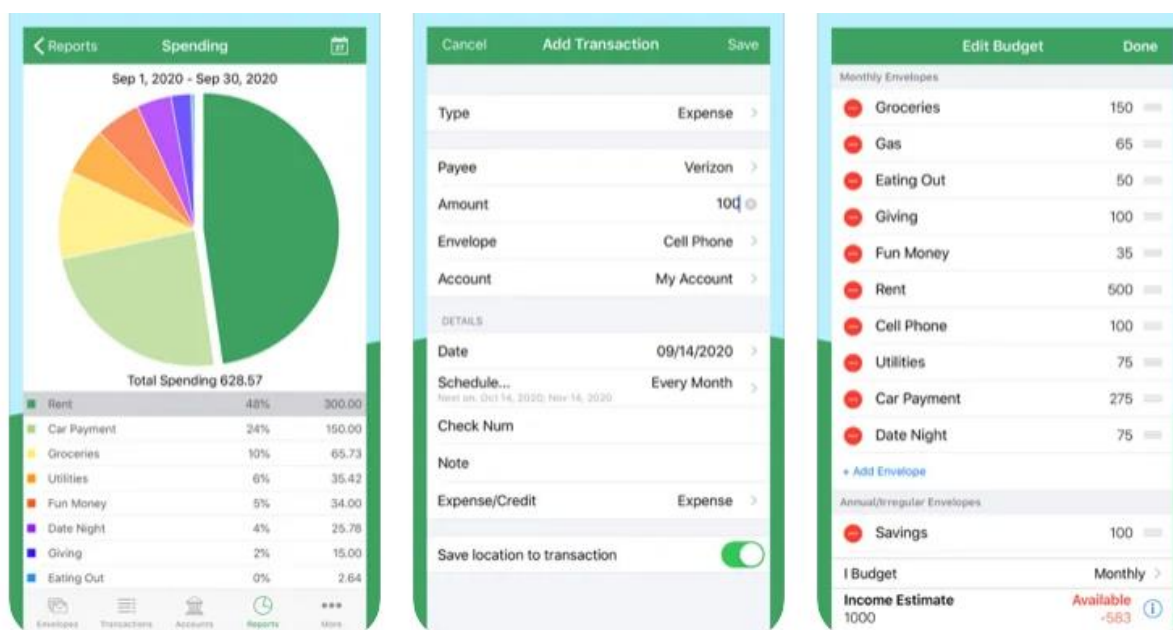


Figure 2.1.5 GoodBudget Mobile Application

Source: (App Store, n.d.d)

Goodbudget which was previously known as the Easy Envelope Budget Aid (EEBA), is a financial mobile application that is great for budget planning for a household. Goodbudget app is taking inspiration from the old-school budgeting method of storing cash for separate categories of expenses in different envelopes. The concept is simple and works well. Each time users receive a paycheck, they can break it up into envelopes to represent expenses, such as food, shopping and entertainment. Once the money in that envelope has been left, they can no longer spend it.

Goodbudget introduces an envelope budgeting into the digital world via smartphone. With this application, users can reduce their expenses and become more conscious of their purchases. Furthermore, Goodbudget allows users to run several customizable reports to track budget trends and monthly spending. Each of these is displayed in an easy-to-grok graph. One of the biggest advantages of Goodbudget is that users can create a shared budget among households across iPhone and Android devices. In addition, a good budget offers features such as the ability to set common goals, hold each other accountable, and plan their budget to ensure everyone knows what is going on.

CHAPTER 2 LITERATURE REVIEW

The weakness of GoodBudget is that it does not provide a budgeting method in the application. Although this is a free version budget planner, it gives limited free envelopes to users. If users want to use an unlimited number of envelopes and upgrade the plan, the price charges will be RM25.99 per month or RM214.99 per year for the ad-free subscription which is quite high in price. Some more, the UI design in the application is less attractive.

CHAPTER 2 LITERATURE REVIEW

2.2 Comparison between the Existing system and Proposed system

	Mint	YNAB	Bluecoins	DollarBird	Goodbudget	Proposed system
Able to add incoming and outgoing transaction	✓	✓	✓	✓	✓	✓
Able to track past transaction	✓	✓	×	✓	✓	✓
Able to filter transaction	✓	✓	✓	✓	✓	✓
Able to delete transaction	✓	✓	✓	✓	✓	✓
Able to view expenses in visualize graph	✓	✓	✓	×	✓	✓
Able to view the summary report	×	×	✓	×	×	✓
Able to customize categories spending	✓	✓	✓	✓	×	✓
Able to set reminder	✓	✓	✓	✓	×	✓
Able to set budget	✓	✓	✓	×	×	✓
Able to filter budget	✓	✓	✓	×	×	✓
Able to delete budget	✓	✓	✓	✓	✓	✓
Calculator	×	✓	×	×	×	✓
Chatbot features	×	×	×	×	×	✓
Free in charge	✓	×	✓	✓	×	✓
Able to have an own account	✓	✓	✓	✓	×	✓

Table 2.3 Comparison table

CHAPTER 3 SYSTEM METHODOLOGY/APPROACH

CHAPTER 3: SYSTEM METHODOLOGY/APPROACH

3.1 System Design Diagram/ Overview

3.1.1 System Architecture Diagram

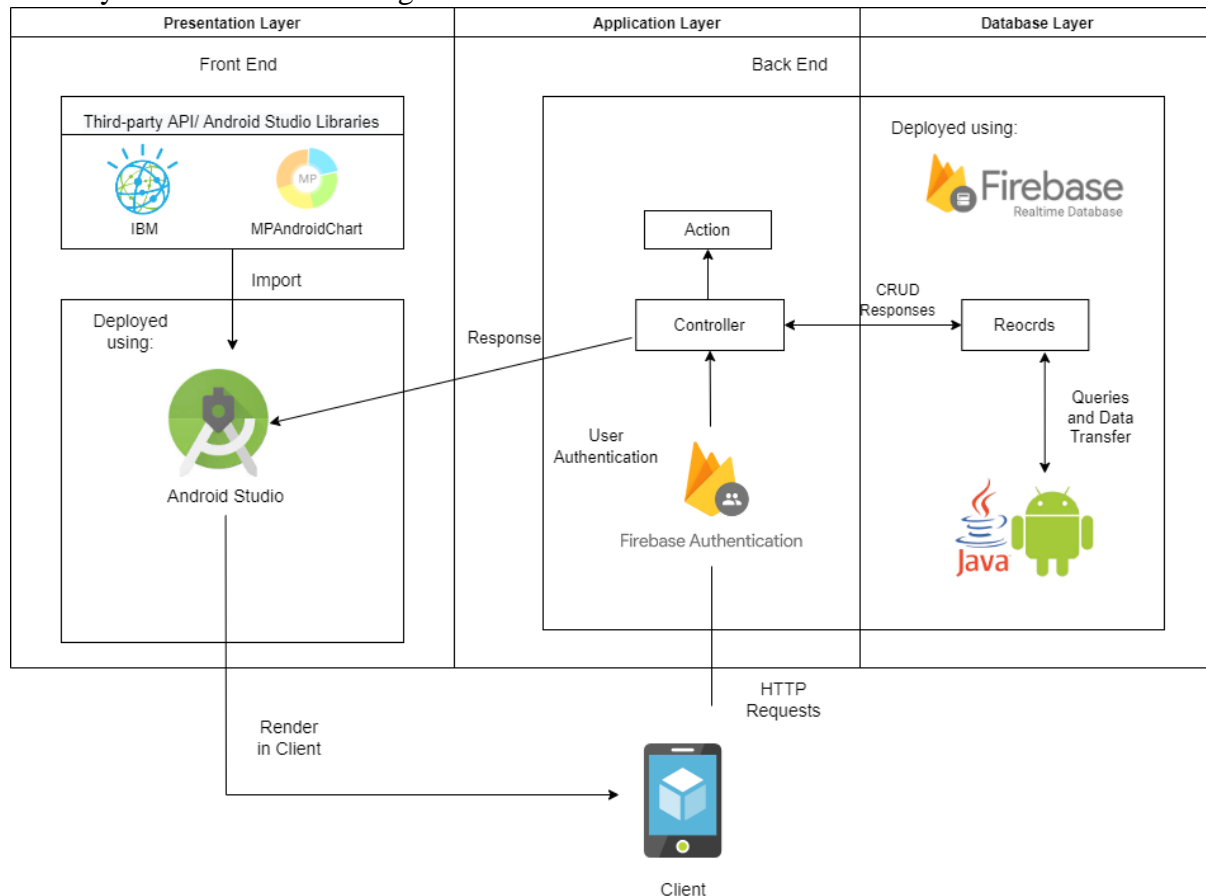


Figure 4.1.1. System Architecture Diagram

Figure 3.1.1 shows the system architecture of my proposed system. The mobile device acts as a user. This application interacts with two APIs which are IBM Watson Assistant Chatbot and MPAndroid Chart. For example, when a user adds a transaction from user interface (Presentation Layer), data will go to the Application Layer first. After the data is validated, it will pass to the Database Layer and insert the data into Firebase Realtime Database. Vice versa, if user wants to retrieve a transaction from the Realtime Database, the request will be processed by the Application Layer first. But before that, user needs to submit the credential info for account verification first via Firebase Authentication. After the request is validated, the request will be sent to the Database Layer and forwarded to the Firebase server to fetch the necessary

CHAPTER 3 SYSTEM METHODOLOGY/APPROACH

records. The wanted records are loaded by the Database Layer and passed it back to the Application Layer then the Application Layer will pass those records to the Presentation Layer and deploy the application using Android Studio. The content will finally load into the Client's device.

CHAPTER 3 SYSTEM METHODOLOGY/APPROACH

3.1.2 Use Case Diagram and Description

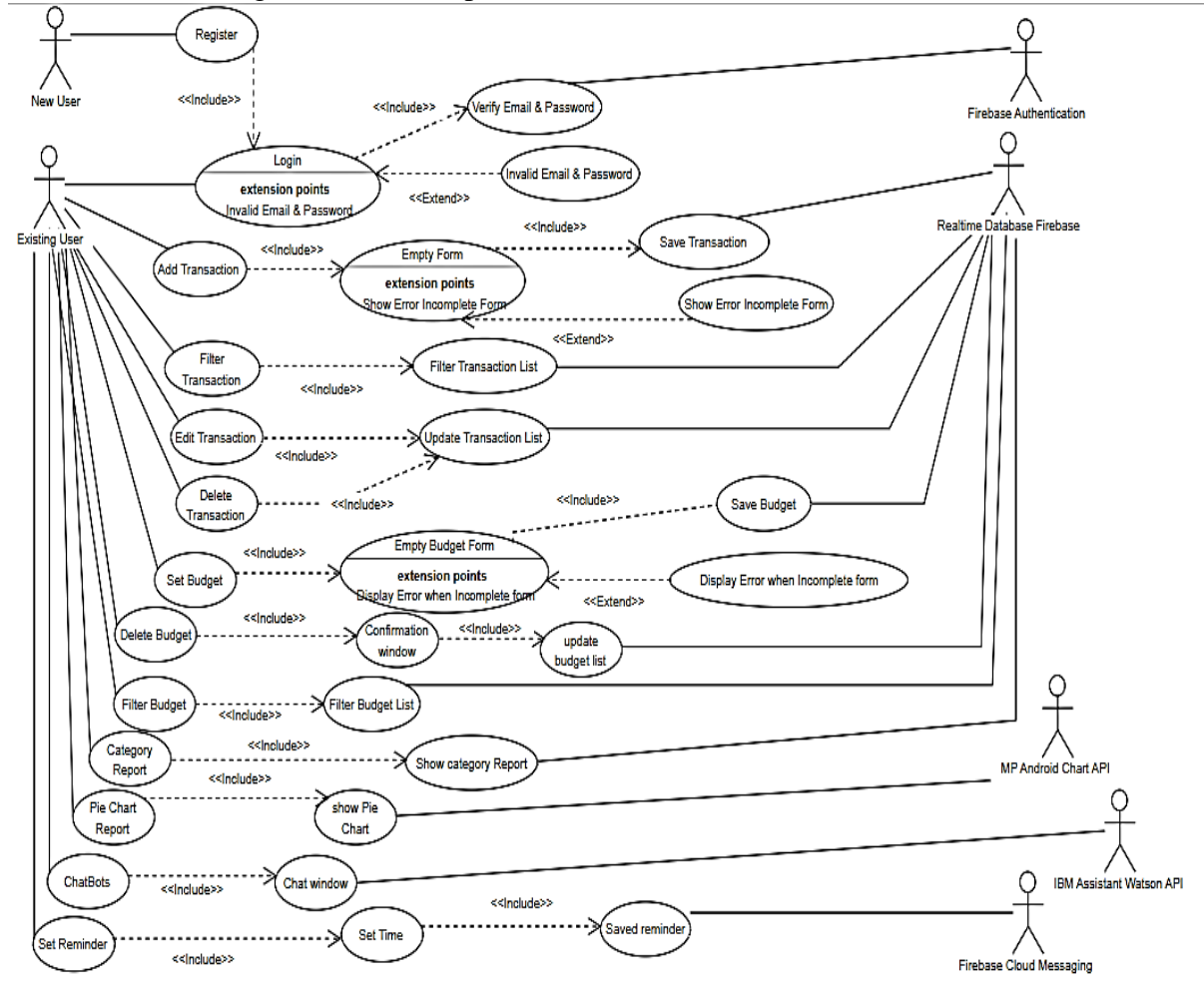


Figure 3.1.2 Use Case Diagram

Use case	Register
Aim	Check if user is an existing user. If user is not an existing user, user needs to register an account.
Actor	New user
Trigger	When user clicks the register button
Main Flow	<ol style="list-style-type: none"> 1. Direct user to register activity. 2. User enters and submits the email and password. 3. Direct user to the home page of the application. 4. The use case ends.
Alternate Flow	none

Table 3.1.2.1 –Register use case description

CHAPTER 3 SYSTEM METHODOLOGY/APPROACH

Use case	Login
Aim	Check credential information matches with the user records in Firebase Authentication or not
Actor	Existing user
Trigger	When application started
Main flow	<ol style="list-style-type: none"> 1. User enters their email and password. 2. System verifies the user's email and password. 3. Direct user to the home activity of the application. 4. The use case end.
Alternate flow	2a. Invalid email and password <ol style="list-style-type: none"> 1. System display Invalid Credential Information. 2. System prompt for email and password. 3. Use case resume at main flow step 1.

Table 3.1.2.2– Login use case description

Use case	Add Transaction
Aim	To insert incoming and outgoing expenses.
Actor	New and Existing user
Trigger	Insert button is clicked
Main flow	<ol style="list-style-type: none"> 1. User Fill in and submit the transaction details. 2. System validates the transaction details. 3. System displays the transaction on the page. 4. The use case end.
Alternate flow	1a. Missing information details <ol style="list-style-type: none"> 1. System prompts user for the missing column. 2. Use case resume at main flow step 1.

Table 3.1.2.3 – Add Transaction use case description

CHAPTER 3 SYSTEM METHODOLOGY/APPROACH

Use case	Filter Transaction
Aim	To filter specific transactions through a date
Actor	New and Existing user
Trigger	When user clicks on the date on the toolbar
Pre-condition	When user at home page
Main flow	<ol style="list-style-type: none"> 1. User selects a date from the date picker 2. System filters the transactions and displays the match transaction on the page. 3. The use case ends.
Alternative flow	None.

Table 3.1.2.4 – Filter Transaction use case description

Use case	Edit Transaction
Aim	To update the transactions
Actor	New and Existing user
Trigger	When user clicks the update button
Pre-condition	When user at home page
Main flow	<ol style="list-style-type: none"> 1. User updates and submits the transaction details. 2. System validates the transaction details. 3. System displays the updated transaction list on the page. 4. The use case end.
Alternative flow	None.

Table 3.1.2.5 – Edit Transaction use case description

Use case	Delete Transaction
Aim	To delete the transactions
Actor	New and Existing user
Trigger	When user clicks the delete button
Pre-condition	User click confirm to delete
Main flow	<ol style="list-style-type: none"> 1. User confirms to delete the transaction 2. System deletes the transaction from database.

CHAPTER 3 SYSTEM METHODOLOGY/APPROACH

	<ol style="list-style-type: none"> 3. System displays the updated transaction list on the page. 4. The use case end.
Alternative flow	None

Table 3.1.2.6 – Delete Transaction use case description

Use case	Add Budget
Aim	To insert a budget to limit spending.
Actor	New and Existing user
Trigger	When user clicks add button on the toolbar
Main flow	<ol style="list-style-type: none"> 1. User fills in and submits the budget details. 2. System validates the budget details. 3. System displays the budget set on the page. 4. The use case end.
Alternative flow	1a. Missing information details <ol style="list-style-type: none"> 1. System prompts user for the missing column. 2. Use case resume at main flow step 1.

Table 3.1.2.7 – Add budget use case description

Use case	Delete Budget
Aim	To delete the inserted budget.
Actor	New and Existing user
Trigger	When user swipe left to delete
Pre-condition	User click confirm to delete
Main flow	<ol style="list-style-type: none"> 1. User confirms to delete the budget. 2. System deletes the budget from the database. 3. System displays the updated budget list on the page. 4. The use case end.
Alternative flow	None.

Table 3.1.2.8 – Delete budget use case description

CHAPTER 3 SYSTEM METHODOLOGY/APPROACH

Use case	Filter Budget
Aim	To filter budget on a weekly, monthly and annual basis.
Actor	New and Existing user
Trigger	When user clicks the budget setting button
Pre-condition	None
Main flow	<ol style="list-style-type: none"> 1. User selects a period from the setting. 2. System filters the transactions and displays the match transaction on the page. 3. The use case ends.
Alternative flow	None.

Table 3.1.2.9 – Filter budget activity use case description

Use case	Category Report
Aim	Give a full insight of expenses and income and balance in the report
Actor	New and Existing user
Trigger	When user at the Report page and selects the summary report
Pre-condition	None.
Main flow	<ol style="list-style-type: none"> 1. System auto sums up and calculates the total expenses, total income, net earnings and displays them on the page. 2. System displays the report on the page. 3. The use case ends.
Alternative flow	None.

Table 3.1.2.10 – Category Report activity use case description

Use case	Pie Chart Report
Aim	Give a full insight of expenses and income and balance in Pie Chart form
Actor	New and Existing user
Trigger	When user at the report page and selects pie chart report
Pre-condition	None.

CHAPTER 3 SYSTEM METHODOLOGY/APPROACH

Main flow	<ol style="list-style-type: none"> 1. System auto sums up and calculates the total expenses, total income, net earnings and displays them on the page. 2. System displays the Pie Chart on the page. 3. The use case ends.
Alternative flow	None.

Table 3.1.2.11 – Pie Chart Report activity use case description

Use case	Chatbots
Aim	As customer support and finance assistant to assist users.
Actor	New and Existing user
Trigger	When user at focuses on the chat window
Pre-condition	None.
Main flow	<ol style="list-style-type: none"> 1. System sends greeting message to user. 2. User sends a message to system. 3. System validates input text. 4. System finds keywords from question bank. 5. System replies to user. 6. The use case ends.
Alternative flow	<p>3a. Missing inputs text</p> <ol style="list-style-type: none"> 1. System prompts user to type message. 2. Use case resumes at flow step 1.

Table 3.1.2.12 – Chatbot activity use case description

Use case	Log In Reminder
Aim	To remind user to log in account.
Actor	New and Existing user
Trigger	When user last login is 2 days ago.
Main flow	<ol style="list-style-type: none"> 1. System verifies the last active day. 2. System sends push notifications to user.
Alternative flow	None.

Table 3.1.2.13 – Log in Reminder activity use case description

CHAPTER 3 SYSTEM METHODOLOGY/APPROACH

3.1.3 Activity Diagram

- Login Activity

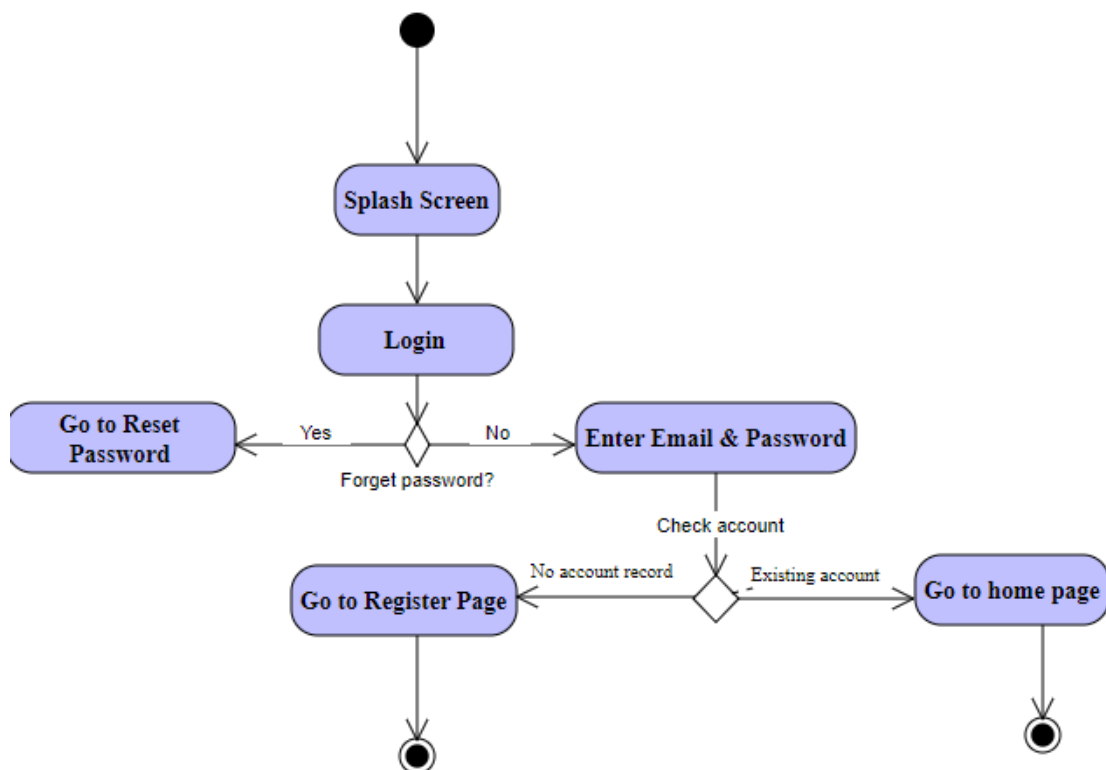


Figure 3.1.3 Login Activity Diagram

When user starts the application, system will come to the splash screen. After a second, system will show the login screen where user needs to fill in the email& password. If user forgets the password, user can go to Reset password Activity to reset their password. Else, system will check the account existence of the login user. If the account is found, user will be directed to the home page.

CHAPTER 3 SYSTEM METHODOLOGY/APPROACH

- Transaction Activity

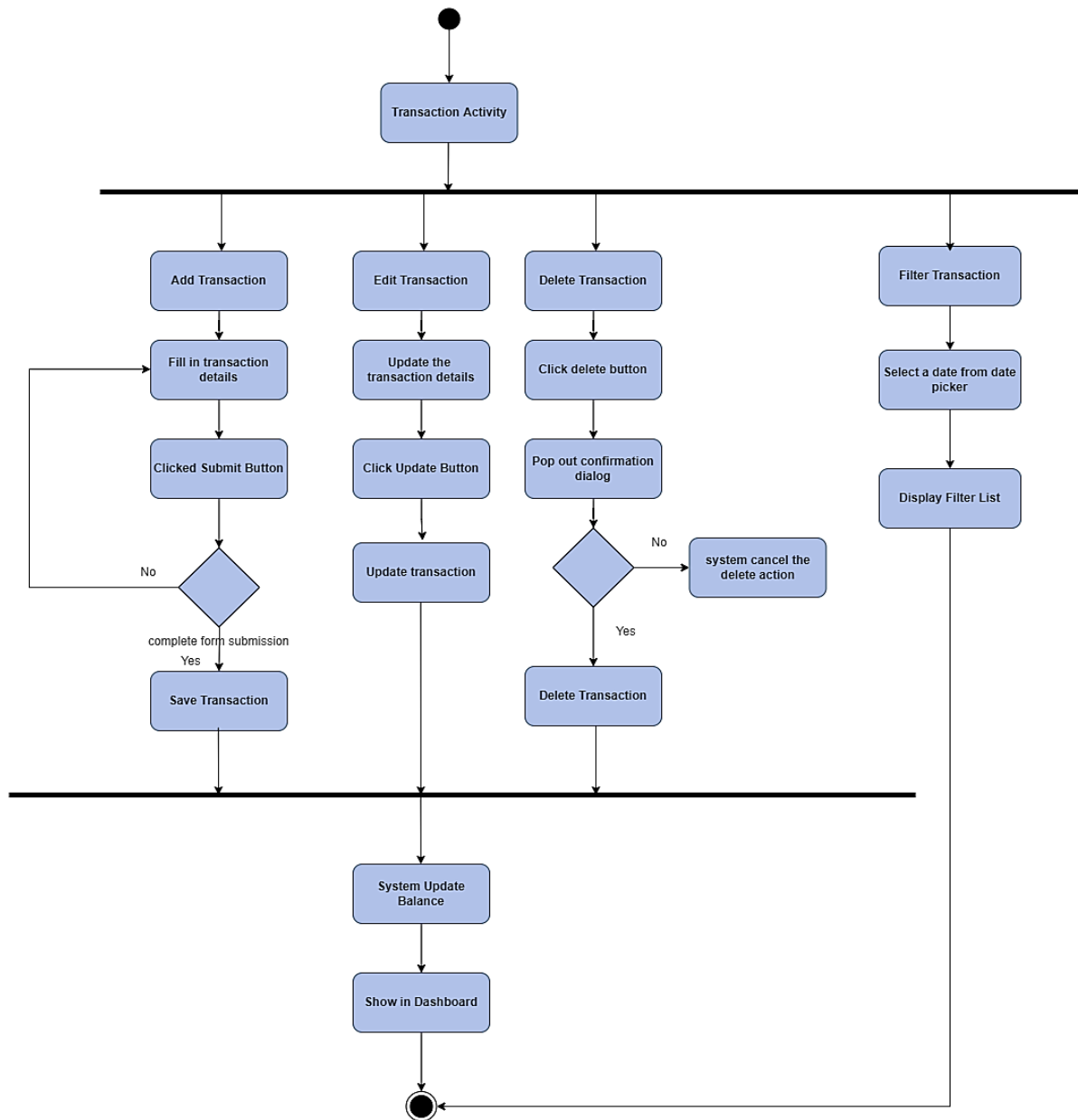


Figure 3.1.4 Add Transaction Activity Diagram

When add transaction button is pressed, system will show a form to let user fill in the information such as transaction amount, transaction category, date and transaction description. When user click add button, the system will stop user from submitting the incomplete form and ask user to refill it again. It continues to loop until a complete form is submitted. The complete form submission will be saved as a new entry of the transaction in the database. If user wants to edit the transaction, user needs to fill in the updated information and click the update button.

