VISUALIZING AND FORECASTING STOCKS USING DASH

BY

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A REPORT

SUBMITTED TO

Universiti Tunku Abdul Rahman

in partial fulfillment of the requirements

for the degree of

BACHELOR OF INFORMATION SYSTEMS (HONOURS) BUSINESS INFORMATION

SYSTEMS

Faculty of Information and Communication Technology

(Kampar Campus)

JAN 2024

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Academic Session: _January 2024____

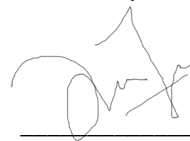I   __OOI YUI THENG_____

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It is hereby certified that <u>*Ooi Yui Theng*</u> (ID No: <u>*20ACB01720*</u>) has completed this final year project/ dissertation/ thesis* entitled " <u>Forecasting & Visualizing Stocks using Dash</u> " under the supervision of <u>Dr, Shakiroh Binti Khamis</u> (Supervisor) from the Department of <u>Digital Economy Technology</u> , Faculty/Institute* of <u>Information and Communication Technology</u> .

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Name : _Ooi Yui Theng_____

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ACKNOWLEDGEMENTS

I would like to express my sincere thanks and appreciation to my supervisor, Dr. Shakiroh binti Khamis who has given me this bright opportunity to engage in my Visualizing and Forecasting Stocks using Dash project. It is my first time to establish the stocks market and visualizing field. And, a thanks to my moderator Ts Dr Wong Pei Voon. They have guide me and giving me lot of advice though my project. A very appreciate thanks to them for providing me with corrected criticism, time and effort.

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ABSTRACT

The need for intuitive and interactive visualization tools is paramount in current stock market environment. Traditional stock market systems provide investors with simple insights and flawless user experiences. This research addresses this gap by proposing a Visualizing and Forecasting Stocks by using Dash that utilizing Power BI. The research identifies the problems in existing systems, such as lack of interactive visualization, inadequate user understanding and unsuitable user interfaces. This research is motivated by the potential for substantial profit in stock forecasting and aims to equip investors with tools to minimize losses and ensure to have a better decision-making. Objectives includes to study the existing stock market system features, developing an interactive forecasting system with intuitive visualization by using dashboards and to evaluate the forecast stock market system dashboard by using usability testing. The methodology for this project is Agile Methodology that separate the projects into planning, analysis, design, development, testing, integration, and maintenance stages. System implementation is relying on Power BI that having a data exploration, visualization, and real time analytics. System evaluation and discussion will include the usability testing questionnaire and basic functionality checks. The results for questionnaire and system testing are overall good and above that shows that the system is in a good direction. In this paper, we aim to provide a stock market system that can visualize and forecast stocks and will focus on incorporating additional stock-related feature in the future enhancements.

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LIST OF ABBREVIATIONS

API   Application Programming Interface

CPU   Central Processing Unit

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Chapter 1

Introduction

In this chapter, it presents the background and motivation of the research, project scope, contributions to the field, and the outline of the thesis. Visualizing and forecasting stocks using dashboard is gathering all the stocks data, currencies and financials data, then put all of it into the dashboard in order for the users to visualize and forecast. Buying and selling shares of public entities is a risky trading. There is always having uncertainty in the stock market, so people are scared about to invest their money in the stock market. Therefore, a strategy that can visualize and forecast the stock market prices to let people to invest in the stock market is needed. Visualizing and forecasting stocks is going to increase the probability of buying or selling the right stocks. It uses the Power BI to visualize and predict the stocks in a view of dashboard. Power BI can manage the complex data into a simple and clear visualization of stock data. The system will show real value and predicted price of the stocks.

1.1   Problem Statement and Motivation

The first problem is current market forecasting stock system is **lack of interactive visualization for the stocks data**. Due to the data may be overload for the current system making it challenging to extract meaningful insights manually. Johansson, C. and Nilsson, R. says that by adding the interactivity to the visual representations, it will be possible to gain an even bigger insight into the data by rearranging and manipulating the data to find patterns and trends [a]. So, dashboard will be needed to process and visualize the data to the users. The key trends and patterns will also be captured and visualized in the dashboard. All the stocks data are visualized in the dashboard will helps the users can see various data in only one view such as the stocks market data, currencies data, financial data and others.

The second problem is **lack of helping the investor to have a better understanding for the stocks**. Nowadays, investing in the stocks is being more common for the young like the university students, they tend to explore new things and can bear the risks that the stocks invest will brings. They will start with a little money in the stocks market and keep learning the knowledge of the stocks market because they are still new when investing the stocks. But stock

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markets are a complex system to be understand in the beginning [b]. In this situation, the current stock markets have not provided some useful tips that the new user needs to know before investing. An analysis from the professional investors will be needed for the system. This analysis is the opinion or suggestion from the professional then gather together in order to help the new users to have a better understanding to the stocks market.

The third problem is **lack of better user experience and user interface in current stock market system.** The existing stock market system having shortcomings in user experience and user interface, it is lack of the efficient participation and navigation for investors of different backgrounds and expertise levels. Users may face different barriers such as the complex interfaces, limited accessibility features and insufficient educational resources. Simplifying the user interface can reduce the market complexity [c]. The dashboard will cater both novice investors and experienced investors to by creating a responsive and visually dashboard with the features of interactive charts and insightful analytics.

The **motivation** for the research in this area is forecasting the stock brings a great profit. Forecasting the stock can help people to minimizes the losses and assures the consistency of buying or selling the correct stock. Even one people only have least knowledge about stock market can have large earnings.

1.2 Objectives

First objective for this project is **to study the features of a forecast stock market system.** A stock market forecasting system is to determine the future value of a company's stock or other financial traded on an exchange. A forecasting stock will have few features like each company's stock market prediction, cryptocurrency, and currencies of each country. It enables user to predict their stock by using this system, they may know when the suitable time will be to buy and to sell their stock.

Second objective is **to develop an interactive forecast stock market system to provide better visualization by using dashboard.** Interactivity between the user and the system is important because it act as a communication between the user and the system. An interactive forecast stock market system will provide user a great experience when using the system. It

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can maintain a long-term relationship between the user and the system [4]. Dashboard is a single page documents that shows only selected data in one page. It is limited only one page, user can view related reports in a short time. Although there is only one page, but user can view the data that they selected, and the data is organized in the dashboard [5].

Last, the third objective is **to evaluate the forecast stock market system dashboard by using usability testing.** Evaluating a system by using usability testing is a group of representative users testing the system. Usability testing can identify the problems as early as possible, so that the issues can be fixed as well. The earlier the issues are identified and be fixed, the cost will be lower [6].

1.3   Project Scope

This project is aimed to develop a visualize and forecast stock system by using dashboard. There are five scopes in this project which are to develop a Today's market module, a Stock Markets module, a Currencies module, a Financials module and last develop a Graph module.

First is **Today's market** module, this module will act as the main dashboard in this system. Today's market dashboard will include various data in only one view. It will have a "Trending News" widget on the top of the dashboard to let the users can see the business news at a glance. It will continue with the summary of the "Stocks" data widget. In this gadget, it will have the latest stocks data and also comes with a graph. When the users visit the system, they can look today's stock data at the first time. The "Currencies" widget will then put below the Stock gadget. This Currencies gadget will same as the Stock gadget that includes the latest currencies data.

Second module will be **Stock Markets** dashboard. This dashboard contains more detailed information about stocks. The first widget is the "Trending Tickers" widget on the top of the dashboard. This widget is let users know which tickers is currently trending in the market. The users may have interesting to invest in the trending tickers. There is a "Analysis and Opinion" widget. This gadget uses to show the analysis and opinion from the professional investors. It is a helpful gadget that may help the new users to make the decisions when investing the stock. "Most Active Stocks" is to let users can see the most active stocks currently in the market.

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"Gainer Stocks" is showing the users the stocks that is gain in that day. "Historical Stock" is the widget that shows all the history of the stock within a date range.

Third is the **Currencies** module. This dashboard is mainly used to show the currency data to the user in table and graph form. So, there will have a "Currency" widget and "Currency Graph" widget. For the currency, it will be in a table form that shows the latest data of the currency. While the currency graph will show the graph in a range of date. There is still have one widget of "History Currencies" to show all the past data of currencies in a table form.

Fourth will be the **Financials** module. This dashboard is to show the user how the company's financial statements situation. There will only have two widgets in this dashboard which is "Financial Table" and "Financial Graph". These two widgets are to show the financial statement in a table form and graph form.

The fifth and the last module will be **Graph** module. This dashboard will help users to forecast and interpret the future direction of a particular stock. In this dashboard, it will only show graph and chart which is the "Stock Candlestick Chart" and "Financial Statement Chart". The stock candlestick chart is to let users can see the moving of the stock whether it is increasing or decreasing. It also let the users can predict the future stocks data by looking at the past moving trends of the stocks. For the financial statement chart, it shown the financial statements chart. By putting these two graphs together, users can have a better decision when they are investing stocks.

1.4   Contributions

There are many new developments in this area, people are hard to notice the difference between each development. The previous studies from others paper that are reviewed from other system had been summarized especially from these five years. It will help people to know more clearly, and without wasting time to reviewed on those similar system one by one.

In the past few years, stock prediction system had been developed by many basic tools. For this time, Power BI is the main tools to develop this visualizing and forecasting system. Power BI is an analytics intelligence platform that can be used for data exploration, visualization and

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have an interactive dashboard that can visualize and forecast the stock market. Power BI dashboard can show all needed data in only one page, readers can view related reports for the details [5]. A stock predict system will be more interactive by using Power BI.

Our contributions in this development and analysis are summarized as follow. Firstly, the previous studies from others paper had been summarized, and can be easily classified those strengths and weakness. Secondly, focusing on developing a stock market system in a clear and understandable visualization to help the people make a better decision when investing their stocks in the market.

1.5   Report Organization

The following chapters display the specifics of this project. A few similar historical contexts are discussed in Chapter 2. Then, the methodology used for the system is presented in Chapter 3. Chapter 4 describes the system design of the project such as the UI of the system, block diagram, entity relationship diagram and others. Chapter 5 then shows the all the details of the system implementation like the process when development the system. Furthermore, system evaluation and discussion will be discussed at Chapter 6. Last, Chapter 7 reports the conclusion for the system.

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Chapter 2

Literature Review

2.1 Related Work

In the past, stock market predictions can be predicted by using technical analysis, time series analysis, statistical analysis and fundamental analysis. Currently, Power BI have been chosen for visualizing and forecasting the stock market. In the system that reviewed, visualizing and forecasting stocks system is mostly comes with the basic functions of the stock market system and also some special features such as the customizable data and charts. In this section, literature review of visualizing and forecasting stock by using Dashboard based on system are reviewed.

2.2 Review on Yahoo Finance system [7]
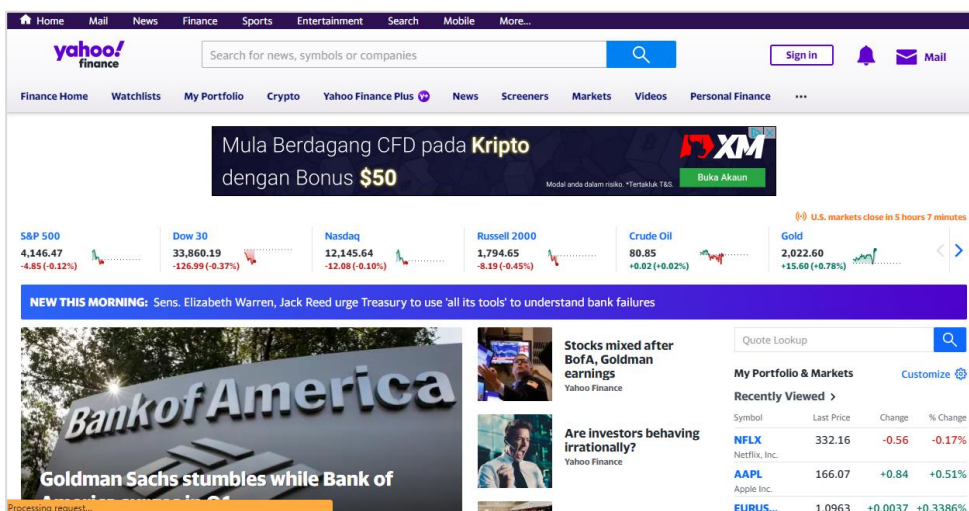
Figure 2.2.1 Yahoo Finance homepage

Yahoo Finance is an online financial information platform operated by Yahoo. This platform provides users with a variety of tools and resources, which included real-time stock data, financial statement, analysis, historical price data, financial news, cryptocurrencies and investment tracking tools.

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Figure 2.2.2 Yahoo Finance's Stock Quotes

Yahoo Finance offers free access to basic financial information and features, including stock quotes, market data, currencies and basic company information.
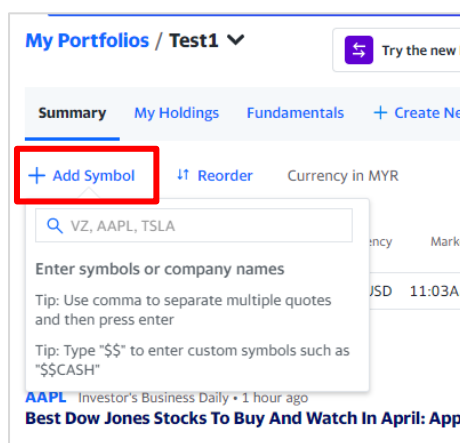
Figure 2.2.3 Yahoo Finance's Create Portfolio

Users can create customized portfolios and track their investments over time. User just need to click the "My Portfolio" on the top of the tab, after that select the "create Portfolio" button. It will let the user to choose whether select the basic portfolio which only included the function to input Buy or the portfolio 2.0 with transactions which included the function to Buy, Sell, Short, Buy to Cover Transactions and much more. After finish select, user can name their portfolio so that they can remember which portfolio is for different use. They can add their preferred company's stocks by clicking the "add symbol" button. Users need to enter the company's symbols or names in order to let the system add the company's stock data to the portfolio.

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Figure 2.2.4 Yahoo Finance's Portfolio data

After adding the company's stocks that wanted into the portfolio, users can compare the stocks together in a place, they do not need to search the company's stocks one by one. They also may forget the first stocks data after they search for the second company's stocks. So, the portfolio is very convenient for the users to compare their preferred stocks at the same time.
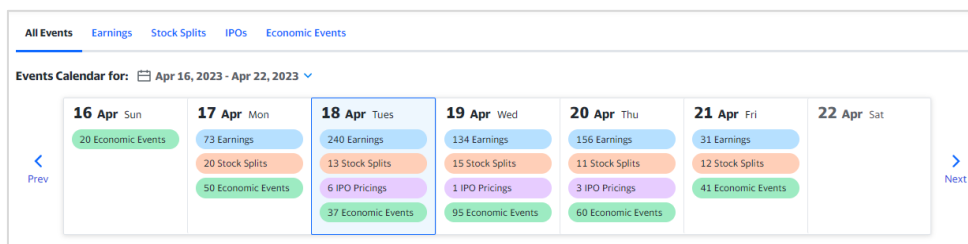
Figure 2.2.5 Yahoo Finance's Calendar

In addition, the calendar function from the Markets tab in the Yahoo Finance can let the user to know the events for different days. Users can click the events that shown in the calendar, they will be navigate to another page of the events selected by the users.

Figure 2.2.6 Yahoo Finance's Currencies

Currencies also provided by Yahoo Finance to let the users know the changes of the currencies daily. Some users bought the stocks and also the currencies, they would like to know the changes for the stocks and also the currencies.

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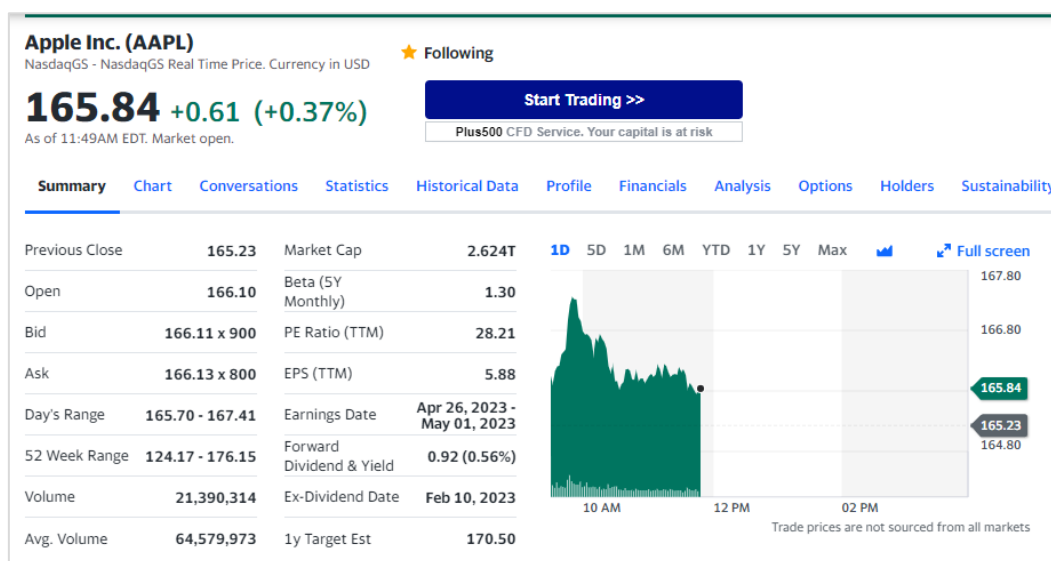
Figure 2.2.7 Yahoo Finance's Stocks Data

The above figure is the Apple Inc.'s stocks data. Users can search or click the company to look for detailed information or data for that company. There will have summary for the stocks data of that company, chart for the stocks to let the user can see more clearly, conversations to let the users leave a comment or chat with other users to provide or gain the information about that company's stocks, the statistics of the company such as valuation measures, trading information and some financial highlights, the historical data of the stocks, the profile of the company that included the information of the company like the address, phone number and the position of the employees, the financials that included the income statement, balance sheet and also cash flow, the analysis that included earnings estimate, revenue estimate and others to let the users can know more about the company's financials in order to decide whether to invest to the company or not, the options that listed the contract, the holders of the company and sustainability to let the users know the environment, social and governance risk ratings of the company.

For the premium features, Yahoo Finance had offered advanced charting and technical analysis tools, real-time market data and research reports from leading financial analysts.

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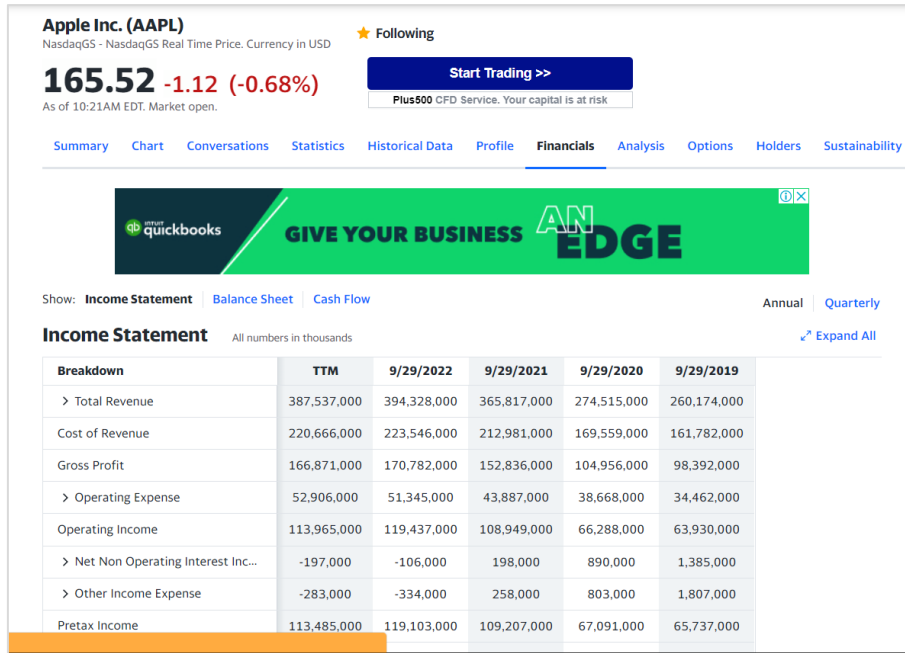
Figure 2.2.8 Yahoo Finance's Financial Analysis

The **strengths** for Yahoo Finance system are it have the <u>customizable portfolio</u> function as shown as Figure 2.2.3. This function can make convenient to the users to compare their stocks at the same time without navigate to another page several times. Moreover, it also provides a <u>wide range of financial data</u> to let the users know more about the company's financials so that the user can make their decisions better whether to invest to the company or not. It had provided balance sheet, income statement and also cash flow for four years as shown as Figure 2.2.8.
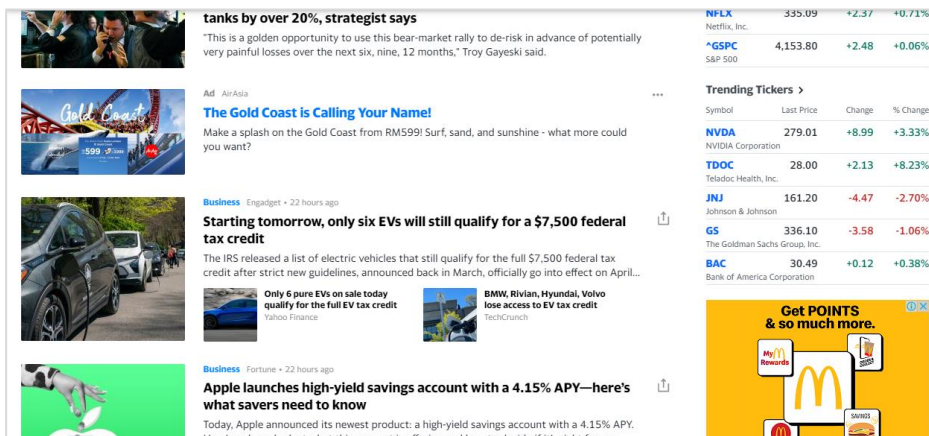
Figure 2.2.9 Yahoo Finance's Advertisement

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The **weaknesses** of the Yahoo Finance are the user interface are too messy. We can see from the above figure, the advertisement and the data are not well organized at the interface. It will distract the user's attention and also affect the user's experience.
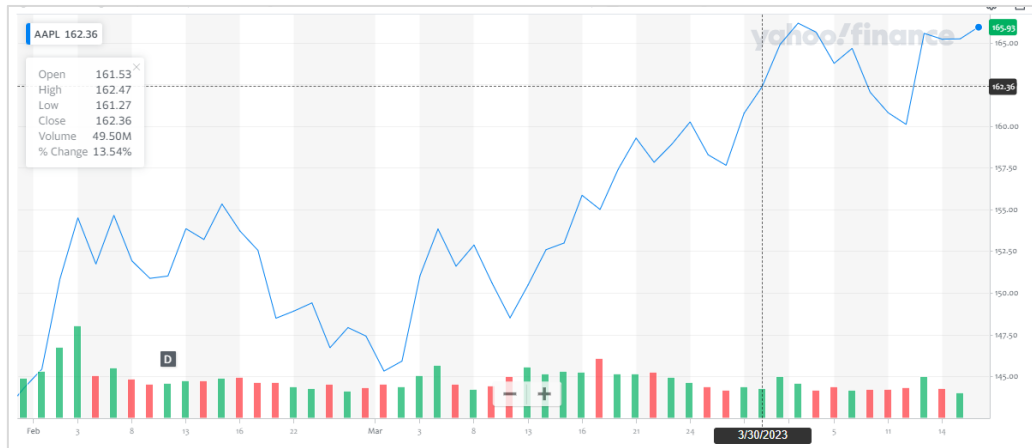
Figure 2.2.10 Yahoo Finance Stock's chart

In addition, Yahoo Finance also lack advanced charting or visualization. It only provides the basic charting tools, it does not have the advanced charting for the users to have a better understanding about the data. Too many data will make the users become confusing when looking at too much information without any visualizing tools.

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2.3 Review on Investing.com system [8]
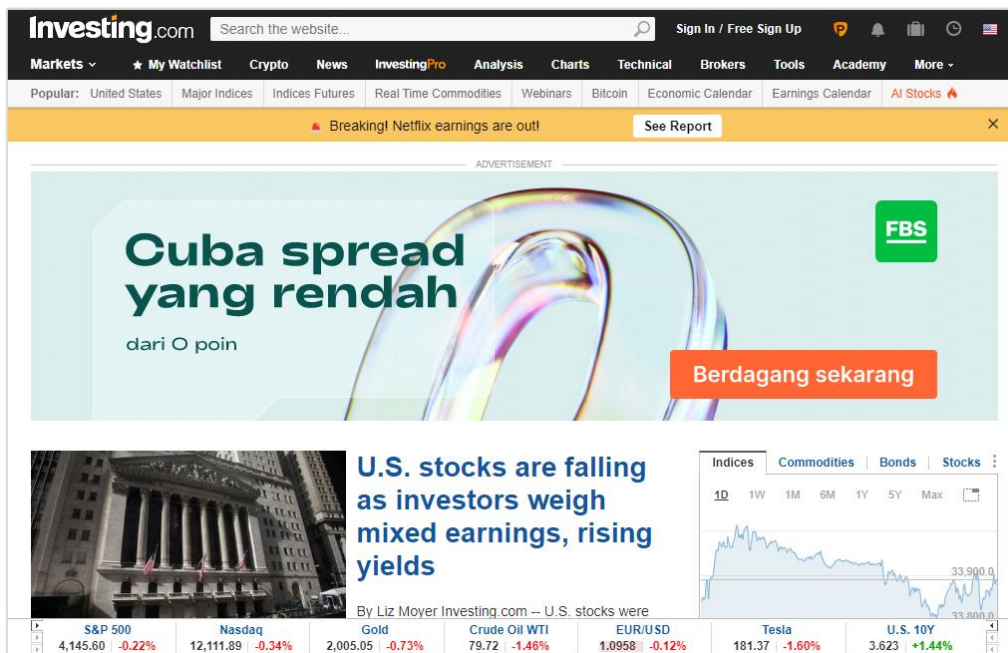
Figure 2.3.11 Investing.com Homepage

Investing.com is a financial website that provides of wide range of financial information, tools and resources for investors and traders. This website offered real-time stock quotes, charts, news, analysis and other data on different financial instruments, including stocks, bonds, commodities, currencies and indices.