CHAPTER 3 SYSTEM METHODOLOGY/APPROACH

System will update and replace the new info with the original info. If user wants to delete the transaction, when user clicks the delete button, a confirmation box will pop out to get a confirmation message on the deletion action. If user click yes, the transaction will be deleted, else system will cancel the delete action. These three actions will trigger the system to update the balance from time to time according to the deletion, insertion and edition of transaction done by the user. A balance summary will show on the dashboard of the home page. Besides, user can filter transactions by selecting a date from the date picker. System will auto compute the transactions that match the date and show the filtered list on the home page of the application

CHAPTER 3 SYSTEM METHODOLOGY/APPROACH

- Budget Activity

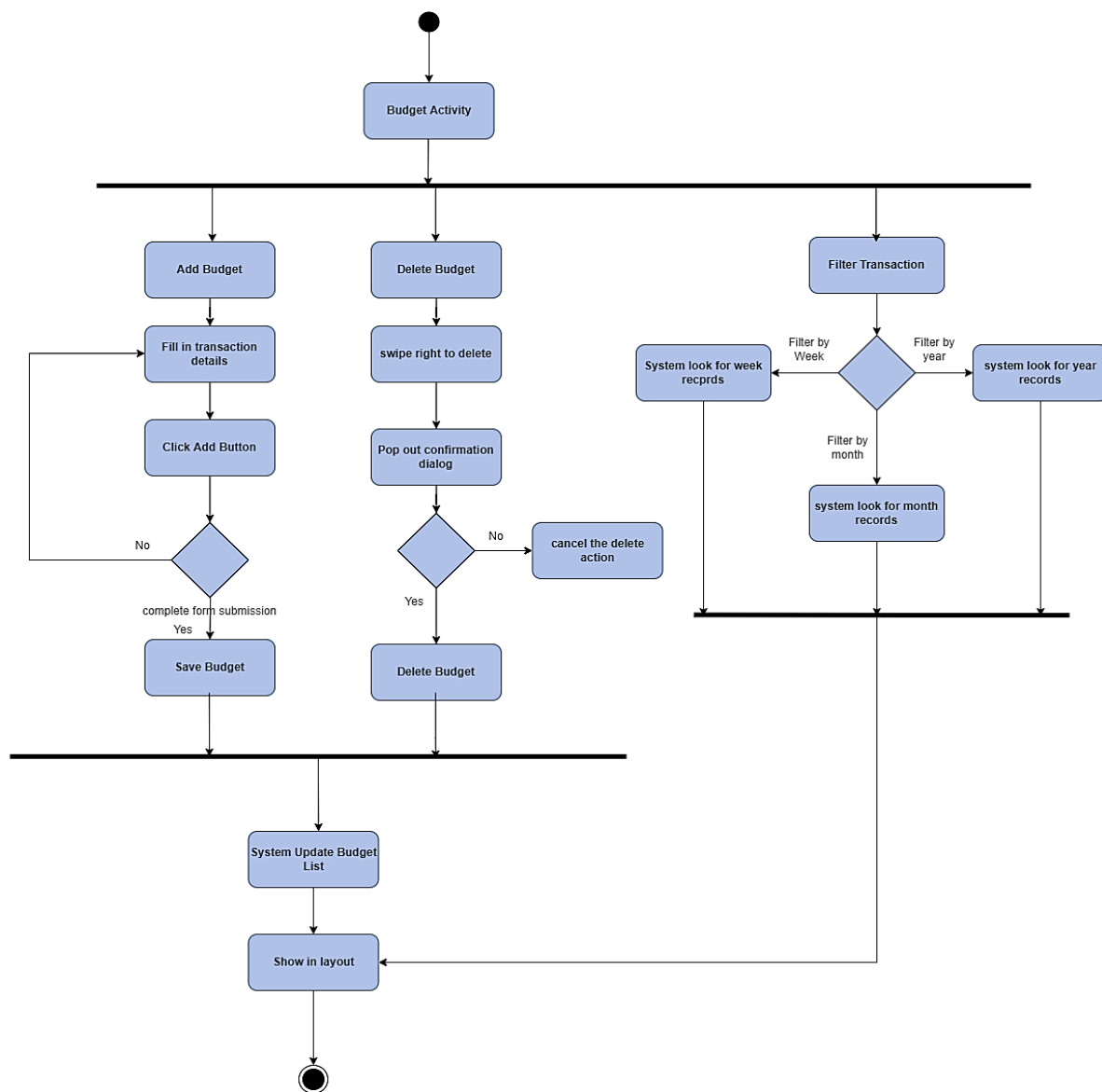


Figure 3.1.5 Budget Activity Diagram

When user clicks add budget button from the toolbar of the budget page, system will show a form to let user fill in the budget information. System will stop user from submitting the incomplete form and ask user to refill it again. It continues to loop until a complete form is submitted. The complete form submission will be saved as a new budget in the database. The budget can be deleted by swiping left to delete. Then, a confirmation dialog will pop out to double confirm with the user on the deletion action. If user select “Yes”, the selected goal will be deleted, and then the budget list will be updated. If user select “cancel”, system will cancel

CHAPTER 3 SYSTEM METHODOLOGY/APPROACH

the action. User is able to filter transactions by week, month and year. The system will update the list based on user selection. Lastly, it will show the filtered budget list in the layout.

- Report Activity

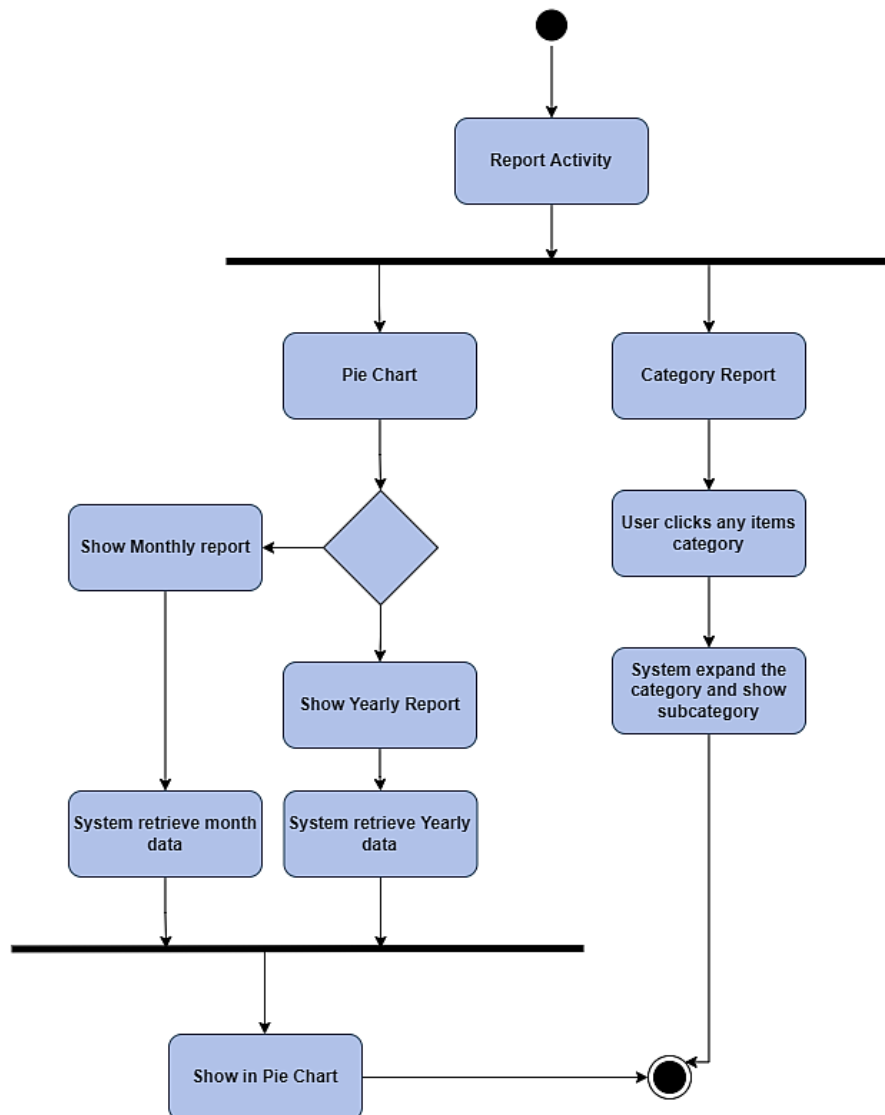


Figure 3.1.6 Report Activity Diagram

User can perform two actions which are view report in a pie chart or view it in a category report. When user wants to view the pie chart, user can select to view in a monthly or yearly basis. The system will retrieve the data according to user selection. The data will then be gathered and formed in a pie chart form to display in the layout. If user selects a category report, an overview report that includes the total amount spent, total amount earned, and net balance will show in a list form. When user clicks on any category from the report, system will show the

CHAPTER 3 SYSTEM METHODOLOGY/APPROACH

past transaction that is categories under the particular subcategory. Lastly, the system will show on the layout.

- Chatbot Activity

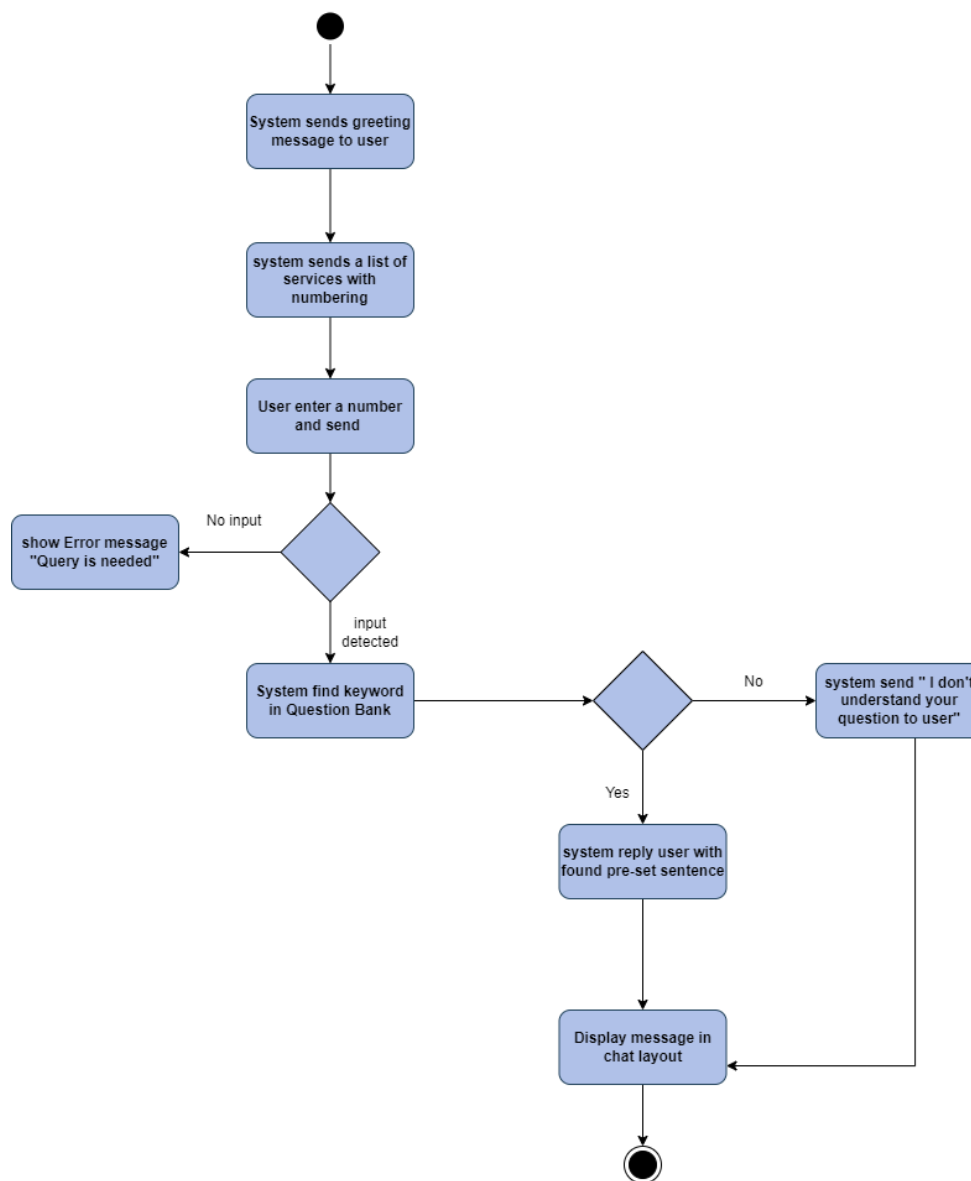


Figure 3.1.7 Chatbot Activity

Come to the Chatbot Activity, user will welcome by a greeting message from system, followed by a number of question selections for user. After user inputs a number, system will check if the user clicks send button without input or not. If user sends without inputs, an error message will show and remind user to key in input before sending a message. Else if the user sends input, system will reply to user with a predefined sentence when keyword found in Question bank. If no keyword is found, system will send “I don’t understand your question” to user.

CHAPTER 4 SYSTEM DESIGN

CHAPTER 4: SYSTEM DESIGN

4.1. System Block Diagram

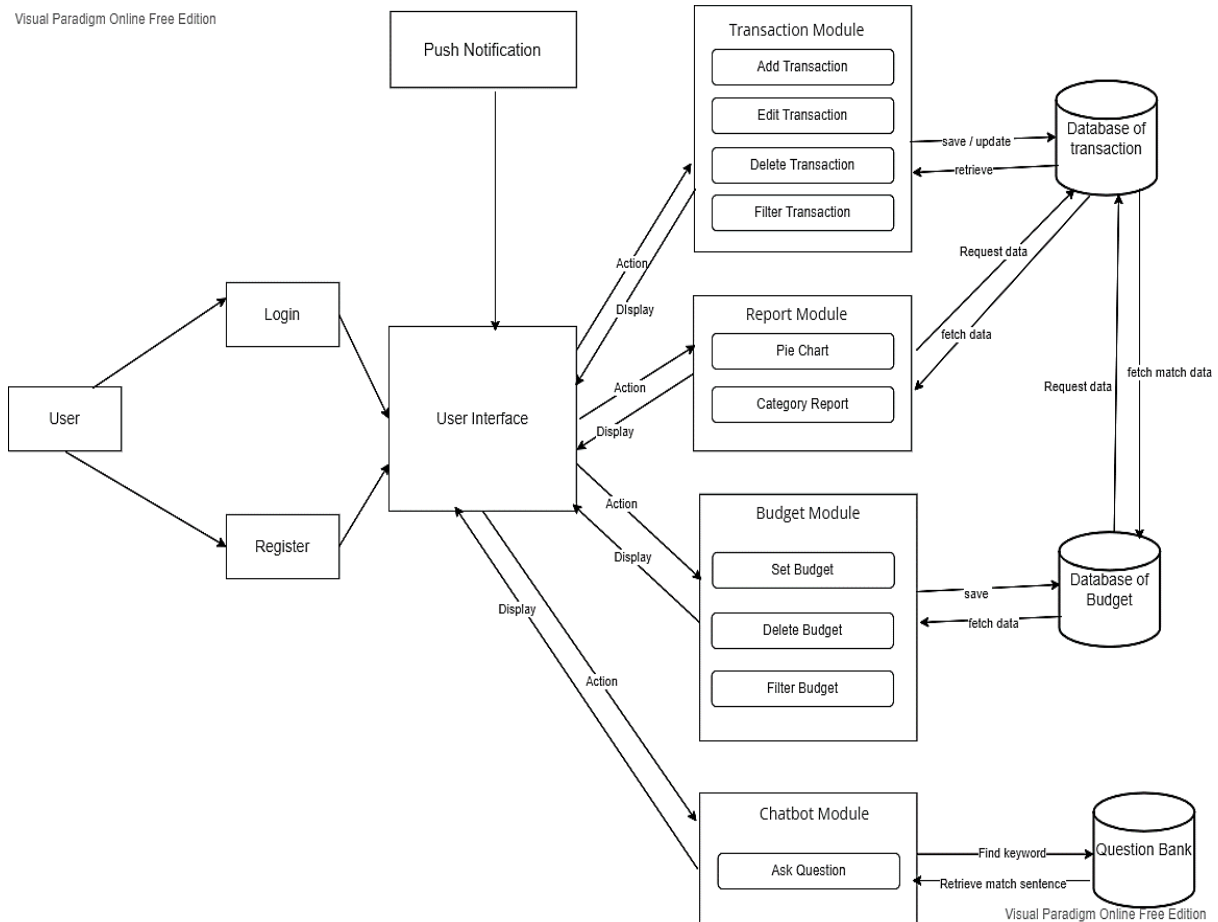


Figure 4.1 System Block Diagram

Figure 4.1 shows the system block diagram of the proposed system. Firstly, the user needs to log in or register an account before entering the application. After that, user will be guided to the main page of the application. This application contains FOUR modules which are the transaction module, report module, budget module and chatbot module. Therefore, user is provided with four activities to choose. For Transaction Module, there are four actions that can be taken by the user, which are add transaction, edit transaction, delete transaction and

CHAPTER 4 SYSTEM DESIGN

filter transaction. All the actions will be stored and updated in the first database, Transaction database. The data will be retrieved back from firebase and shown in the user interface.

For Report Module, there are two actions that can be taken by the user, which are Pie Chart Report and Category Report. Report Module will request to access the Transaction Database and fetch the match dataset back to the module to form a visualize graph and show it on the interface. Both types of reports will go the same flow for retrieving and transforming data and show in on the interface.

For Budget Module, there are three actions that can be taken by the user, which are set budget, delete budget and filter budget. All the actions will save to the second database, Budget Database. At the same time, the set budget activity will request to access the Transaction Database and fetch the match transaction records based on category. The records will be retrieved back to the budget module to indicate the progress bar ongoing value and show on the interface. For filter budget, it only needs to access the budget database and retrieve the matched records and show them on the interface.

For Chat Module, only one action can be taken by the user, which is asking the questions. The whole sentences sent will match with the Question bank to find match keywords. The question bank will retrieve the match sentence to the sender and show it on the interface. The push notification will be push to the interface from the cloud.

CHAPTER 4 SYSTEM DESIGN

4.2 System Flowchart Diagram

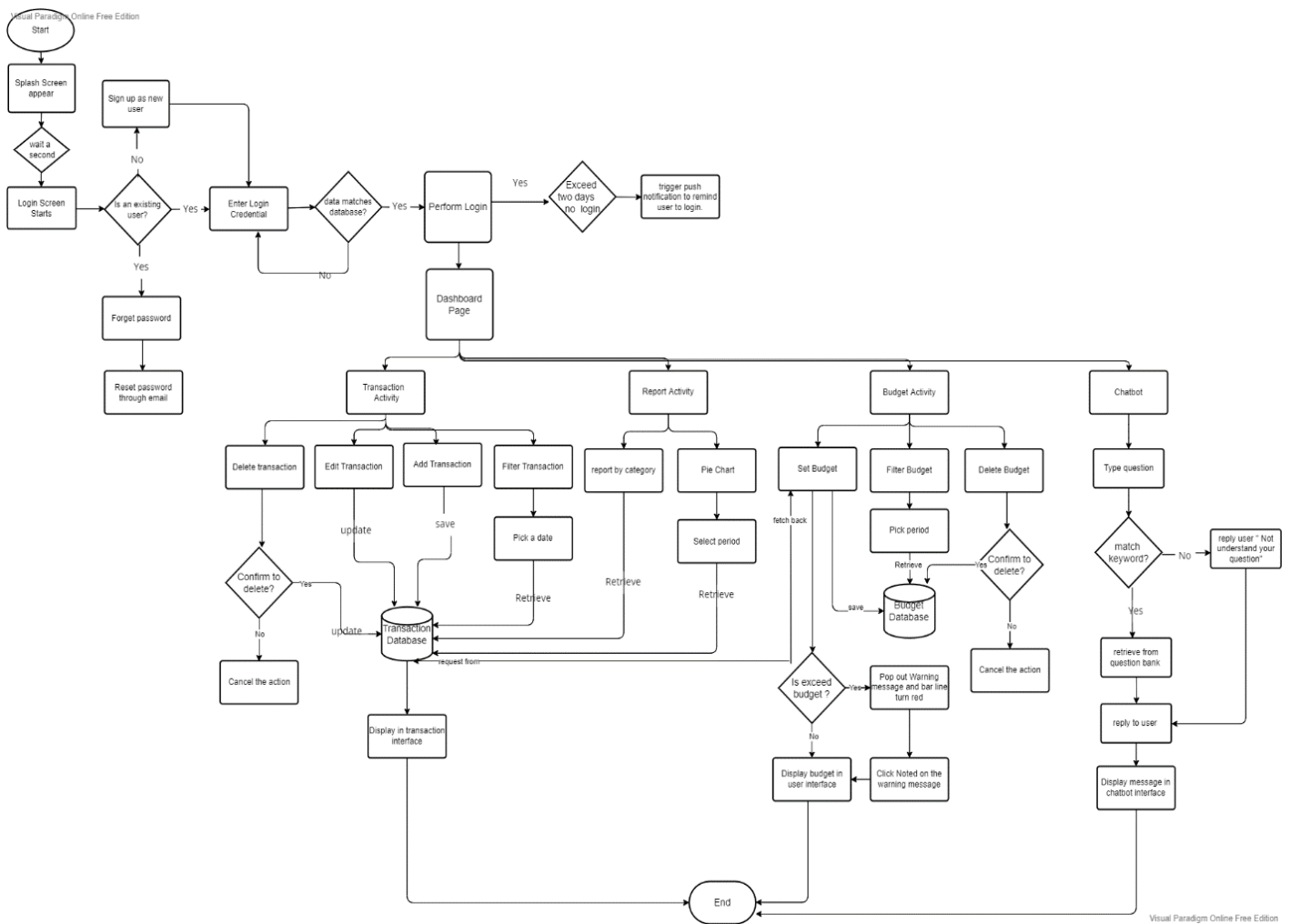


Figure 4.2 System Flowchart Diagram

Figure 4.2 shows the System Flowchart diagram for this proposed system. The system flow starts with an animated splash screen. It will come to the Login screen where user needs to enter a password and email to log in to the account. Firebase Authentication will check whether the user is an existing user. If the user is a new user, user needs to register an account. Meanwhile, if the user is an existing user but they forget their password, they are required to reset the password with email. If the user is an existing user and under the condition where the credential details match with the user records in Firebase Authentication, only then they will successfully login into the dashboard page. Else, they will need to re-login again with the correct email and password. After login into the account, user is welcomed by the dashboard page. There are four activities selection under the bottom navigation bar. If user is being

CHAPTER 4 SYSTEM DESIGN

detected by the system where the last login expired 2 days, the system will send a push notification to the user's device to alert them log in to the application.

Transaction Activity Flow:

If the user selects transaction activity from the bottom navigation bar, user can perform add/edit/delete/filter transactions. If user wants to add a transaction, the transaction details will be stored in the first database, the Transaction database and display the added transactions to the interface. If user wants to edit a transaction, the updated information will be stored and replaced with the original information that was stored in the transaction firebase previously. The updated transaction will be retrieved from the transaction database and displayed on the interface. If user wants to delete the transaction, the selected row of the transaction will be deleted from the transaction database and the deleted transaction will not show in the interface. If user wants to filter the transaction, user needs to pick a date from the calendar picker. The matching records from firebase will fetch back to the interface.

Report Activity Flow:

If user selects report activity from the bottom navigation bar, user can either view report in pie chart form or report by category form. If user wants to view the report in pie chart form, user can filter the report by month or year. The matching transaction will be retrieved from the transaction database and shown in the form of a Pie Chart. If user wants to view the report by category, the matching transaction will be retrieved from the transaction database and shown row by row.

Budget Activity Flow:

If user selects budget activity from the bottom navigation bar, user will set the budget by filling in the budget amount together with the wanted category. The budget set will be saved in the second database, Budget Database. At the same time, system will access to the transaction database and retrieved back all the matched transactions and check if the total amount spent exceed the budget set amount or not. The progress bar will show in yellow colour once the user has started to spend on that particular category. Meanwhile, the progress bar will show in red colour when the budget is exceeded. A reminder dialog will pop, if user clicked "Noted" button, the dialog message will disappear which indicates that the user is alert to the budget exceeding

CHAPTER 4 SYSTEM DESIGN

message. If the specific category amount spent has not yet exceeded the budget amount set, no action will be taken by the system until it hit the budget set.

Chatbot Activity Flow:

If user selects Chatbot activity from the bottom navigation bar, the system will bring user to the dialog interface. Chatbot will auto send the greeting message first that set by default. After that, user needs to type a question in the textbox and send the message. The system will detect the matching keyword from the question bank. If the keyword was found from the question bank, the pre-set answer will reply to the user. If no keyword was found from the sender's message, the system will reply "I do not understand your question" to the user.