Investing.com provides a platform for users to access global financial markets, track market movements and make informed investment decisions. This platform also offered a range of financial tools such as stock screener, economic calendar and different calculators to help users make informed decisions. Investing.com also have their mobile app, it can allow the users to access the financial information or stocks data from their phone immediately.

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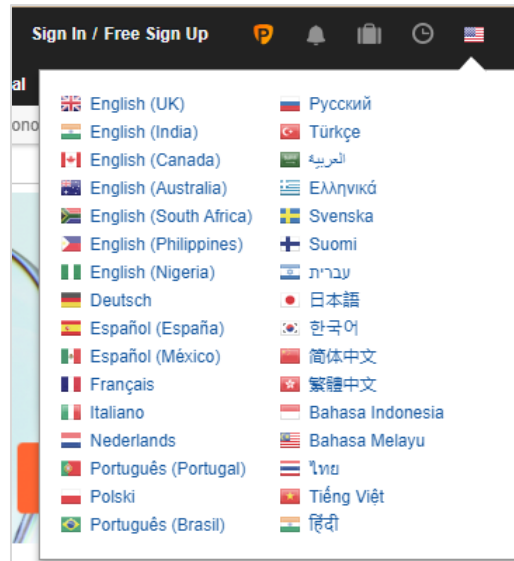
Figure 2.3.2 Investing.com Languages Options

The **strengths** of the Investing.com is it <u>provides multiple language</u> for the users. Users can select which language to use for the system for their convenience. Investing.com had provided wide range of data so there will be many users to use this system to see the stocks data, multiple language can attract users from different country that this system will not limited by the language.
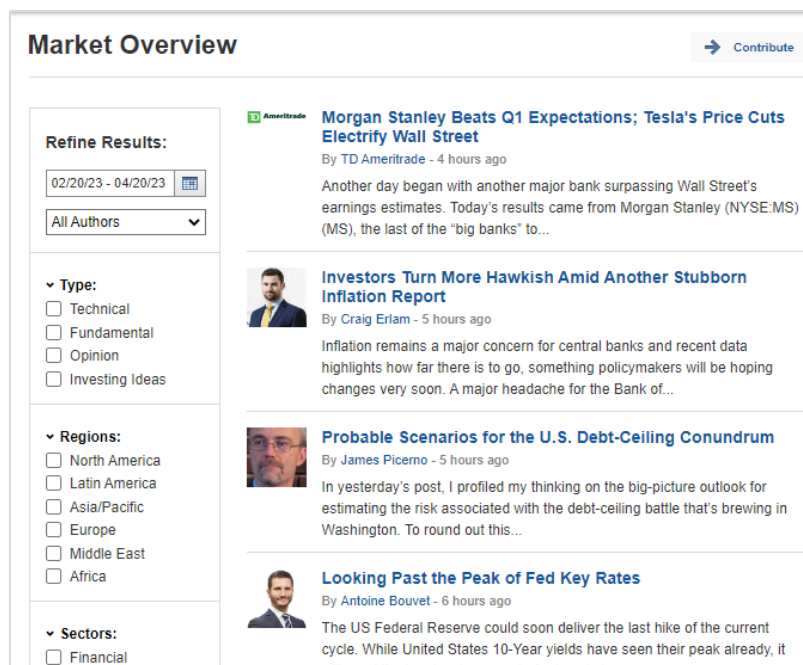
Figure 2.3.3 Investing.com Analysis

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The second strengths of Investing.com is it has the <u>analysis function</u> which allow the users look at the professionals analyze on the different stocks or their advice. Users can filter the result according to what they are looking for. This will help the investors to make a better decision when they are trying to invest on the stocks.

Figure 2.3.4 Investing.com Drawing Chart

Figure 2.3.5 Investing.com Insert Text

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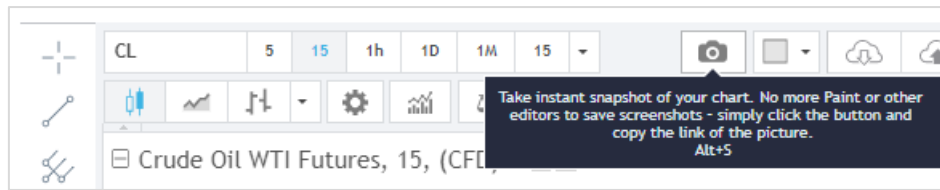
Figure 2.3.6 Investing.com Screenshot Chart
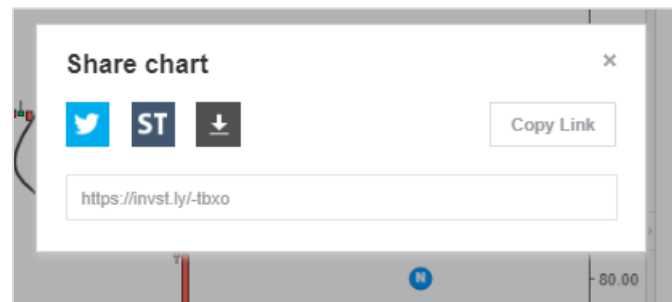
Figure 2.3.7 Investing.com Download Screenshot

The third strength is it allow the users to <u>perform some functions on the live chart</u>. First, it allows the users to draw whatever they want on the live charts as shown as Figure 2.3.4. Users can circle some part of the chart for further use. Second, users can insert text in the live chart as shown as Figure 2.3.5. Third, users can screenshot the live charts after editing by clicking the camera icon stated on the above as shown as Figure 2.3.6. After screenshot has done, users can choose how to share the photo, they also can download the photo by clicking the download icon as shown as Figure 2.3.7.
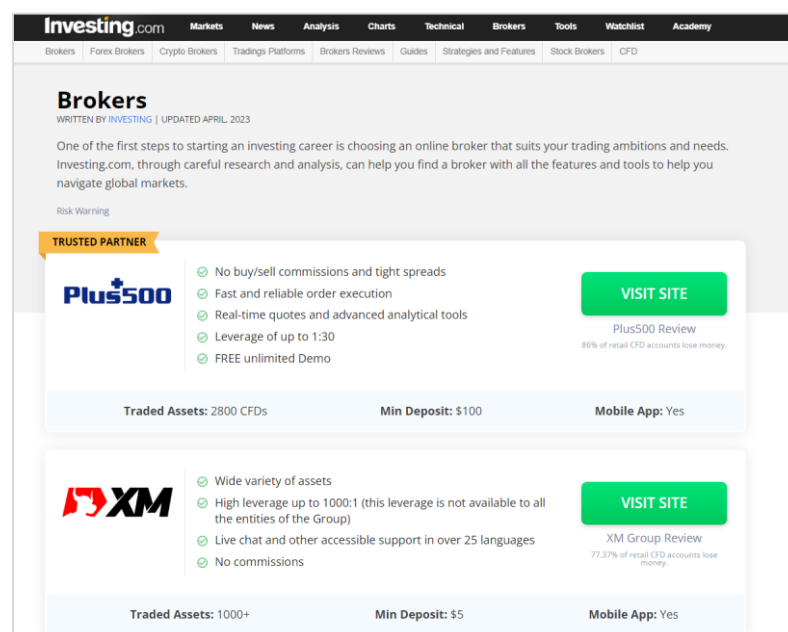
Figure 2.3.8 Investing.com Broker Suggest

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The fourth strength is <u>broker suggest</u> for the users. A stockbroker is a financial professional or an investment advisor. They will handle transactions for a number of individuals or customers. They are paid on a commission by doing the transactions for their customers [https://www.investopedia.com/terms/s/stockbroker.asp]. At the Investing.com website, it provided the broker suggestion for the users, users can find their preferred broker at there and contact them immediately. Users just need to choose which broker's site they wish to corporate with and click the button "visit site". The page will automatically navigate to the broker's website and users can start their trading afterwards.

Figure 2.3.9 Investing.com Chart

The **weakness** of this system is it <u>does not have the advanced charts or better visualization</u> for the users to see. It only has the basic bar charts for the stocks data. Advanced charts will help the users to analyze their stocks better and faster without looking at the complex stock's data in the table.

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Figure 2.3.10 Investing.com Advertisement

The second weakness is the <u>advertisement at the system is too heavy</u> as shown as Figure 2.3.10. It will distract the users when they are trying to look at the stocks data. Users may also be confused on where to look at the data because of the advertisement is stick around the stocks data. Some users may find the number and placement of the advertisement on the website to be overwhelming.

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2.4 Review on Koyfin system [9]
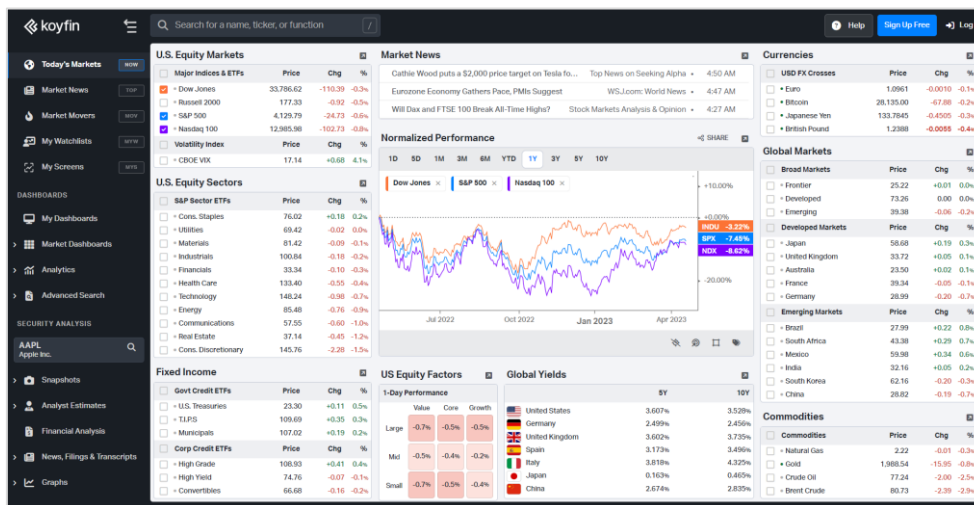
Figure 2.4.1 Koyfin Homepage

Koyfin is a financial data and analytics platform that provides investors, analysts and financial professionals with a comprehensive set of tools to analyze the stocks, ETFs and also other financial assets. Moreover, it offered a range of features such as real-time stocks data, interactive charts, financial statements, news and research and portfolio tracking. Koyfin allows users to customize and save their own charts and dashboards. Koyfin also offers a suite of advanced tools for options analysis, screening and backtesting. Koyfin is used by investors, financial advisors and institutional investors to make informed investment decisions.

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Figure 2.4.2 Koyfin Menu

The **strength** of Koyfin is Koyfin provides <u>user-friendly and interactive user interface</u>. This platform is designed to be easy to use and navigate. Users can easily find what they want from the menu and click on it. Some menus will design too complicated, users will get confused when looking at the menu. Koyfin had designed their menu very well in a simple and straight way.

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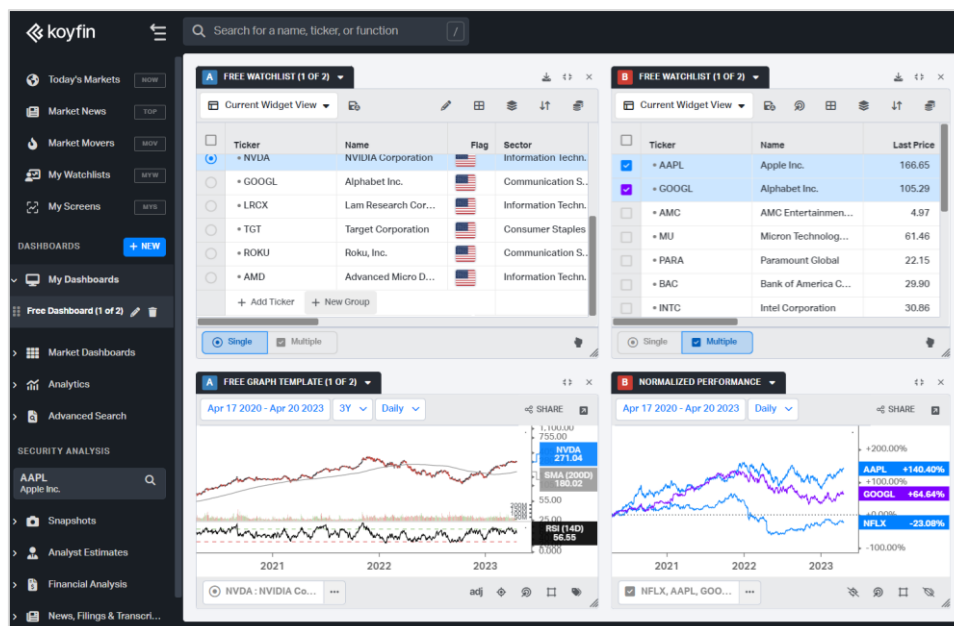
Figure 2.4.3 Koyfin Dashboard
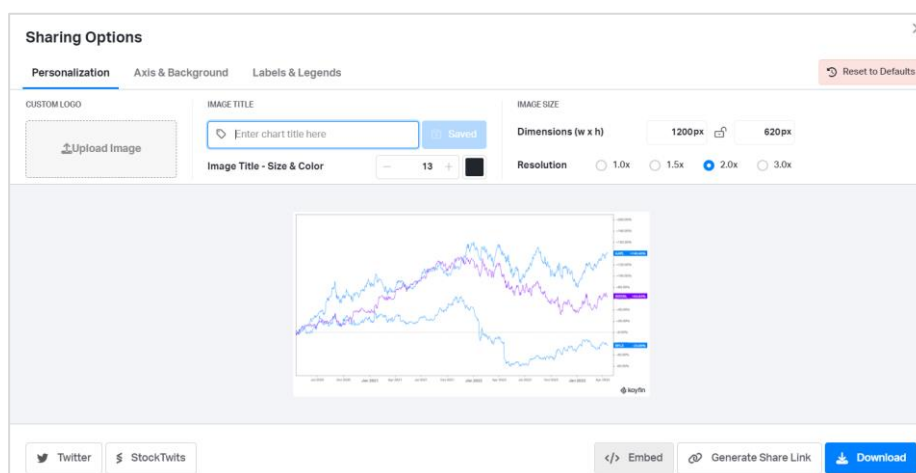
Figure 2.4.4 Koyfin Download Graph

The second strength of Koyfin is it allows users to <u>customize their own dashboard</u>. Users can select which country of the stocks they wish to see at and also the company's stocks too. After choosing, the system will automatically provide the stocks data that the users chosen previously as shown as Figure 2.4.3. Moreover, users can also choose to download their dashboard after they had done editing it by clicking the download icon at the top of the dashboard. They also can share the graph into a picture by clicking the share button on the top right of the graph. Users can customize the image setting as shown as Figure 2.4.4 after clicking the sharing button.

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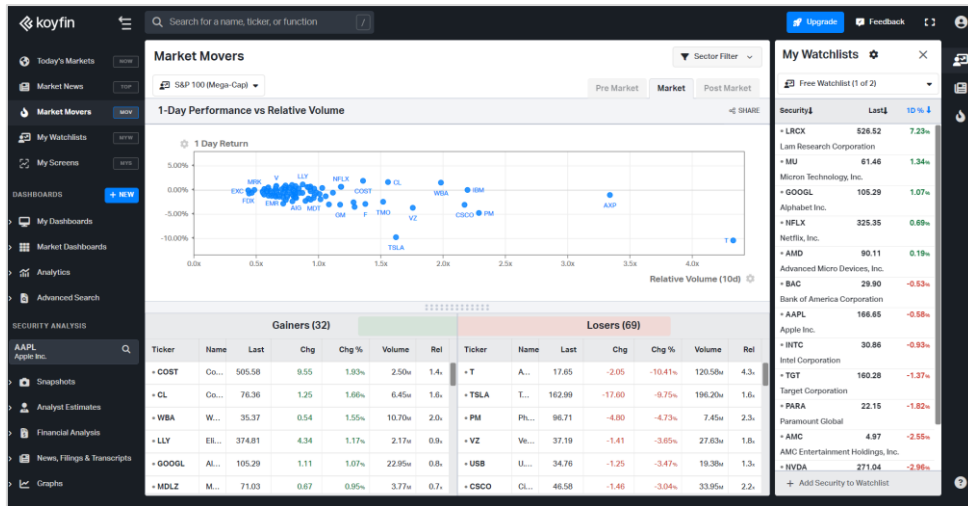
Figure 2.4.5 Koyfin Market Movers Page

The third strength of Koyfin is Koyfin is an <u>adless system</u>. They do not add any advertisement inside their system as shown as Figure 2.4.5. Whichever the uses click on any of the tab, Koyfin also do not include any advertisement at their system. This will make the users more comfort when using the system. Users may not distract by the advertisement at the system and focus on the stock data they wish to see.
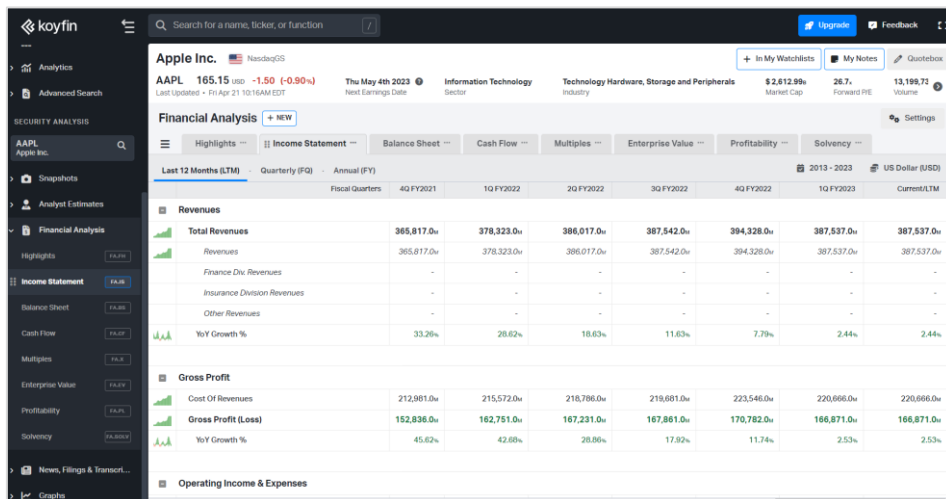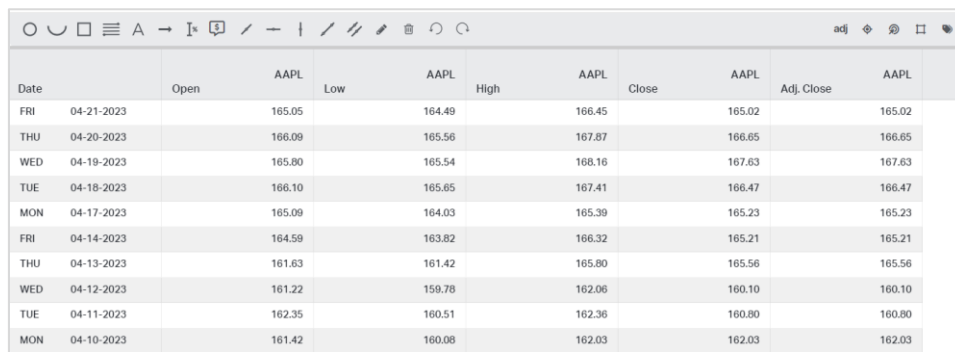
Figure 2.4.6 Koyfin Financial Analysis

The fourth strength is Koyfin had <u>provides financial analysis</u> at their system. The income statement, balance sheet, cash flow, multiples which includes the sales or revenues, earnings and book value, enterprise value, profitability and solvency. All of this financial analysis will help the investors to decide whether to invest to that company's stock or not.

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Figure 2.4.7 Koyfin Historical Data

The **weakness** of Koyfin is Koyfin do not provide the function for downloading the historical data. Some of the users may need to download the historical data for some purpose, they may want to analyze the data of the company or make some research of that company, so they need to download the data to use. They can organize the historical data in their own way and analyze the data.

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2.5 Summary of Reviewed System

System	Function	Strengths	Weaknesses
Yahoo Finance	- real-time stock data - financial statement analysis - historical price data - financial news - cryptocurrencies - investment tracking tools - customizable portfolio	- Customizable portfolio - Wide range of financial data	- User interface too messy - Lack of advanced charts & visualization
Investing.com	- wide range of financial information - real-time stock quotes - charts - news - stocks - bond - commodities - currencies - indices - financial markets - stock screener. - economic calendar - different calculators	- Provides multiple languages. - Analysis function that providing market overview. - Can perform many functions on live charts. - Broker suggests	- Lack of advanced chart & visualization - Advertisement too heavy
Koyfin	- real-time stocks data - interactive charts - financial statements - portfolio tracking - customizable charts and dashboards	- User-friendly & interactive user interface - Customizable dashboard - Adless system - Provides financial analysis	Do not have the function for downloading historical data

Table 2.5.1 Summary of Reviewed System

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Chapter 3

System Methodology/Approach OR System Model

3.1 Methodology
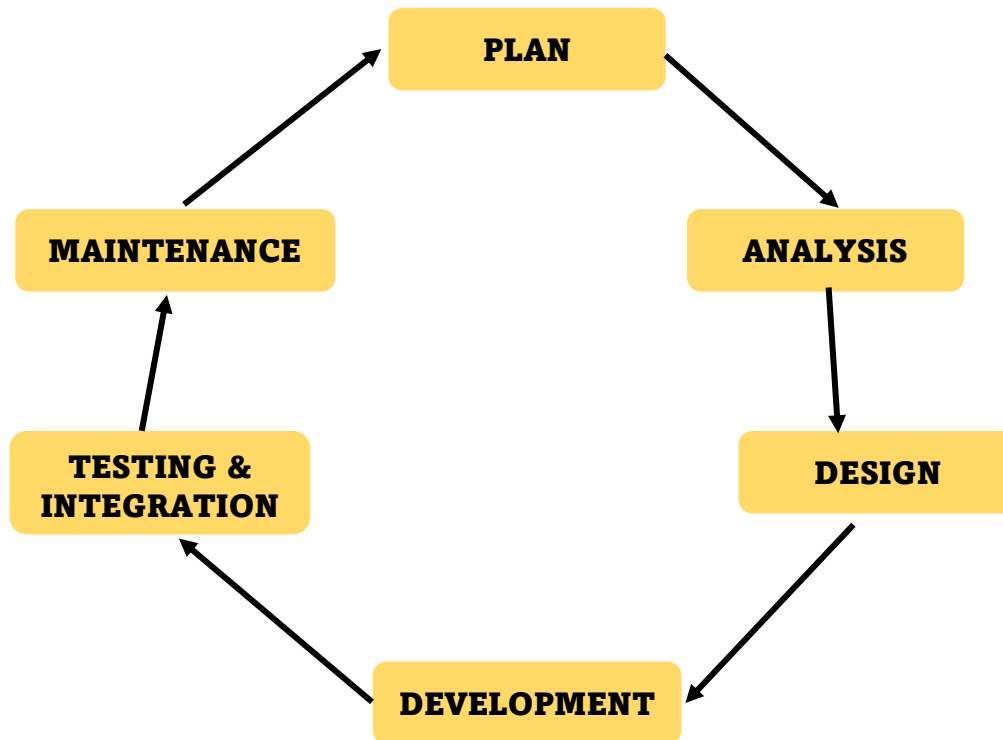
Figure 3.1.1 Agile Methodology

The methodology for this Visualizing and Forecasting Stock System is agile methodology. Agile methodology is a way to manage a project by breaking up into several phases. There are a total 6 stages in Agile methodology which are planning, analysis, design, development, testing and integration and maintenance.

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| 1utar | Visualizing and Forecasting Stocks by using Dash |

	Task name	Start date	End date	January 2023 23-29 (4w)	30-5 (5w)	February 2023 6-12 (6w)	13-19 (7w)	20-26 (8w)	27-5 (9w)	6-12 (10w)	March 2023 13-19 (11w)	20-26 (12w)	27-2 (13w)	3-9 (14w)	April 2023 10-16 (15w)	17-23 (16w)	24-30 (17w)	1-7 (18w)	8-14 (19w
		30/01/2023	28/04/2024																
1	⊟ Plan	30/01/2023	31/01/2023	Plan ⏐ 30/01/2023 - 31/01/2023															
1.1	Gantt Chart	30/01/2023	31/01/2023	Gantt Chart															
2	⊟ Analysis	01/02/2023	05/02/2023	Analysis ⏐ 01/02/2023 - 05/02/2023															
2.1	Scope	01/02/2023	05/02/2023	Scope															
3	⊟ Design	06/02/2023	16/02/2023	Design ⏐ 06/02/2023 - 16/02/2023															
3.1	User Interface Design	06/02/2023	08/02/2023	User Interface Design															
3.2	Block Diagram	09/02/2023	10/02/2023	Block Diagram															
3.3	Use Case Diagram	11/02/2023	12/02/2023	Use Case Diagram															
3.4	Entity Relationship Diagr...	13/02/2023	14/02/2023	Entity Relationship Diagram															
3.5	Class Diagram	15/02/2023	16/02/2023	Class Diagram															
4	⊟ Development	21/02/2023	07/04/2024	Development ⏐ 21/02/2023 - 07/04/2024															
4.1	Stock Markets module	21/02/2023	15/03/2023						Stock Markets module										
4.2	Currencies module	16/03/2023	10/04/2023								Currencies module								
4.3	Financials module	11/04/2023	30/04/2023											Financials module					

Figure 3.1.2 Gantt Chart of FYP1

| 1utar | Visualizing and Forecasting Stocks by using Dash |

	Task name	Start date	End date	29-4 (5w)	5-11 (6w)	February 2024 12-18 (7w)	19-25 (8w)	26-3 (9w)	4-10 (10w)	March 2024 11-17 (11w)	18-24 (12w)	25-31 (13w)	1-7 (14w)	8-14 (15w)	April 2024 15-21 (16w)	22-28 (17w)	29-5 (18w)	6-12
		30/01/2023	28/04/2024															
1	⊟ Plan	30/01/2023	31/01/2023															
1.1	Gantt Chart	30/01/2023	31/01/2023															
2	⊟ Analysis	01/02/2023	05/02/2023															
2.1	Scope	01/02/2023	05/02/2023															
3	⊟ Design	06/02/2023	16/02/2023															
3.1	User Interface Design	06/02/2023	08/02/2023															
3.2	Block Diagram	09/02/2023	10/02/2023															
3.3	Use Case Diagram	11/02/2023	12/02/2023															
3.4	Entity Relationship Diagr...	13/02/2023	14/02/2023															
3.5	Class Diagram	15/02/2023	16/02/2023															
4	⊟ Development	21/02/2023	07/04/2024															
4.1	Stock Markets module	21/02/2023	15/03/2023															
4.2	Currencies module	16/03/2023	10/04/2023															
4.3	Financials module	11/04/2023	30/04/2023															
4.4	Financials module	05/02/2024	04/03/2024			Financials module												
4.5	Graphs module	05/03/2024	28/03/2024								Graphs module							
4.6	Today's market module	29/03/2024	07/04/2024										Today's market module					
5	Testing & Integration	08/04/2024	21/04/2024												Testing & Integration			
6	Maintenance	22/04/2024	28/04/2024													Maintenance		

Figure 3.1.3 Gantt Chart of FYP2

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The first stage is **planning**. Planning is the most important and fundamental stage. The planning for this project will be roughly describes at here. In this stage, the project timelines will be determined and shown. Gantt chart will used to present the project timelines as shown in figure 3.1.2 and figure 3.1.3. Project 1 had done until the development phase, so for the project 2 will continue with the rest of the module. The first stage is planning, this project needs one day to plan and do the Gantt chart. The second stage analysis will use five days to complete the project scope. The third stage design will be completed in ten days. The fourth stage is developing the system, this stage will separate for project 1 and project 2. For the project 1, it uses around 2 months to develop for two modules. For the project 2, it continues with the rest module and needed 2 months to complete the system. After complete development of the system, testing and integration will start for 2 weeks. Last, 1 weeks will be used for the maintenance stage.

After the planning, we continue with the second stage which is **Analysis stage**, the project scope will be determined at this stage. The scope for this project is develop a visualizing and forecasting stock market system by using dashboard to help the users have a better visualization when looking at the stock market. The system contains of five modules which are the Today's Market module, Stock Market module, Currencies module, Financials module and Graph module. For the Today's Market module, it will be the main dashboard of the system because it contains of various data in one view such as the stock data, currencies data, financials data and others. If users wish to see more detailed information, the system also have the stock market dashboard, currencies dashboard, financials dashboard and graph dashboard.

The third stage is **Design stage**. This system is design based on the project scope and requirements that mentioned above. It will include the system user interface design that describes how the system will looks like, block diagram to describe the system's function, use case diagram to state the possible interactions between user and system, entity relationship diagram and class diagram.

The fourth stage will be the **Development stage**. There are five module needs to be developed for this system, which is the Today's Market module, Stock Markets module, Currencies module, Financials module and Graphs module. This stage is separate in two parts which is from project 1 and project 2. Project 1 had completed two modules of the system, so

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project 2 will need to complete the rest of the module. It will start from outlining the functions and widget that needed to be developed. Then continue with breakdown the tasks into smaller and actionable tasks that daily needs to be done. The tasks are separate by dashboard, the system should be developed dashboard by dashboard. The rest dashboard will be Currencies dashboard, Graphs dashboard and Today's market dashboard. The development will follow the sequence of the rest dashboard.

The fifth stage is **Testing & Integration stage**. Usability Testing will be use at this stage. Usability is a quality attribute that assesses how easy user interfaces to be used [10]. Usability testing is defined by five quality components which is learnability, efficiency, memorability, errors and satisfaction. It will start from creating a questionnaire following this usability testing five components. After created, then will give to three experts that have invest in the stock markets to fill in the questionnaire. Then will continue with analyzing the responses and integrate the system. Of course, some of the basic testing will also be conducted to ensure that there is not having any bug or error in the system.

And last comes with the final stage which is the **Maintenance stage**. If there is having error or bug in the future, then maintenance will also be needed at that time. System needs to be maintenance in a regular time such as one time per month. This stage is to ensure that it continues to meet the scope and requirements of the end users. It will also include bug fixes, security updates and feature enhancements.

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Chapter 4

System Design

4.1 UI Design
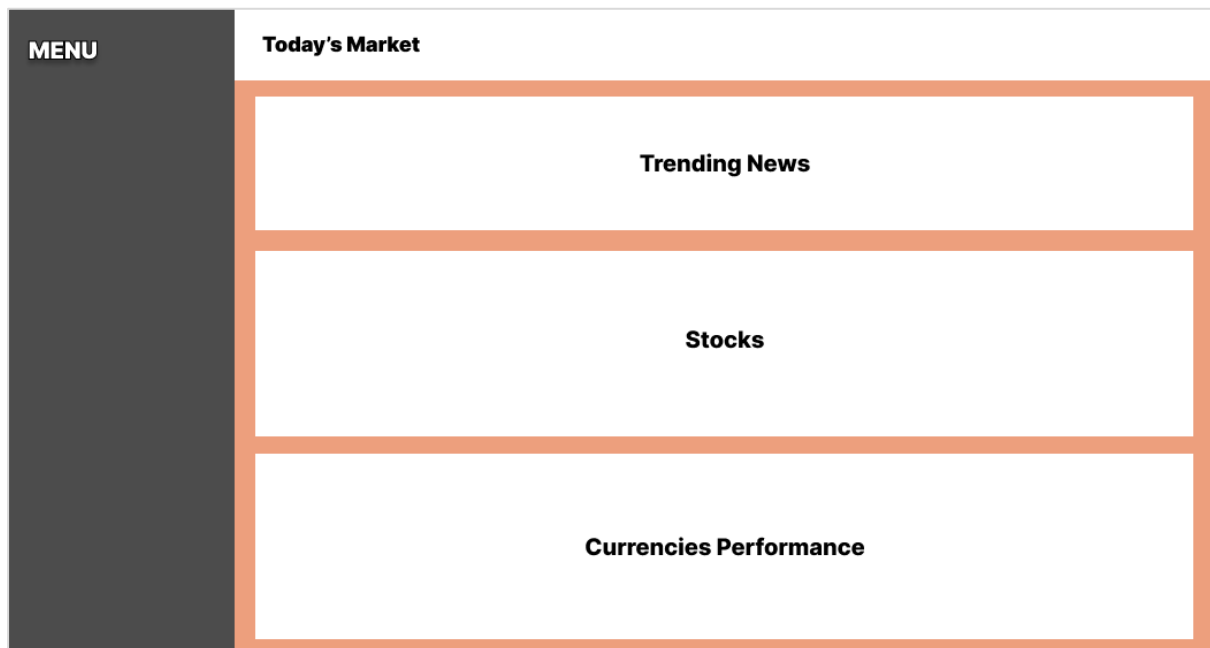
Figure 4.1.1 Today's Market Dashboard

This dashboard will be the main dashboard of the whole system. When users came into the system, it will default shown this dashboard to the users. It consists of the trending market news, stocks graph and currencies graph. Users can see all the important information in only one view.

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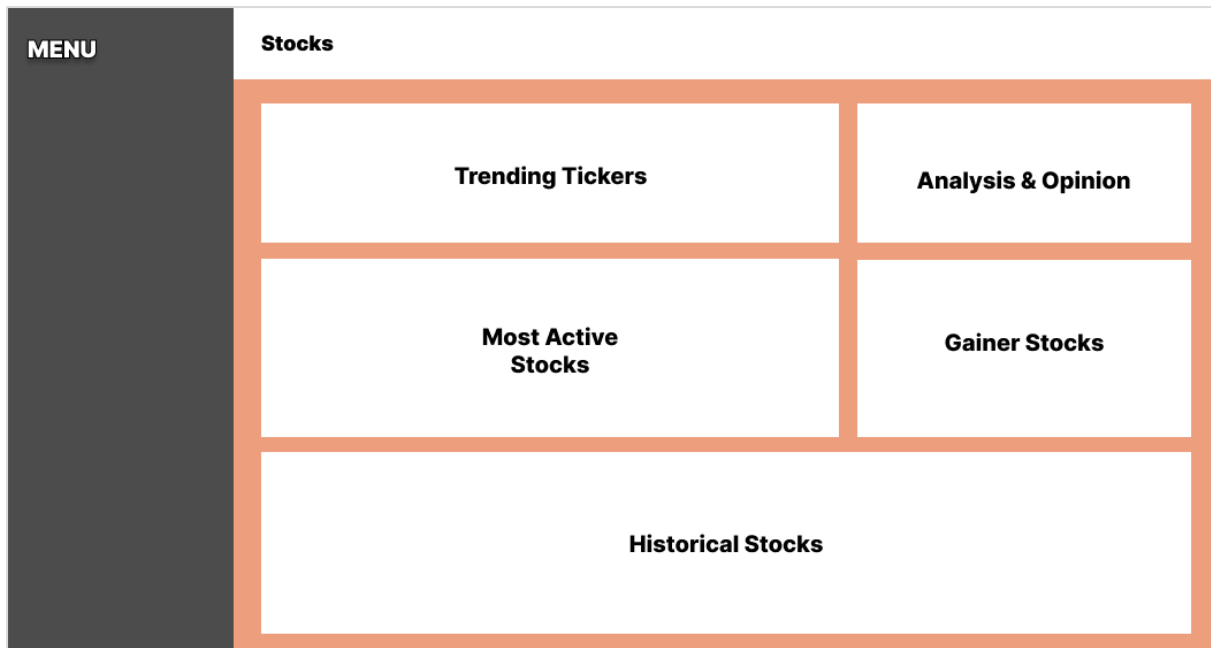
Figure 4.1.2 Stocks Dashboard

Users can click "Stock Markets" in the menu to dive into the stocks market dashboard. At here, users can know more about the stocks market. There will have a more detailed filter for the users to filter to the specific date range that they wish to see.
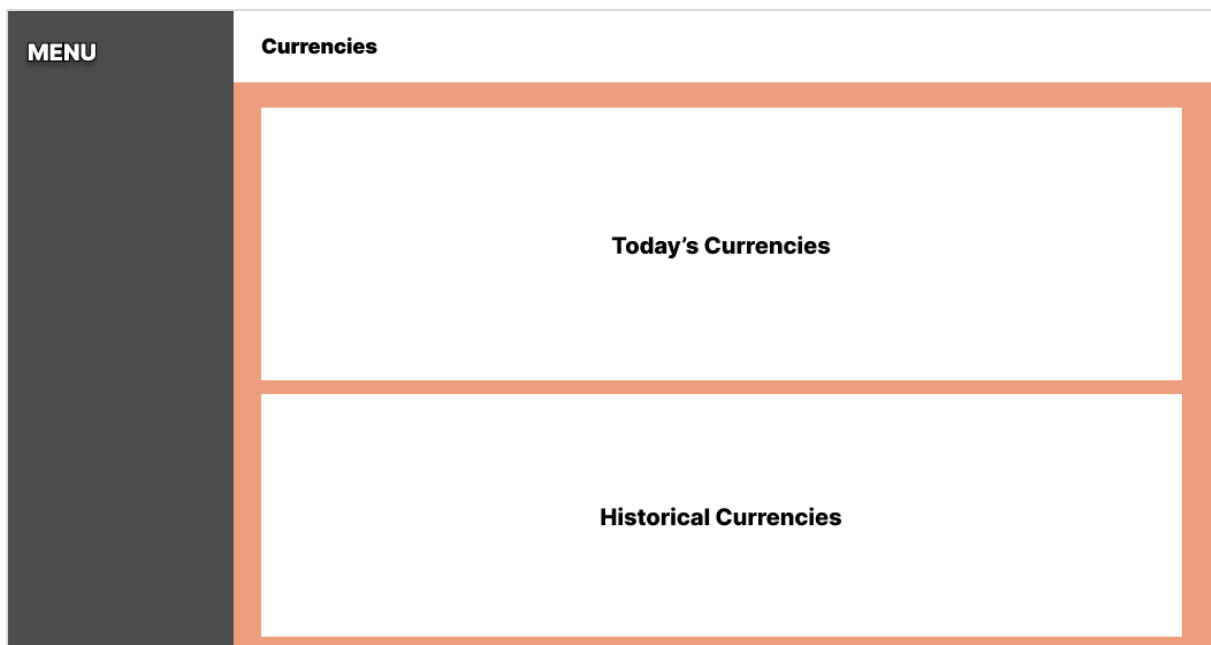
Figure 4.1.3 Currencies Dashboard

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Users can also see the currencies dashboard though the menu. This currencies dashboard also allows users to filter it to the specific date range. There is also provides the history data of the currency so users can see the past history.
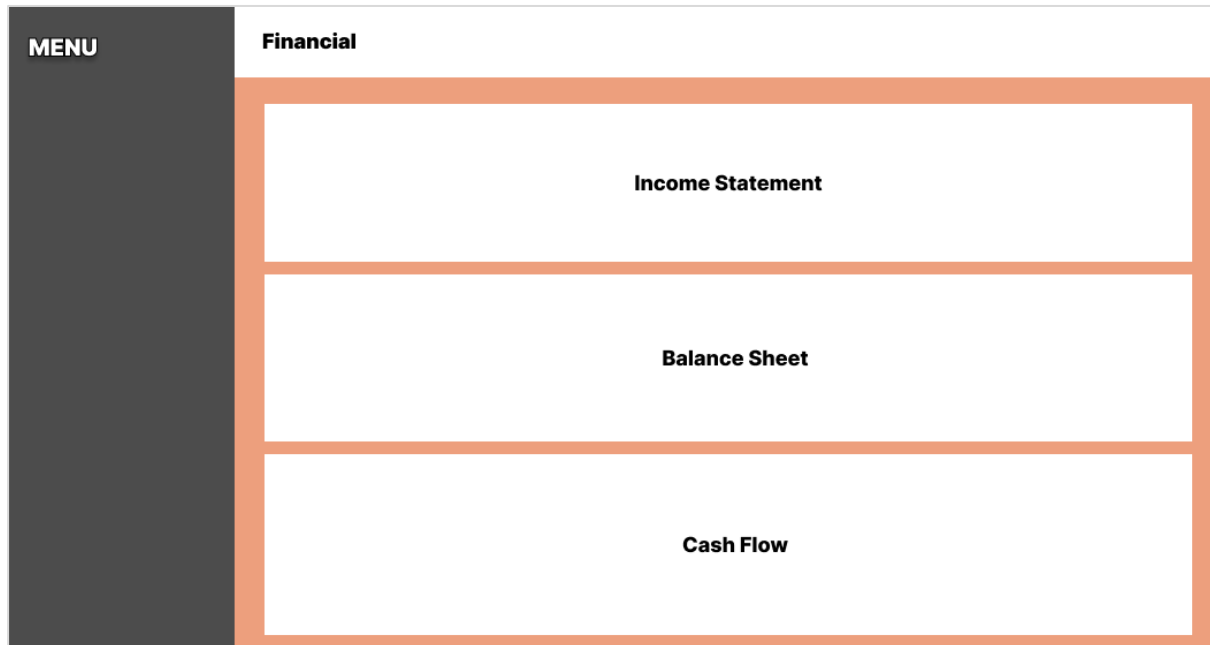
Figure 4.1.4 Financial Dashboard

This will be the financial dashboard, it records the financial statement which is the Income statement, Balance sheet and cash flow. The financial statement will help the users to decide whether they want to invest in the stock or not by looking at the company financial situation such as the company's profit or loss.

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Figure 4.1.5 Graph Dashboard

The above figure is the Graph Dashboard in the system. It only shows two graph which is the stocks and financial. Since these two fields of data is related when investing in the stock market, so user can know well and make decisions by looking at these two graphs at the same time. The reason that shows the stocks data in a candle stick chart is candle stick chart can show the close price is higher or lower than the open price at that day, if higher the candle will be in green color means the price is increasi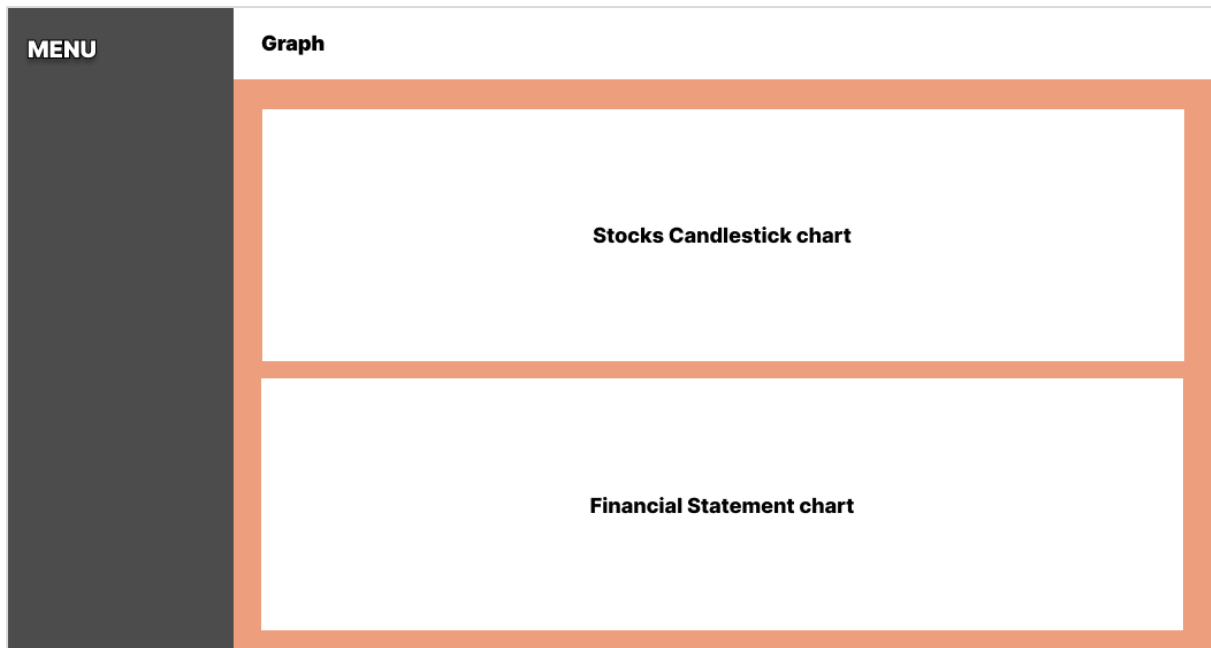ng, if lower than the candle will be in red color means that the price is decreasing. Moreover, candle stick chart has the wick that is a straight-line place on top and at below of the candle. This wick is to let user know how high or how low the price is going on that day. For the financial graph, it will consist of Income Statement, Balance Sheet and Cash flow statement.

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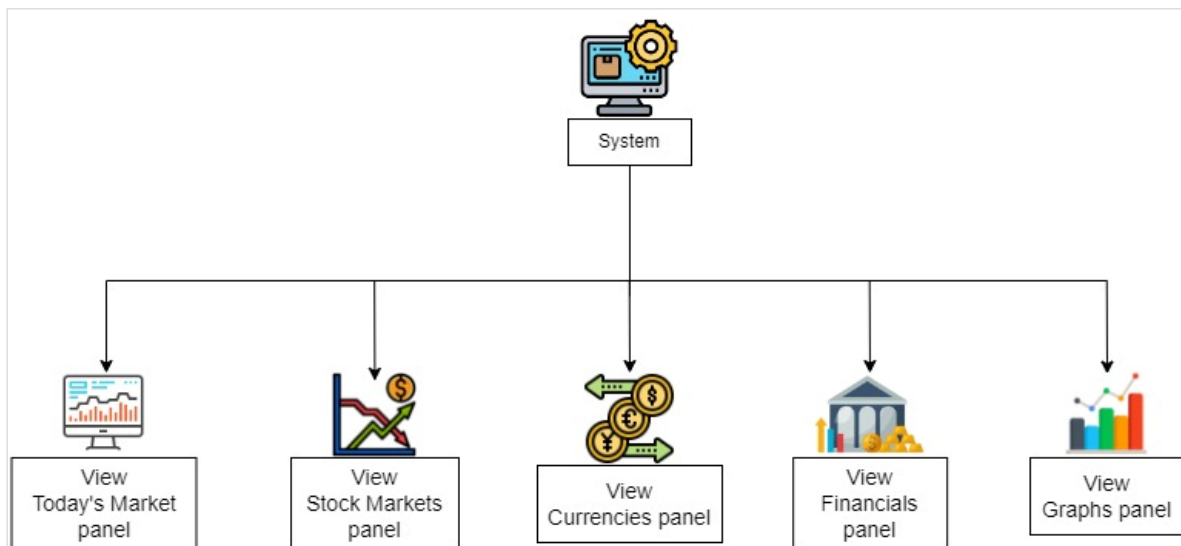
4.2 Block Diagram

Figure 4.2.1 Block Diagram

This block diagram shows the system's functions and the describe the relationships within the system. When users use the system, they can visit these five dashboards which is Today's Market dashboard, Stock Markets dashboard, Currencies dashboard, Financials dashboard and Graphs dashboard. The Today's Market dashboard will act as the main dashboard, it will include the summary of the stocks market data, currencies data and financial data. Users can see all different data in only one view. When they wish to see more detailed information, they can proceed to the Stock Market dashboard, currencies dashboard or financials dashboard. The Graph dashboard will include only graph for the user to know quickly whether the performance of the stocks is increasing or decreasing compared to looking at the stocks data.

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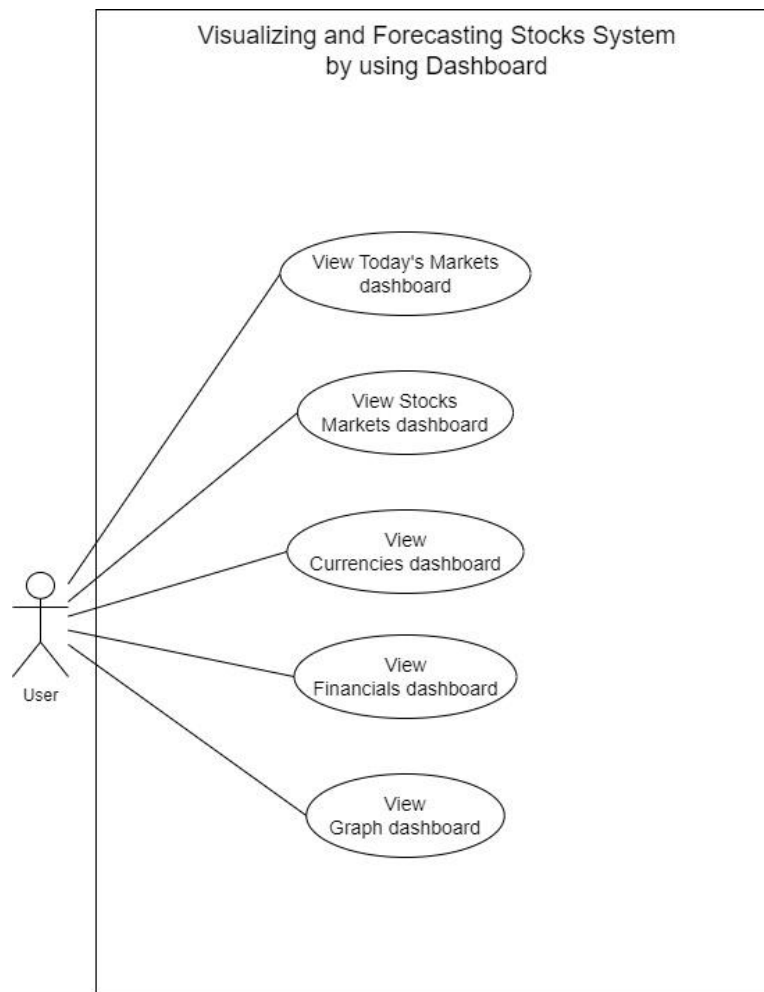
4.3 Use Case Diagram

Figure 4.3.1 Use Case Diagram

The above figure is the use case diagram for this system. Users can perform five main functions in this system. First, they can see the Today's Market dashboard when they visit the system. Today's Market dashboard will act as the main dashboard of the system, it has the stocks market data, currencies data, financial statement data and also the trending market news. The other four dashboard will consist of more details of the data that is not shown in the Today's Market dashboard.