CHAPTER 4 SYSTEM DESIGN

4.3 System Components Specifications

• Report Activity Class Diagram

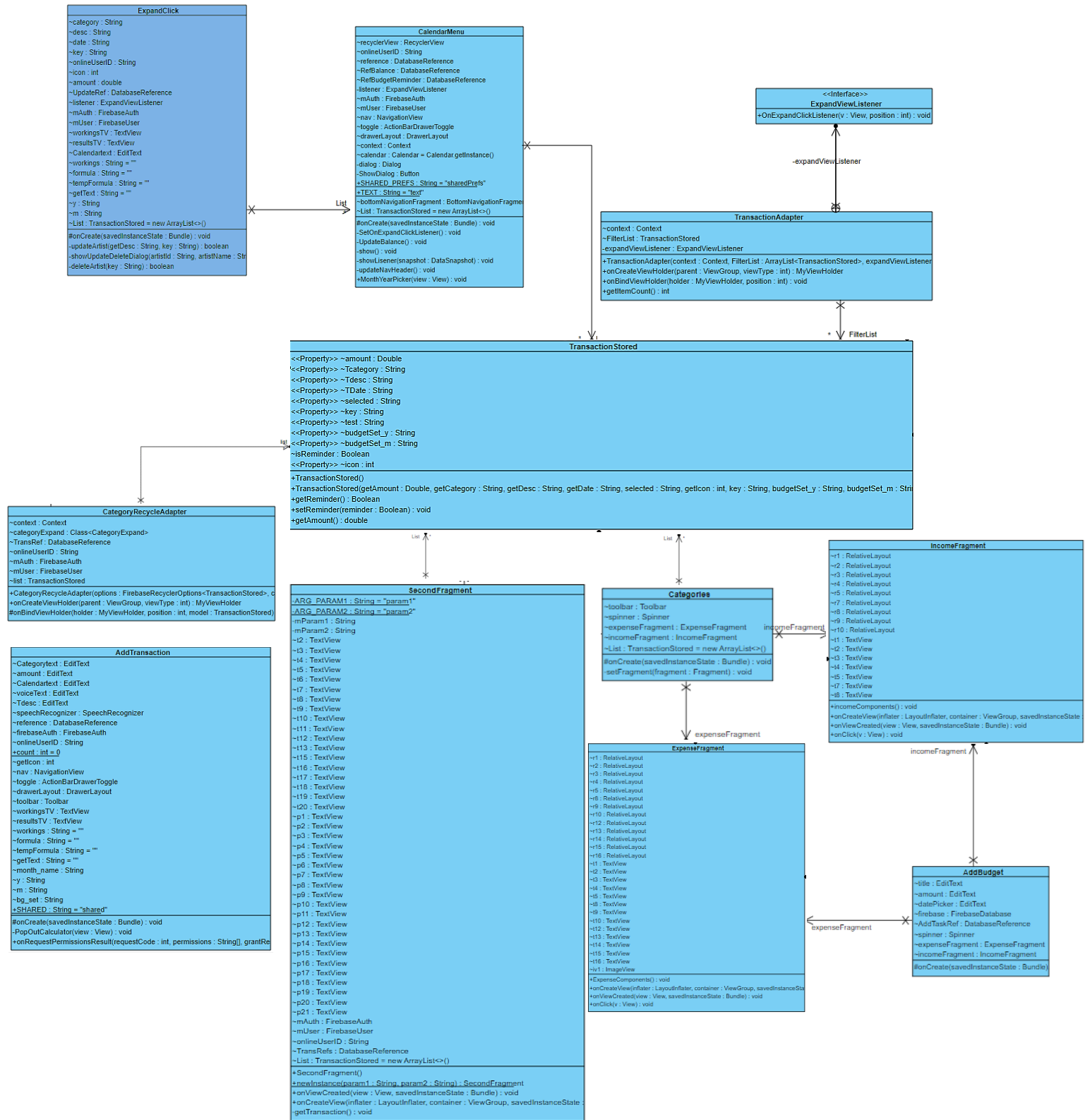


Figure 4.3 Report Activity Class Diagram

CHAPTER 4 SYSTEM DESIGN

The diagram above is the class diagram for the Report Activity. The class and method used in the program are as below:

- **Fragment:**

Expense Fragment	A sub-activity is used to display transactions under the expense category on a page.
Income Fragment	A sub-activity is used to display transactions under the income category on a page

- **Interface:**

ExpandView Interface	Call onlickListener method when the view (component) is clicked.
----------------------	--

- **Adapter:**

CategoryRecycler Adapter	Act as a bridge between transaction stored model class and Second Fragment.
Transaction Adapter	Act as a bridge between transaction stored model class and Calendar menu class.

- **Model:**

Transaction Stored	A class that holds transaction data.
--------------------	--------------------------------------

- **Class activity:**

CalendarMenu	Perform onCreate() method
AddTransaction	Perform onCreate() method
Categories	Perform onCreate() method
AddBudget	Perform onCreate() method
ExpandClick	Perform onCreate() method

CHAPTER 4 SYSTEM DESIGN

- Budget Activity Class Diagram

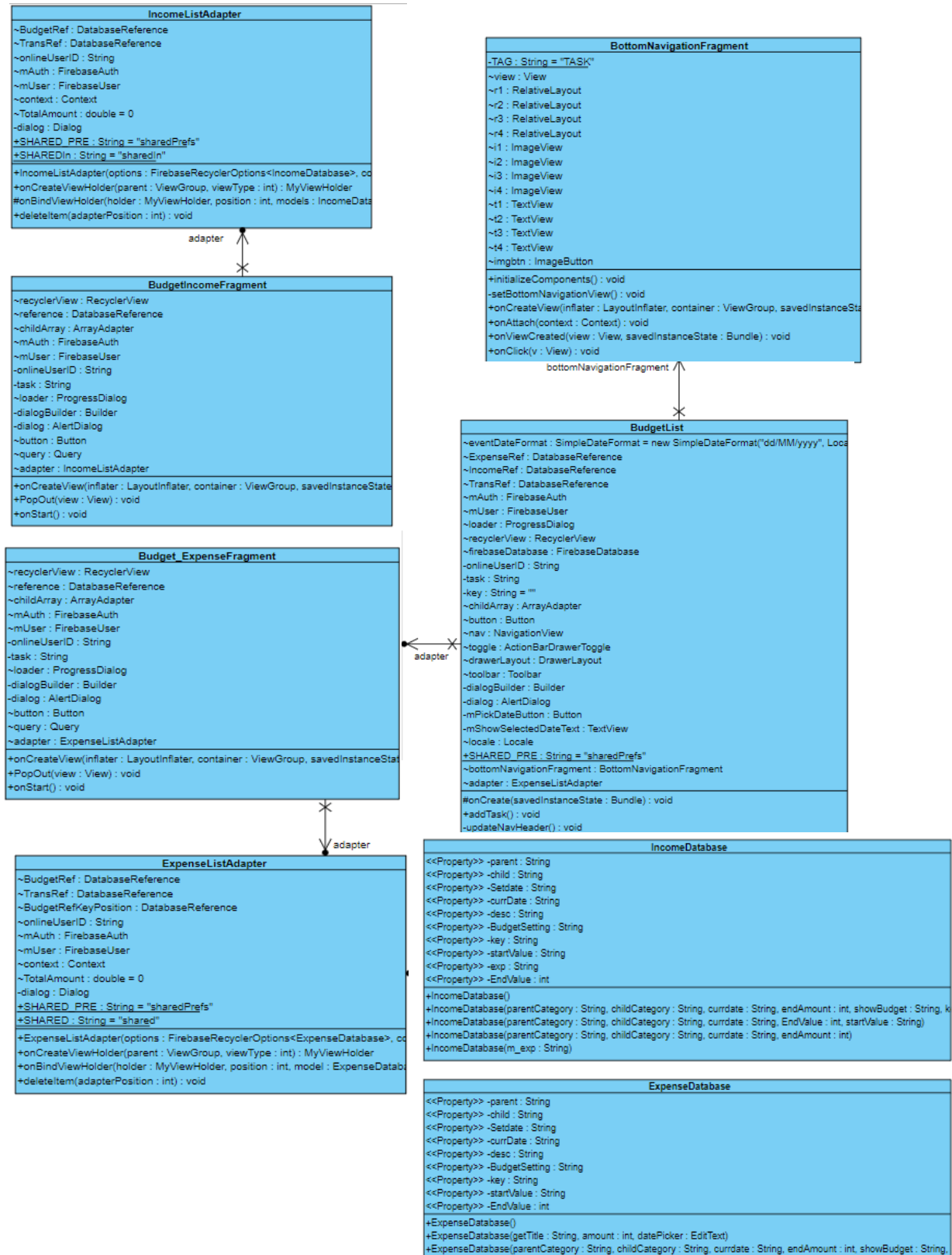


Figure4.4 Budget Activity Class Diagram

CHAPTER 4 SYSTEM DESIGN

The diagram above is the class diagram for Budget Activity. The class and method used in the program are as below:

- Fragment:

Budget Income Fragment	A sub-activity is used to display the budget under the income category on a page.
Budget Expense Fragment	A sub-activity is used to display the budget under the expense category on a page.

- Adapter:

IncomeList Adapter	Act as a bridge between IncomeDatabase model class and Budget Income Fragment.
ExpenseList Adapter	Act as a bridge between ExpenseDatabase model class and Budget Expense Fragment.

- Model:

ExpenseDatabase	A class that holds the budget data for expense.
IncomeDatabase	A class that holds budget data for income

- Class activity:

BudgetList	Perform onCreate() method
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CHAPTER 4 SYSTEM DESIGN

- Transaction Activity Class Diagram

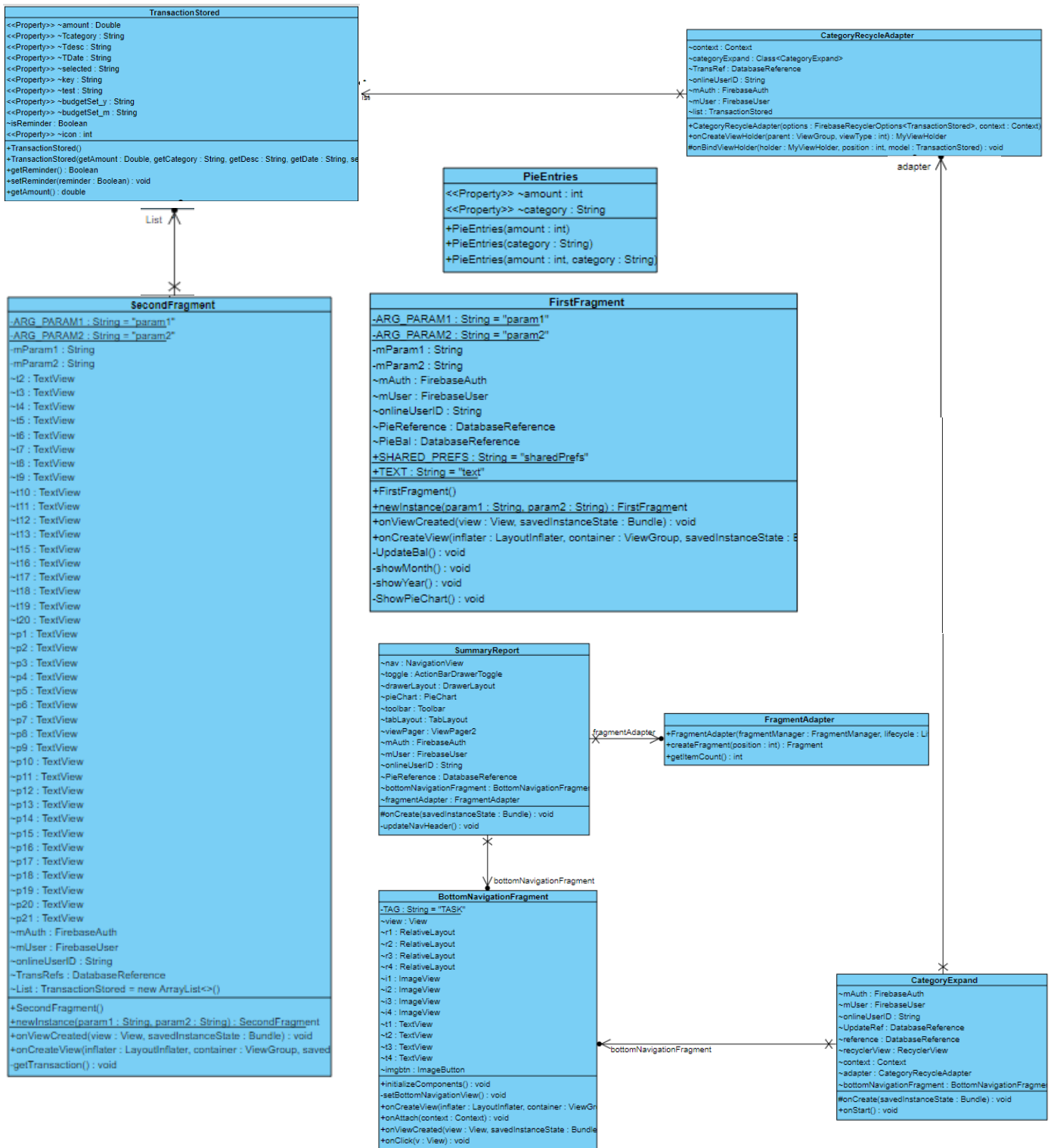


Figure 4.5 Transaction Activity Class Diagram

CHAPTER 4 SYSTEM DESIGN

The diagram above is the class diagram for Transaction Activity. The class and method used in the program as below:

- **Fragment:**

First Fragment	A sub-activity is used to display the budget under the income category on a page.
Second Fragment	A sub-activity is used to display the budget under the expense category on a page.

- **Adapter:**

Fragment Adapter	Act as a bridge between Summary report class activity and First and Second Fragment.
CategoryRecycler Adapter	Act as a bridge between Transaction Stored model class and CategoryExpand class activity.

- **Model:**

PieEntries	A class that holds pie chart data.
Transaction Stored	A class that holds transaction data.

- **Class activity:**

CategoryExpand	Perform onCreate() method
Summary Report	Perform onCreate() method

CHAPTER 4 SYSTEM DESIGN

- Chatbot Activity Class Diagram

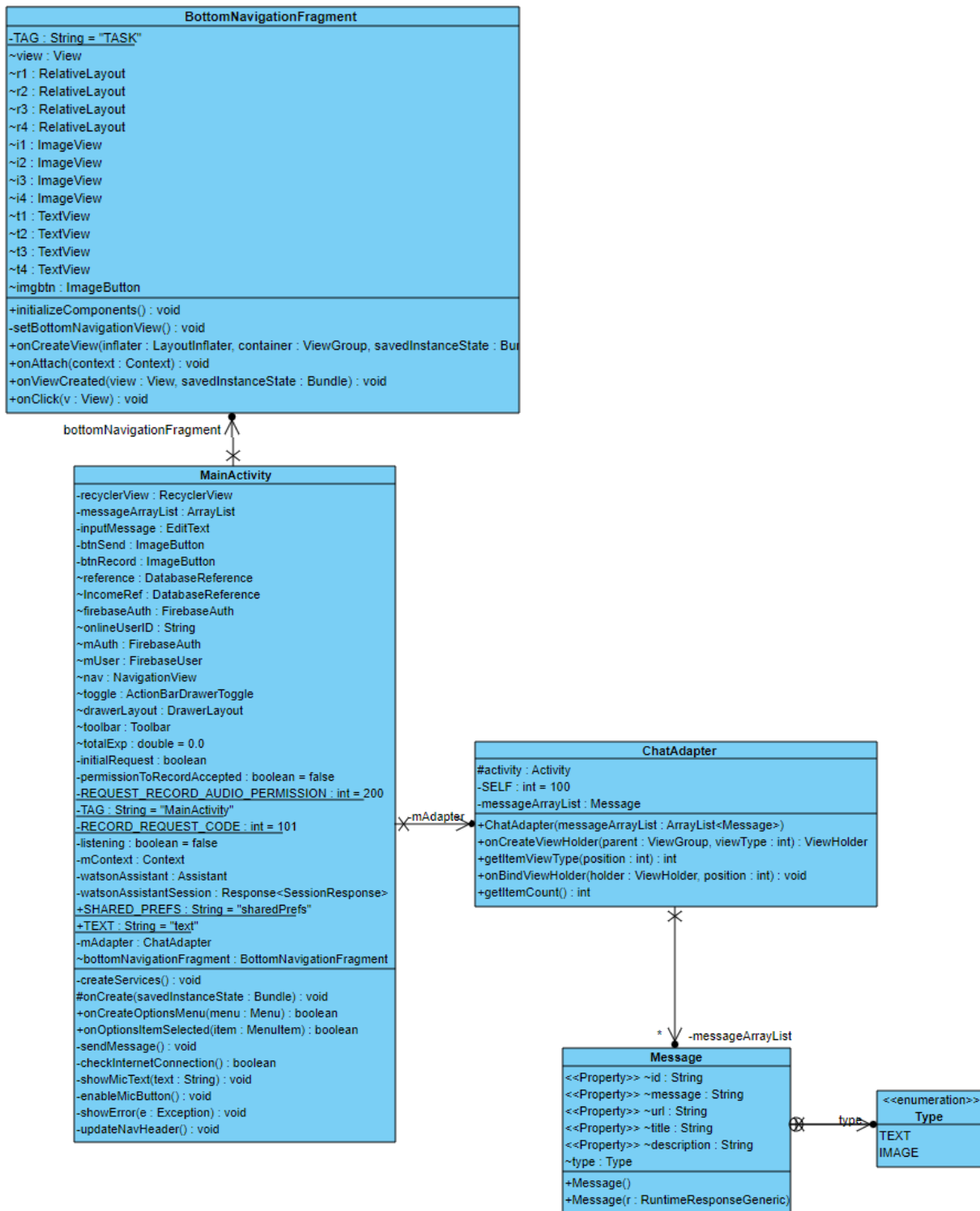


Figure4.6 Chatbot Activity Class Diagram

CHAPTER 4 SYSTEM DESIGN

The diagram above is the class diagram for Chabot Activity. The class and method used in the program are as below:

- Adapter:

ChatAdapter	Act as a bridge between Message model class and MainActivity class.
-------------	---

- Model:

Message	A class that holds message data.
---------	----------------------------------

- Class activity:

MainActivity	Perform onCreate() method
--------------	---------------------------

CHAPTER 4 SYSTEM DESIGN

4.4 System Components Interaction Operations

- **Splash Screen /Login / Register Page**

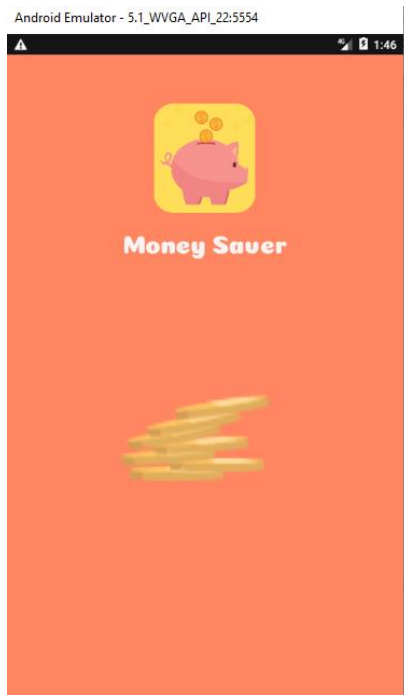


Figure 4.4.1 Splash Screen

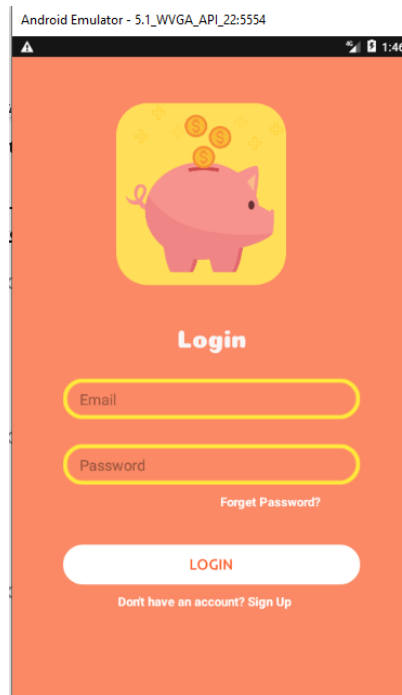


Figure 4.4.2 User Login

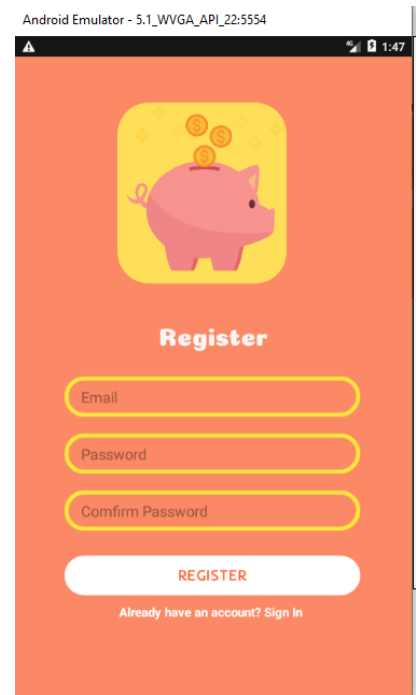


Figure 4.4.3 New User Register

When the application started, user login screen will come after the splash screen. For existing user, user requires to enter the email and password as in Figure 4.4.2 while new user needs to register an account first as in Figure 4.4.3. If they forget the password, they can click the forget password under the password textbox to reset their password.

CHAPTER 4 SYSTEM DESIGN

- **Reset Password Page**

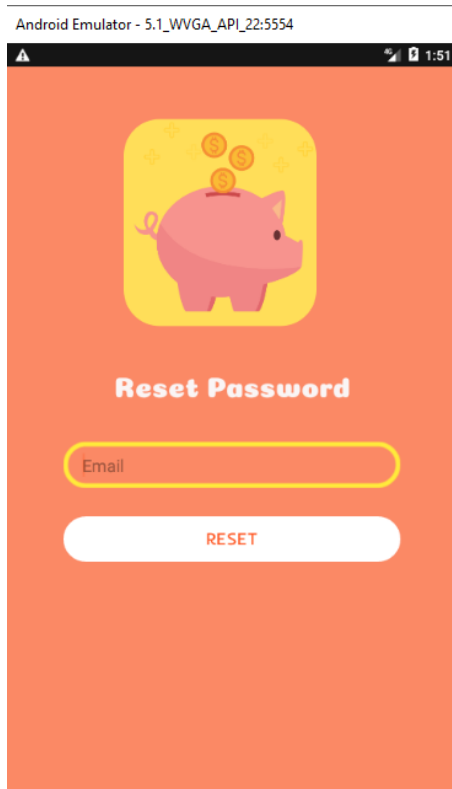


Figure 4.4.4 Reset Password

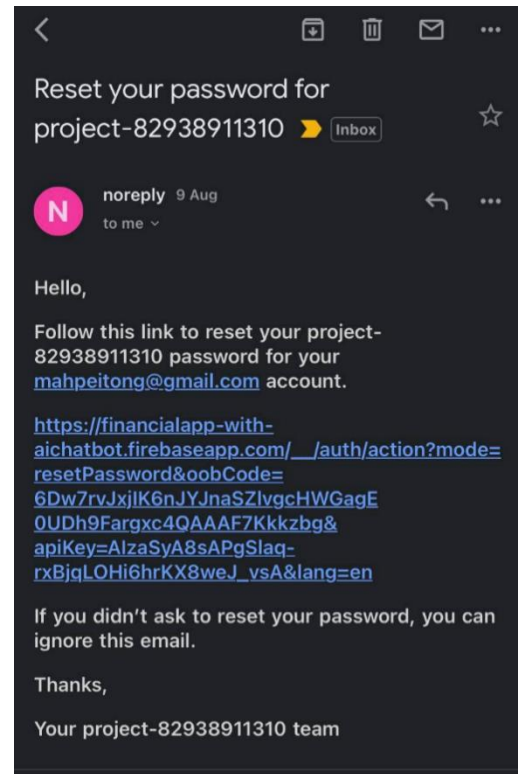


Figure 4.4.5 Reset Link

Once the user click forgets password, user needs to type the email. Only emails that are already registers and user will be directed to Figure 4.4.4 Reset password page to let user enter their registered email account. A reset link will be sent to the user's Gmail account. Users are able to reset the password by clicking the link as in Figure 4.1.5. After user reset the password, they will be directed back to the login screen to enter an email and reset password to login into their account.

CHAPTER 4 SYSTEM DESIGN

- Above Page

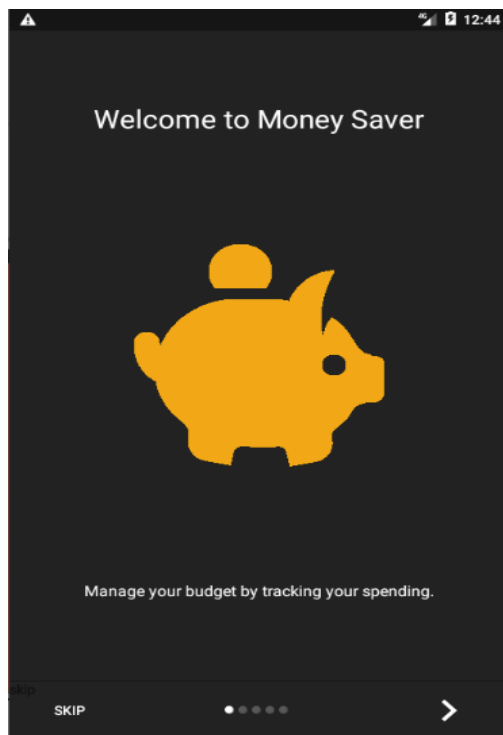


Figure 4.4.6 About page 1

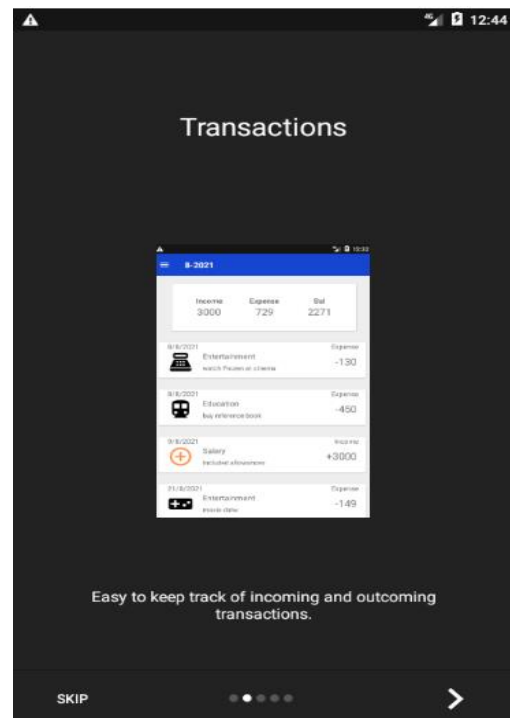


Figure 4.4.7 About page 2

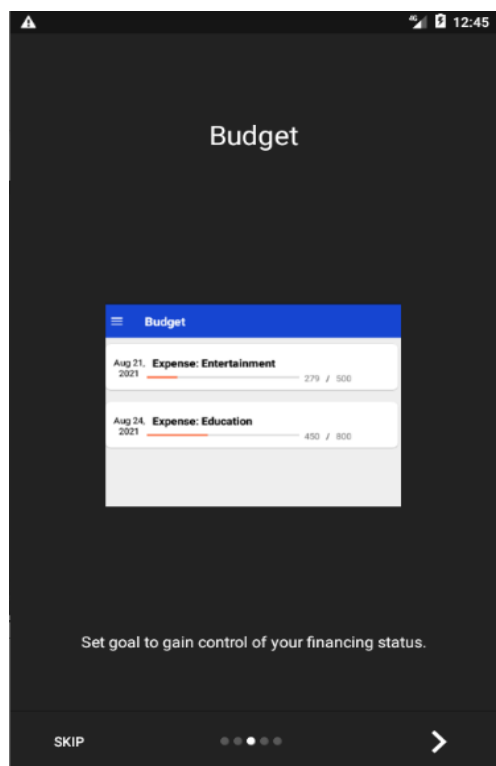


Figure 4.4.8 About page 3

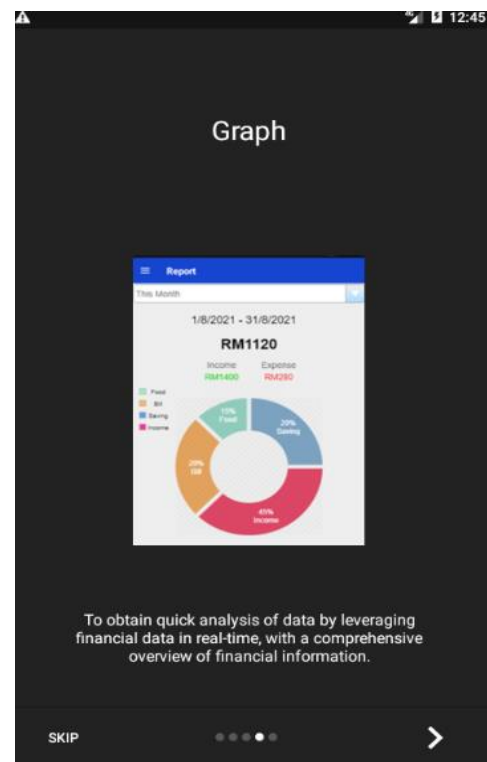


Figure 4.4.9 About page 4

CHAPTER 4 SYSTEM DESIGN

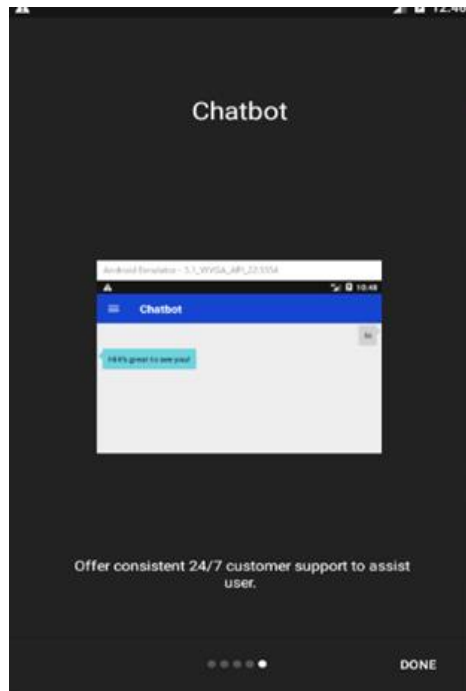


Figure 4.4.10 About page 5

These 5 about pages are designed to give an overview feature of the application to users. Users may have a better understanding on the application especially for the new users. Therefore, when new user has registered an account, system will direct user to this activity to brief user on the basic features in this application before going to the main activity of the application.