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4.4 Entity Relationship Diagram
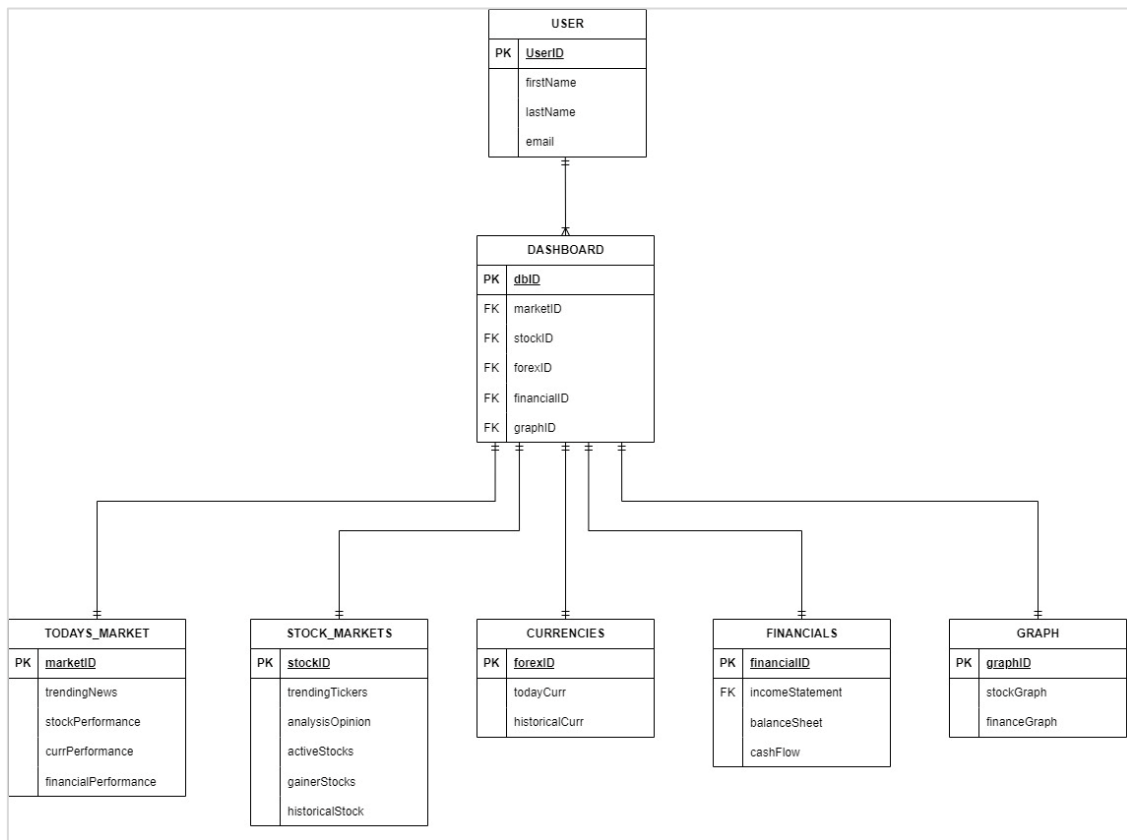
Figure 4.4.1 Entity Relationship Diagram

The above diagram is the entity relationship diagram of the system. Each user will have one or many view of the dashboard and each dashboard will belongs to only one user when they visit the system. There are five sub dashboard belongs to a main dashboard. The main dashboard can view these five dashboards and each five dashboards will belong to this system only. In the user entity, will have a userID, first name, last name, and email address. For the dashboard entity, it will have a dbID as a primary key and marketID, stockID, forexID, financialID and graphID as the foreign key to let the user can view the five dashboards in the system.

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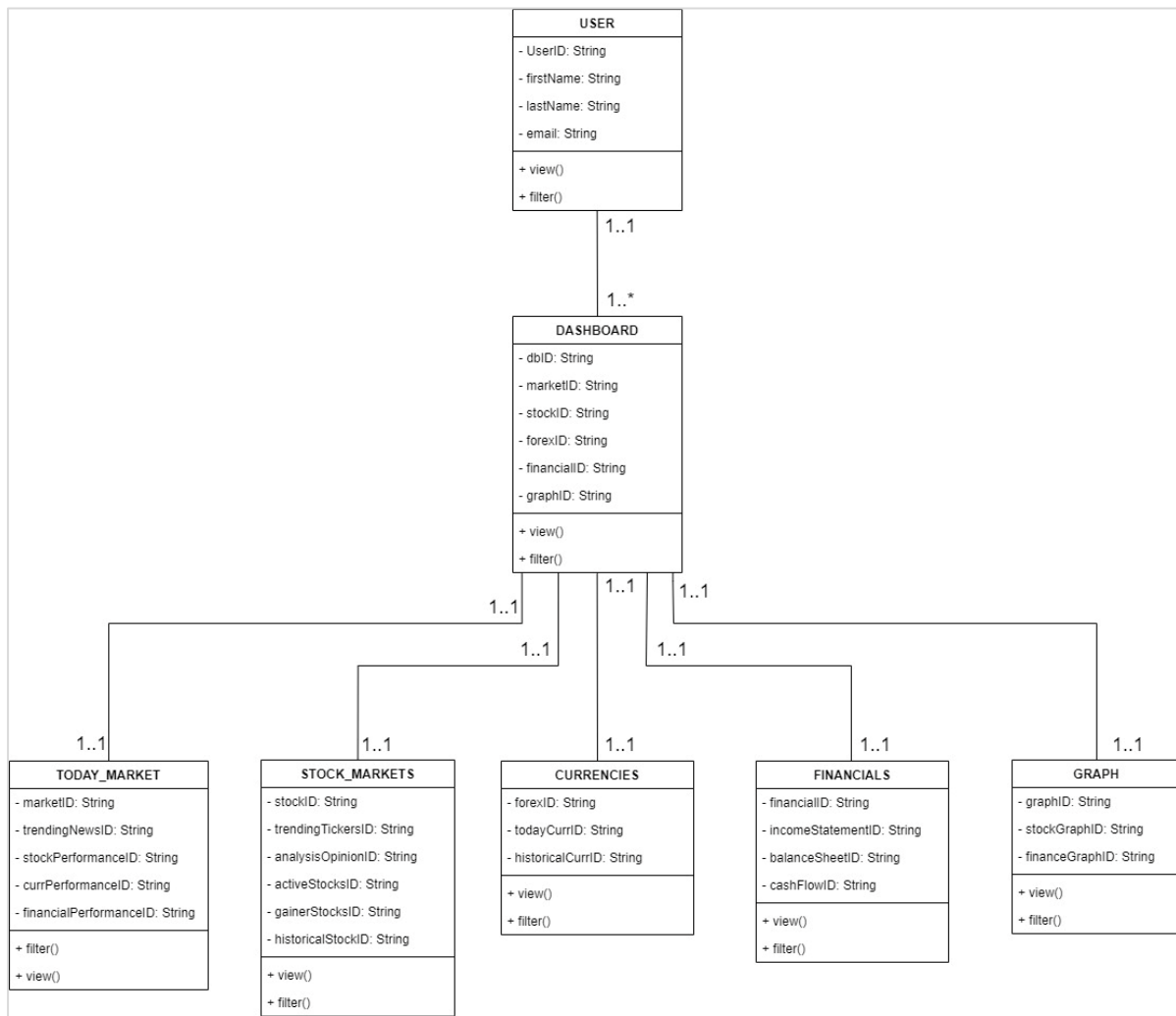
4.5 Class Diagram

Figure 4.5.1 Class Diagram

The above diagram is showing the class diagram of the system. Each user can view one or many of the dashboards and the dashboards will only belongs to one user. The dashboard will contain five dashboards which is the today market, stock markets, currencies, financials, and graph. The relationship between the dashboard and the five dashboard is one to one. Each of the class will have operations of view() and filter(). These two operations are to let the user can view the dashboard and information, filter is to let the user can filter the date, company, or currencies.

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Chapter 5

System Implementation

5.1 Software

There is only one software needed to be installed and downloaded in the laptop:

1. Power BI Desktop Version 2.115.842.0

Power BI is a unified, scalable platform for self-service and enterprise business intelligence (BI). Power BI can visualize any data in a dashboard and also provide data decision making. Power BI rely on one of the largest and fastest growing business intelligence clouds. It can create and share interactive data visualization across global data centers, it is suitable for this visualizing and forecasting stock system. Power BI can stream analytics in real time. A real time analytic is suitable for forecasting the stock market [11].

5.2 Hardware

The hardware involved in this project is a laptop:

Description	Specifications
Model	Laptop / Notebook
Processor	Laptop-T3JU4UJ5 15.6" Laptop
Operating System	Windows 11
Graphic	Intel(R) Core (TM) i5-10210U CPU @ 1.60GHz 2.11 GHz
Memory	8GB
Storage	475GB

Table 5.2.1 Hardware Specifications

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5.3 Development

5.3.1 Menu & Dashboard format

Figure 5.3.1.1 Menus
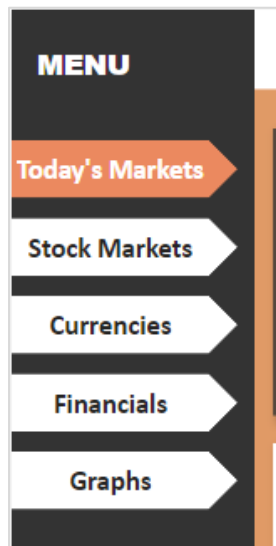
There have five dashboards in the menus which is the Today's Markets, Stock Markets, Currencies, Financials and Graphs. This menu is using the navigator to let the user can navigate to the page that they want.

Figure 5.3.1.2 Canvas Setting

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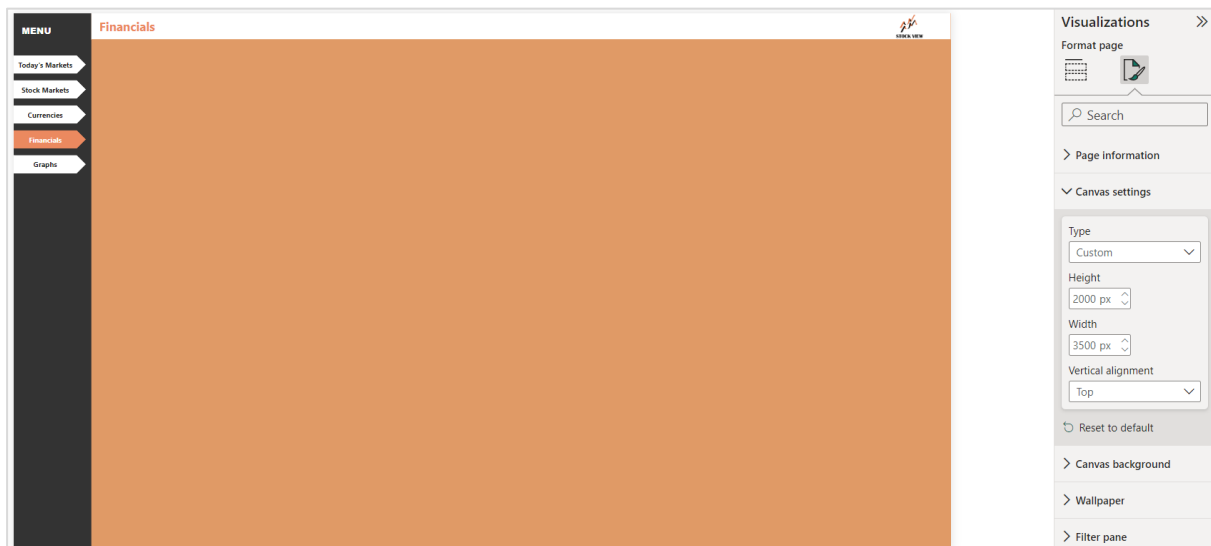
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The height for all the dashboard is 2000px and the weight will be 3500px. The background is using light orange. Every dashboard will have a title on top and also the logo at the top right corner.

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5.3.2   Today's Market Dashboard
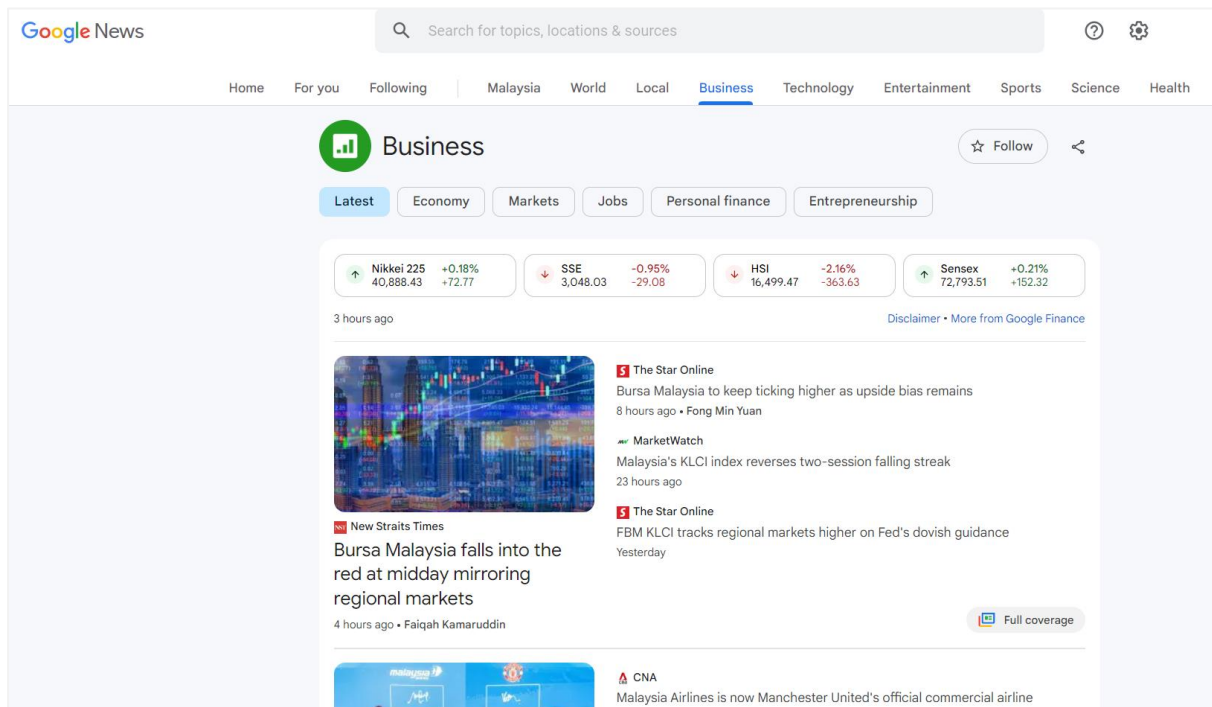
Figure 5.3.2.1 Google News

Figure 5.3.2.2 Get Data in Power BI

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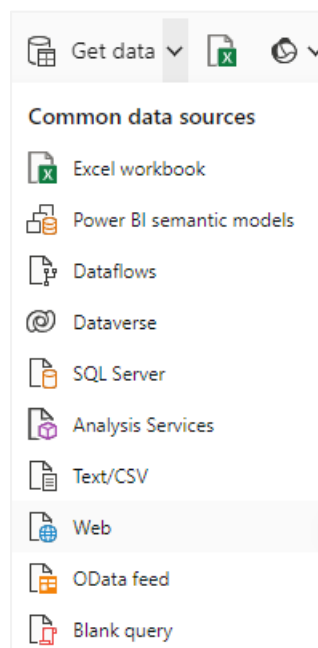
39

First, the **"Trending News" widget** will be developed. It needs to use the function of get the data from web in Power BI as shown in figure 5.3.2.2. The Google News hyperlink will be needed to paste it here in order to connect power BI with the Google News.

Figure 5.3.2.3 Data Load from Google News

After connected, the data from the Google News then can import to the Power BI as shown in the figure 5.3.2.3. The suitable table can be chosen before load the data into Power BI. After clicking the "Load" button at the bottom right, Power BI will create a new table in Power BI. The Trending News widget then can show all the news that import from the Google News.

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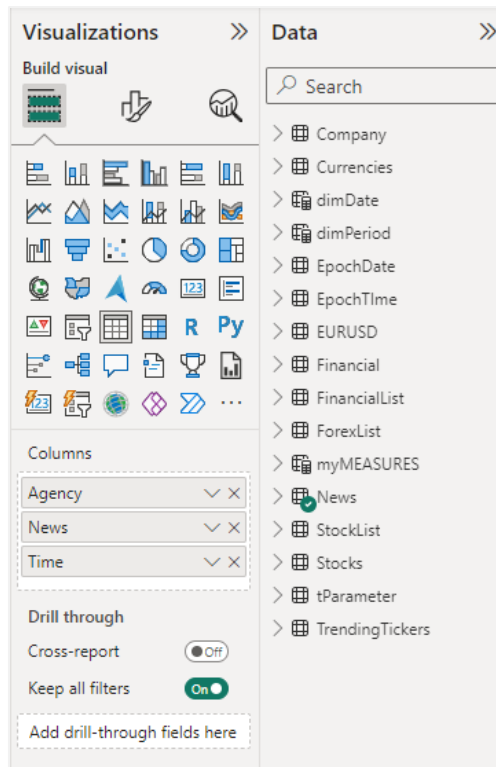
Figure 5.3.2.4 Visualization in Power BI

After having the data in Power BI, can starts to create a visual for the Trending News by select the table in the visualization to show the data in a table visual. Then select the data that wish to show in the table which is the Agency, News and Time.

Figure 5.3.2.5 Trending News widget

The final table of the Trending News widget is shown in the Figure 5.3.2.5.
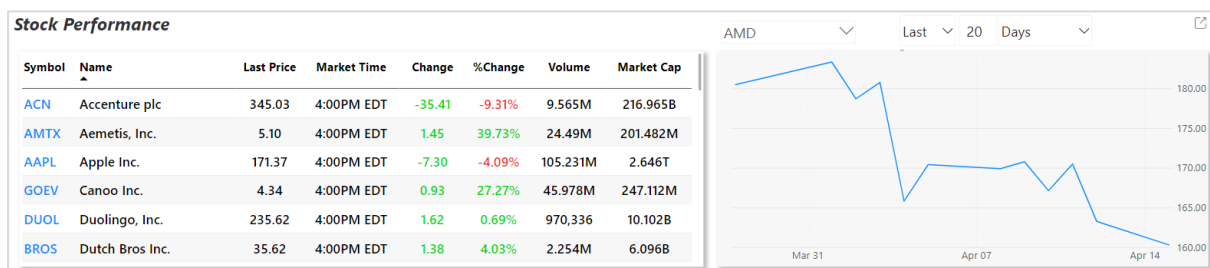
Figure 5.3.2.6 Stock Performance widget

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Second, the summary of the **"Stock Performance" widget** will be developed. The first step will be using the get data function from the yfinance then import the data to the power bi. This widget is same as the Trending Tickers widget in the Stock Markets dashboard. Both is using the same dataset in the power bi. There will be not have any additional development needed for this widget since it is first developed in the Stock Markets dashboard. The final widget is show in the figure 5.3.2.6.
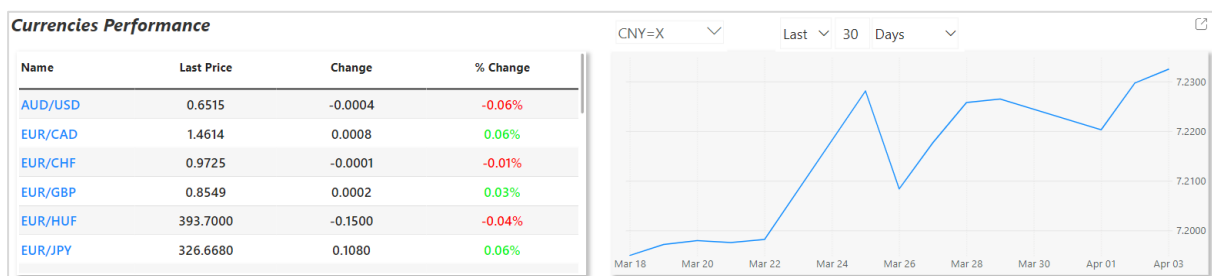
Figure 5.3.2.7 Currencies Performance widget

Then continue developing the third widget in this dashboard which is the **"Currencies Performance"**. This currencies performance same as before need to use the get data function to connect to the yahoo finance to get the data into the power bi. After getting the data into the Power BI then can start to do the visualization for this widget. Since the table has been developed in the Currencies dashboard, here will not have any additional steps need to be taken. The graph is using the line graph that showing the close price and date. There is also having a filter on the top of the graph. User can filter the currencies they wish to see and also a filter to filter the date in a range.

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5.3.3 Stock Markets Dashboard

The first widget that developed in this Stock Markets dashboard is **"Trending Tickers"**. This widget is to show the trending stock to the users. It needs to use the Get Data function in power bi and paste the web link to the function so that power bi can connect with the Yahoo Finance. After connected successfully, the data need to be arranged into clearer and tidier.
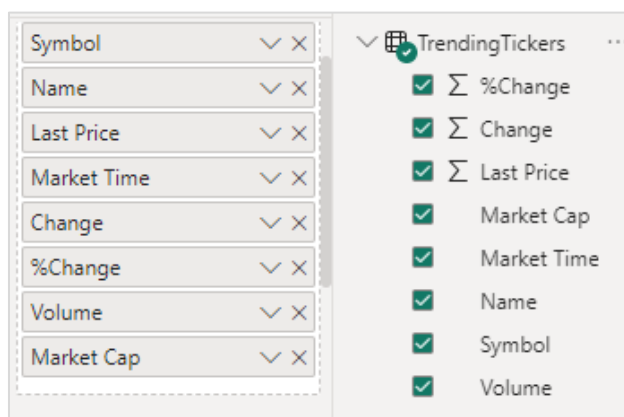
Figure 5.3.3.1 Visualization and Data

After that, a table will use to visualize this Trending Tickers widget. In this table, symbol and name of the stocks will be chosen, last price, market time, change, percentage of change, volume and market cap will also be included.

Figure 5.3.3.2 Trending Tickers widget

The final visualization of the Trending Tickers is shown in the figure 5.3.3.2. For the percentage of change, it shown with three colors which is green color means the changes between open price and close price had increase, red color means decreases, and black color means do not have any changes on the prices.

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The second widget is **"Analysis & Opinion"**. This widget is to help the users have better understanding or giving a reference to the user about the stocks investing. Same as before, it needs to import the data to power bi by using the function Get Data. After getting the data, it will be visualized in a table form to let the users see all the opinion written by the professions.

Figure 5.3.3.3 Analysis & Opinion widget

This table will include the opinion, author that wrote the opinion and the time they publish to the website. If users wish to see the full analysis and opinion that provided by the professional, they can click the open icon at the top right corner of the widget. After clicking, it will redirect the users to the website of the opinion.

Figure 5.3.3.4 Most Active Stocks widget

Figure 5.3.3.4 is showing the most active stocks. This widget is developed by connecting yahoo finance and Power Bi and get the data. After getting the data then can start to develop the visualization for this widget. It is shown in a table form with the data of symbol, price, change, percentage of change, volume, average volume, market cap and PE ratio.

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Figure 5.3.3.5 Gainer Stocks widget

Figure 5.3.3.5 is showing the Gainers stock widget. Same as others widget, it also imports the data from the yahoo finance. Then put it in the visualization of the table form. It consists of the data of symbol, price, change, percentage of change, volume, average volume, market cap and PE ratio.

Figure 5.3.3.6 Historical Stock data

The last widget for this dashboard is **"Historical Stocks"**. This widget data importing is same as before, it also using the python code to fetch the data into the power bi system. The python code allows the system always to fetch 5 years data from the current data, so it will always up to date to the latest data every 12 a.m. of the day as shown in figure 5.3.3.6. After saving the

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data into the system, it can be continued to visual the data to the users. It has two forms to visual it which is table form and line graph form.

Figure 5.3.3.7 Historical Stocks table

Figure 5.3.3.7 is showing the table form of the historical stock data. It has two filter which is to filter to the specific stock by the symbol and another filter is to filter the relative date that the users wish to see. For example, they can see the last 30 days or 100 days.

Figure 5.3.3.8 Historical Stocks graph

Figure 5.3.3.8 is showing the line graph of the historical stock data. This line graph is affected by the date filter in figure 5.3.3.7. if the user chooses to see last 30 days of the stocks data, then the line graph will also showing the last 30 days data.