CHAPTER 4 PRELIMINARY WORK

- Add Transaction Page

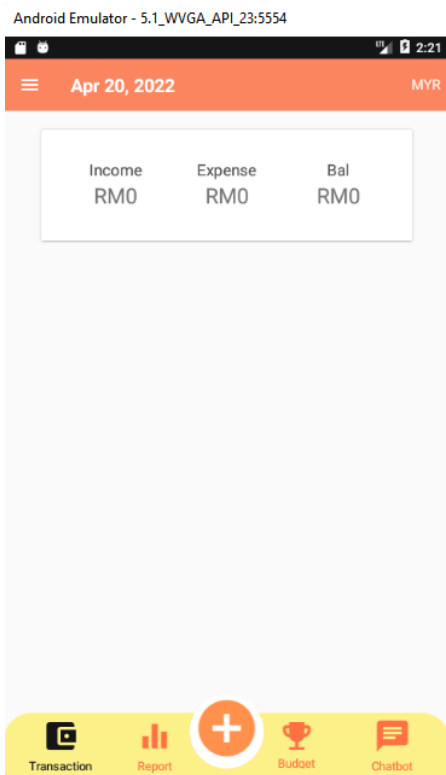


Figure 4.4.11 Homepage

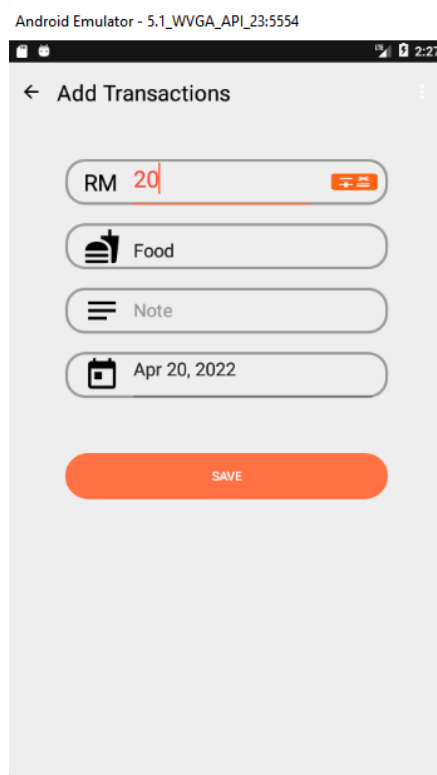


Figure 4.4.12 Add Transaction

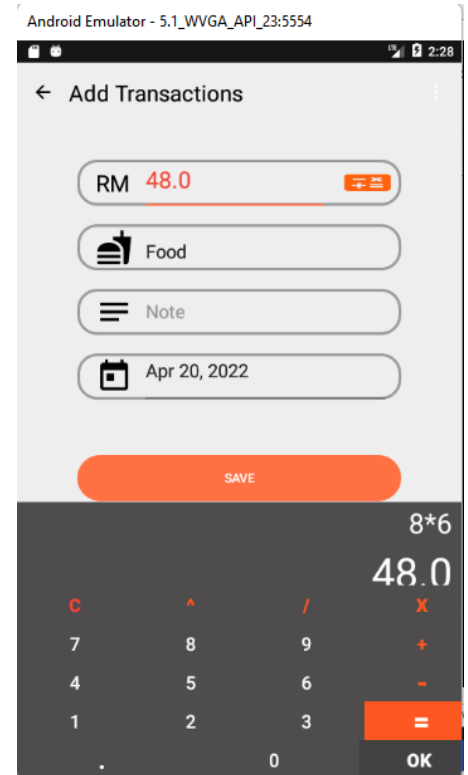


Figure 4.14.13 Calculator

Figure 4.4.11 shows the homepage of the application. When users click the add button located at the centre of the bottom navigation bar. User will be directed to Add Transaction page and information need to be filled up before they are able to save the transaction. There are two ways of inserting the amount. For example, in figure 4.4.12 and figure 4..13, user is able to key in the amount directly; user is also able to press the calculator to perform the calculation and click ok button.

CHAPTER 4 PRELIMINARY WORK

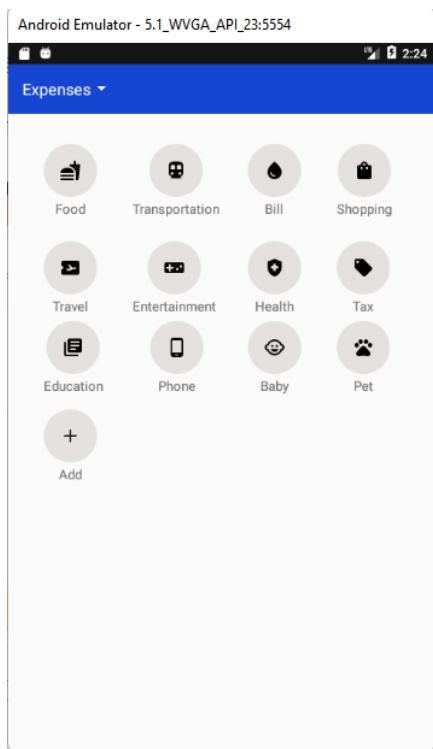


Figure 4.4.14 Expenses category

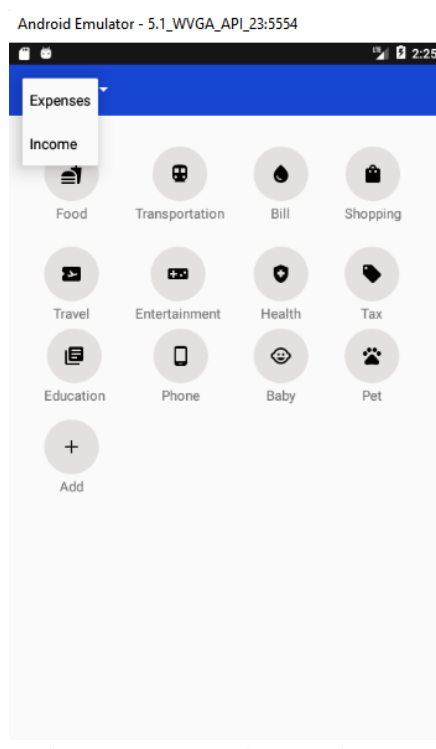


Figure 4.4.15 Navigate to income category

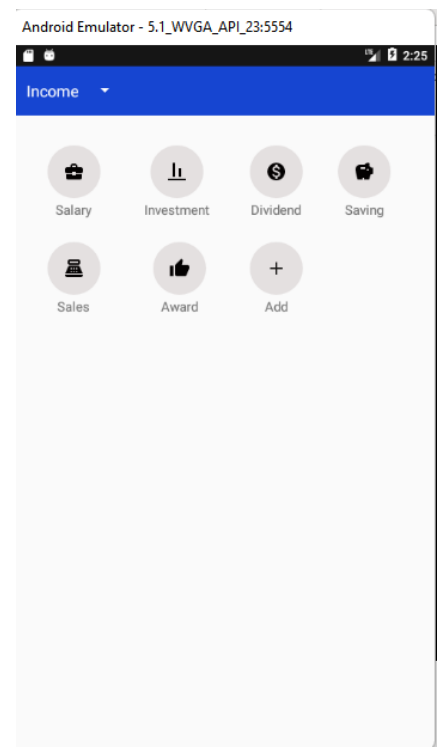


Figure 4.4.16 Income Category

After inserting the amount, user needs to select a category of expenses as Figure 4.4.14. This is a list of expenses categories that user can select. User can go to Income category by clicking the spinner on the toolbar as figure 4.4.15. Income category will show in figure 4.4.16.

CHAPTER 4 PRELIMINARY WORK

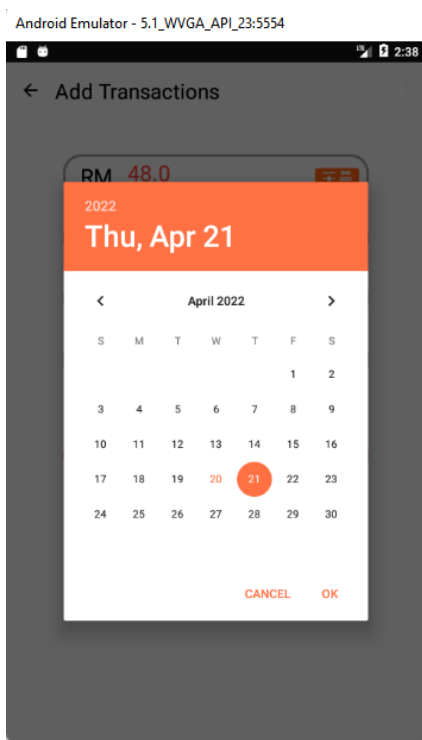


Figure 4.4.17 Date picker

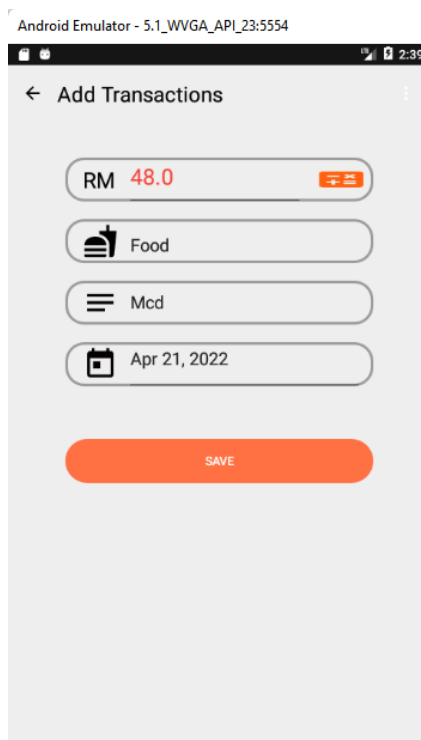


Figure 4.4.18 Fill in full details

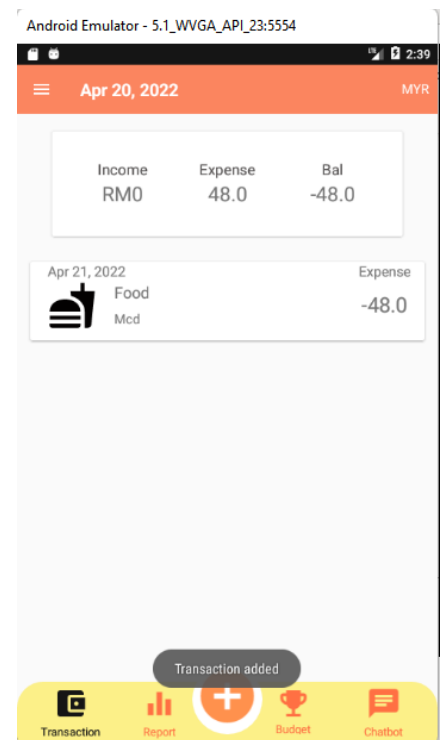


Figure 4.4.19 Add Transaction successfully

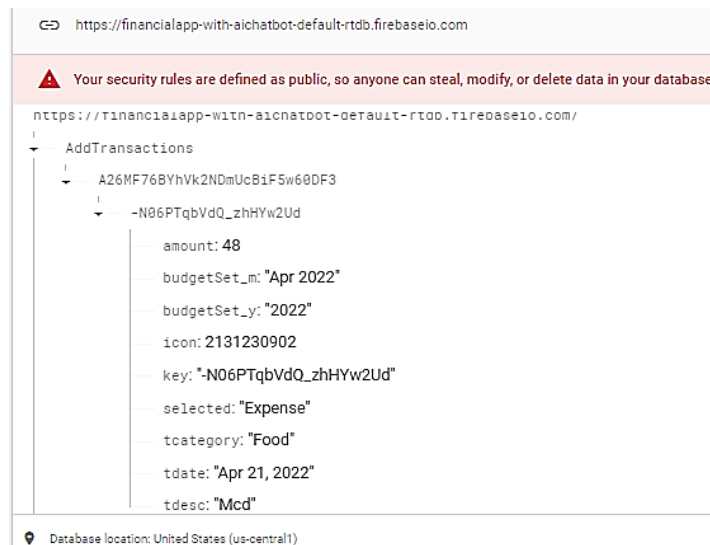


Figure 4.4.20 Firebase

After selecting the expenses category, user will need to select a date from the date picker as figure 4.4.17. After filling in all the full details as figure 4.4.18, user click the save button and the transaction will show on the homepage and the total income, expense amount and net balance will be updated in the dashboard as figure 4.4.19. The record will be added to the firebase as Figure 4.4.20.

CHAPTER 4 PRELIMINARY WORK

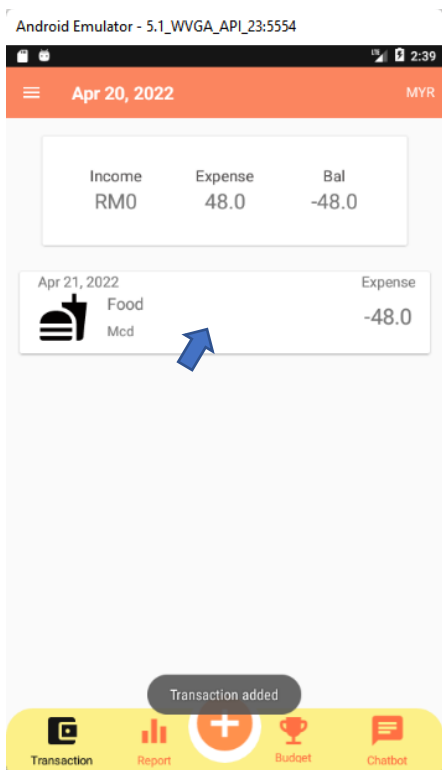


Figure 4.4.21 Expand transaction

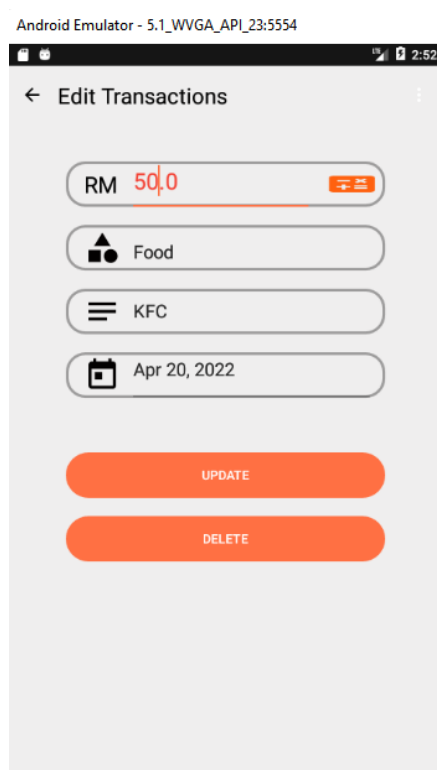


Figure 4.4.22 update details

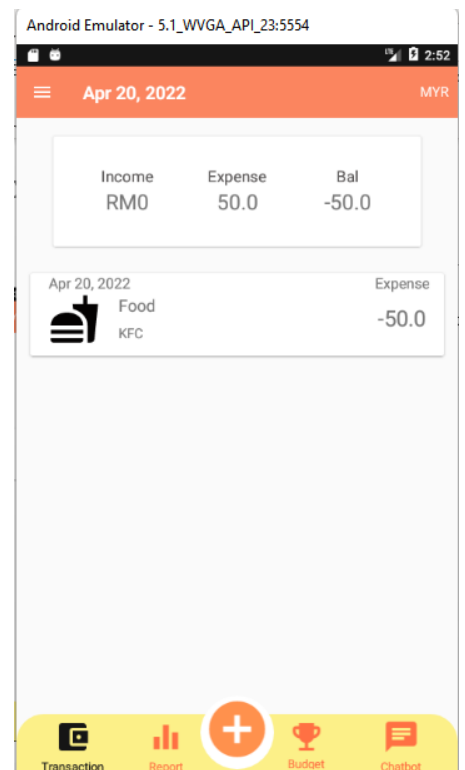


Figure 4.4.23 Updated Transaction successfully

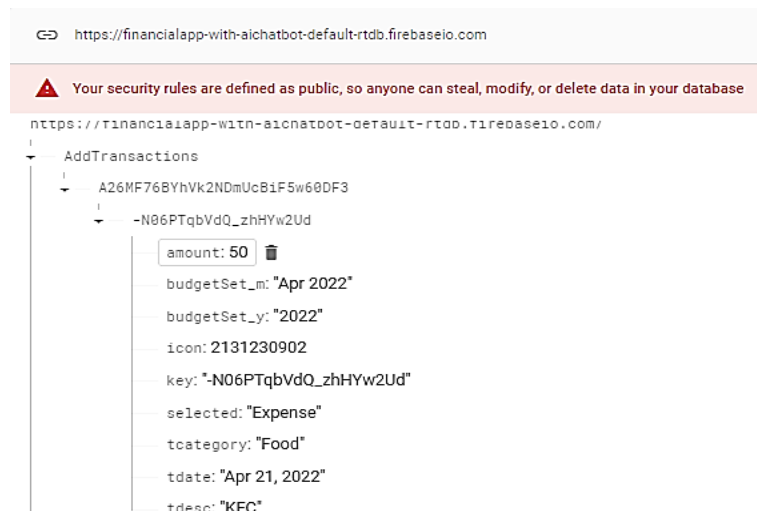


Figure 4.4.24 updated Firebase

When user click the food transaction as figure 4.4.21, user needs to update the details and click the update button. The updated transaction will be show on the page as figure 4.4.23. The firebase will also be updated at the same time as figure 4.4.24.

CHAPTER 4 PRELIMINARY WORK

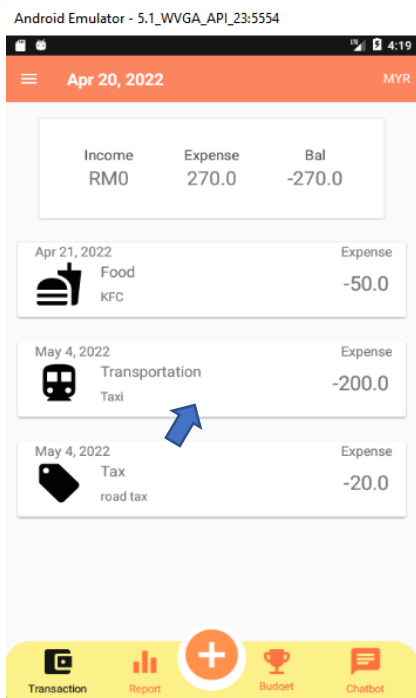


Figure 4.4.25 Click transaction

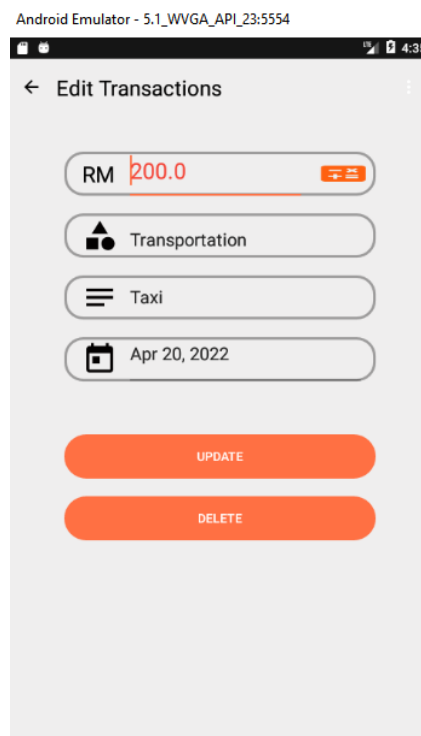


Figure 4.4.26 delete button

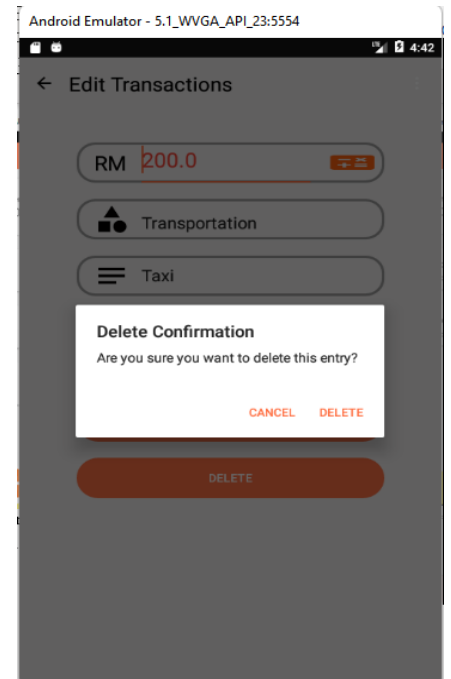


Figure 4.4.27 Confirmation dialog

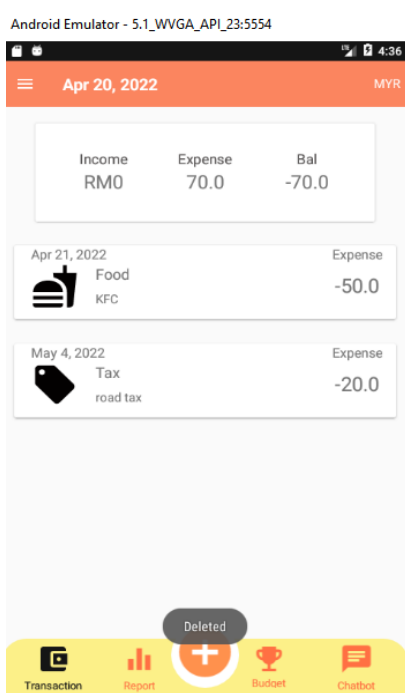


Figure 4.4.28 Updated List

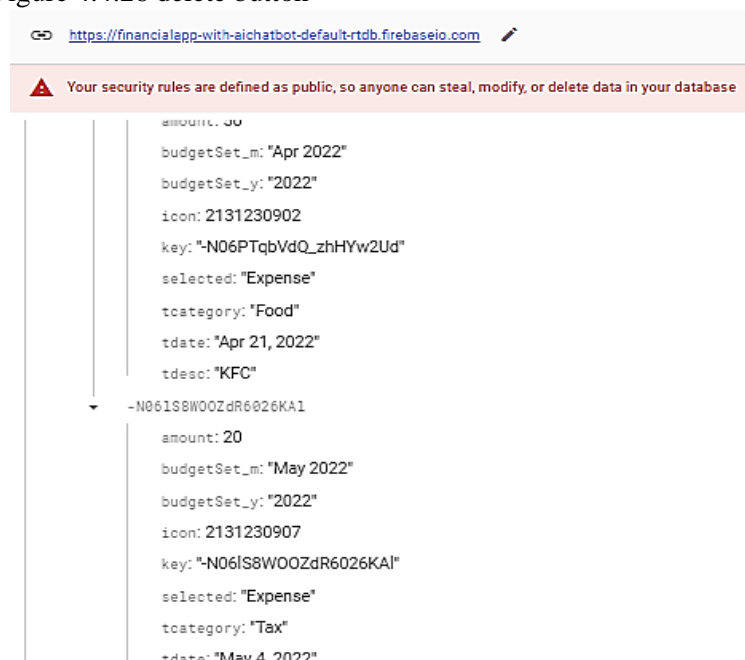


Figure 4.4.29 Deleted Firebase

When user clicks the transportation transaction as figure 4.4.25, user needs to click the delete button as figure 4.4.26. A confirmation dialog box will pop out as figure 4.4.27 to get double confirmation from the user before performing the delete action. If user click delete, an updated

CHAPTER 4 PRELIMINARY WORK

list will show as figure 4.4.28. The firebase will be updated to only two transactions left as Figure 4.4.29.

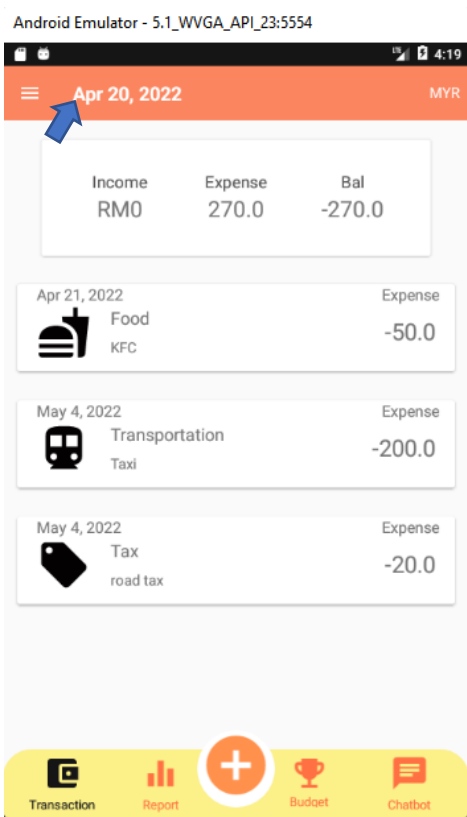


Figure 4.4.30 Transaction list

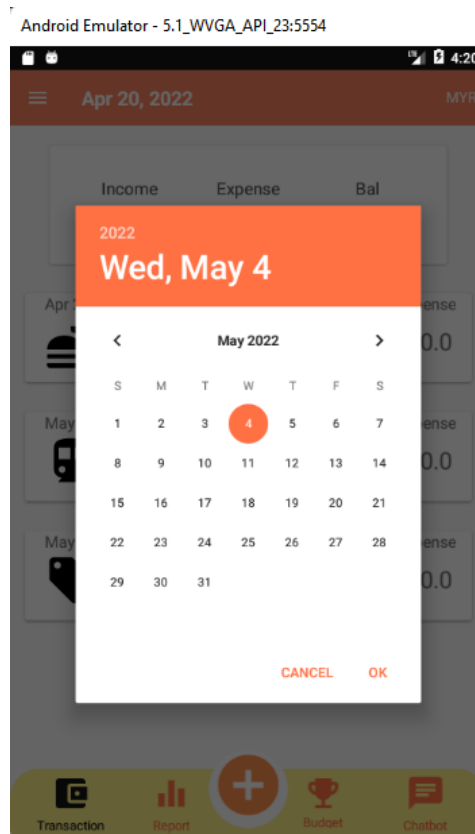


Figure 4.4.31 Select a date

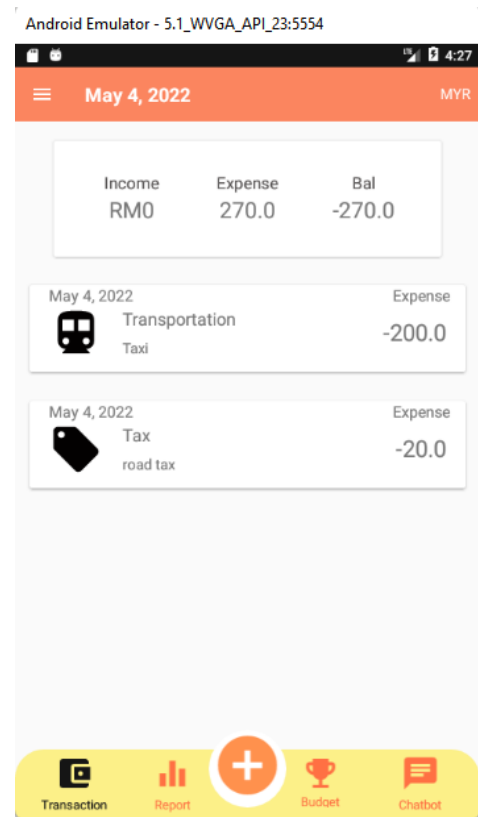


Figure 4.4.32 Filtered list

When user clicks the date from the toolbar as figure 4.4.30, a date picker will show as figure 4.4.31. For example, user selects May 4, 2022. An updated transaction list with the date May 4, 2022 will show in figure 4.4.32.

CHAPTER 4 PRELIMINARY WORK

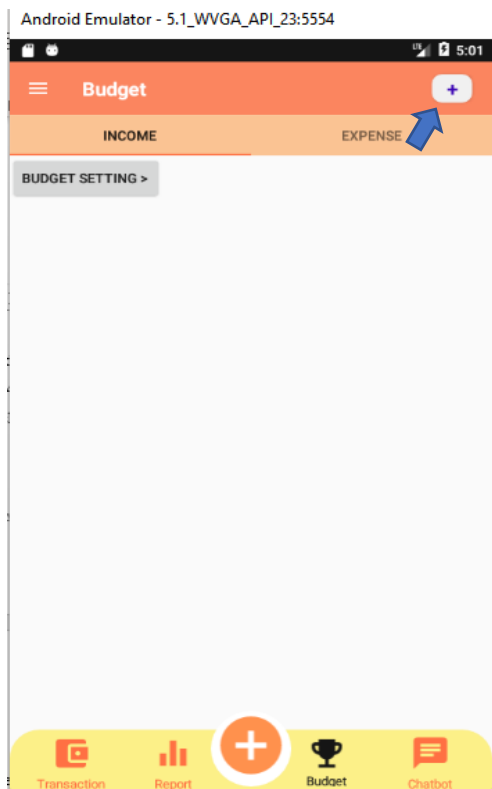


Figure 4.4.33 Budget Home page

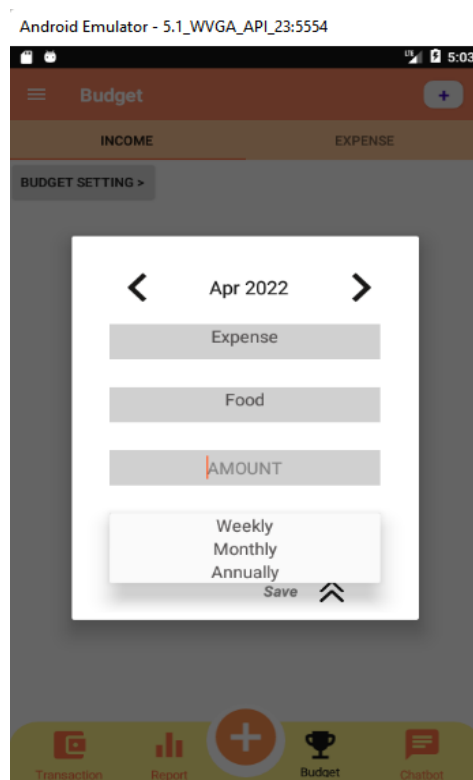


Figure 4.4.34 period selection

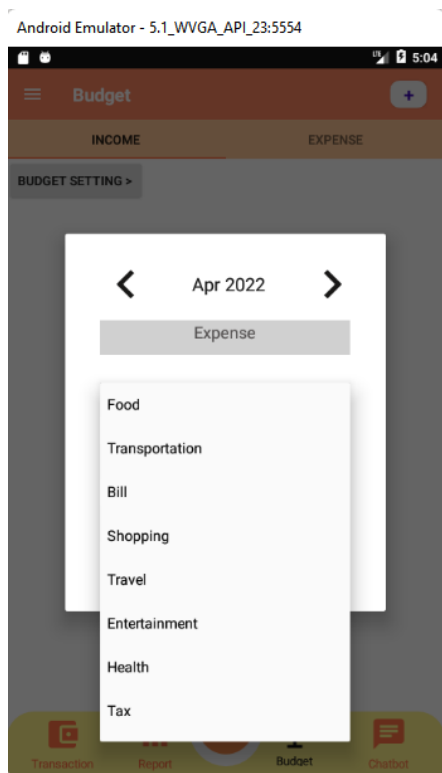


Figure 4.4.35 Expense category

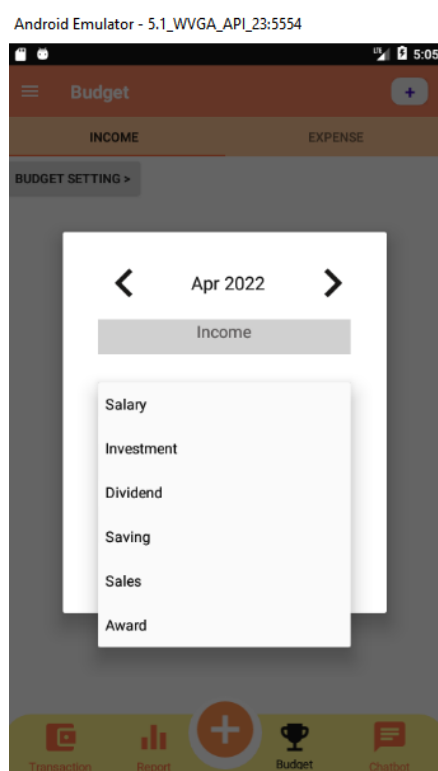


Figure 4.4.36 Income category

CHAPTER 4 PRELIMINARY WORK

User needs to click the add button in the toolbar as figure 4.4.33 to add a budget. A dialog window will pop out as figure 4.4.34 where user is able to select the category of the expenses, amount set and the budget period on a weekly or monthly or annually basis. There are two categories under the first spinner. When user selects Expense from the parent spinner, a list of expenses selection categories will show at the child spinner as Figure 4.4.35. When user selects Income from the parent spinner, a list of the income selection categories will show at the child spinner as Figure 4.4.36.

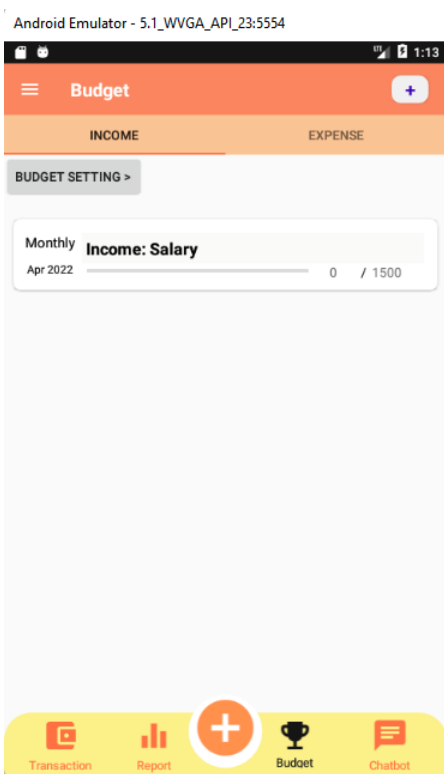


Figure 4.4.37 New Income budget

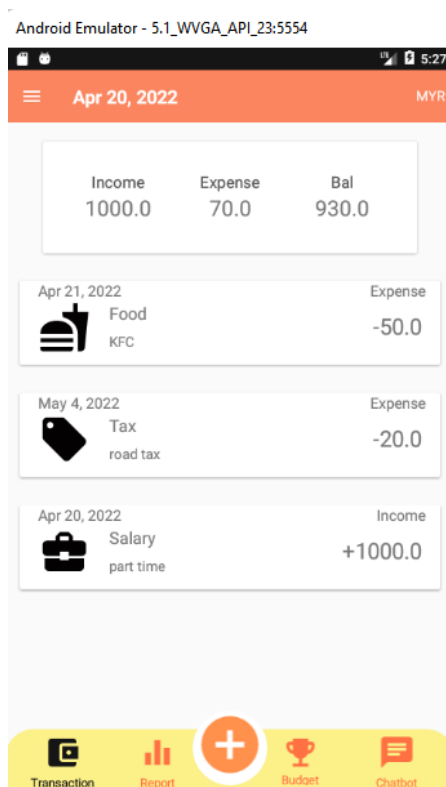


Figure 4.4.38 New Income Transaction add in

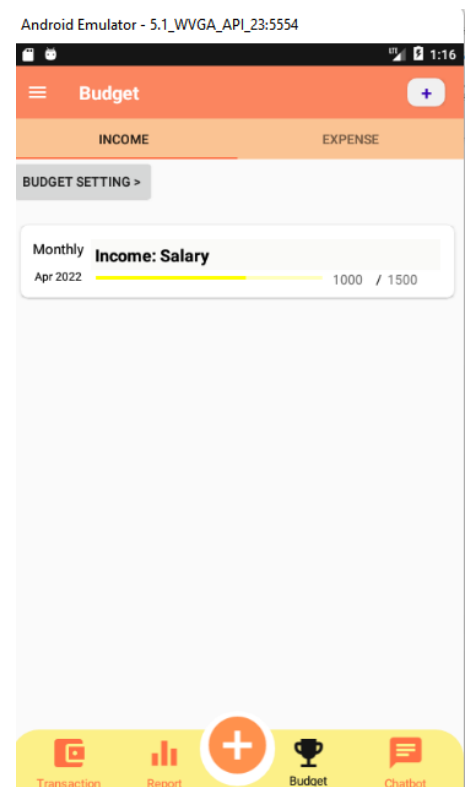


Figure 4.4.39 Show progress bar

```

SetIncomeBudget
├── A26MF76BYhVk2NDmUc8iF5w60DF3
│   └── -N07HVMN3wKQIpj9zaXo
│       ├── budgetSetting: "Monthly"
│       ├── child: "Salary"
│       ├── currDate: "Apr 2022"
│       ├── endValue: 1500
│       ├── parent: "Income"
│       └── startValue: ""
    
```

Figure 4.4.40 Expense Budget Firebase

CHAPTER 4 PRELIMINARY WORK

There are two fragments on the budget page which are Income fragment and Expense fragment. When Income budget has been added, it will show in the Income Fragment while Expense budget will show in the expense fragment. For example, user adds the budget as Figure 4.4.37. The budget will be added to the Income Fragment since salary is under the income category. As you can see in Figure 4.4.38, the progress bar shows zero but after we added a new income transaction. But in figure 4.4.39, the progress bar started to run and show in yellow colour which is used to indicate how much is left for that budget. At the same time, this budget will be stored in the firebase as figure 4.4.40.

CHAPTER 4 PRELIMINARY WORK

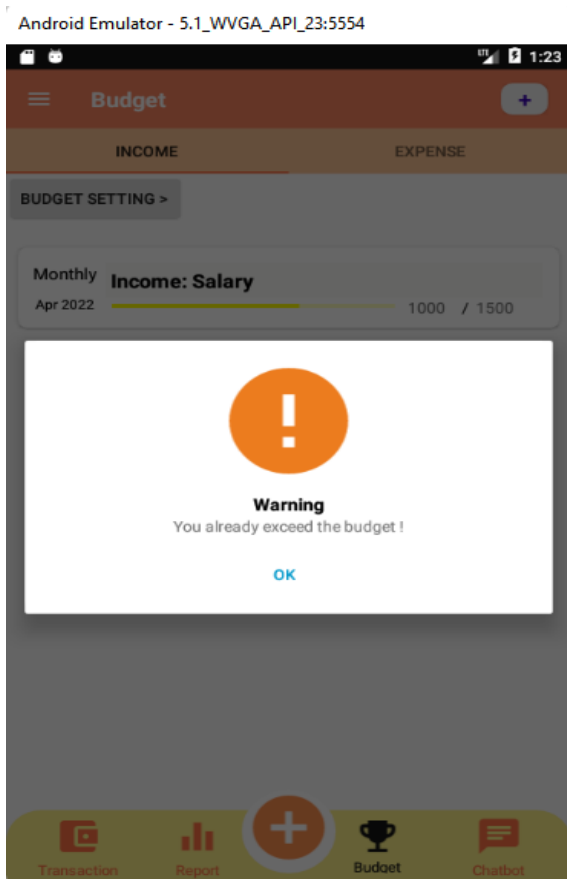


Figure 4.4.41 Select a date

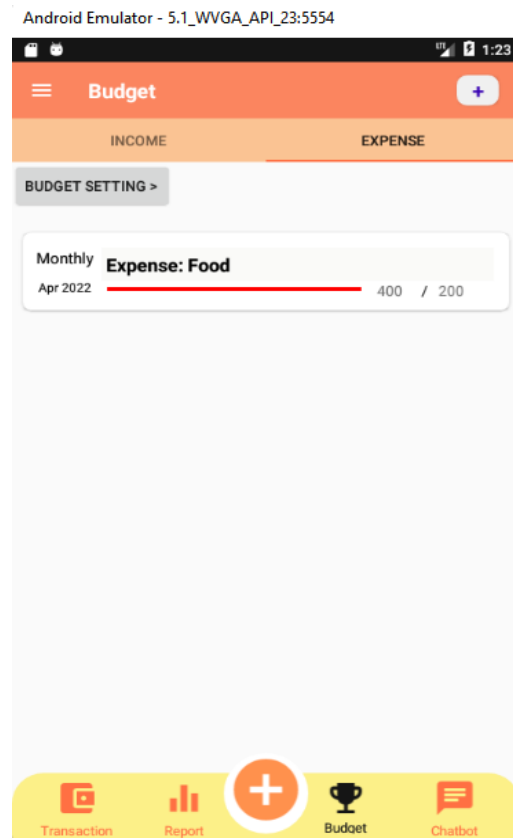


Figure 4.4.42 Filtered list

```
SetExpenseBudget
├── A26MF76BYhVvk2NDmUcB1F5w60DF3
│   └── -N07DYSrwSaH9r6WLI5t
│       ├── budgetSetting: "Monthly"
│       ├── child: "Food"
│       ├── currDate: "Apr 2022"
│       ├── endValue: 200
│       ├── key: "-N07DYSrwSaH9r6WLI5t"
│       ├── parent: "Expense"
│       └── startValue: "200"
```

Figure 4.4.43 Firebase

For example, if user wants to create a new budget for food. The budget will display and add into the expense fragment since food is under expense categories. Besides, it will add the new budget into the database in figure 4.4.43. When the amount spent hit the limit set in budget, It will pop out a warning dialog box to remind user that they have already exceed their spending as in figure 4.4.41. When user click ok, user is able to see the food category where the progress bar is in red line because spending already exceed budget of RM200 in figure 4.4.42.

CHAPTER 4 PRELIMINARY WORK

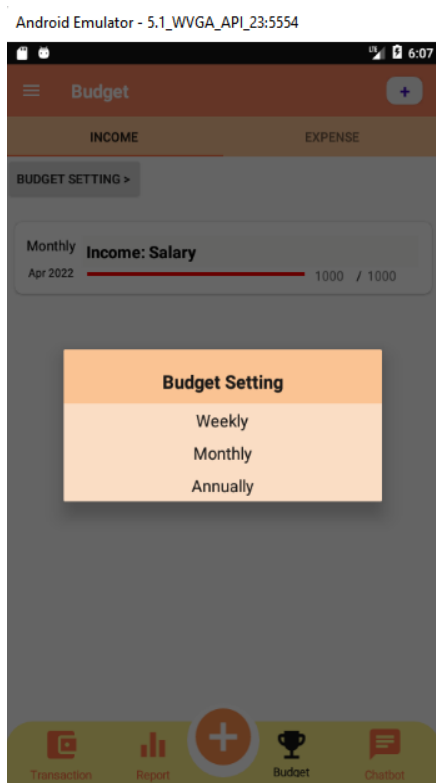


Figure 4.4.43 Budget setting

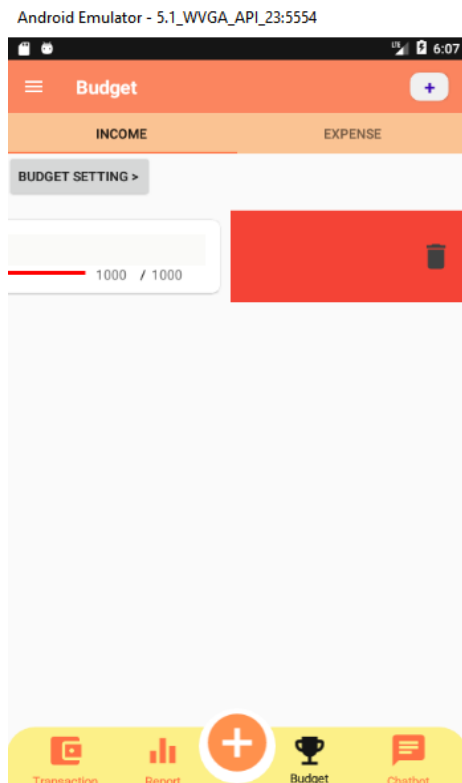


Figure 4.4.44 Delete Budget

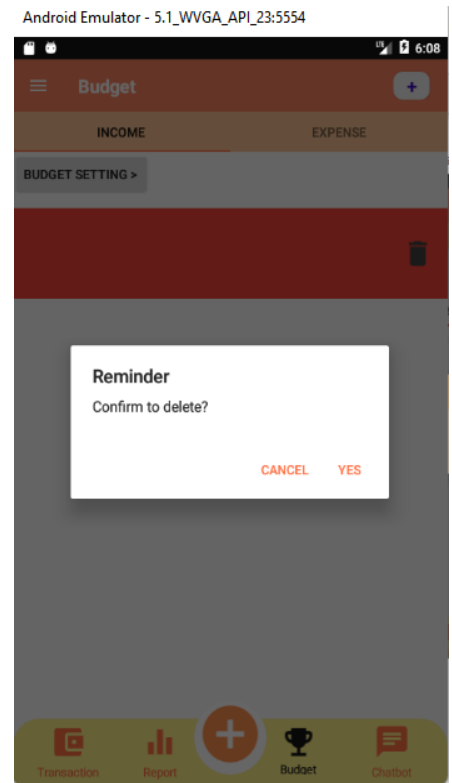


Figure 4.4.45 Confirmation deletion

User can filter the budget in weekly, monthly or annually. The filtered list will be show on the page after user selection. Besides, user is able to delete the budget by swiping to the left as figure 4.4.44. A confirmation delete box will pop out and show to the user. If user clicks delete, the selected budget will be deleted from screen and also firebase.

CHAPTER 4 PRELIMINARY WORK

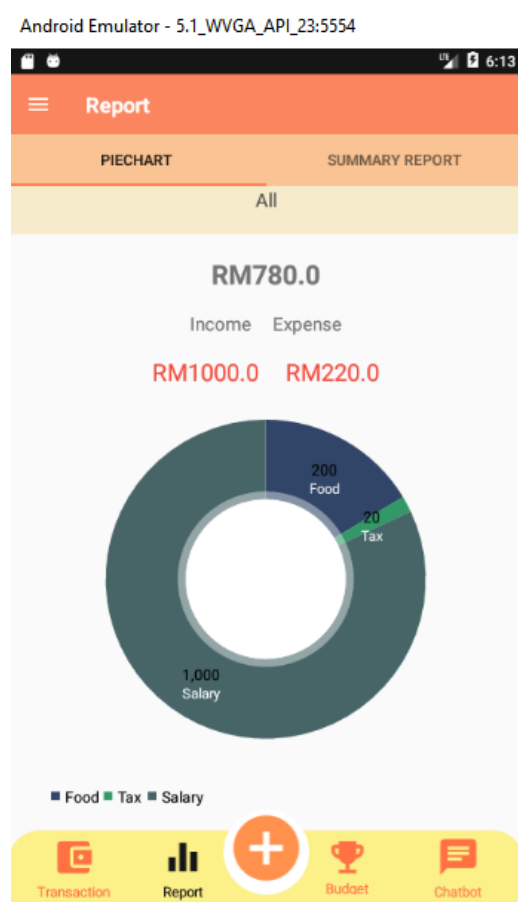


Figure 4.4.46 Report Graph

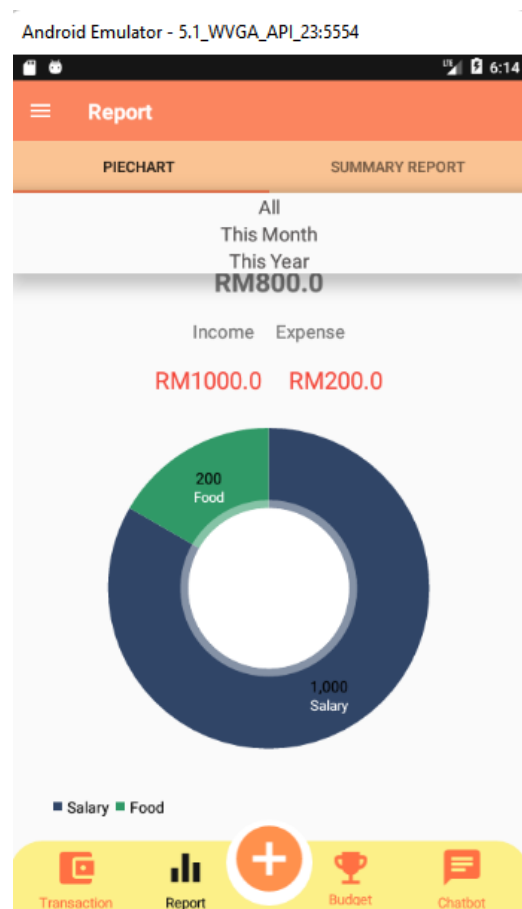


Figure 4.4.47 Chatbot

When user selects the report under the bottom navigation bar, the system will lead user to the screen as figure 4.4.46. Under the report activity, there are two types of reports that can be selected by user which are pie chart and summary report. The Pie Chart report shows expenses by category with different colour indications. User is able to filter the pie chart on a monthly and yearly basis by clicking the spinner on top. To improve the convenience, a net balance, amount of total income and amount of expense are shown at the top to give user know the balance.