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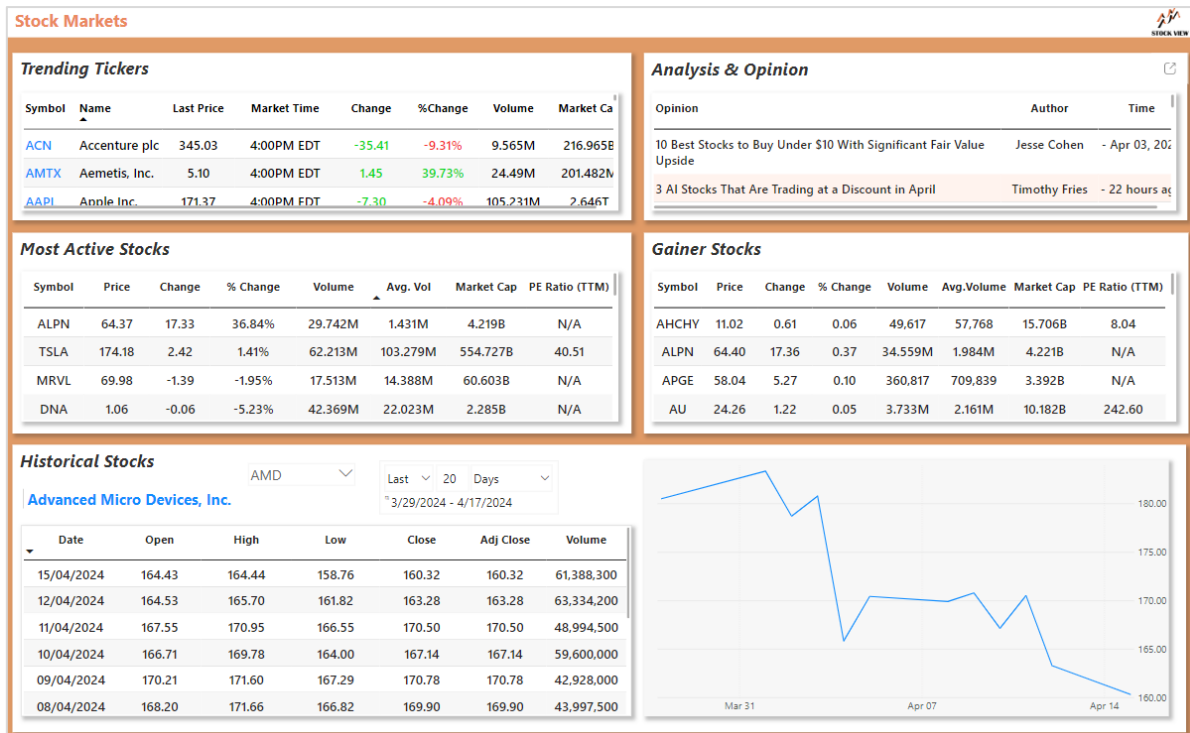
Figure 5.3.3.9 Stocks Market dashboard

The full view of the Stocks Market dashboard is as shown in the figure 5.3.3.9.

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5.3.4 Currencies Dashboard

First for this dashboard, **"Today's Currencies"** widget will be developed. This widget is to let the user can see the latest currency data when they visit this dashboard.

Figure 5.3.4.1 Currency Data Import

This widget will start from importing the currency data from the website www.yfinance.com. Same as before, it uses the Get Data function in power bi and paste the link from the yfinance. After connected successfully, there will have few tables to be chosen to store which data into the power bi as shown in figure 5.3.4.1. Table 4 has been chosen to be stored into the system. After loading the data into power bi, it will continue to do the visualization in the system.

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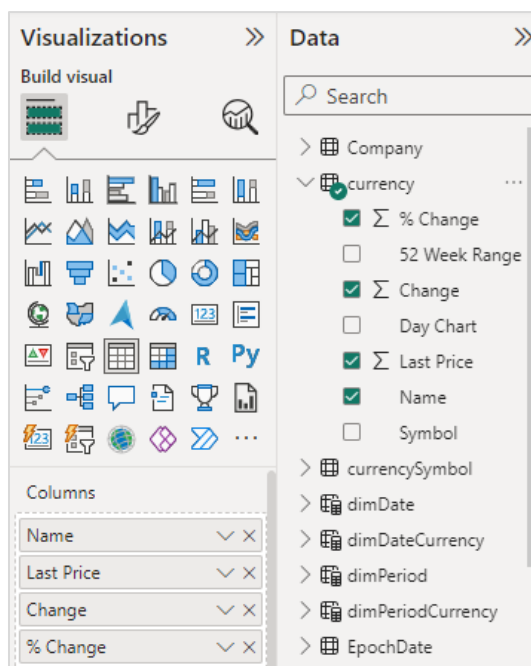
Figure 5.4.3.2 Visualizations & Data Formatting

This Today's currencies widget will be in a table form. In this table, it will show 4 data which is the currency name, last price of the currency and changing how much compare with last close price and the percentage of change.
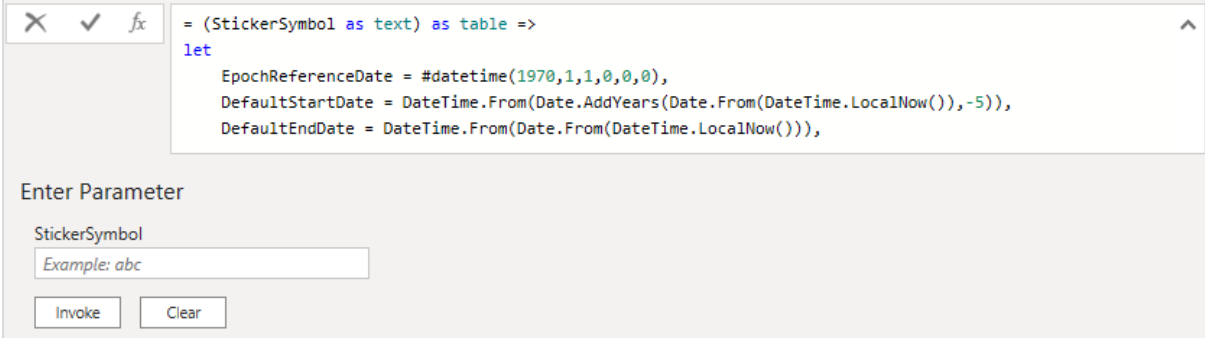
Figure 5.3.4.3 Today's Currencies widget

The final widget will look like figure 5.3.4.3. There will have a filter to let the user can filter to a specific currency they wish to see. The data of percentage of change will have three colors which is green color, red color and black color. Red color means that the currency had drop compared to the last close price, green color means it has been increasing, black color is to indicate the price did not increase or decrease. All the latest currency data will be in this table to let the user can see that day currency data.

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Second widget to develop for this dashboard is the **"Historical Currency Data"**. Same as another widget, it still needs to import the historical currency data into the system.


```
= (StickerSymbol as text) as table =>
let
    EpochReferenceDate = #datetime(1970,1,1,0,0,0),
    DefaultStartDate = DateTime.From(Date.AddYears(Date.From(DateTime.LocalNow())),-5)),
    DefaultEndDate = DateTime.From(Date.From(DateTime.LocalNow())),
```

Enter Parameter

StickerSymbol

Example: abc

Invoke   Clear

Figure 5.3.4.4 Currency API python code

This data importing is a little bit different that before, it uses python coding to connect the API with the Yahoo Finance website.

	CurrencySym...	Name	+
1	EURUSD=X	EUR/USD	
2	JPY=X	USD/JPY	
3	GBPUSD=X	GBP/USD	
4	AUDUSD=X	AUD/USD	
5	NZDUSD=X	NZD/USD	
6	EURCAD=X	EUR/CAD	
7	EURSEK=X	EUR/SEK	
8	EURCHF=X	EUR/CHF	
9	EURHUF=X	EUR/HUF	
10	EURJPY=X	EUR/JPY	
11	CNY=X	USD/CNY	
12	HKD=X	USD/HKD	
13	SGD=X	USD/SGD	
14	INR=X	USD/INR	
15	MXN=X	USD/MXN	
16	PHP=X	USD/PHP	
17	IDR=X	USD/IDR	
18	THB=X	USD/THB	
19	MYR=X	USD/MYR	
20	ZAR=X	USD/ZAR	
21	RUB=X	USD/RUB	
+			

Figure 5.3.4.5 Currency Symbol Table

After connected successfully, each currency data can be imported by using their symbol such as EURUSD=X as shown in figure 5.3.4.5.

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Figure 5.3.4.6 Currency Historical Data

All the historical currency data will then be imported into the power bi includes the name of the currency, date, open price, highest price, lowest price, closing price and adjusted price.
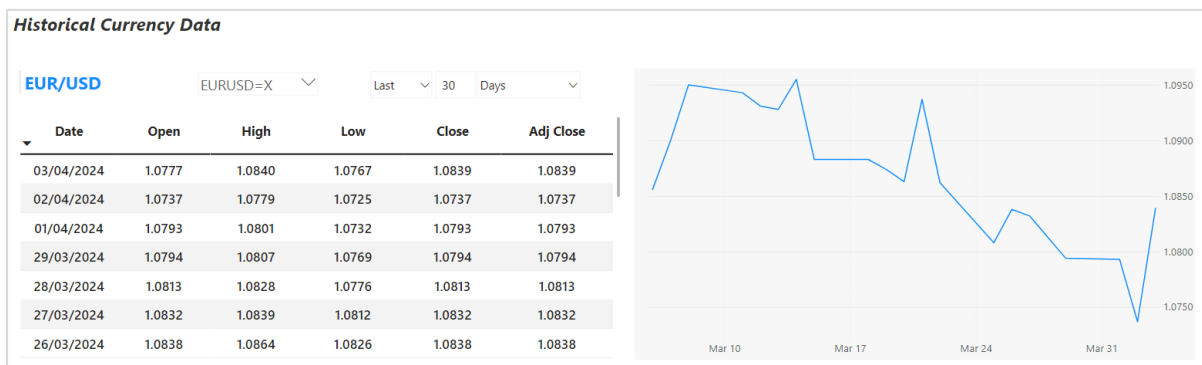
Figure 5.3.4.7 Historical Currency widget

In this widget, the historical currency will be shown in two visual which is table form and line graph form. For the table form, it records all the information of the currency. Users can also search a specific currency by using the filter. Another filter is to use to show the relative data of the currency such as last 2 days, last 25 days. For the line graph form, it will show the past data according to the relative date filter that choose by the users.

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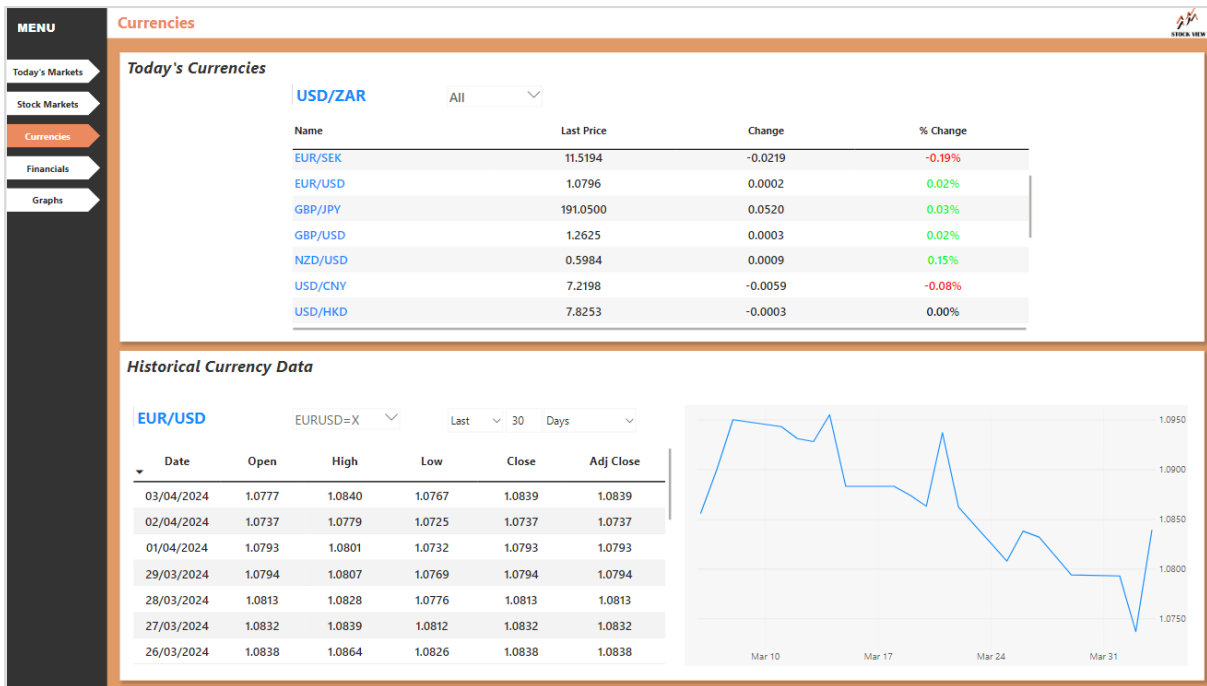
Figure 5.3.4.8 Currencies Dashboard

Figure 5.3.4.8 is showing the full dashboard of the Currencies.

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5.3.5 Financials Dashboard
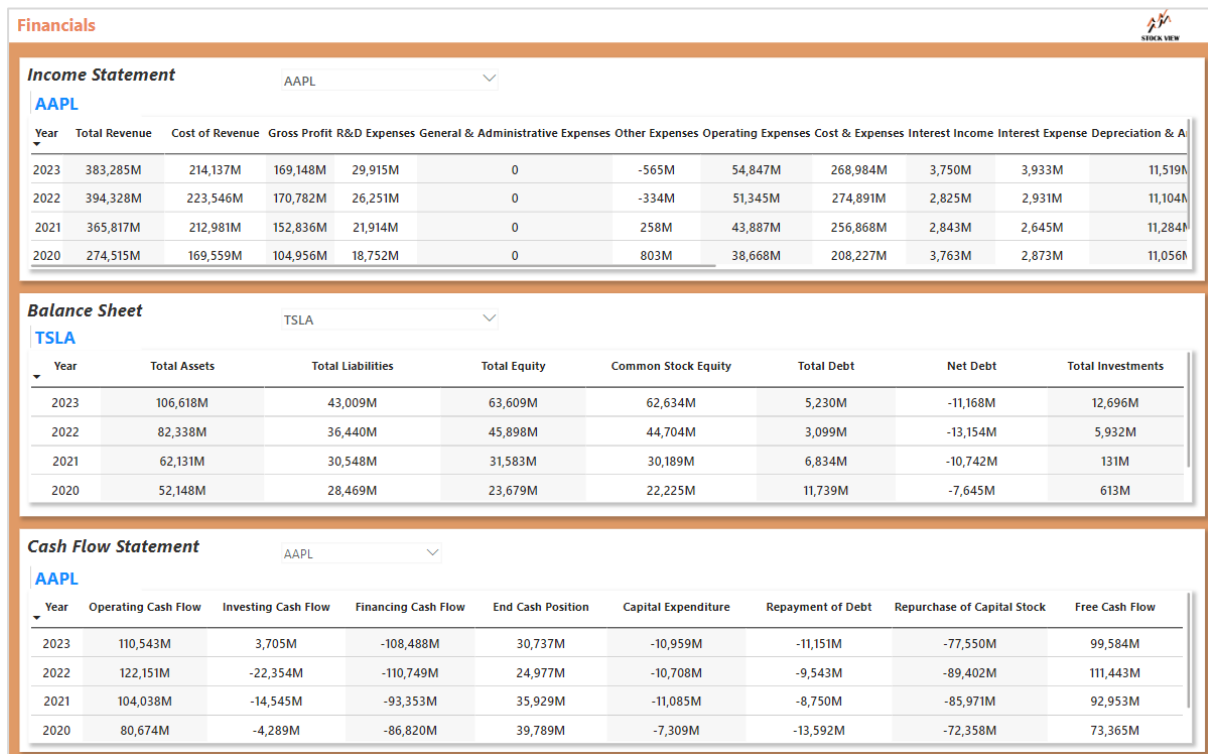
Figure 5.3.5.1 Financials Dashboard

Figure above showing the full dashboard of the Financials, it has 3 widget which are the Income Statement, Balance Sheet and Cash Flow Statement. These three statements are using the same method to import the data into the Power BI by using the 'Get Data' function.

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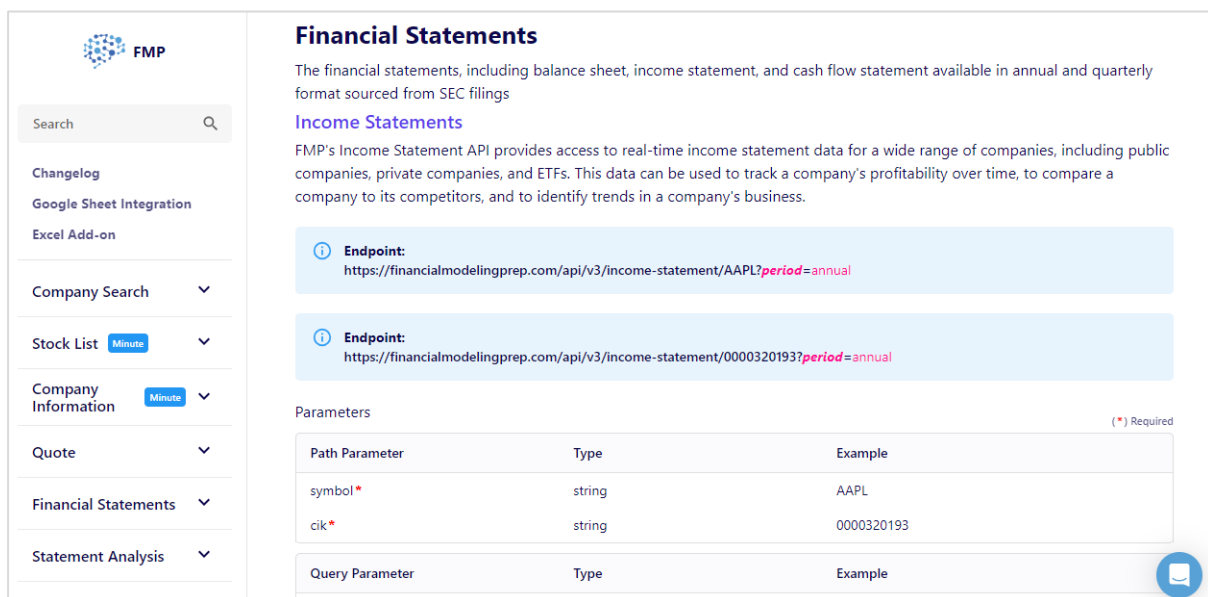
Figure 5.3.5.2 Financial Modeling Prep website

Copy the link from the above figure, then paste it into the Power BI. The data then will be imported into the system. After all the three statement's data have been imported finish, then can continue with the visualization. The data is put in table visual to let the users can see the amount accurately in numeric form. There will have a filter on the top of each statement, this is to allow the user can filter to the specific company that they wish to see the financial statement. On the top left corner of each widget also have the company card as the level, it is in blue color so that user will not confusing that which company statement they are looking for.

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5.3.6   Graphs Dashboard
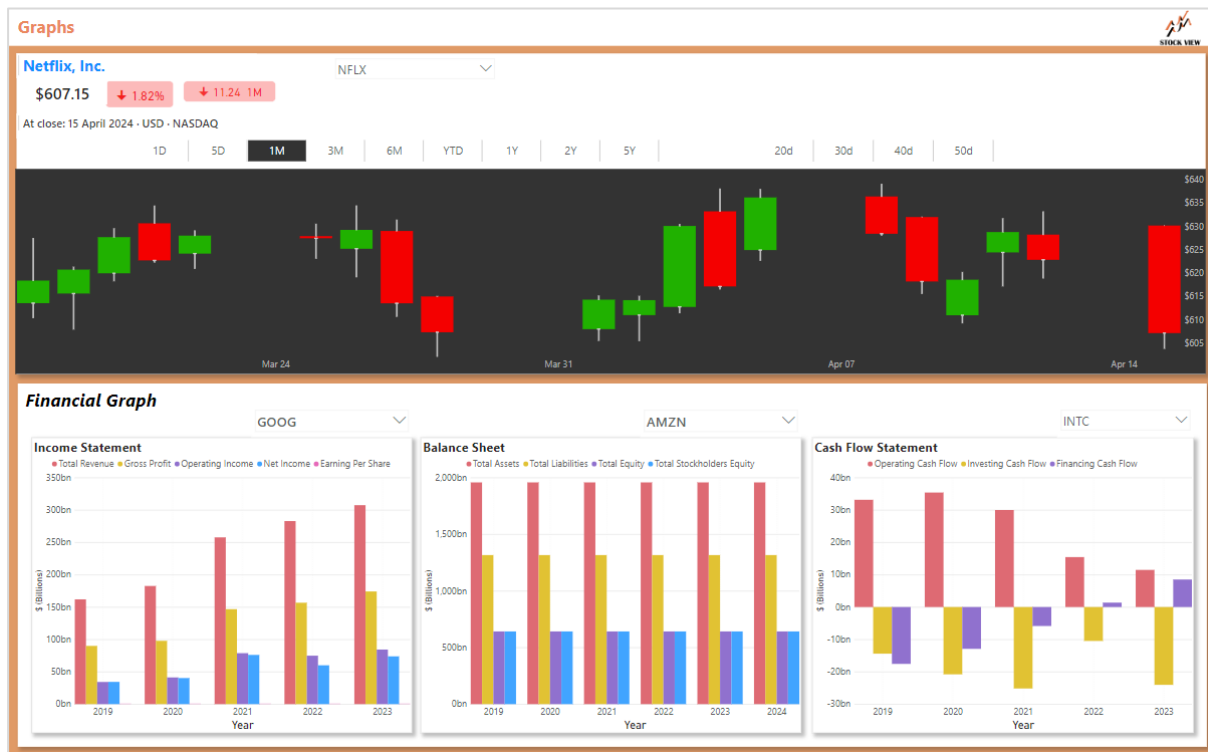
Figure 5.3.6.1 Graphs Dashboard

The above figure showing the full dashboard of the Graphs. There have two widgets in this dashboard which is the Stock Performance Candlestick Chart and the Financial Bar Chart. For the Stock Performance candlestick chart, it needs to create a function that will use Yahoo Finance API to automatically fetch multiple stock price on a daily basis. Then create some measures in the Power Bi to calculate the moving average, low price, high price of the stocks. After all measures needed have been added, then will start to create the visual of the candlestick chart.
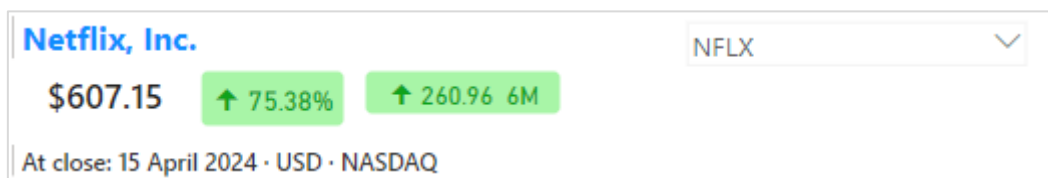
Figure 5.3.6.2 Candlestick chart filter

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First will insert a card into the widget. The card is to show the company of the stocks. It is in blue color and bold to be more eye catching for the users to see. Then insert a filter at the right-hand side of the card. The filter is to let the user to select the company that they wish to see. Under the company card, there have a last close price card to show the user the stocks last close price of the latest day. There is a card in green color, is to show the percentage of change of the stocks. The second smaller card is the difference of the change of the stocks. These two cards will change according to the date filter that user select at the date filter. There is a date added under the prices, it is showing the last close date of the stocks.

Figure 5.3.6.3 Date filter

The date filter is added into the chart to let the user can filter the date range that they want. there is also have a moving average filter at the right-hand side.

Figure 5.3.6.4 Candlestick chart

The above diagram shows the candlestick chart of the stock market. The green color is to show the stock's closing price is higher than the opening price. Oppositely, the red color is to show decreasing means that closing price is lower than the opening price. There is a whisker add on top and above the candlestick. This whisker is to show the highest price and lowest price of that day that the stocks reach. The dotted line is added into the chart to show the moving average of the stocks, it will change based on the moving average filter that the user selects. At the above of the chart, it will have a date title to let the user knows that what date is for the specific date. At the right hand of the chart will also have a price label to show the price of the stocks on different date.

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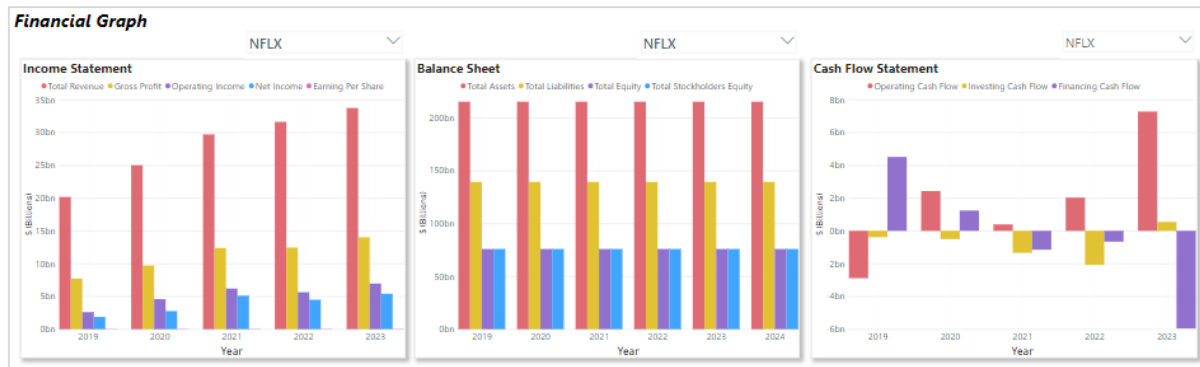
Figure 5.3.6.5 Financial graph

This widget has three bar charts for Income Statement, Balance Sheet and Cash Flow Statement. All the charts will have a filter to choose the company. These bar charts only take the key data to show as a chart due to the statement is having too much data. Bar charts can show the data whether is in a positive value or negative value.

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Chapter 6

System Evaluation and Discussion

6.1   System Testing
6.1.1 Develop Questionnaire

A questionnaire is developed to collect the response from the investors to know whether the system is developed in a good direction or not. The question from the questionnaire is based on the usability testing components to set it. Since the system is in a specific area which is stock markets, so it will need only three expert investors to test and response to the questionnaire only. It will consist of 24 questions in this questionnaire.

6.1.2 Develop Testing in System

Of course, some basic testing will also conduct to test this system such as navigate dashboard by dashboard, choose the filter to make sure everything can be shown correctly. The testing will start from first dashboard to the last dashboard.