CHAPTER 4 PRELIMINARY WORK



Figure 4.4.48 Report Graph

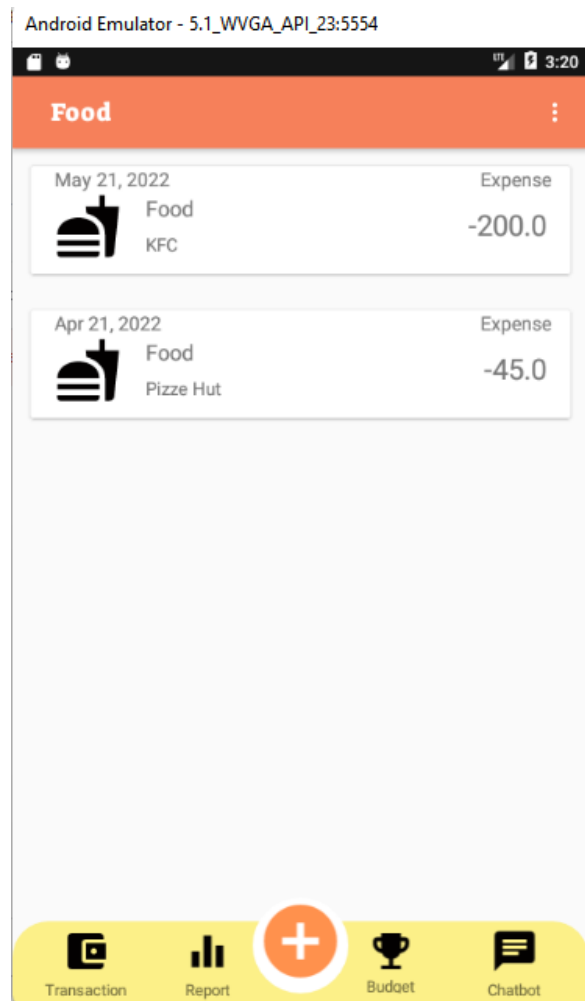


Figure 4.4.49 Expand category

Another type of report is the summary report in category. As you can see figure 4.4.48, a list of expense categories with total sum amount, a list of Income with total sum amount and net earnings. User can click and expand one of the categories like food category. A expanded screen will show to the user. All the food transactions will show out and let user have a view of them as figure 4.4.49. The user able to filter the report in a monthly or yearly basis by selection the spinner.

CHAPTER 4 PRELIMINARY WORK



Figure 4.4.50 Chatbot

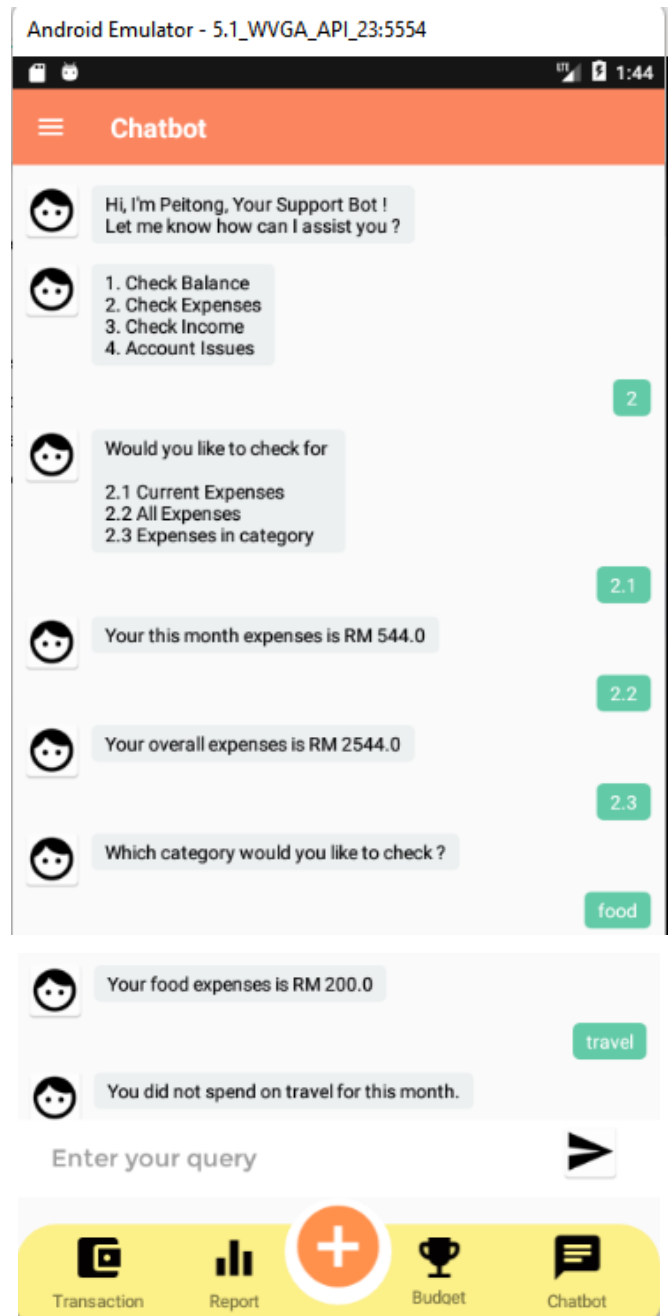


Figure 4.4.51 Chatbot Replies

When user clicks the chatbot button from the bottom navigation bar, a chatbot dialog will show in figure 4.1.50 where chatbot will start the conversation by greeting message. User can start to chat with Chatbot by typing the number they wish to ask in the textbox. The chatbot will reply automatically within second to the users as Figure 4.4.51.

CHAPTER 4 PRELIMINARY WORK

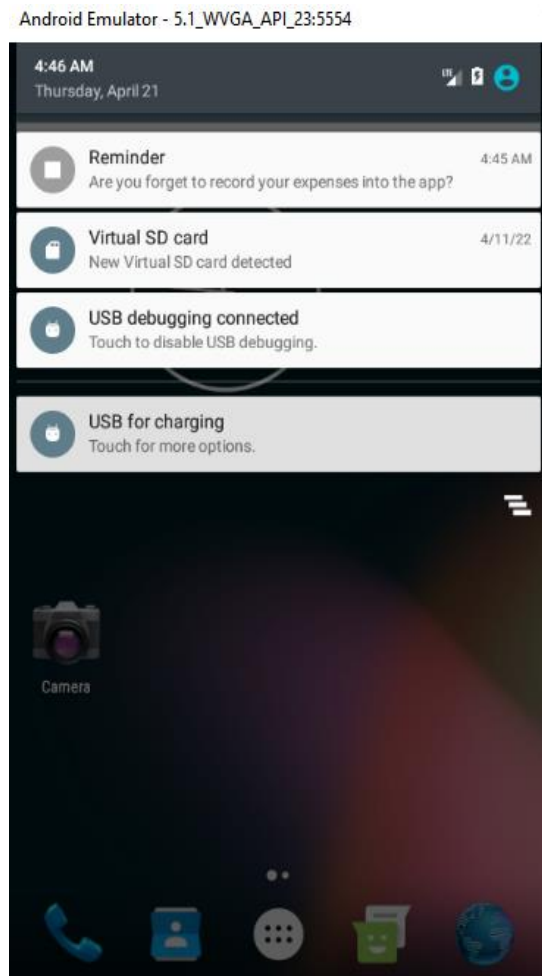


Figure 4.1.52

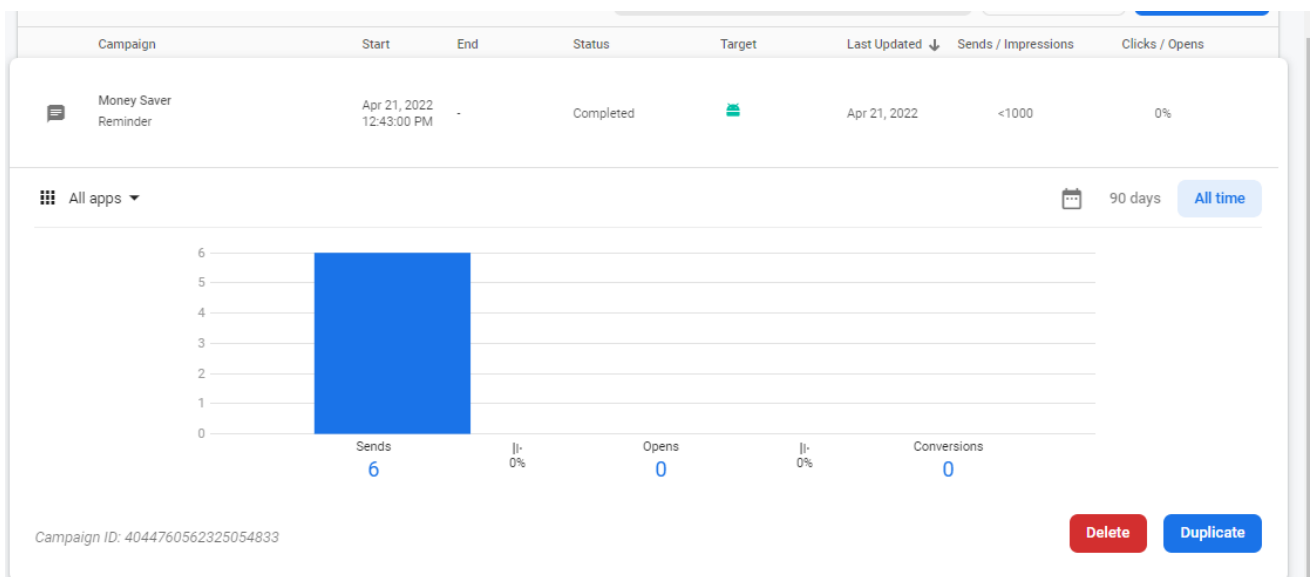


Figure 4.1.53

CHAPTER 4 PRELIMINARY WORK

As you can see in figure 4.1.52, it shows a notification reminder to ask user to log in to the app when system detects user has not been login to the app for about two days. Thus, user can click the notification, and the system will direct user to the app to perform login. This reminder is trigger by the Firebase Cloud Messaging, no database will be used for this notification feature. Figure 4.1.53 shows the configuration setting of the notification such as the schedule and a analyzes graph about the times of signal sent , received and clicked.

CHAPTER 5 SYSTEM IMPLEMENTATION

CHAPTER 5: SYSTEM IMPLEMENTATION

5.1 System Methodology

In this proposed project, the methodology that will be used is Prototyping Model. The software will undergo two activities which are prototype development and iterative development. This methodology ensures that the customer is always working with the system and providing feedback to the system developers. Feedbacks from clients help the developers to make the necessary changes in a timely manner via a prototype, and the prototype is created again for further feedback until the requirement hit the baseline. It can quickly be developed to show the visual design of the requirement and get better software development solutions from customer reviews.

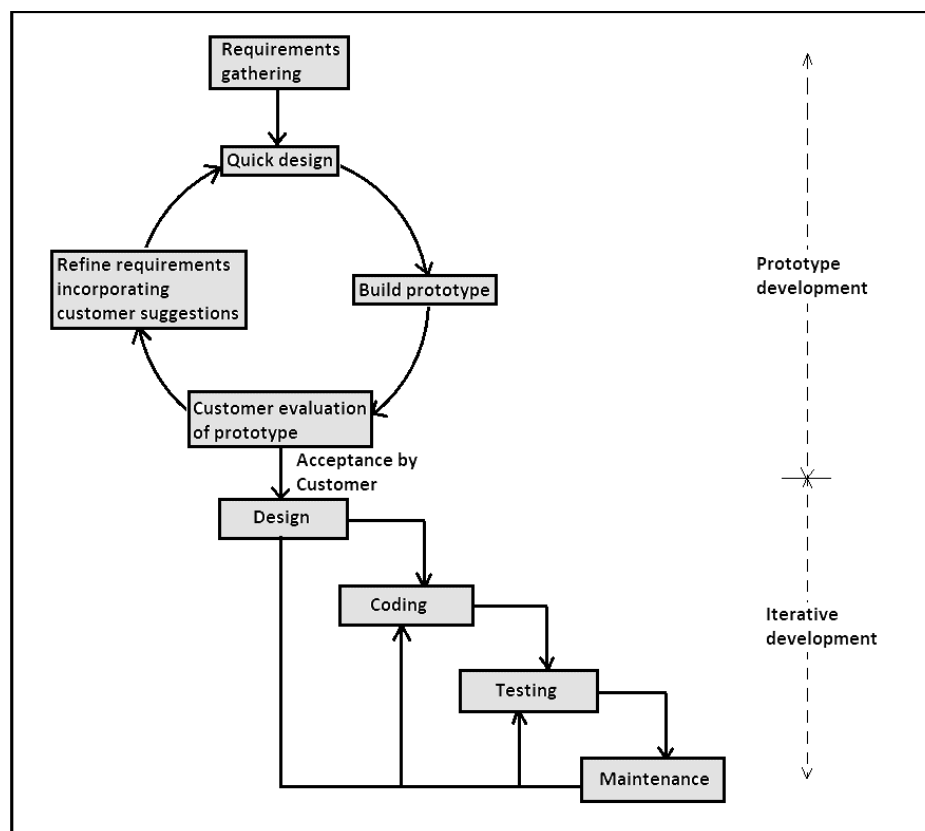


Figure 5.1.7 Prototype Model Phase

Source: (Tutorial And Example 2020)

CHAPTER 5 SYSTEM IMPLEMENTATION

Prototype Development

In this phase, prototype development will start with an initial requirement gathering for the system because it is important to know about the user expectation from the system. After that, we will use CASE tools to design how the user interface looks and a set of plans will be created like time estimate to complete the system, budget constraints, and technical feasibility of the actual implementation. A quick design will be created based on the user requirement which will show a brief overview of the system to the user. A developed prototype will be sent to the customer for the initial evaluation. Based on the customer feedback, the comment and suggestions will be recorded and sent to the developer to let them better discover the pro and cons of the current working model. Therefore, the developer always refines the requirement according to user s' feedback until the acceptable outcome is achieved. The final system is developed on the basis of the approved final prototype, otherwise, this phase will only end when all the requirements specified by the user are fulfilled.

Iterative Development

Iterative Development is more like a cyclical process that separates into a few repeated stages. During the initial planning stage, it is used to map out hardware and software requirements as preparation for other stages to follow. The second stage is an analysis to determine the database models that will be taken place after all requirements are determined. Only when this step is done, programmer will only proceed to the next step which is the implementation and coding process. All planning, specifying and design documentation at this stage will be encoded as the first version of the software and implemented in the project. When this current build iteration has been encoded and implemented, the next step is to proceed with a set of test procedures to identify and localize potential bugs or issues that have occurred.

Finally, a user acceptance test is necessary to determine whether the systems meet the user requirements or not. After the testing phase, the team will review the project status to determine where it needs to be and what should change. It returned to the planning stage and development stage to repeat itself over again based on any evaluation feedback. If the user is satisfied and has no problem with the application, then it is ready to implement and release to the user, but developers still have to do maintenance work to make changes to the application to support its operational effectiveness.

CHAPTER 5 SYSTEM IMPLEMENTATION

5.2 Project Timeline

Activity	Period													
	W1	W2	W3	W4	W5	W6	W7	W8	W9	W10	W11	W12	W13	W14
1:INTRODUCTION														
Background Information	█													
Project introduction	█													
Motivation and Problem Statement	█													
Project Scope	█													
Project Objectives	█	█												
Contribution		█												
Report Organization		█												
2:LITERATURE REVIEW														
Review of the technologies		█												
Fact Finding		█	█											
Compare Existing Systems		█	█											
3: SYSTEM METHODOLOGY														
System Design Diagram				█										
Design prototype				█	█	█								
4: SYSTEM DESIGN														
System Block Diagram							█	█						
System Components Specifications							█	█						
System Components Interaction Operations								█	█					

CHAPTER 5 SYSTEM IMPLEMENTATION

5: SYSTEM IMPLEMENTATION														
Coding														
6: SYSTEM EVALUATION														
System testing														
7: CONCLUSION														
Finalise FYP 2 Report														
FYP2 Report Submission														
FYP 1 Demonstration														

CHAPTER 5 SYSTEM IMPLEMENTATION

5.3 Review of the Technologies

5.3.1 Hardware Platform

Hardware	Specification	Description
Computer Processor	Intel® Core™ i5-8250U CPU @ 1.60GHz 1.80GHz	Computer speed of performance
RAM	8.00 GB	A platform for application to stored data processed
Graphic Card	32-bits colour	To render the graphic and UI
Input Device	Mouse, Keyboard	To input data.

Table 5.3.1 Hardware Requirements

The Hardware requirements for this proposed system are computer processor, RAM, graphic card and input device. The computer processor is Intel® Core™ i5-8250U CPU @ 1.60GHz 1.80GHz processor and memory will be 8 GB to store data. Additionally, the computer used is 32-bits colour graphic card to render the graphic and display UI. Lastly, a mouse and keyboard will be used to control the input data.

5.3.2 Software Platform

Software	Purpose
Android Studio	Framework to develop the system
Notepad++	Used for file input.
Firebase	Connect to the server database to store data
Google Chrome	A browser to run local host and search for information

Table 5.3.2 Software Requirements

Four software are used to develop the proposed application. The main development platform is Android Studio, where I code the program. The application is connected to Firebase to access different services like Realtime database firebase, cloud messaging for push notifications and firebase authentication for a user account. Notepad is also used to run the file input, meanwhile,

CHAPTER 5 SYSTEM IMPLEMENTATION

Google chrome is used to assist my development process like browsing information for debugging and so and so on.

5.3.3 OS / Database

	Specification	Description
Operating System	Window 11	Use to run application software.
Database	Realtime Database Firebase	Used to store user data

Table 5.3.3 OS / Database Requirements

The Window 11 operating system will be used to develop the proposed system. Google Firebase will be used to store all the data of the user. Google Firebase is an open-source, multi-threaded, and easy-to-use database with free licenses.

5.3.4 Programming Language

The proposed system heavy relies on Android Java Programming Language. This proposed application required knowledge and skills in using Java as a basic language which is supported by Android as the main programming language. We need to know some of the Java concepts such as inheritance, usage of superclass and subclass, abstract, method overriding, interface, and constructor to apply throughout the development of the application.

Besides, I required knowledge of Extensible Markup Language (XML) to code the interface layout for each of the designs in the proposed application. We need to know which situation should use which type of layouts such as Relative Layout, Constraint Layout, Linear Layout and other specified terms to call a button, Text View and so on.

CHAPTER 5 SYSTEM IMPLEMENTATION

5.3 Technologies and Tools Involved

- **Android SDK**

Android SDK is a development tool used to develop android applications that provide all the necessary developers including libraries tools for android in Windows. It comprises all the tools to code the programs from scratch and testing. It provides a smooth flow of the development process developing and debugging, through to packaging. Android SDK comes bundled with Android Studio, Google's official integrated development environment (IDE) for the Android operating system. Thus, this Android SDK is vital to be used.

- **Android Emulator**

Android Emulator is a QEMU-based device-emulation tool that simulates Android devices on your computer, so we can test applications on different devices and Android API levels, without needing to have physical devices for each. The Android emulator provides almost all of the capabilities of a real Android device. Often it is faster and easier to test your app with an emulator instead of using a physical device.

- **Firebase**

Firebase is a backend service under Google mobile application development platform. I used the Firebase Realtime Database to store the data of my application and synced between users in real-time. The Firebase Realtime Database is a cloud-hosted NoSQL database that lets us store and sync data between your users in real-time which remain available when my app goes offline. It is a free tool that is best suited for a student to use like me. The reason why I use Firebase rather than SQLite is that firebase stores data on the cloud and sync in real-time, while SQLite is stored locally on the device. Firebase does not have to worry about the wrong code of the SELECT and queries because Firebase does it all for you.

- **IBM Watson Assistant API**

IBM Watson Assistant API is an artificial Intelligence virtual agent that understands questions by learning. It provides fast, consistent and accurate answers across any messaging platform by adding the API under the dependencies of Gradle build of Module in Android Studio. I registered an IBM Cloud Lite account which is free of charge for a temporary 1-month period.

CHAPTER 5 SYSTEM IMPLEMENTATION

- **MP AndroidChart API**

MP AndroidChart API is a powerful chart and graph view library which support various type of chart. It works on Android API 8 and above. It is easy to use, all I need to do is add the API under the dependencies of Gradle build of Module in Android Studio.

CHAPTER 5 SYSTEM IMPLEMENTATION

5.4 Summary of Technology Review

In summary, both sides of software and hardware technologies are used to develop this proposed system. The main development platform is Android Studio which includes android libraries that include everything needed to build an app. Additionally, Android Emulator and Android SDK are integrated with the Android Studio which is vital to be used to develop the proposed system. A proper checking in terms of compatibility and system requirements is performed. The system requirements for Android Studio installation are the minimum Window 8 operating system and a minimum 8GB RAM for IDE + Android SDK +Android Emulator. My laptop fulfils the minimum requirement to download and install the Android Studio software. Besides, A free account on Google Firebase has been registered. Firebase is a free database platform that syncs data in real-time, and it provides various types of services. Besides, two APIs have implemented into my application which is IBM Watson API to support new added chatbot features and MP AndroidChart API to support pie chart view of my application. These two APIS will Gradle project module in Android Studio. Basically, the developer needs to be familiar with two programming language which is Android Java Programming Language and Extensible Markup Language. Android Java Programming Language is for program coding while XML language is for the front-end part.

CHAPTER 5 SYSTEM IMPLEMENTATION

5.5 Project Implementation Issues and Challenges

I think the most challenging part during the development of Personal Finance Management Mobile application with chatbots is the implementation of Chatbot. At first, I am not able to register an account under the IBM cloud due to being unable to add credit cards. I wasted a week getting help from the IBM Watson customer service support and waiting for their reply on how to deal with the issue. Besides, it is hard to integrate into the mobile application due to the failure of `checkDuplicateClass` when running the emulator on Android Studio. It shows that 100 rows of code are having these issues. But when I remove the IBM Watson API from the dependencies, it works fine. Thus, I have tried out all the ways like deleting the dependencies or excluding other dependencies to solve the issues, but no way is working until I seek help from IBM Watson customer service support centre again because the error happened with their given API. Finally, they can help me solve the issue.

Another technical challenge that I faced was the android studio helping me to auto-update to a new version without my permission. When I run the android emulator, all the libraries and dependencies are not compatible with the new version of android studio. I wasted a long time to re-find all the compatible version dependencies for more than 20 different sources of dependencies and trying one by one to find out which version is the best fit with my latest version of android studio.

Additionally, one of the challenges I faced when developing this application is installation failure. Sometimes when I run the APK with the virtual mobile devices, the error pops out saying that the APK is not able to install on the virtual mobile devices. Therefore, I need to restart the Android Studio and run the virtual mobile device again to resolve the issues. It was very troublesome to restart the android studio because the time to launch the software is around 10-15 minutes. It results in I need to waste time troubleshooting this problem

CHAPTER 6 SYSTEM EVALUATION AND DISCUSSION

CHAPTER 6: SYSTEM EVALUATION AND DISCUSSION

6.1 System Testing and Performance Metrics

The testing stage is a compulsory stage that needs to be done before an application can be published to the market. While performance metrics are used to evaluate the system performance from many perspectives. According to (SpringerLink 2022), it stated that questionnaires are considered an efficient method to evaluate the user acceptance of the application regarding usability, effectiveness, reliability and usefulness. Therefore, system testing will be conducted by distributing a Test Questionnaire to ask users to give feedback after testing the system. From the obtaining feedbacks, I will gather the result to determine the user satisfaction level with my proposed system and parts that having technical problems. The questionnaire will be created by google form. A download link for APK will be attached to the questionnaire to allow respondents to install and try the application.

CHAPTER 6 SYSTEM EVALUATION AND DISCUSSION

6.2 Testing Result

• Demographic Information

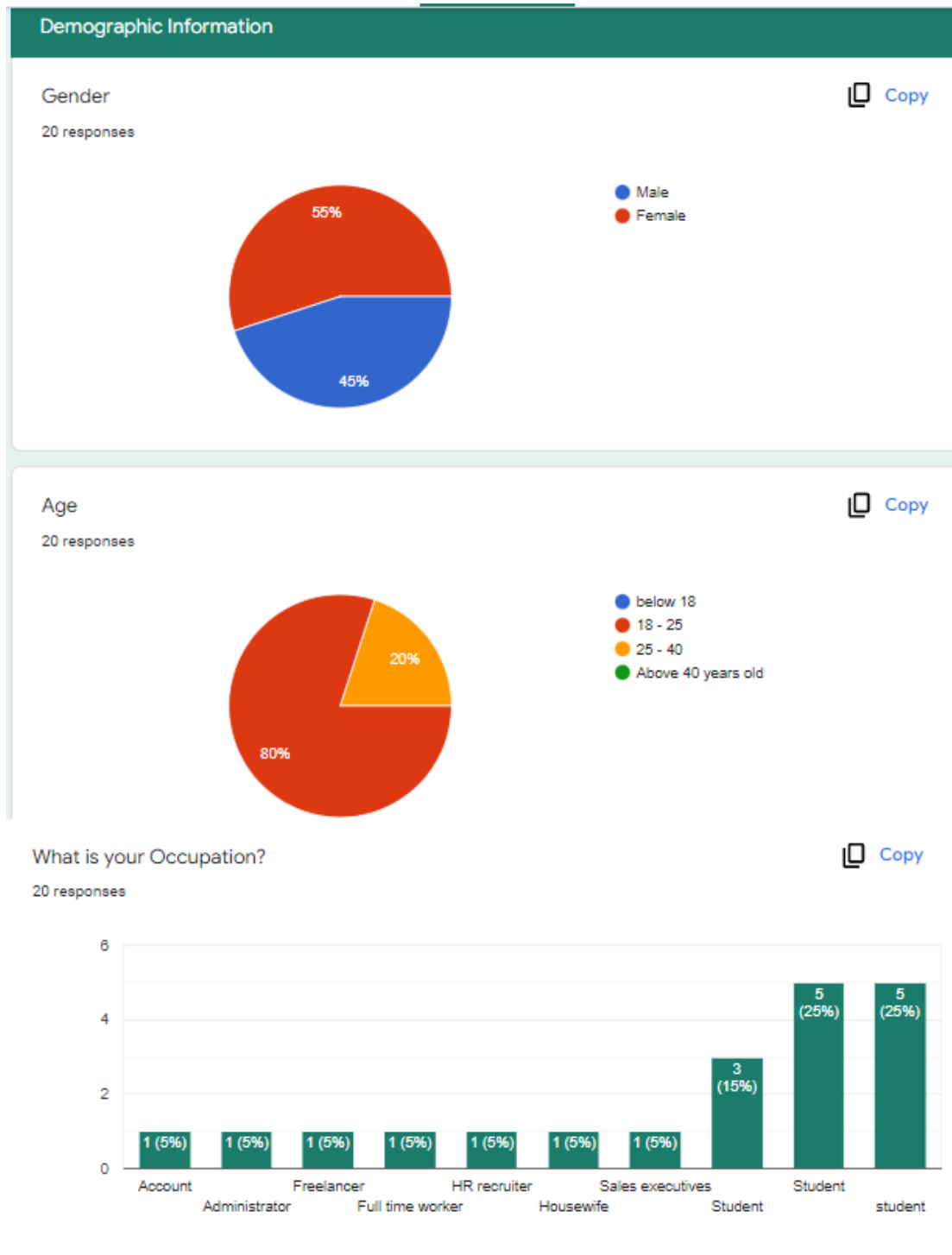


Figure 6.2.1

Figure 6.2.1 shows the respondents' age distribution and gender distribution. Most of the respondents belong to this 18-25 age group and most of them are students which are 65%.