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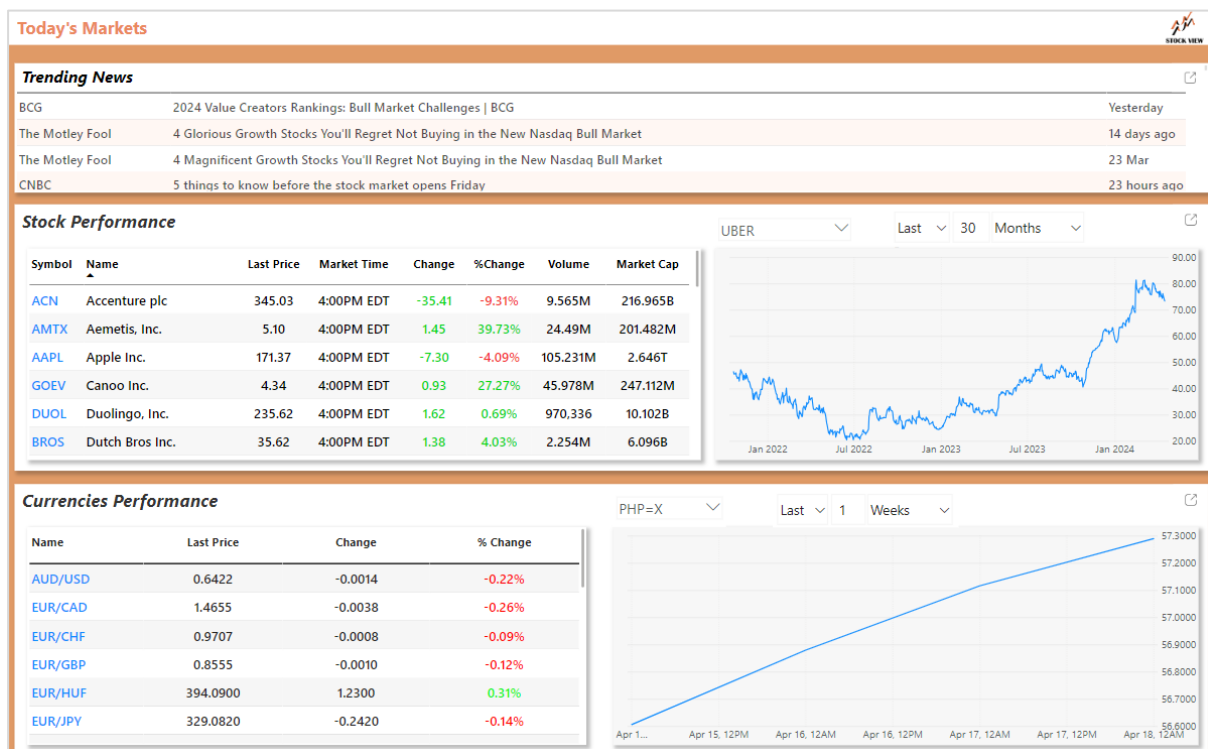
Figure 6.1.2.1 Today's Markets Dashboard

The first dashboard will be the Today's Markets dashboard. The trending news widget have a 'open' icon on the top right corner that connect to the Google News. It needs to make sure that the button can perform to let the user to navigate to the website to see the full article of the news. The stock performance widget is having a filter for the company, date filter and a 'Open' icon on the top right corner. Same goes to the Currencies performance widget. The testing will make sure that all the buttons can perform well.
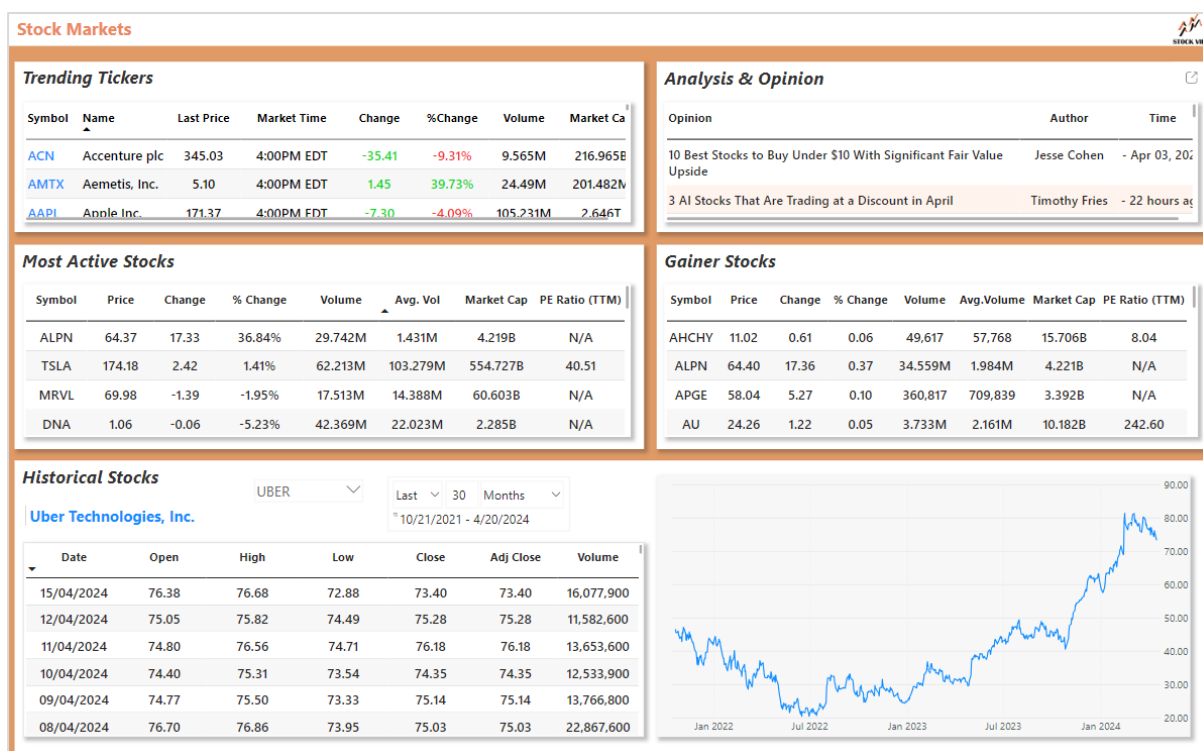
Figure 6.1.2.2 Stock Markets Dashboard

There has a 'open' icon in the Analysis & Opinion widget that connect to the website that showing the full Analysis & Opinion contents. It needs to make sure that when users click the icon, it can bring the user to the correct website. Next things to test are the filter in Historical Stocks widget. The company filter and date filter, after selecting the company, needs to ensure that the table is showing the stocks correctly and also the card is showing the correct company that selected. The date range filter also needs to be test that it will shows the correct date range in the table and also the graph.

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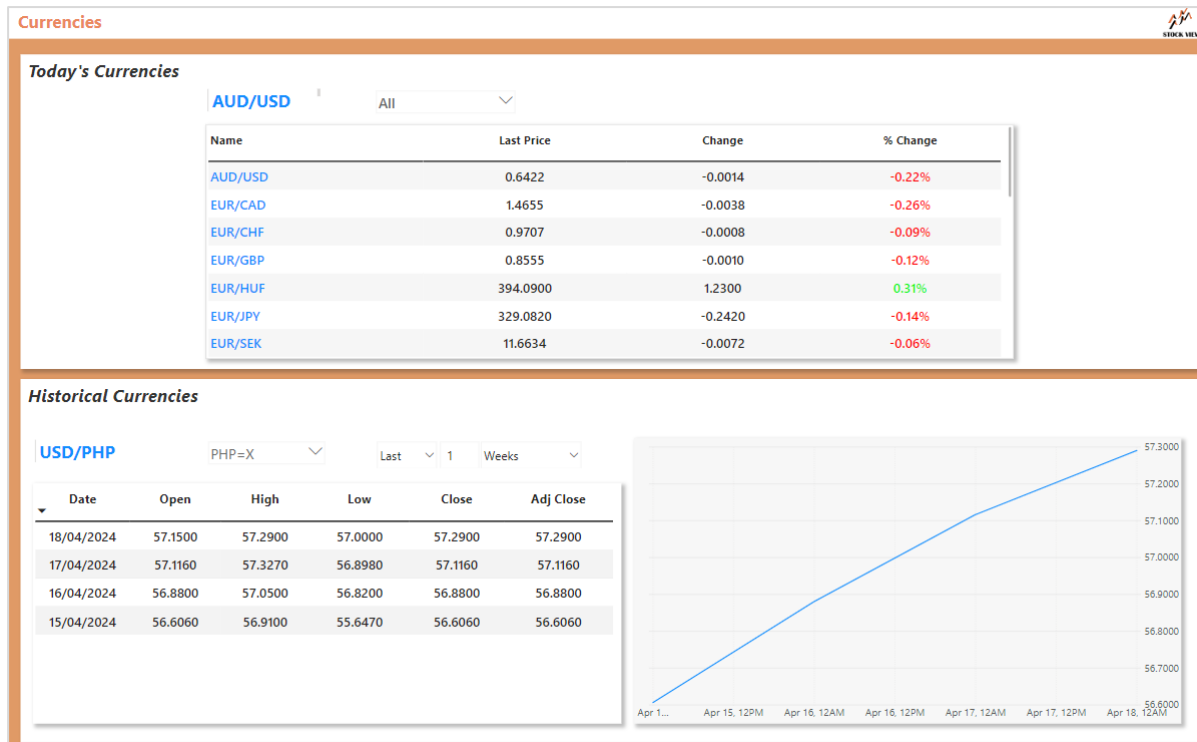
Figure 6.1.2.3 Currencies Dashboard

In this dashboard, there are three filter need to be test. First is the currency filter in the Today's currencies widget. It needs to make sure that when users click the specific currency, the table will show the correct currency. The percentage of change also need to check that when it is positive value, then the value should be in green color. Oppositely, when the value is negative, then it should be in red color. Second is the currency filter and the date range filter in the Historical Currencies widget. When the user selects the specific currency and choose the date range, the table and the graph should show the correct currency's data.

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Financials

STOCK VIEW

Income Statement   GOOG ⌄

GOOG

Year	Total Revenue	Cost of Revenue	Gross Profit	R&D Expenses	General & Administrative Expenses	Other Expenses	Operating Expenses	Cost & Expenses	Interest Income	Interest Expense	Depreciation & A...
2023	307,394M	133,332M	174,062M	45,427M	16,425,000,000	556M	89,769M	223,101M	3,865M	308M	11,946M
2022	282,836M	126,203M	156,633M	39,500M	15,724,000,000	-3,514M	81,791M	207,994M	2,174M	357M	15,928M
2021	257,637M	110,939M	146,698M	31,562M	13,510,000,000	12,020M	67,984M	178,923M	1,499M	346M	12,441M
2020	182,527M	84,732M	97,795M	27,573M	11,052,000,000	6,858M	56,571M	141,303M	1,865M	135M	13,697M

Balance Sheet   INTC ⌄

INTC

Year	Total Assets	Total Liabilities	Total Equity	Common Stock Equity	Total Debt	Net Debt	Total Investments
2023	191,572M	81,607M	109,965M	105,590M	49,278M	42,199M	23,784M
2022	182,103M	78,817M	103,286M	101,423M	42,051M	30,907M	23,106M
2021	168,406M	73,015M	95,391M	95,391M	38,101M	33,274M	30,724M
2020	153,091M	72,053M	81,038M	81,038M	36,401M	30,536M	25,374M

Cash Flow Statement   MSFT ⌄

MSFT

Year	Operating Cash Flow	Investing Cash Flow	Financing Cash Flow	End Cash Position	Capital Expenditure	Repayment of Debt	Repurchase of Capital Stock	Free Cash Flow
2023	87,582M	-22,680M	-43,935M	34,704M	-28,107M	-2,750M	-22,245M	59,475M
2022	89,035M	-30,311M	-58,876M	13,931M	-23,886M	-9,023M	-32,696M	65,149M
2021	76,740M	-27,577M	-48,486M	14,224M	-20,622M	-3,750M	-27,385M	56,118M
2020	60,675M	-12,223M	-46,031M	13,576M	-15,441M	-5,518M	-22,968M	45,234M

Figure 6.1.2.4 Financials Dashboard

It has three company filter in this dashboard, it is used to show the company's statement. After user had selected the company, the card and table need to show the correct company name and statement's data.

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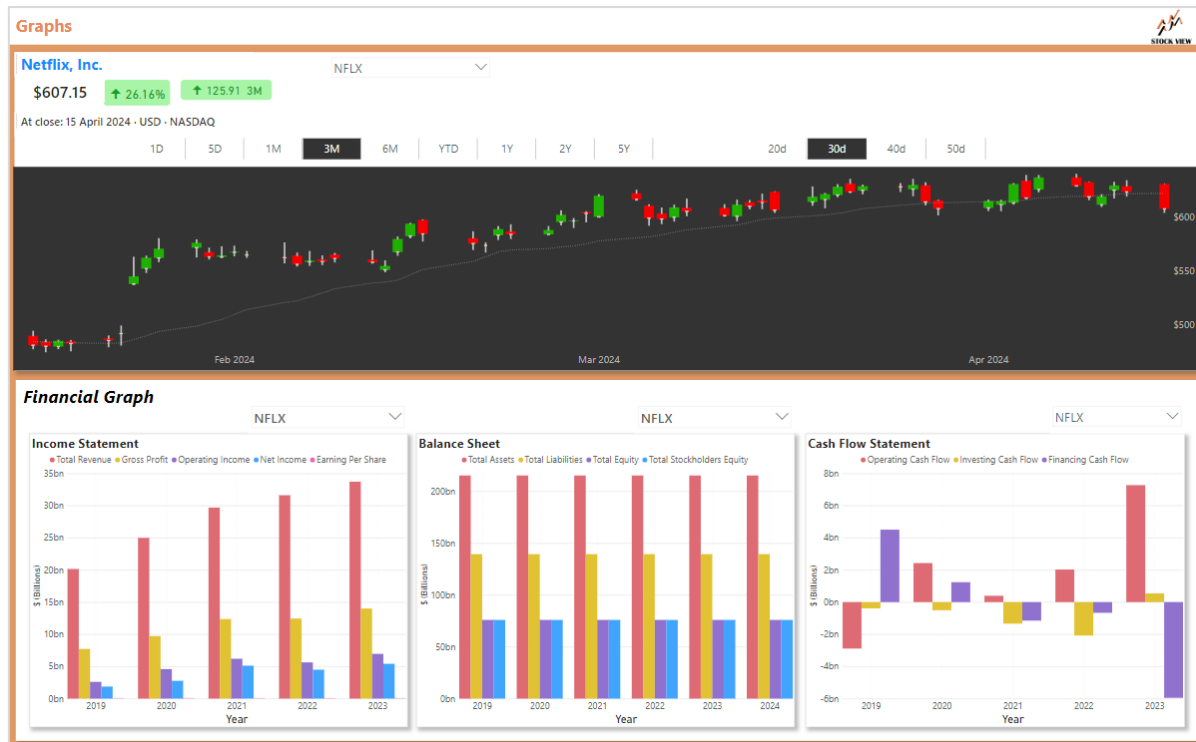
Figure 6.1.2.5 Graph Dashboard

In the Stock candlestick chart, it has a company filter that let the user to choose the company that they want to see. It needs to make sure that the filter can works well to show the correct data to the user. The last close price, percentage of change, difference on changes and last close price date also needs to follow the correct data in the stock markets after users select a specific company. There is a date filter and moving average filter above the chart. When users select the date filter and moving average, the chart needs to show correct charts and line following the filter. For the Financial graph widget, it needs to make sure that the three company filter can work correctly to show the users statement chart.

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6.2 Testing Result

6.2.1 Questionnaire Result

Demographic Section:
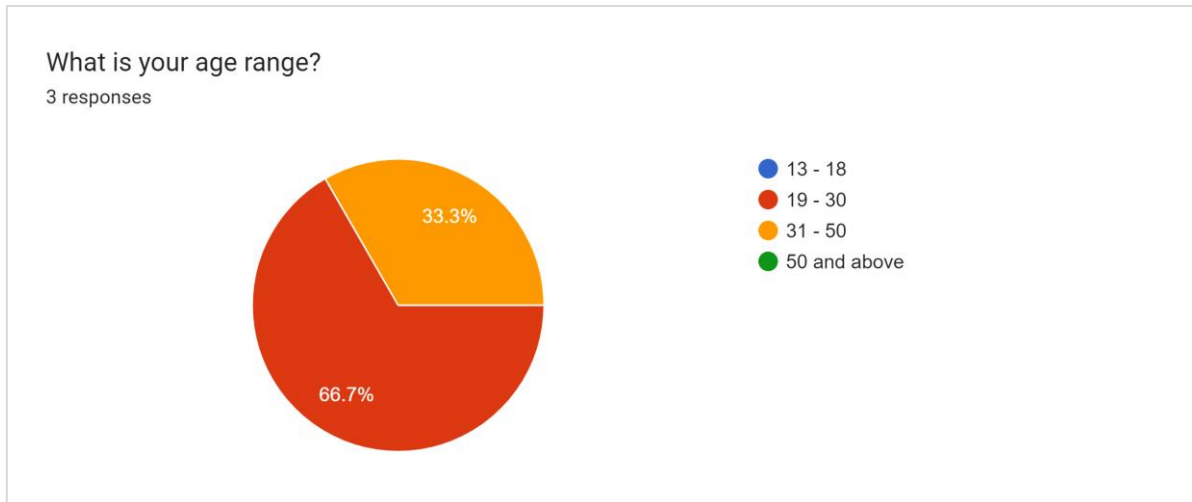
Figure 6.2.1.1 Question 1

This question is to know the investor age range is fall in which group. From the response can know that two investors are between 19 and 30, and one investor is between 31 to 50.
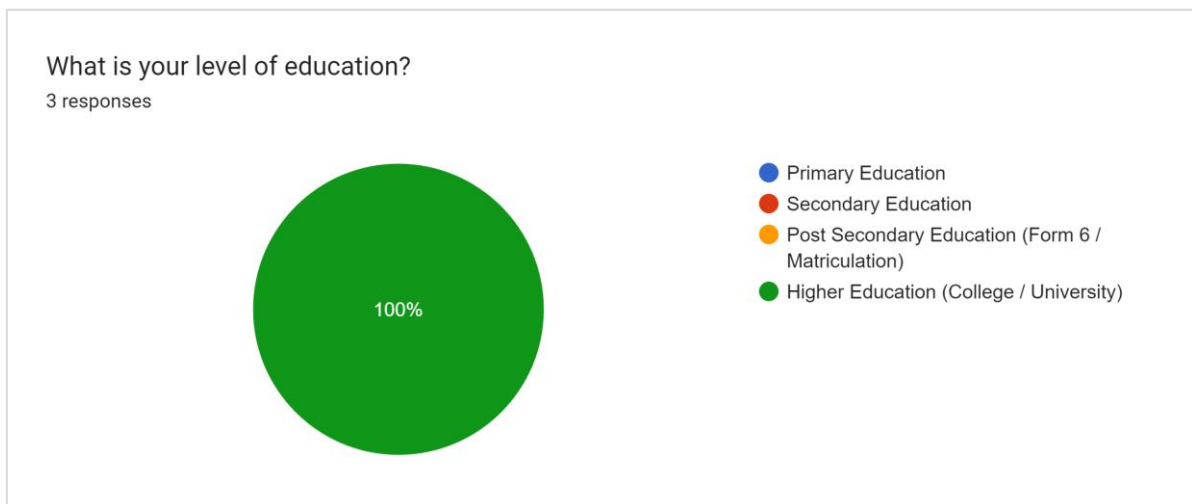
Figure 6.2.1.2 Question 2

This question is asking the level of the education of the investors to know the level of education will affect the knowledge to the stock markets or not. All three investors is study until the higher education.

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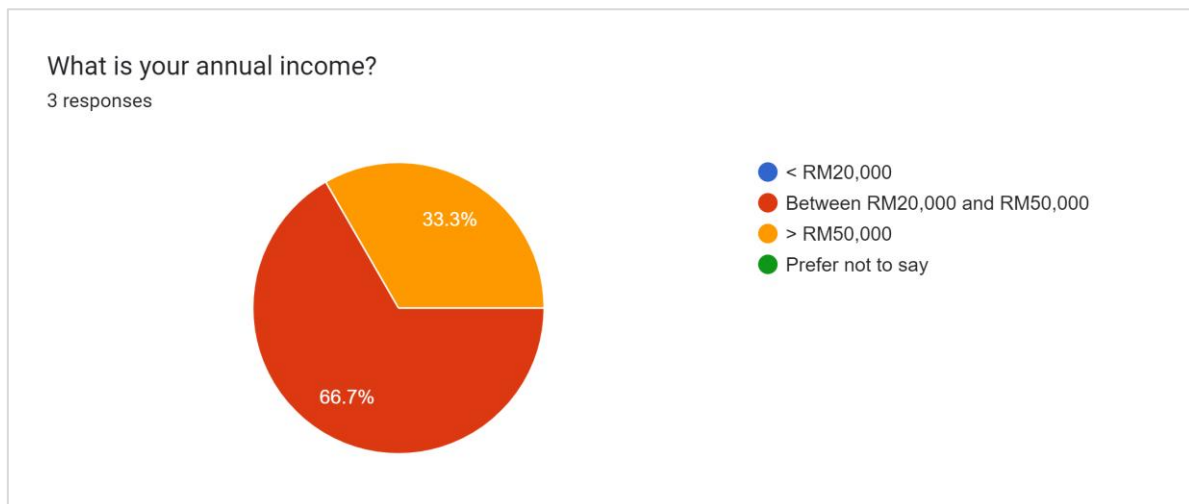
Figure 6.2.1.3 Question 3

This question is to know the investors annual income. Two investors are between RM20,000 and RM50,000 and one investor more than RM50,000.
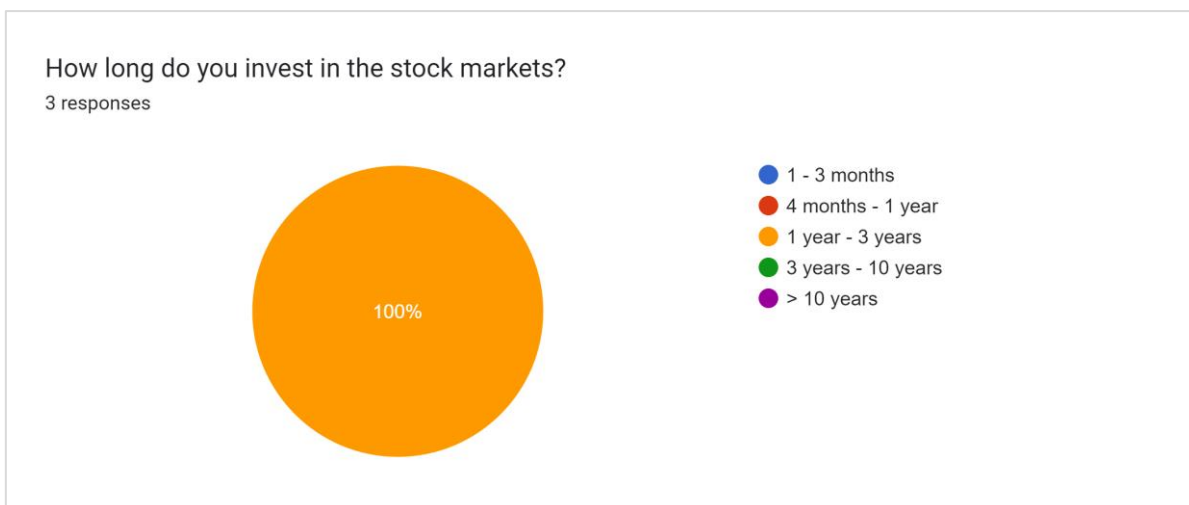
Figure 6.2.1.4 Question 4

This question is to analyze that whether the time invest in the stock will affect their needs or not. For example, some beginner investor may not need so much information, but for experienced investors they may need much information to make decision to invest in the stocks. From the response, all three investors invest in the stock markets is between 1 year and 3 years, meaning that they are all in the stage that convert from beginner investors to junior investors.

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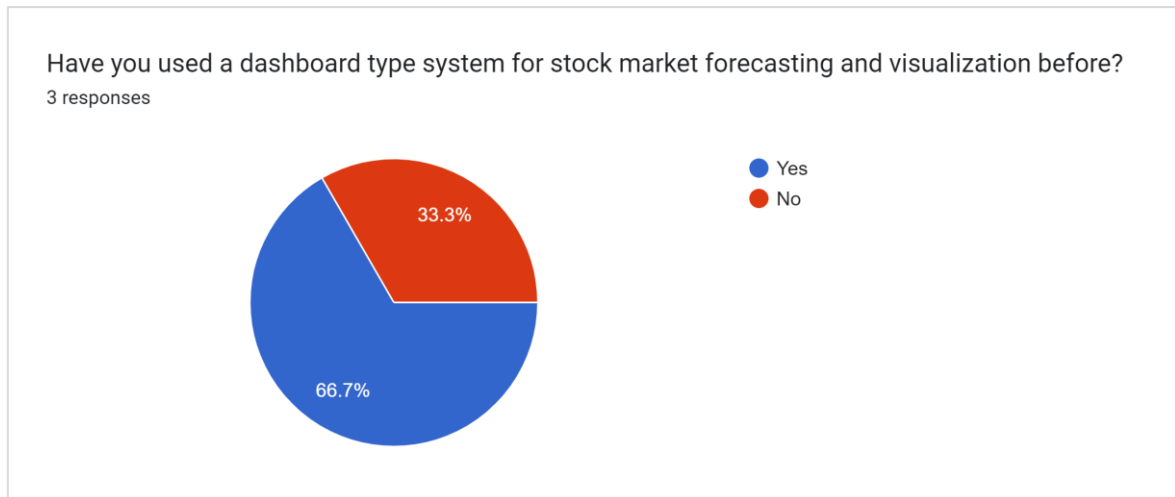
Figure 6.2.1.5 Question 5

This question is to know that whether the investors had used the dashboard type stock market system before, so when using this current system some of them may be more familiar with the process and usability of the system. Two investors have used this kind of system before, but one of the investors never used it before.

Section 1: Learnability
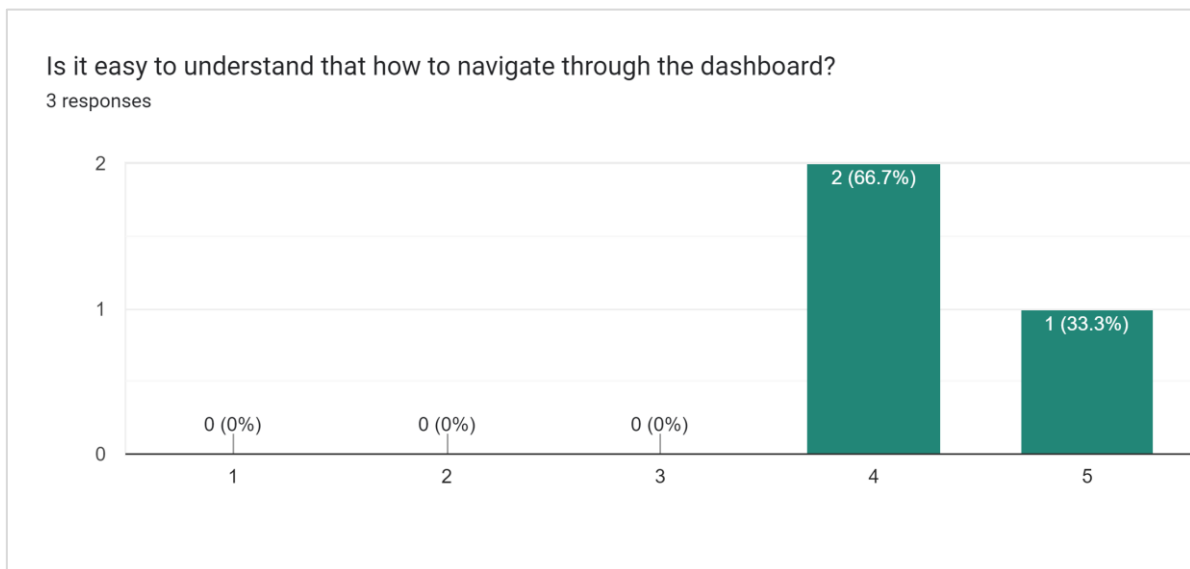
Figure 6.2.1.6 Question 6

This question is asking the users for the understandability to the system in term of navigation. two users had chosen a rating of 4 and one user had chosen rating of 5 meaning that the navigation is very easy to understand and learn.

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Did you find the layout and organization of information intuitive? (e.g. organization of stock prices/currencies)

3 responses
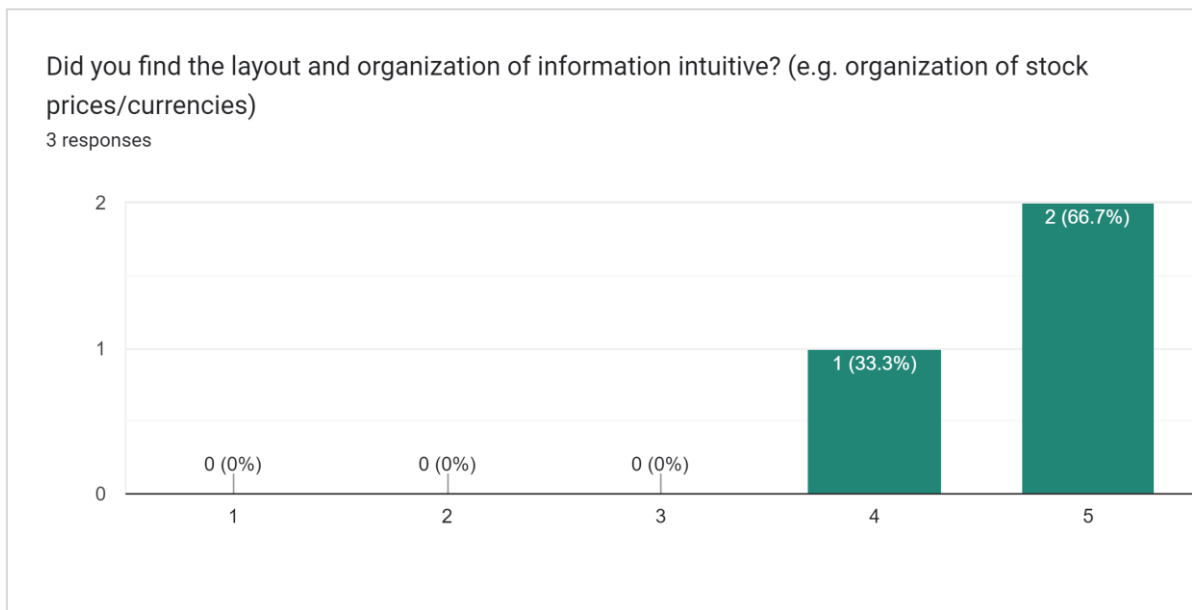
Figure 6.2.1.7 Question 7

This question is to ask the users whether easy to find the layout and organization of information intuitive or not. One user said give a rating of 4 and two users give a rating of 5. So, the information such as the organization of stock price or currencies is shown straightly to the users.

How quickly were you able to grasp the basic functions of the dashboard?

3 responses

Figure 6.2.1.8 Question 8

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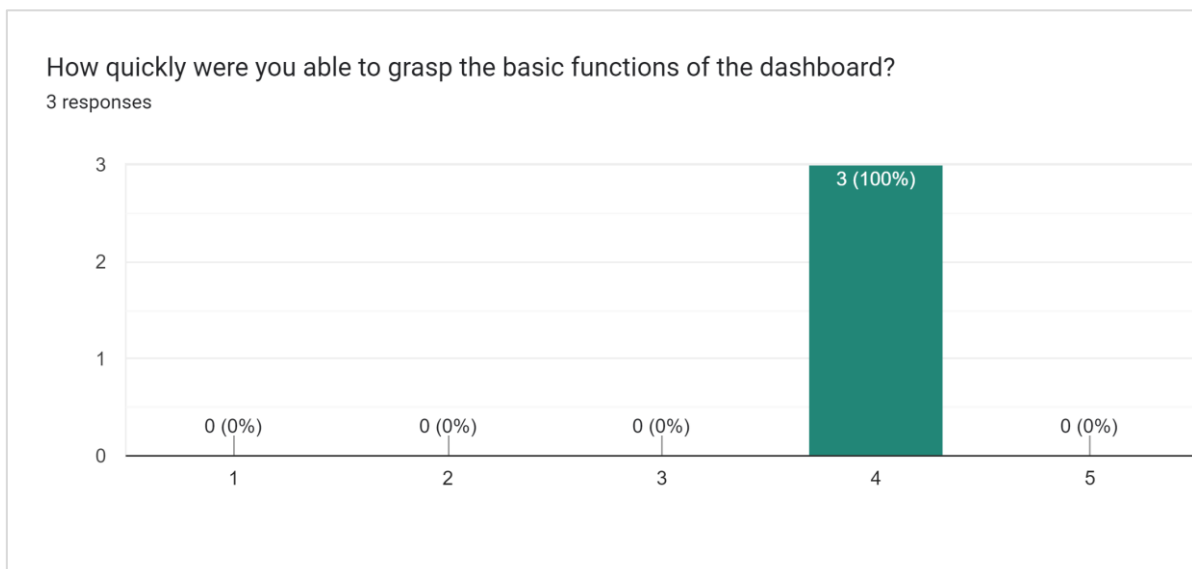
This question is asking the users how fast they can learn the basic functions of the dashboard. All of the three users' response for a rating of 4. This means that the dashboard system is still can be handle by the users that had familiar with the dashboard or not familiar with dashboard.

Section 2: Efficiency
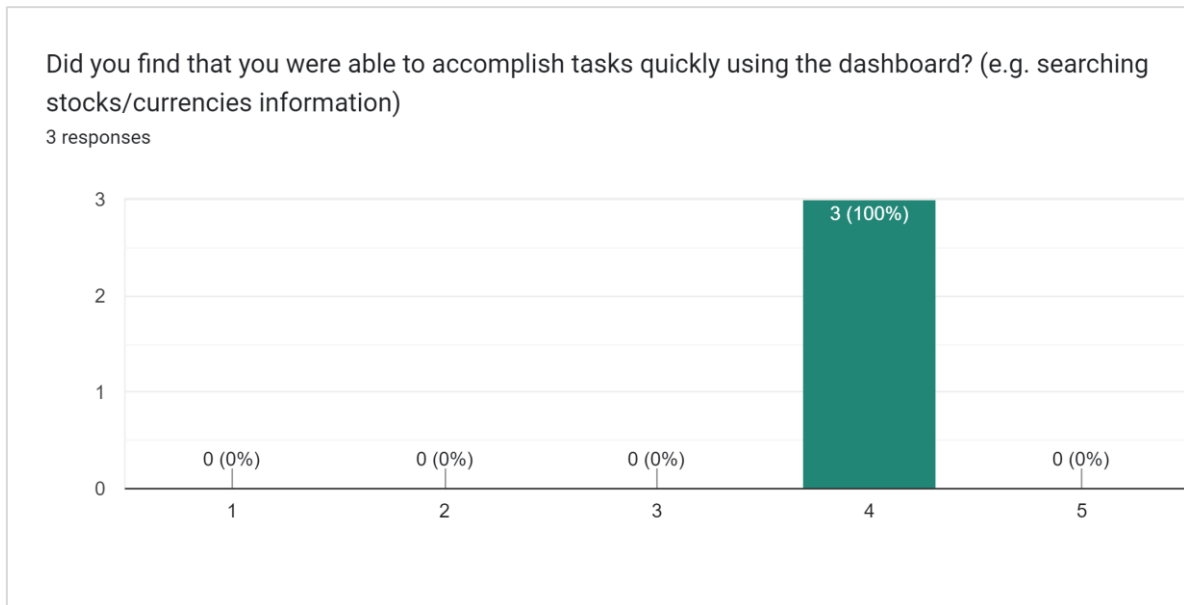
Figure 6.2.1.9 Question 9

This question is to know whether the users can accomplish tasks quickly using the dashboard or not. From the response above, three users give a rating of 4, meaning that is still in a good range that they can accomplish the tasks.
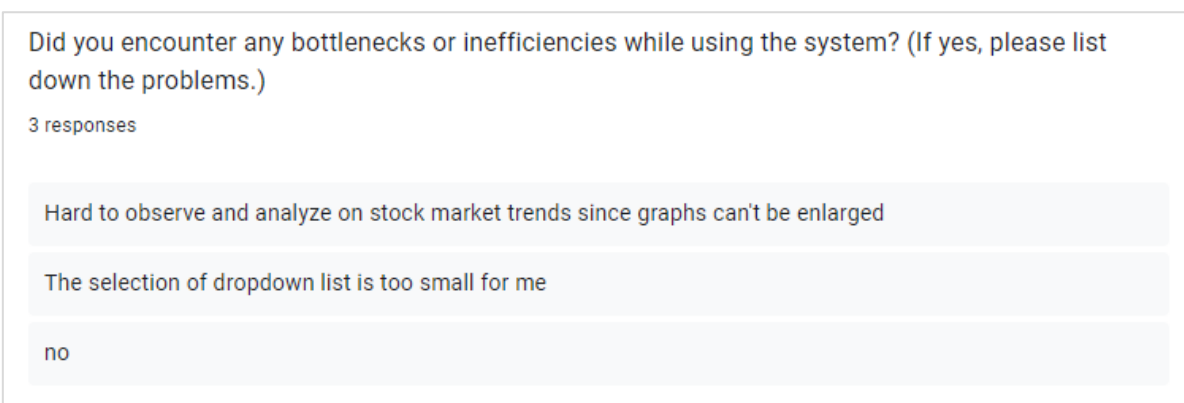
Figure 6.2.1.10 Question 10

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This question is asking the users to list down the bottlenecks or inefficiencies while using the system. Their opinion is in the figure 6.2.1.10. The future maintenance will integrate the system by considering the responses get.
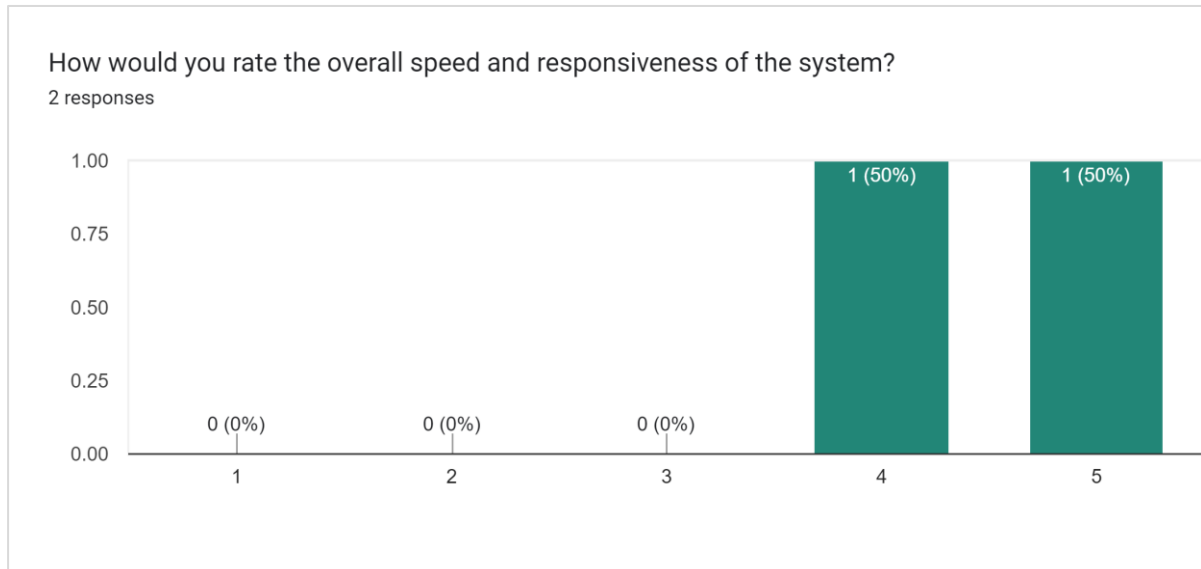
Figure 6.2.1.11 Question 11

This question needs to let the users rate the overall speed and responsiveness of the system. The rating is fall between 4 and 5. The system is still in a responsive system.
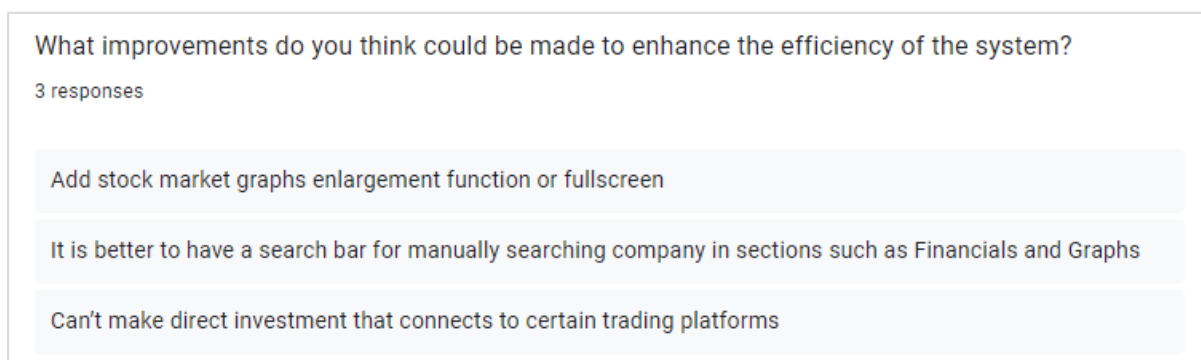
Figure 6.2.1.12 Question 12

This question is to ask the user's opinion whether the system is needing any improvement to enhance the efficiency of the system. All the opinion will be considered for the future enhancement to make the system better.

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Section 3: Memorability
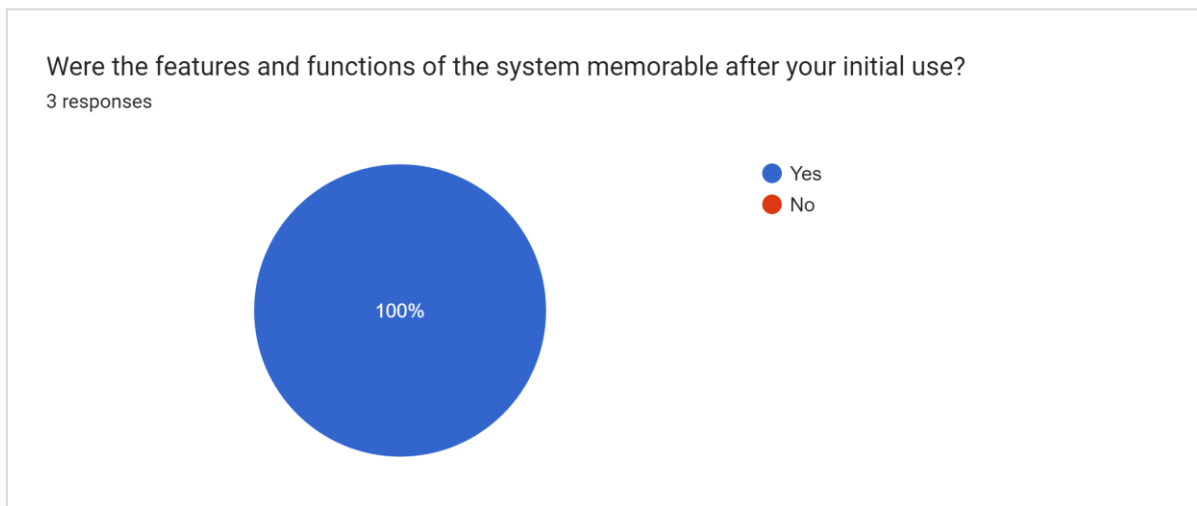
Figure 6.2.1.13 Question 13

This question is to know the user's memorability for the features and functions in the system. Three investors chosen the options yes, meaning that the features and functions in the system is easy to memorize.
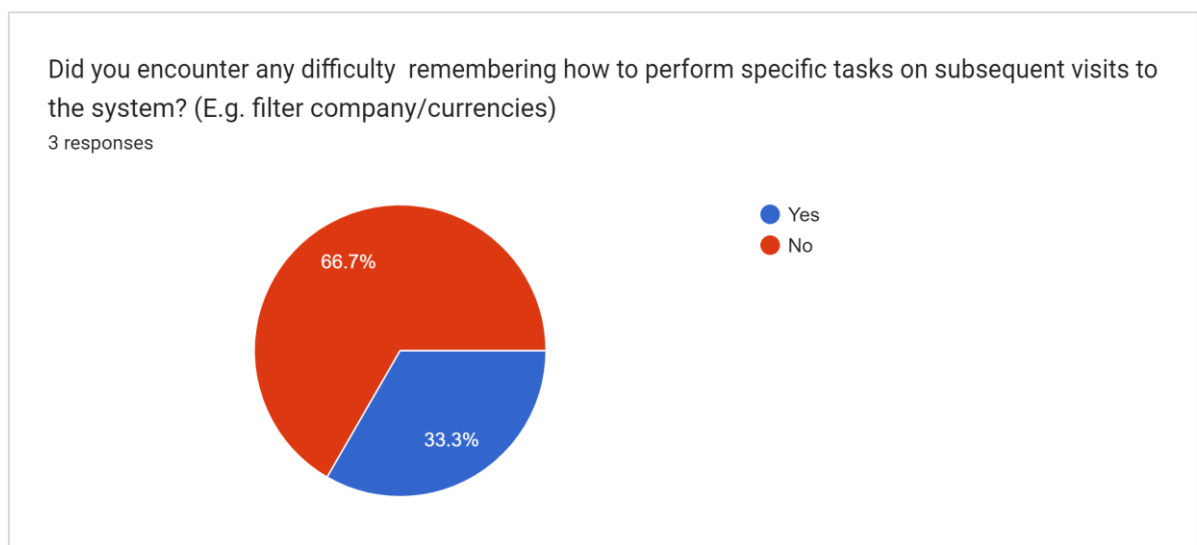
Figure 6.2.1.14 Question 14

From the above question, can knows that two users had not encounter any difficulty remember the process of perform the tasks in the system while one user feels that is hard to perform specific tasks.

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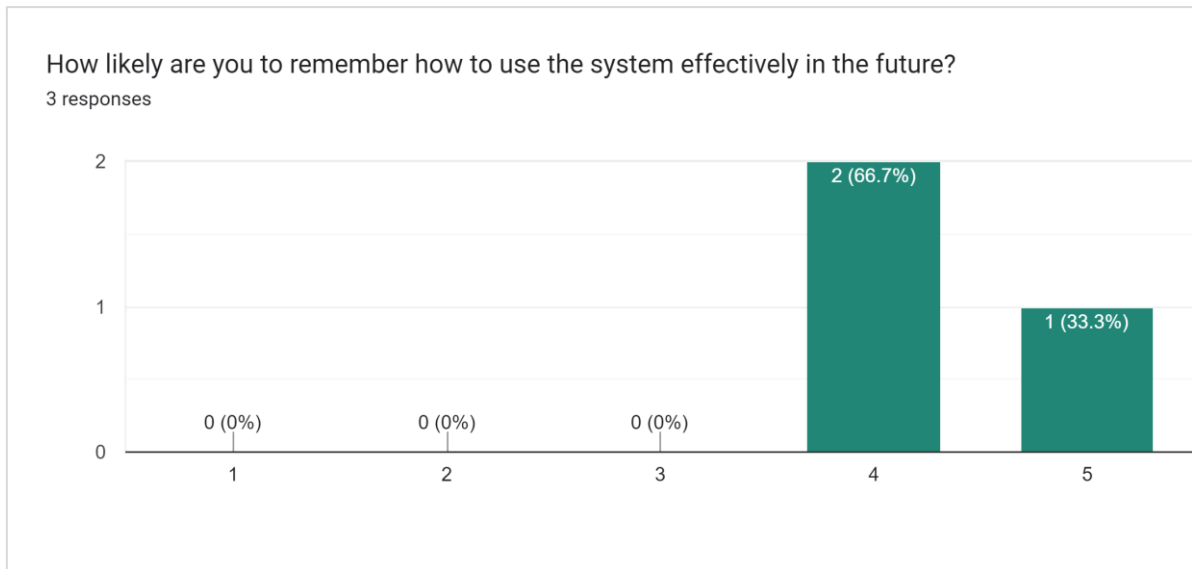
Figure 6.2.1.15 Question 15

This question is to know the user can remember how to use the system effectively in the future or not. Two of the users give a rating of 4 and one of the users choose a rating of 4. This can conclude that the system is very easy to on hand perform task and easy to be remember.

Section 4: Errors
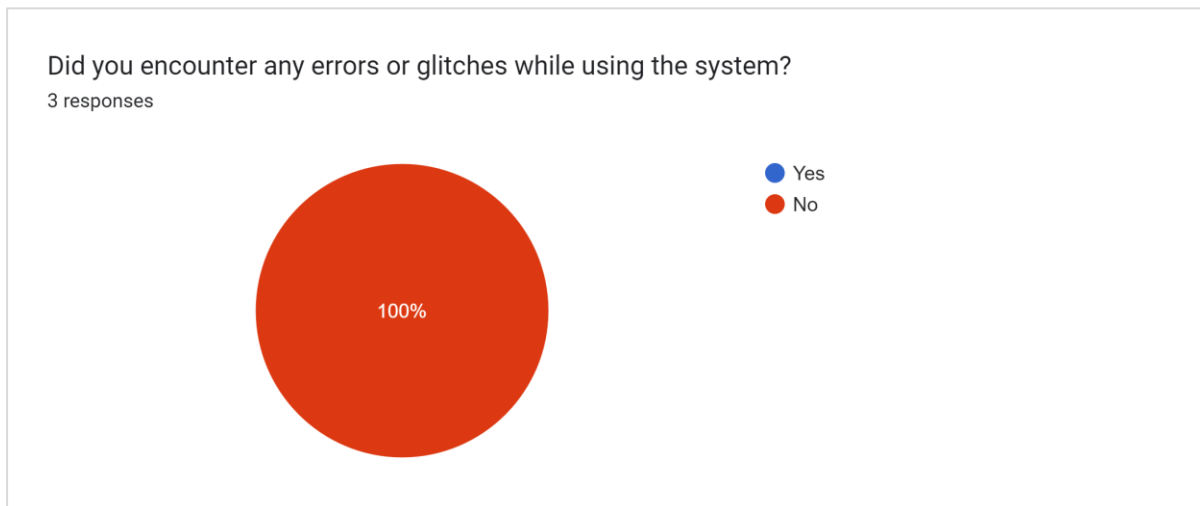
Figure 6.2.1.16 Question 16

This question is to ask the users that they have encounter any errors or glitches while using the system or not. From the response, it can be known that there is no error and glitches in the system.