CHAPTER 6 SYSTEM EVALUATION AND DISCUSSION

6.2.1 General Question

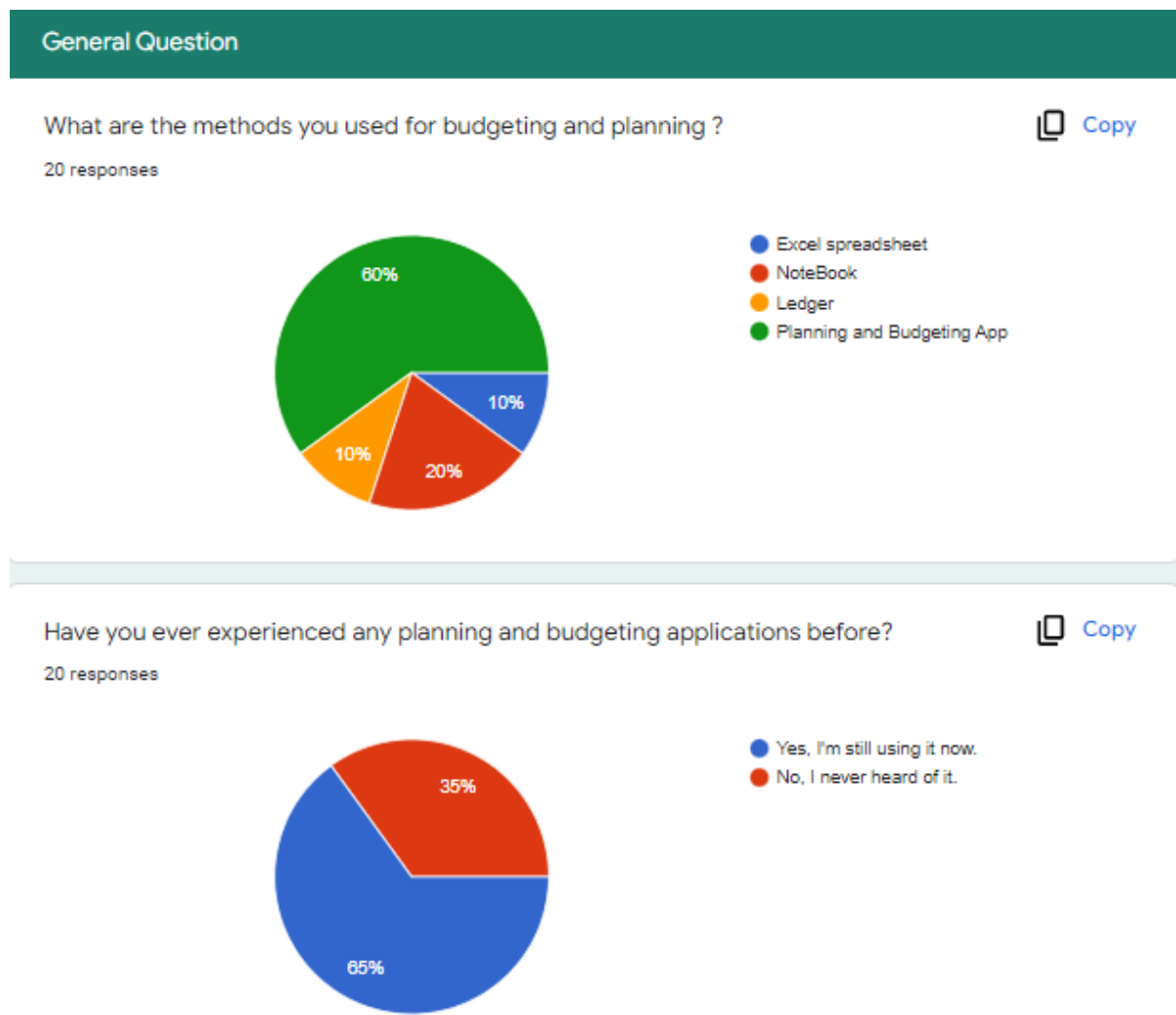


Figure 6.2.1.1

This section is to collect the general understanding and the thought of the respondents about the budgeting app. The first question is to collect respondents' current methods of budgeting and planning. From figure 6.2.1.1 above, it shows that 60% of the respondents are using planning and budgeting application which is higher than the other traditional methods (40%) like notebook, ledger and excel spreadsheets. The majority of them are still using the budgeting app as a tool to plan and budget.

CHAPTER 6 SYSTEM EVALUATION AND DISCUSSION

What motivate you want to install a Planning and Budgeting application?

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20 responses

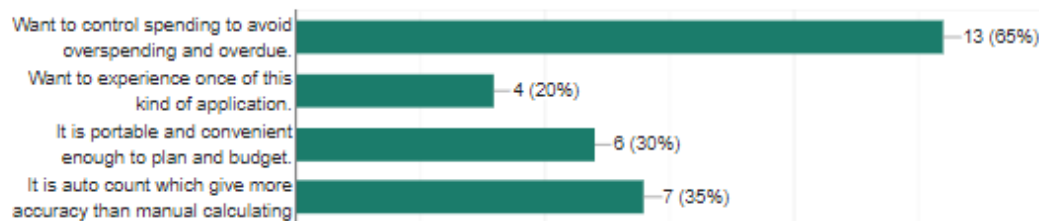


Figure 6.2.1.2

Do you think a non-technical person can comprehend this kind of application?

 Copy

20 responses

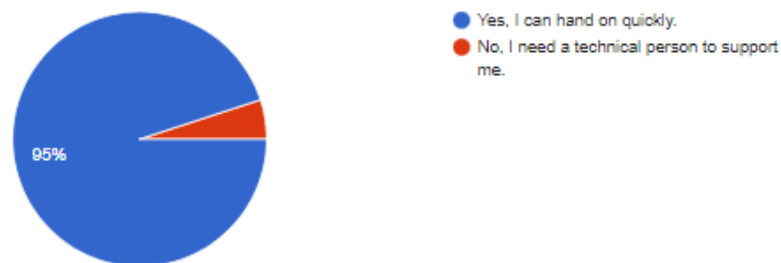


Figure 6.2.1.3

From Figure 6.2.1.3, the top reason why respondents used the budgeting application is wanting to avoid overspending, follow by the auto-calculation which is to ensure figure accuracy and it is portable enough to plan and budget just with a mobile app. Besides, it shows that the budgeting app is an easy tool to hand on quickly.

CHAPTER 6 SYSTEM EVALUATION AND DISCUSSION

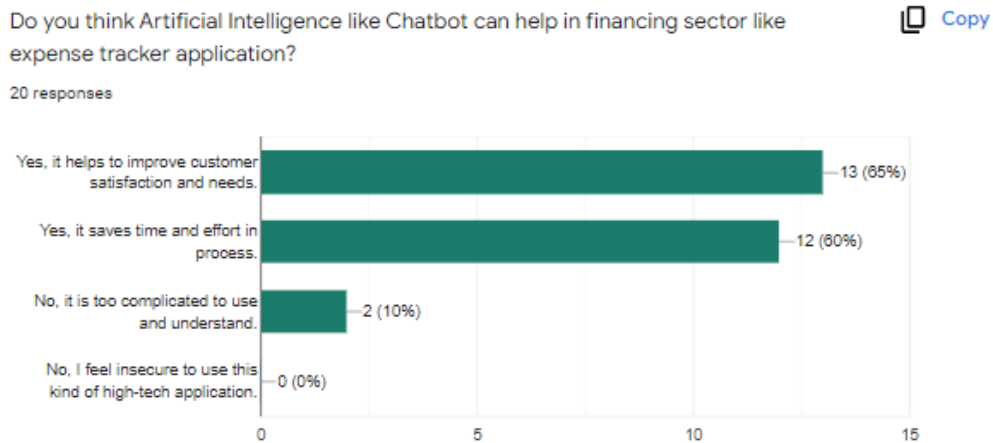


Figure 6.2.1.4

This question is to collect the attitude of our respondents towards the Chatbot. From figure 6.2.1.4, we observed that our respondents have more positive feelings than negative feelings about implementing a chatbot in the budgeting application. The majority of the respondents agree that it helps to improve satisfaction and save time in process. It shows that they are confident in chatbot.

6.2.2 User Interface Design Feedback

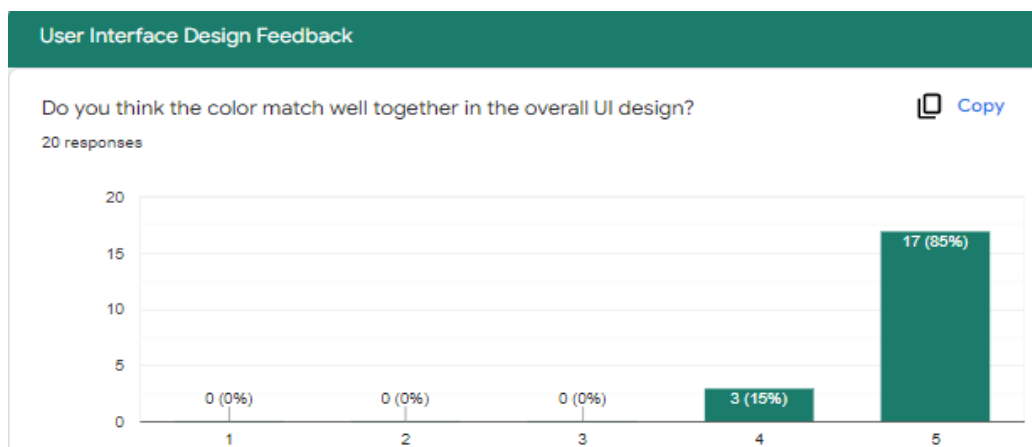


Figure 6.2.2.1

This section is to collect the feedback from our respondents regarding the user interface design of this proposed application. From the figure 6.2.2.1, all the respondents agree that the colours match well together.

CHAPTER 6 SYSTEM EVALUATION AND DISCUSSION

Do you think the navigation design is easy and clear to find what you want instantly?

 Copy



Do you think the navigation design is easy and clear to find what you want instantly?

 Copy

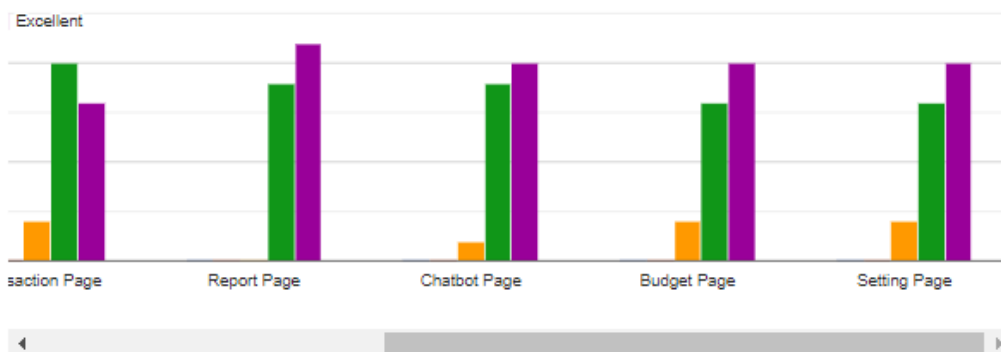


Figure 6.2.2.2

This question is to collect respondent satisfaction level towards each interface module of the application. From figure 6.2.2.2, we can see that all the respondents are able to find what they want instantly according to the navigation design of the application. It shows that the system provides clear navigation to user regarding the on-page messaging and view.

CHAPTER 6 SYSTEM EVALUATION AND DISCUSSION

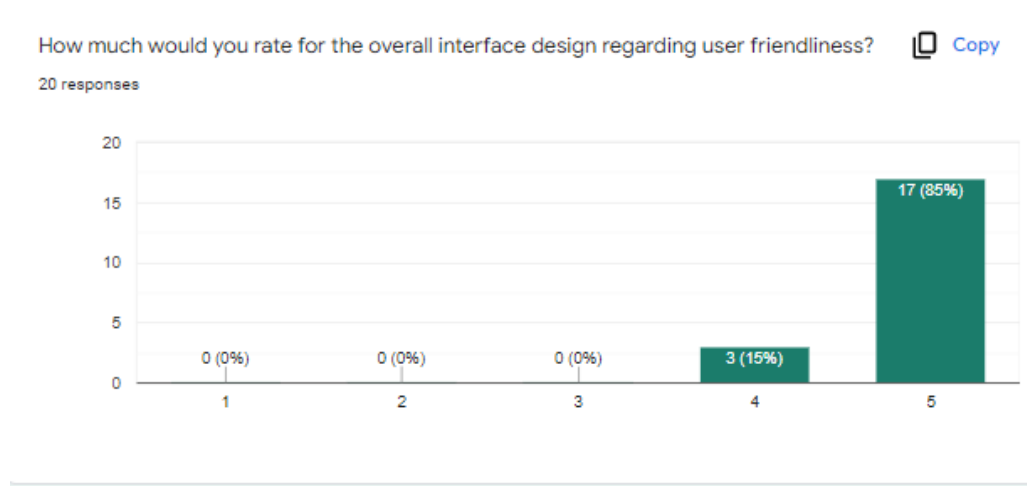


Figure 6.2.2.3

From figure 6.2.2.3, it shows that around 85% of respondents rate excellent while only 15% of the rate good to the overall interface design of the proposed application. It shows that most of them give a good review and think it is easy to use.

Any recommendation for use to improve more regarding the layout design?

20 responses

- Design very need improvement especially the orange colour.
- the balance display in red color once expenses over income
- Overall is good
- Love cool colour design
- Design can be more unisex
- Overall okay, colour very attractiveness and look like easy to use and control
- Mix with more color
- I think it's a good design, but I would suggest try to adjust abit to make it more to unisex
- Can mix more colours

Figure 6.2.2.4

These are the recommendation we obtained from the user regarding the layout design for the whole application. Majority of the respondents liked the design.

CHAPTER 6 SYSTEM EVALUATION AND DISCUSSION

6.2.3 System Requirement Feedback



Figure 6.2.3.1

This section is to collect respondent feedback on our system regards the user-friendliness, and usability of the features. From figure 6.2.3.1, the grading for overall features is good. But a minority of the respondents think that some of the features need improvements such as filtering transactions by date, displaying balance on the dashboard and filtering budget.

CHAPTER 6 SYSTEM EVALUATION AND DISCUSSION

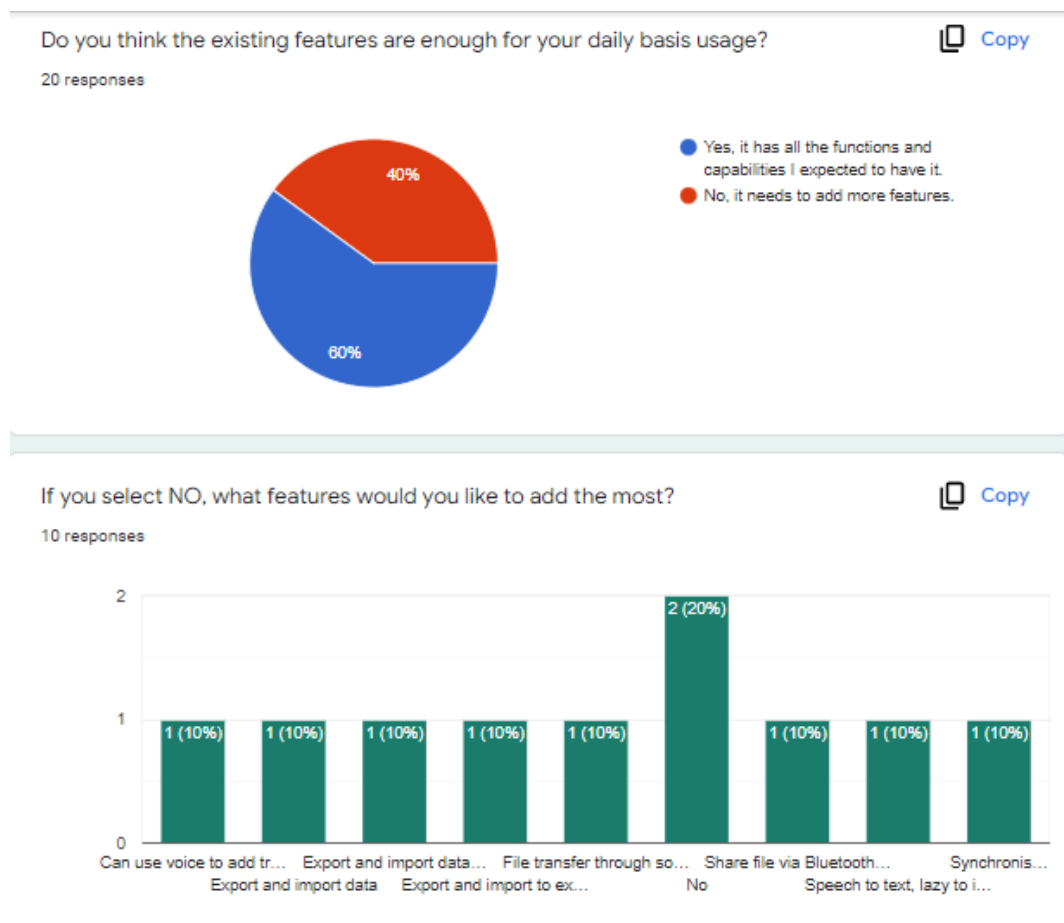


Figure6.2.3.2

From the figure 6.2.3.2, 60% of the respondents think the proposed app has all the features and capabilities expected of it while 40% of the respondents respond that the features are not enough for daily basis usage. It shows that future enhancements are needed to improve the proposed system.

CHAPTER 6 SYSTEM EVALUATION AND DISCUSSION



Figure 6.2.3.3

The above two questions are to examine the functionality of budget reminder and reset the password via email. From the survey, it shows that 100% of respondents were able to receive a dialog reminder to remind user when exceeded budget and, they are able to receive the password link. This shows that there are no technical issues happening.

CHAPTER 6 SYSTEM EVALUATION AND DISCUSSION

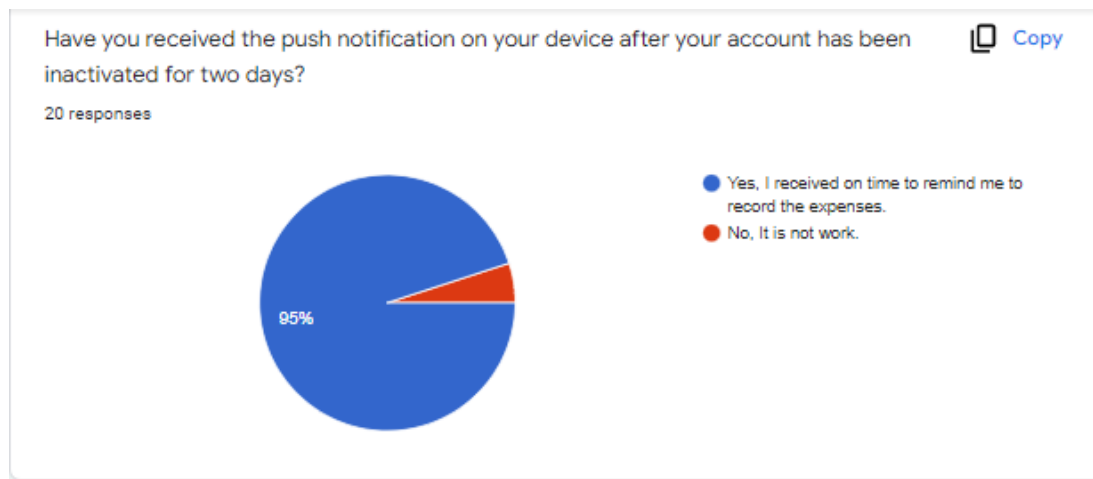


Figure 6.2.3.4

These questions examine the functionality of log in reminder and chatbot. From the survey, it shows that 95% of respondents were able to receive the push notification on their device after their account was inactivated for two days. Meanwhile, only 1 respondent was not able to receive the push notification. This shows that we need to resolve this issue.

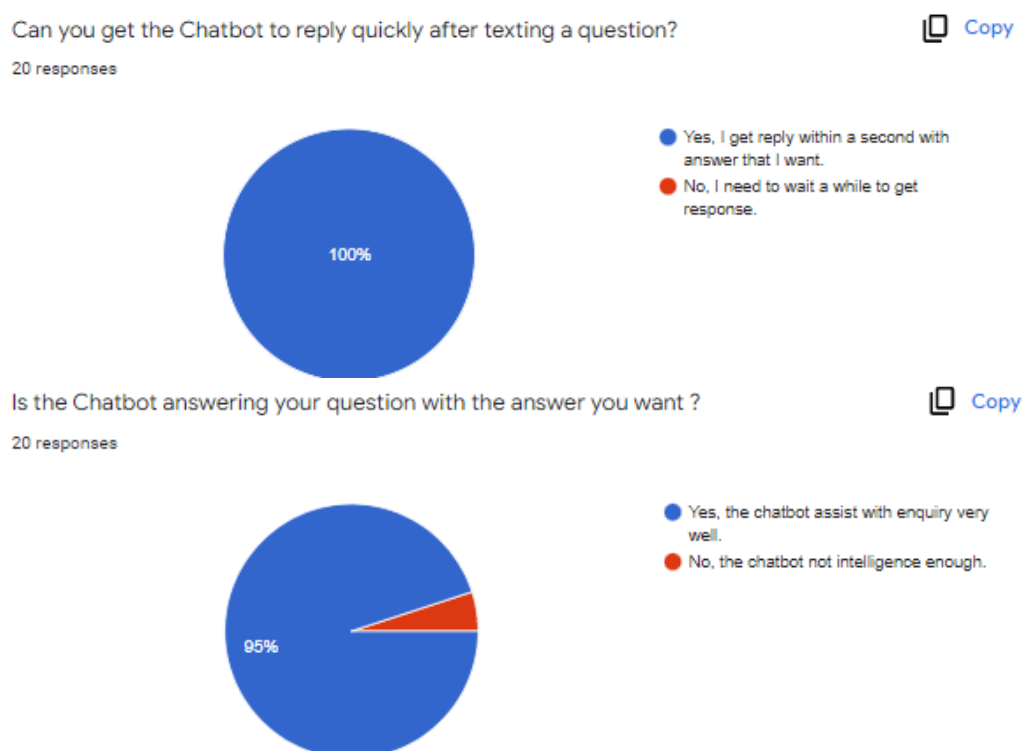


Figure 6.2.3.5

CHAPTER 6 SYSTEM EVALUATION AND DISCUSSION

For chatbot testing, 100% of the respondents were able to receive the replies from chatbot within seconds with the answer that they want. Meanwhile, only 1 person fails to get the answer they want. This shows that we need to improve on the chatbot functions.

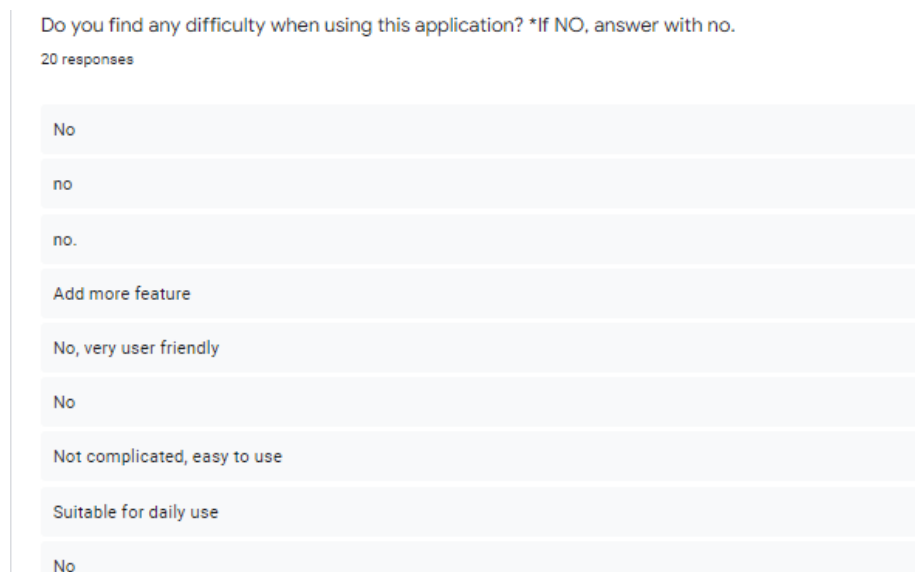


Figure 6.2.3.6

From figure 6.2.3.6, majority of the respondents think the proposed application is user-friendly and not complicated to use.

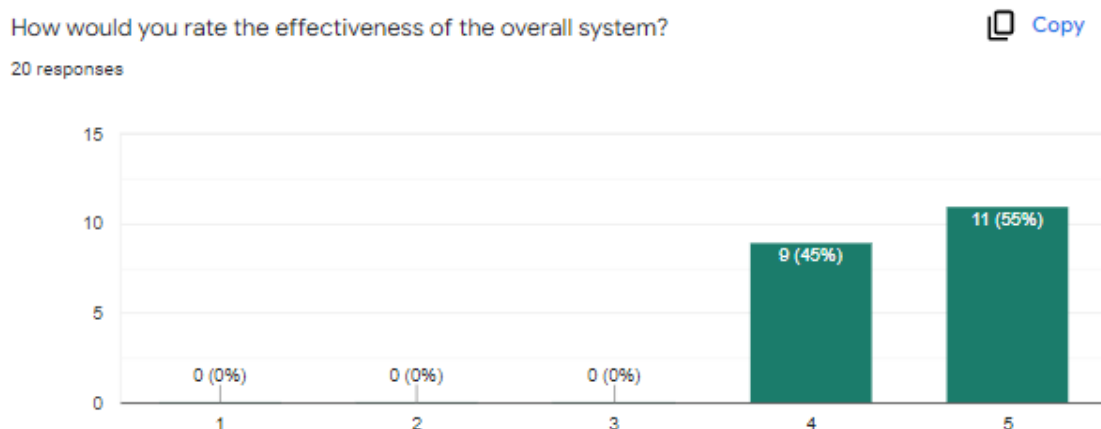


Figure 6.2.3.7

For chatbot testing, 100% of the respondents were able to receive the replies from chatbot within seconds. This shows that no technical issues are happening in chatbot replying.

CHAPTER 6 SYSTEM EVALUATION AND DISCUSSION

6.4 Objectives Evaluation

- **To develop a user-friendly personal finance management mobile application with auto precise calculation.**

This objective has been achieved. This project utilises an auto count algorithm to calculate the net balance of the account. It improves the accuracy of the figure since the net balance is calculated by the system instead of calculated manually. Referring to Figure 6.2.1.2 (respondent's survey), respondents agree that the budgeting app can reduce mistakes in calculation which is more easier to perform budgeting and planning with the auto sum up features in my proposed system.

- **To develop a personal finance management mobile application that is portable enough to let user add in transaction whenever they make transaction immediately.**

This objective has been achieved. The proposed project has successfully been developed which provides enough efficiency to user because it is portable to bring along anywhere. Referring to Figure 6.2.1.2 (respondent's survey), respondents agree that the budgeting app solved the problem of inconvenient accessing the mobile application. User able to add the transactions once they spent into the application.

- **To develop a personal finance management mobile application with Chatbot**

This objective has been achieved. The proposed project has successfully built a chatbot with automation replies to users' questions. As the feedback get from the test questionnaire, refer to Figure 6.2.3.5, the result shows that the chatbot function in the proposed system is successfully achieved and satisfied by the users.

CHAPTER 7 CONCLUSION AND RECOMMENDATION

CHAPTER 7: CONCLUSION AND RECOMMENDATION

7.1 Conclusion

The proposed project is a personal finance management mobile application with chatbot and the purpose of this application is to help users to keep track of their flow of cash, and provide them better visibility into their financial status. The target user of this project is those who are not aware of their overspending and have no idea where they have spent their money.

The core function of the application allows users to record incoming and outgoing expenses. This application will be a computerized diary to record all the expenses where user is able to refer the past transactions. To be more efficient in tracking back the past transaction, user allows filtering the transaction by date. Besides, the budget feature can let users set a budget limit to let them have control of their spending. Moreover, users are also able to look at a visual graph for their overall spending which is more informative and useful to view all the expenses on one page.

My proposed project combined a few features from the existing application that I have reviewed Mint, YNAB, Bluecoins, DollarBird, Goodbudget. In order to let the application become more unique than others, I added two new features that these five applications did not include such as Chatbot and smart reminder. A chatbot will act as a financial assistant to assist customer's enquiries while the smart reminder will be a tool to remind those inactive users to log in to their account to ensure their real spending is consistent with the in-app spending. Customer satisfaction will be highly instructive due to the implementation of these two features.

The methodology used is Prototyping Model. This methodology ensures that the developer can quickly get better software development solutions from customer reviews until the requirement is baselined. The main language developed in this system is Android Java and XML while the technology and tools such as Android SDK, Android Emulator, Firebase, Android Studio and a few APIs are used to develop this proposed system. Besides, the timeline is brought into use in this project to keep track of the progress. I successfully build the prototype for this proposed application by the set due date.

CHAPTER 7 CONCLUSION AND RECOMMENDATION

7.2 Recommendation

There are four recommendations for the application system that we were able to conclude throughout the system testing questionnaire from figure 6.2.3.2. One of the future enhancements of the application that can be done is to support the export and import data feature. User is able to export a backup out of the application and keep it in the storage of the device. It brings convenience to the user to import data into the other devices.

Besides, From the survey we gathered, some users wish to share their files via Bluetooth and WhatsApp. Therefore, we can add this feature to the application to facilitate the sharing process. Moreover, from the survey result, some user feels very troublesome adding personal details one by one when registering an account. Therefore, they recommend synchronizing the user's profile data to the application through an existing email or social network account instead of entering all the personal information on their own. For the data input side, a respondent recommends adding speech to text features to improve the efficiency of the system. They think this will be much more convenient to use voice to add the transaction instead of manual typing.

For user interface design of the application, there are a few improvements we can make on it. Some users feel that the interface design is more to the girl's preferences. Apart from that, one of the respondents thinks the balance that shows in the dashboard of the homepage should be highlighted in red colour once it shows a negative value. Therefore, we will make an adjustment to it by designing the application from a unisex perspective too and setting the font colour to red colour once the expenses are higher than the income. We will improve the application in future.

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APPENDIX

APPENDIX FYP POSTER

Personal Finance Management Mobile Application with Chatbot

Fintech utilizes Personal Financial Management to provide personal financial analysis, personal financial health evaluation and be a tool to monitor and control usage based on users' financial planning goals.

<h3>Problem Statement</h3> <ul style="list-style-type: none">• Inefficiencies and mistakes using manual method to perform financial planning• Difficult and inconvenient using Excel to plan and budget• Inadequate of Artificial Intelligence in the existing system 	<h3>Objective</h3> <ul style="list-style-type: none">• To develop a user-friendly personal finance management mobile application with auto precise calculation.• To develop a personal finance management mobile application that is portable and convenient to plan and budget.• To develop a personal finance management mobile application with Chatbot 
<h3>Methodologies</h3> <ul style="list-style-type: none">• Prototyping Development Model• Develop using JAVA language with Firebase database• Timeline is bought into use in this project to keep track of progress	<h3>Project Scope</h3> <ul style="list-style-type: none">• Record incoming and outgoing expenses• Filter transactions• Set Budget• Summarize report in visualisation graph• Chatbot finance services• Voice input recognition input• Set reminder for recording transactions• Export data to CSV
<h3>Conclusion</h3> <ul style="list-style-type: none">• The design of the application will be as simple as possible.• Additional features like Chatbot and Voice Recognition input will be a competitive advantage compare to other similar apps.• Free of charge application. 	

(FINAL YEAR PROJECT)

Project Developer
Mah Pei Tong
18ACB03609
Bachelor Information System (HONOURS)
Business Information System

Project Supervisor
Su Lee Seng
Lecturer of UTAR
Faculty of Information
and Communication Technologies



APPENDIX

FINAL YEAR PROJECT WEEKLY REPORT

(Project II)

Trimester, Year: Y3T3	Study week no.: 1
Student Name & ID: Mah Pei Tong 18ACB03609	
Supervisor: Mr. Su Lee Seng	
Project Title: Personal Finance Management Mobile Application with Chatbot	

1. WORK DONE

[Please write the details of the work done in the last fortnight.]

Discuss with supervisor about the overall system design and project planned.

2. WORK TO BE DONE

Revised and deeply go through what need to be included in the proposed system before coding prototype.

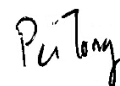
3. PROBLEMS ENCOUNTERED

Consider deducting few proposed features because too many features have been proposed before.

4. SELF EVALUATION OF THE PROGRESS



Supervisor's signature



Student's signature

APPENDIX

FINAL YEAR PROJECT WEEKLY REPORT

(Project II)

Trimester, Year: Y3T3	Study week no.: 2
Student Name & ID: Mah Pei Tong 18ACB03609	
Supervisor: Mr. Su Lee Seng	
Project Title: Personal Finance Management Mobile Application with Chatbot	

1. WORK DONE

[Please write the details of the work done in the last fortnight.]

Discuss with supervisor about the done features that have been done in FYP1.

2. WORK TO BE DONE

Start to write FYP2 report.

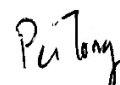
3. PROBLEMS ENCOUNTERED

Need improvement on the existing features.

4. SELF EVALUATION OF THE PROGRESS



Supervisor's signature



Student's signature

APPENDIX

FINAL YEAR PROJECT WEEKLY REPORT

(Project II)

Trimester, Year: Y3T3	Study week no.: 3
Student Name & ID: Mah Pei Tong 18ACB03609	
Supervisor: Mr. Su Lee Seng	
Project Title: Personal Finance Management Mobile Application with Chatbot	

1. WORK DONE

[Please write the details of the work done in the last fortnight.]

Discuss with supervisor about the progress of the development

2. WORK TO BE DONE

Modified 25% of the existing system.

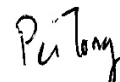
3. PROBLEMS ENCOUNTERED

Did not have a clear mindset on how to improve the existing features.

4. SELF EVALUATION OF THE PROGRESS



Supervisor's signature



Student's signature

APPENDIX

FINAL YEAR PROJECT WEEKLY REPORT

(Project II)

Trimester, Year: Y3T3	Study week no.: 4
Student Name & ID: Mah Pei Tong 18ACB03609	
Supervisor: Mr. Su Lee Seng	
Project Title: Personal Finance Management Mobile Application with Chatbot	

1. WORK DONE

[Please write the details of the work done in the last fortnight.]

Inform supervisor about my working progress on program.

2. WORK TO BE DONE

Modified 50% of the exiting features.

3. PROBLEMS ENCOUNTERED

Take long time to debug the code.

4. SELF EVALUATION OF THE PROGRESS



Supervisor's signature



Student's signature

APPENDIX

FINAL YEAR PROJECT WEEKLY REPORT

(Project II)

Trimester, Year: Y3T3	Study week no.: 5
Student Name & ID: Mah Pei Tong 18ACB03609	
Supervisor: Mr. Su Lee Seng	
Project Title: Personal Finance Management Mobile Application with Chatbot	

1. WORK DONE

[Please write the details of the work done in the last fortnight.]

Inform supervisor about my working progress on program.

2. WORK TO BE DONE

Modified 80% of the exiting features.

3. PROBLEMS ENCOUNTERED

Take long time to debug the code.

4. SELF EVALUATION OF THE PROGRESS



Supervisor's signature



Student's signature

APPENDIX

FINAL YEAR PROJECT WEEKLY REPORT

(Project II)

Trimester, Year: Y3T3	Study week no.: 6
Student Name & ID: Mah Pei Tong 18ACB03609	
Supervisor: Mr. Su Lee Seng	
Project Title: Personal Finance Management Mobile Application with Chatbot	

1. WORK DONE

[Please write the details of the work done in the last fortnight.]

Enhancement on the existing features have been completely done.

2. WORK TO BE DONE

Start to work on report and new features that will added into the system.

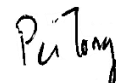
3. PROBLEMS ENCOUNTERED

Take long time to debug the code. Hectic week because need to prepare for other subject's midterm tests and quiz.

4. SELF EVALUATION OF THE PROGRESS



Supervisor's signature



Student's signature

APPENDIX

FINAL YEAR PROJECT WEEKLY REPORT

(Project II)

Trimester, Year: Y3T3	Study week no.: 7
Student Name & ID: Mah Pei Tong 18ACB03609	
Supervisor: Mr. Su Lee Seng	
Project Title: Personal Finance Management Mobile Application with Chatbot	

1. WORK DONE

[Please write the details of the work done in the last fortnight.]

Discuss with supervisor about the idea of new features that can be added in.

2. WORK TO BE DONE

Start to work on report and new features that will added into the system.

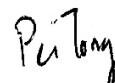
3. PROBLEMS ENCOUNTERED

Take long time to debug the code. Hectic week because need to prepare for other subject's midterm tests and quiz.

4. SELF EVALUATION OF THE PROGRESS



Supervisor's signature



Student's signature

APPENDIX

FINAL YEAR PROJECT WEEKLY REPORT

(Project II)

Trimester, Year: Y3T3	Study week no.: 8
Student Name & ID: Mah Pei Tong 18ACB03609	
Supervisor: Mr. Su Lee Seng	
Project Title: Personal Finance Management Mobile Application with Chatbot	

1. WORK DONE

[Please write the details of the work done in the last fortnight.]

Report my ongoing progress for both report and coding part to supervisor and discuss on the problem that I have encountered.

2. WORK TO BE DONE

Start to code the first added new feature which is Report part.

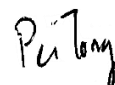
3. PROBLEMS ENCOUNTERED

Hard to find any references about the coding and design regards the report part.

4. SELF EVALUATION OF THE PROGRESS



Supervisor's signature



Student's signature

APPENDIX

FINAL YEAR PROJECT WEEKLY REPORT

(Project II)

Trimester, Year: Y3T3	Study week no.: 9
Student Name & ID: Mah Pei Tong 18ACB03609	
Supervisor: Mr. Su Lee Seng	
Project Title: Personal Finance Management Mobile Application with Chatbot	

1. WORK DONE

[Please write the details of the work done in the last fortnight.]

Report my ongoing progress for both report and coding part to supervisor and discuss on the problem that I have encountered.

2. WORK TO BE DONE

Need to complete the report part program.

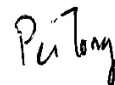
3. PROBLEMS ENCOUNTERED

Hard to find any references about the coding and design regards the report part.

4. SELF EVALUATION OF THE PROGRESS



Supervisor's signature



Student's signature

APPENDIX

FINAL YEAR PROJECT WEEKLY REPORT

(Project II)

Trimester, Year: Y3T3	Study week no.: 10
Student Name & ID: Mah Pei Tong 18ACB03609	
Supervisor: Mr. Su Lee Seng	
Project Title: Personal Finance Management Mobile Application with Chatbot	

1. WORK DONE

[Please write the details of the work done in the last fortnight.]

Complete the development of Report part of the program.

3. WORK TO BE DONE

Start to code second added new feature which is Chatbot.

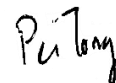
3. PROBLEMS ENCOUNTERED

Hard to find any references about the coding and design regards the report part.

4. SELF EVALUATION OF THE PROGRESS



Supervisor's signature



Student's signature

APPENDIX

FINAL YEAR PROJECT WEEKLY REPORT

(Project II)

Trimester, Year: Y3T3	Study week no.: 11
Student Name & ID: Mah Pei Tong 18ACB03609	
Supervisor: Mr. Su Lee Seng	
Project Title: Personal Finance Management Mobile Application with Chatbot	

1. WORK DONE

[Please write the details of the work done in the last fortnight.]

Report my ongoing progress for both report and coding part to supervisor and discuss on the problem that I have encountered.

2. WORK TO BE DONE

Need to code complete the Chatbot by next week. And test the whole system to ensure it is running smoothly.

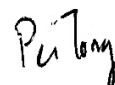
3. PROBLEMS ENCOUNTERED

Hard to find any references about the coding and design regards the report part.

4. SELF EVALUATION OF THE PROGRESS



Supervisor's signature



Student's signature

APPENDIX

FINAL YEAR PROJECT WEEKLY REPORT

(Project II)

Trimester, Year: Y3T3	Study week no.: 12
Student Name & ID: Mah Pei Tong 18ACB03609	
Supervisor: Mr. Su Lee Seng	
Project Title: Personal Finance Management Mobile Application with Chatbot	

1. WORK DONE

[Please write the details of the work done in the last fortnight.]

Inform the final progress about my overall FYP2 report and prototype.
Discuss with supervisor about the report submission and presentation.

2. WORK TO BE DONE

Finalize the report.

3. PROBLEMS ENCOUNTERED

No problems encountered when working in this part.

4. SELF EVALUATION OF THE PROGRESS



Supervisor's signature



Student's signature

APPENDIX

TURNITIN CHECK RESULT

FYP2			
ORIGINALITY REPORT			
4%	3%	1%	2%
SIMILARITY INDEX	INTERNET SOURCES	PUBLICATIONS	STUDENT PAPERS
PRIMARY SOURCES			
1	code.tutsplus.com Internet Source		1%
2	kipdf.com Internet Source		<1%
3	myfinancexpress.blogspot.com Internet Source		<1%
4	umpir.ump.edu.my Internet Source		<1%
5	doras.dcu.ie Internet Source		<1%
6	documents.mx Internet Source		<1%
7	www.malaymail.com Internet Source		<1%
8	Submitted to City University Student Paper		<1%
9	zenodo.org Internet Source		<1%

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12	uir.unisa.ac.za Internet Source	<1 %
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15	Tao Yue. "Automated Transition from Use Cases to UML State Machines to Support State-Based Testing", Lecture Notes in Computer Science, 2011 Publication	<1 %
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19	Submitted to Napier University Student Paper	<1 %

researchoutput.csu.edu.au

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20	Internet Source	<1 %
21	Leonice Souza-Pereira, Nuno Pombo, Sofia Ouhbi, Virginie Felizardo, Nuno Garcia. "Clinical decision support systems for chronic diseases: A Systematic literature review", Computer Methods and Programs in Biomedicine, 2020 Publication	<1 %
22	Submitted to Technological Institute of the Philippines Student Paper	<1 %
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27	Sedra, Adel S.. "Solved Problems to Accompany Microelectronic Circuits", Oxford University Press Publication	<1 %
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29	bura.brunel.ac.uk Internet Source	<1 %
30	etd.astu.edu.et Internet Source	<1 %
31	serisc.org Internet Source	<1 %
32	www.tutorialandexample.com Internet Source	<1 %
33	Haddock, Steven H. D.. "Practical Computing for Biologists", Oxford University Press Publication	<1 %
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35	www.scribd.com Internet Source	<1 %

Exclude quotes On

Exclude matches < 7 words

Exclude bibliography On

APPENDIX

PLAGIARISM CHECK RESULT

Universiti Tunku Abdul Rahman			
Form Title : Supervisor's Comments on Originality Report Generated by Turnitin for Submission of Final Year Project Report (for Undergraduate Programmes)			
Form Number: FM-IAD-005	Rev No.: 0	Effective Date: 01/10/2013	Page No.: 1of 1



FACULTY OF INFORMATION AND COMMUNICATION TECHNOLOGY

Full Name(s) of Candidate(s)	Mah Pei Tong
ID Number(s)	18ACB03609
Programme / Course	Bachelor of Information Systems (HONOURS) Business Information Systems
Title of Final Year Project	Personal Finance Management Mobile Application with Chatbot

Similarity	Supervisor's Comments (Compulsory if parameters of originality exceeds the limits approved by UTAR)
Overall similarity index: <u>4</u> % Similarity by source Internet Sources: <u>3</u> % Publications: <u>1</u> % Student Papers: <u>2</u> %	
Number of individual sources listed of more than 3% similarity: <u>0</u>	
Parameters of originality required and limits approved by UTAR are as Follows: (i) Overall similarity index is 20% and below, and (ii) Matching of individual sources listed must be less than 3% each, and (iii) Matching texts in continuous block must not exceed 8 words <i>Note: Parameters (i) – (ii) shall exclude quotes, bibliography and text matches which are less than 8 words.</i>	

Note Supervisor/Candidate(s) is/are required to provide softcopy of full set of the originality report to Faculty/Institute

Based on the above results, I hereby declare that I am satisfied with the originality of the Final Year Project Report submitted by my student(s) as named above.

SuLee

Signature of Supervisor

Signature of Co-Supervisor

Name: Su Lee Seng

Name: _____

Date: 20/4/2022

Date: _____

APPENDIX

FYP 2 CHECKLIST



UNIVERSITI TUNKU ABDUL RAHMAN

FACULTY OF INFORMATION & COMMUNICATION TECHNOLOGY
(KAMPAR CAMPUS)

CHECKLIST FOR FYP2 THESIS SUBMISSION

Student Id	18ACB03609
Student Name	Mah Pei Tong
Supervisor Name	Mr. Su Lee Seng

TICK (✓)	DOCUMENT ITEMS
	Your report must include all the items below. Put a tick on the left column after you have checked your report with respect to the corresponding item.
/	Front Plastic Cover (for hardcopy)
/	Title Page
/	Signed Report Status Declaration Form
/	Signed FYP Thesis Submission Form
/	Signed form of the Declaration of Originality
/	Acknowledgement
/	Abstract
/	Table of Contents
/	List of Figures (if applicable)
/	List of Tables (if applicable)
/	List of Symbols (if applicable)
/	List of Abbreviations (if applicable)
/	Chapters / Content
/	Bibliography (or References)
/	All references in bibliography are cited in the thesis, especially in the chapter of literature review
/	Appendices (if applicable)
/	Weekly Log
/	Poster
/	Signed Turnitin Report (Plagiarism Check Result - Form Number: FM-IAD-005)
/	I agree 5 marks will be deducted due to incorrect format, declare wrongly the ticked of these items, and/or any dispute happening for these items in this report.

*Include this form (checklist) in the thesis (Bind together as the last page)

I, the author, have checked and confirmed all the items listed in the table are included in my report.

Pei Tong

(Signature of Student)

Date: 18/4/2022

FYP 2 SYSTEM TESTING QUESTIONNAIRE

System Testing on Personal Finance Management Mobile Application with Chabot

Dear Respondents,

I am undergraduate Final Year students of Bachelor of Information Systems (HONOURS) Business Information System at Universiti Tunku Abdul Rahman (UTAR) Kampar Campus. I am conducting my Final Year Project that related to the topic stated above. I kindly seek your participation to help me to collect data for my system development and further improvement.

I appreciate your time and effort in taking a few minutes to answer all of my questions. There is no risk involved in your participation in this survey. Your identity and responses will be kept private and confidential. The completion of this study implies consent for us to consolidate your data with others and publish the results without identifying any respondents.

Instructions:

1. There will be around 26 questions in this questionnaire.

This questionnaire consists of 4 main sections:

- Section 1: Demographic Information
- Section 2: General Question
- Section 3: User Interface Design Feedback
- Section 4: System Requirement Feedback

2. Please read and answer ALL the questions.

3. The LINK to download the application will attach below.

APK Link: <https://drive.google.com/drive/folders/1VHlvijQa8fh1tPtYLDl3jniUDQYM--0P?usp=sharing>

If you have any enquiries is important related to this research, please do not hesitate to contact me via the email address stated below:

Mah Pei Tong 1803609 mahpeitong63@utar.my

Your data privacy is important to us. Personal data collected will be protected in accordance with Personal Data Protection Act 2010.

mahpeitong@gmail.com [Switch account](#)



* Required

Email *

Your email

Next

Clear form

Demographic Information

Gender *

- Male
- Female

Age *

- below 18
- 18 - 25
- 25 - 40
- Above 40 years old

What is your Occupation? *

Your answer _____

Back

Next

Clear form

General Question

This section consists of 5 questions.

What are the methods you used for budgeting and planning ? *

- Excel spreadsheet
- NoteBook
- Ledger
- Planning and Budgeting App

Have you ever experienced any planning and budgeting applications before? *

- Yes, I'm still using it now.
- No, I never heard of it.

What motivate you want to install a Planning and Budgeting application? *

- Want to control spending to avoid overspending and overdue.
- Want to experience once of this kind of application.
- It is portable and convenient enough to plan and budget.
- It is auto count which give more accuracy than manual calculating

Do you think a non-technical person can comprehend this kind of application? *

- Yes, I can hand on quickly.
- No, I need a technical person to support me.

Do you think Artificial Intelligence like Chatbot can help in financing sector like expense tracker application? *

- Yes, it helps to improve customer satisfaction and needs.
- Yes, it saves time and effort in process.
- No, it is too complicated to use and understand.
- No, I feel insecure to use this kind of high-tech application.

Back

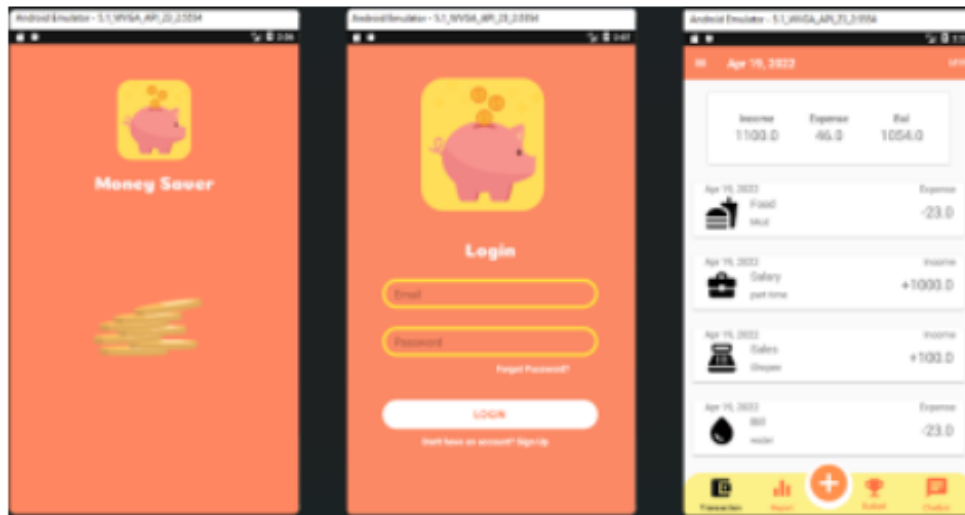
Next

Clear form

User Interface Design Feedback

This section consists of 4 questions.

Splash Screen / Login / Homepage



Do you think the color match well together in the overall UI design? *

1 2 3 4 5

Unmatch Match

Do you think the navigation design is easy and clear to find what you want instantly? *

	Very Poor	Poor	Moderate	Good	Excellent
Sign in Page	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Register Page	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Transaction Page	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Report Page	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Chatbot Page	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Budget Page	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Setting Page	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

How much would you rate for the overall interface design regarding user friendliness? *

	1	2	3	4	5	
Dislike	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Like

Any recommendation for use to improve more regarding the layout design? *

Your answer

Back

Next

Clear form

System Requirement Feedback

This section consists of 10 questions.

How much do you feel about the features below meet your needs? *

	Worst	Need improvement	Moderate	Good	Excellent
Add Transaction	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Edit Transaction	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Delete Transaction	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Track past transactions	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Filter transactions by date	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Calculator	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Display balance on dashboard	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Visualize financial graph in Pie Chart	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Summary Report in category	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Set Budget	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Filter Budget	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Log in reminder	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Assistant Chatbot	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Do you think the existing features are enough for your daily basis usage? *

- Yes, it has all the functions and capabilities I expected to have it.
- No, it needs to add more features.

If you select NO, what features would you like to add the most?

Your answer _____

Did a dialog box pop out on the screen when your budget is exceeded? *

- Yes, it pop out on the budget page.
- No, nothing pops out even though the amount spent already exceeds the budget set.

Are you able to receive the reset password link in your mailbox? *

- Yes, I am able to received the email within seconds.
- No, I am not able to receive the email.

Have you received the push notification on your device after your account has been inactivated for two days? *

- Yes, I received on time to remind me to record the expenses.
- No, It is not work.

Can you get the Chatbot to reply quickly after texting a question? *

- Yes, I get reply within a second with answer that I want.
- No, I need to wait a while to get response.

Is the Chatbot answering your question with the answer you want ? *

- Yes, the chatbot assist with enquiry very well.
- No, the chatbot not intelligence enough.

Do you find any difficulty when using this application? *If NO, answer with no. *

Your answer _____

How would you rate the effectiveness of the overall system? *

- | | | | | | | |
|-------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------|
| | 1 | 2 | 3 | 4 | 5 | |
| Worse | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | Excellent |

Back

Submit

Clear form