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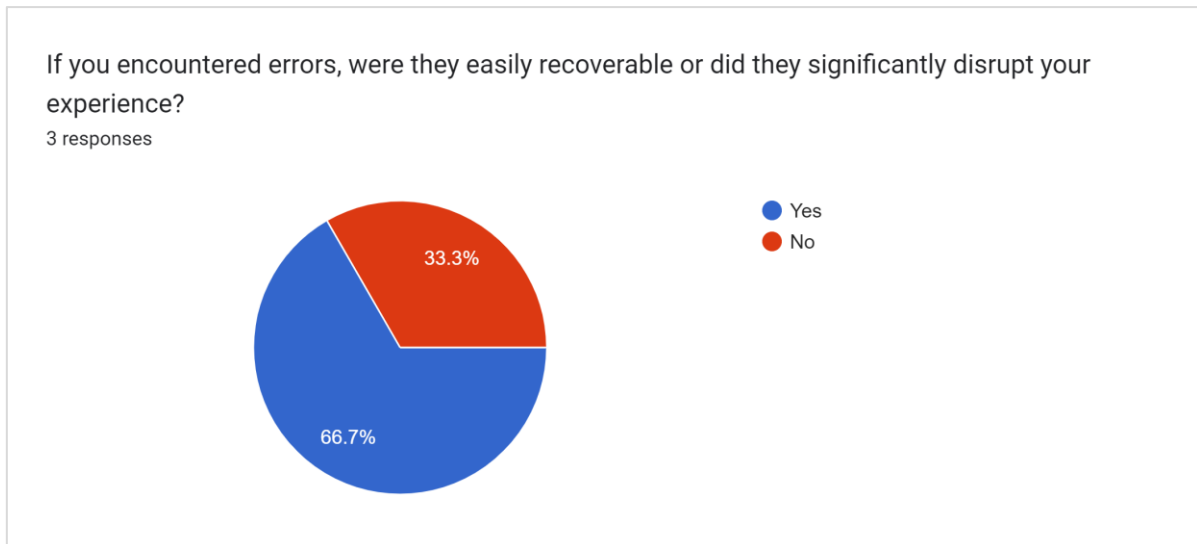
Figure 6.2.1.17 Question 17

This question asking the users when they encountered any errors, did they easily recoverable it or not. The response shows that two users state yes, meaning that the errors is easily recoverable. One user answer no, meaning that it is not easy to recover.
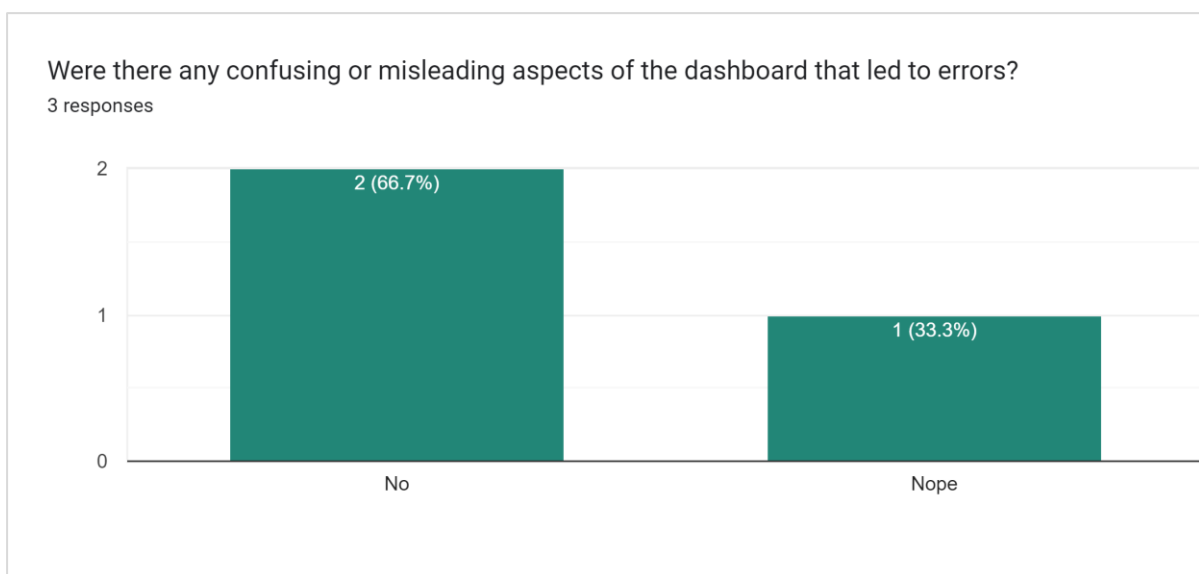
Figure 6.2.1.18 Question 18

This question asks about whether there are any confusing or misleading aspects of the dashboard that led to errors. From the above response, it can be known that the system is not having confusing information that led to errors.

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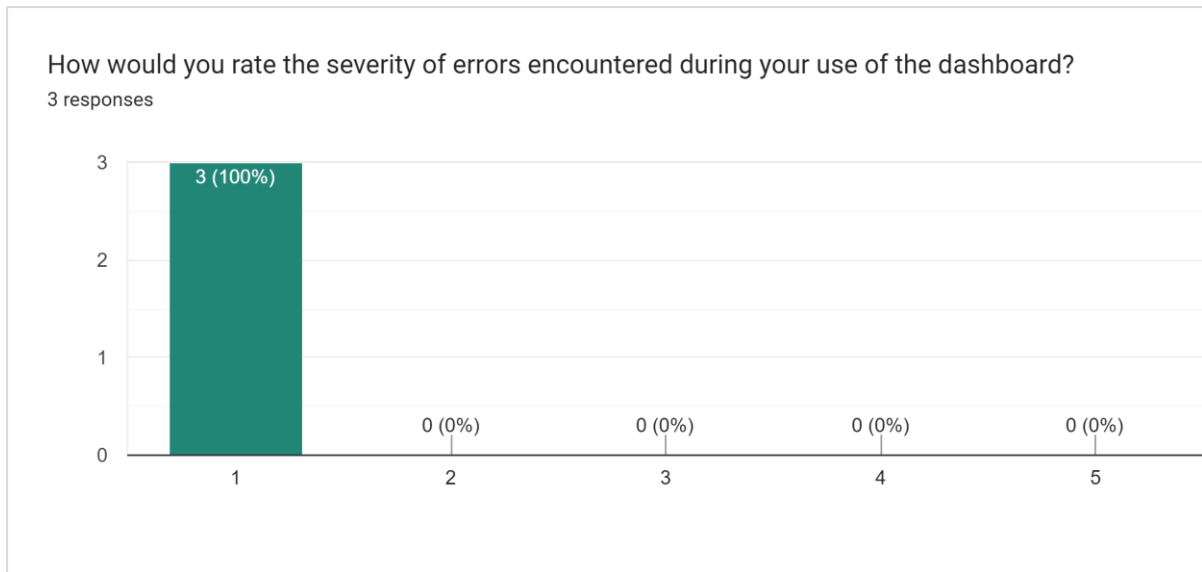
Figure 6.2.1.19 Question 19

This question is let the users to rate the severity of errors encountered during your use of the dashboard. All the three users rate 1, meaning that there is no errors when the use the system.

Section 5: Satisfaction
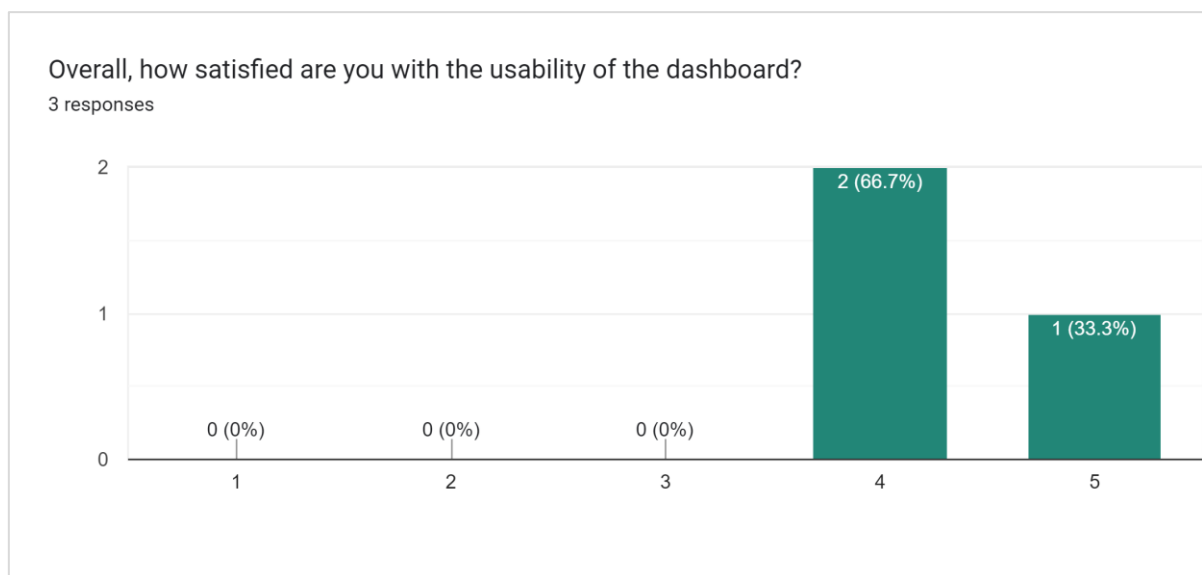
Figure 6.2.1.20 Question 20

This question is to know how satisfied the users with the usability of the dashboard are. Two users' rate for 4 and one user rate for 1. The system is having a good usability for the users to use.

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Did the system meet your expectations in terms of its usability and functionality?

3 responses

● Yes
● No
● Maybe

100%
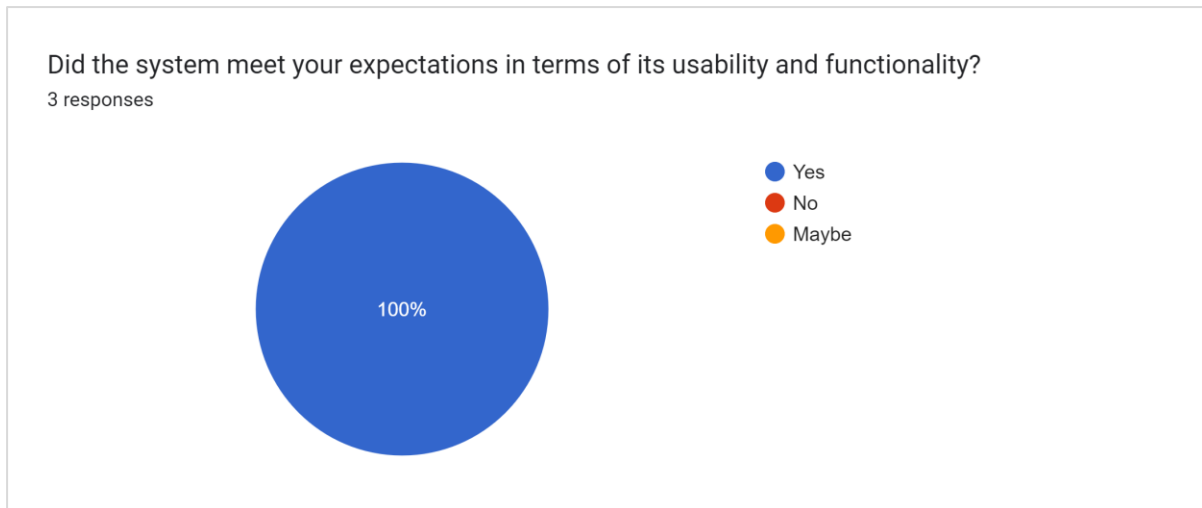
Figure 6.2.1.21 Question 21

From the response above, we can know that the system had meet the expectations in terms of its usability and functionality.

How likely are you to recommend this system to others based on your experience?
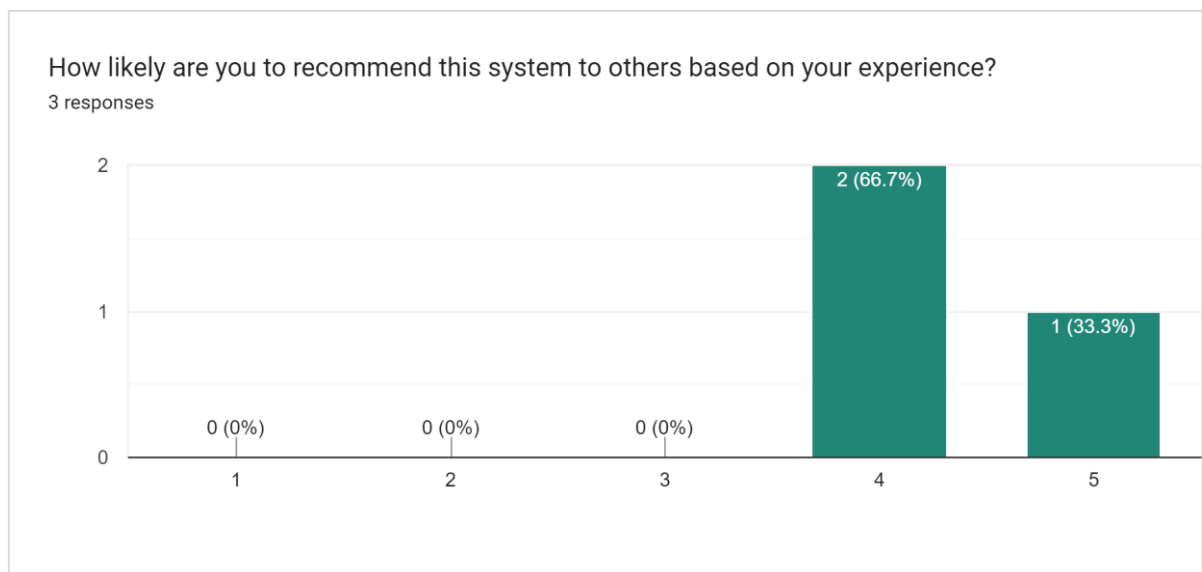
3 responses

Figure 6.2.1.22 Question 22

The question is asking how likely the users will recommend the system to others. From the response get, can know that they will recommend this system to other investors.

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What aspects of the system did you find most satisfying? (e.g. filter/function/widget)

3 responses

Widget

Function

Real-time news for stock markets

Figure 6.2.1.23 Question 23

This question is to know what aspects of the system that the users find most satisfying. Their opinion is in the figure 6.2.1.23.

What improvements would you like to see to enhance your satisfaction with the system?

3 responses

Graphs illustration feature

Hope to have all information on one page

Hope to have more stock related features or functions

Figure 6.2.1.24 Question 24

This question is to know whether there are any improvements can be made to the system. From the suggestions that the users state, the graph illustration feature may be needed to enhance and also add more stock related features or functions.

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6.2.2   System Testing Result
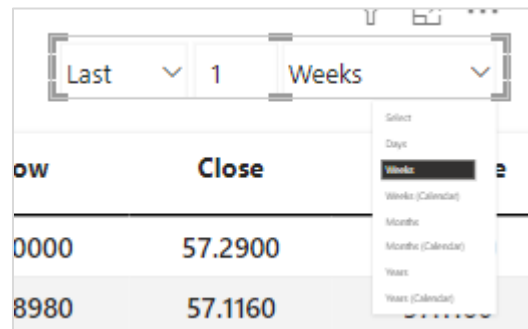
Figure 6.2. Date Filter

The date filter options are in a very small font size. Even though has change the font size to a bigger size, the options still do not response to it.

Overall, for others filter function and graph function, it is working correctly without any errors.

6.3   Project Challenges

The challenge for this system will be connecting the API to the Yahoo Finance or others website. Some websites will restrict and not allowed to connect the API, it then causes the data cannot be imported into the Power BI. There will also have some problems when the API is connected but the data import into the system shown error. This needs to fix by trying a few times to import the data.

Another challenge is Power BI will have some minor bugs that causes the data cannot show correctly in the visual. So, there will needs some bug fixing for this. The relationship for each table will automatically connects together when they have the same column name even though the table did not have any relations between them. It needs to delete the relationship when Power BI automatically connects the entity.

The last challenge for this project is the knowledge to the stock markets. Stock markets is a complex thing that cannot be learned in a short time. The project needs to complete in few months, but the knowledge may not meet the system needs. So, there will lack of some

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important data that may need to add into the system or some information is misleading to the users.

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6.4   Objectives Evaluation

6.4.1   To study the features of a forecast stock market system.

This objective had been achieved in this project. To study the features of a forecast stock market system, there will needs to review few systems in the current market. In the literature review, there are three system been reviewed for this project, it has list down all the features, strengths and weaknesses for each three system. The system reviewed are Yahoo Finance, Investing.com and Koyfin. For the Yahoo Finance, it has some special features such as the customizable portfolio to allow the users can customize its own portfolio that store the graph or data inside. But there is also have some weakness which is the user interface may be too messy for the new user to see. For the Investing.com, the most special features are that it provides multiple languages in the system, this will attract many countries of the users to use this system. the weakness for this Investing.com will be the advertisement is too heavy. The strengths for the Koyfin will be it is an adless system and dashboard type can show many data in only one page. The weakness for this system is it cannot download the stocks data, this may cause some inconvenient to some users. Until here, it can study the current market system basic function, strengths and weaknesses, so the objective had been achieved.

6.4.2   To develop an interactive forecast stock market system to provide better visualization by using dashboard.

This objective has been achieved by developing an interactive forecast stock market system by using the Power BI. This system is following the project scope and successfully developed a dashboard system to forecast and visualize the system. The system has five dashboards in it, which includes Today's Market, Stock Markets, Currencies, Financials and Graph. These five dashboards will provide the users the basic information in the system and some extra information such as the trending news for users to knows the market news and analysis and opinion for users to know the expert investors suggestions or opinions on some stocks. The system is built with interactive charts and graph for users can catch the data quickly rather than looking at all of the words and numbers. For example, the stock performance is visual in a candlestick chart, so the investors can look at the candlestick then will know the opening price, closing price, highest price and lowest price of that day. This chart is very suitable for the stock

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performance. This system is achieved the objective that develop an interactive forecast and visualize stock market system by using dashboard.

6.4.3   To evaluate the forecast stock market system dashboard by using usability testing.

This objective had been achieved in this project when creating the questionnaire. Usability testing had been included in the questionnaire and let three expert investors to respond to this questionnaire. Usability testing has five quality components to check whether the system is doing correctly or not. The five components are break down into five sections to ask the user some questions for each component. It had got the feedback and suggestions from them and can improve the system by looking at the responses. After collected the responses from the experts, it needs to analyze the response to knows whether the system needs to do enhancement or some bug fixes. When all the testing has been done, the objective will then be achieved.

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6.5 Concluding Remark

In a conclude for the system evaluation, a questionnaire of usability testing and basic system testing has been developed. The questionnaire has collected the user's responses after they used the system. All of the responses will be used for future enhancements and also for the bug fixes. The system testing also can know if any errors or bugs is in the system, then can have some bug fixing or enhancement to the system to make the system better and suitable for the investors to use for. There will also have some project challenges when developing the system. It cannot be avoided but it will also be a point to make the system more perfect and useful. The objective has been evaluated, all of the three objectives already been achieved for this project.

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Chapter 7

Conclusion and Recommendation

7.1 Conclusion

This project is visualizing and forecasting stocks market system by using the dashboard. This stocks market system is using Power BI to develop. The problems for this project are lack of interactive visualization for the stocks data, lack of helping the investor to have a better understanding for the stocks and providing a better user experience and user interface in current stock market system. The problems had been solved by achieving the objectives of study the features of a forecast stock market system, develop an interactive forecast stock market system to provide better visualization by using dashboard and evaluate the forecast stock market system dashboard by using usability testing. The motivation for this project is to brings a great profit in visualizing and forecasting stock to help people in investing the stock. Three current stock market system had been reviewed to study the features of the stock market system. Agile methodology is used in this project to develop the system to make the process of development on track. After the system developed finish, and usability testing will be conducted to evaluate the system. This system is going to provide a better visualization and forecasting stocks system by using dashboard in a better understanding and organized way.

7.2 Limitations and Recommendations

The limitation is there is no customizable function that can allow the users to customize their own portfolio by adding their favorite data or widget into it. Unlike some competing platforms that offer extensive customization options, Power BI restricts users to predefined visualization types and data connectors, which limits their ability to customize the platform to their unique needs or preferences. The second limitation is that the graph and chart do not allow the users drawing. Power BI do not have this built-in feature that allow users to draw directly on the graph within the system. This lack of functionality restricts interactive engagement and real-time collaboration, necessitating users to resort to external tools or custom development for such features.

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CHAPTER 7

The recommendation is that there will be more stock related features added into the system to integrate the system become more suitable for the investors to use and invest the stocks. By including these enhancements, Power BI becomes more than just a visualization tool, it can transform into a comprehensive stocks market analysis platform.

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APPENDIX

Questionnaire

Visualizing & Forecasting Stock Market by using Dashboard System

1. What is your age range?

   Mark only one oval.

   - ⬭ 13 - 18
   - ⬭ 19 - 30
   - ⬭ 31 - 50
   - ⬭ 50 and above

2. What is your level of education?

   Mark only one oval.

   - ⬭ Primary Education
   - ⬭ Secondary Education
   - ⬭ Post Secondary Education (Form 6 / Matriculation)
   - ⬭ Higher Education (College / University)

3. What is your annual income?

   Mark only one oval.

   - ⬭ < RM20,000
   - ⬭ Between RM20,000 and RM50,000
   - ⬭ > RM50,000
   - ⬭ Prefer not to say

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APPENDIX

4. How long do you invest in the stock markets?

Mark only one oval.

◯ 1 - 3 months

◯ 4 months - 1 year

◯ 1 year - 3 years

◯ 3 years - 10 years

◯ > 10 years

5. Have you used a dashboard type system for stock market forecasting and visualization before?

Mark only one oval.

◯ Yes

◯ No

Section 1: Learnability

6. Is it easy to understand that how to navigate through the dashboard?

Mark only one oval.

	1	2	3	4	5	
Not	◯	◯	◯	◯	◯	Easy

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A-2

7. Did you find the layout and organization of information intuitive? (e.g. organization of stock prices/currencies)

Mark only one oval.

	1	2	3	4	5	
Not	◯	◯	◯	◯	◯	Intuitive

8. How quickly were you able to grasp the basic functions of the dashboard?

Mark only one oval.

1	2	3	4	5
◯	◯	◯	◯	◯

Section 2: Efficiency

9. Did you find that you were able to accomplish tasks quickly using the dashboard? (e.g. searching stocks/currencies information)

Mark only one oval.

1	2	3	4	5
◯	◯	◯	◯	◯

10. Did you encounter any bottlenecks or inefficiencies while using the system? (If yes, please list down the problems.)

_____

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A-3

11. How would you rate the overall speed and responsiveness of the system?

Mark only one oval.

	1	2	3	4	5	
Bad	◯	◯	◯	◯	◯	Best

12. What improvements do you think could be made to enhance the efficiency of the system?

_____

_____

_____

_____

Section 3: Memorability

13. Were the features and functions of the system memorable after your initial use?

Mark only one oval.

◯ Yes

◯ No

14. Did you encounter any difficulty remembering how to perform specific tasks on subsequent visits to the system? (E.g. filter company/currencies)

Mark only one oval.

◯ Yes

◯ No

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A-4

15. How likely are you to remember how to use the system effectively in the future?

Mark only one oval.

	1	2	3	4	5
	◯	◯	◯	◯	◯

Section 4: Errors

16. Did you encounter any errors or glitches while using the system?

Mark only one oval.

◯ Yes

◯ No

17. If you encountered errors, were they easily recoverable or did they significantly disrupt your experience?

Mark only one oval.

◯ Yes

◯ No

18. Were there any confusing or misleading aspects of the dashboard that led to errors?

_____

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A-5

19. How would you rate the severity of errors encountered during your use of the dashboard?

Mark only one oval.

	1	2	3	4	5	
No e	○	○	○	○	○	Many errors

Section 5: Satisfaction

20. Overall, how satisfied are you with the usability of the dashboard?

Mark only one oval.

	1	2	3	4	5	
Uns	○	○	○	○	○	Satisfied

21. Did the system meet your expectations in terms of its usability and functionality?

Mark only one oval.

◯ Yes

◯ No

◯ Maybe

22. How likely are you to recommend this system to others based on your experience?

Mark only one oval.

	1	2	3	4	5	
Unlil	○	○	○	○	○	Likely

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APPENDIX

23. What aspects of the system did you find most satisfying? (e.g. filter/function/widget)

_____

24. What improvements would you like to see to enhance your satisfaction with the system?

_____

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FINAL YEAR PROJECT WEEKLY REPORT
(Project II)

Trimester, Year: T3, Y3	Study week no.: 2
Student Name & ID: Ooi Yui Theng, 20ACB01720	
Supervisor: Dr. Shakiroh binti Khamis	
Project Title: Visualizing and Forecasting Stocks by using Dash	

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

- Introduction, objective, problem statement, project scope and contributions had been written.
- Literature review
- poster

2. WORK TO BE DONE

- methodology

3. PROBLEMS ENCOUNTERED

- problem statement needs to be more specific.

4. SELF EVALUATION OF THE PROGRESS

- Following the timeline

_____ _____
Supervisor's signature   Student's signature

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FINAL YEAR PROJECT WEEKLY REPORT
(Project II)

Trimester, Year: T3, Y3	Study week no.: 4
Student Name & ID: Ooi Yui Theng, 20ACB01720	
Supervisor: Dr. Shakiroh binti Khamis	
Project Title: Visualizing and Forecasting Stocks by using Dash	

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

- More specific problem statements

2. WORK TO BE DONE

- Development of the stocks market module

3. PROBLEMS ENCOUNTERED

- Develop of the stocks market module by making it can update to real time stocks data.

4. SELF EVALUATION OF THE PROGRESS

- In a good process

_____ _____

Supervisor's signature   Student's signature

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FINAL YEAR PROJECT WEEKLY REPORT
(Project II)

Trimester, Year: T3, Y3	Study week no.: 6
Student Name & ID: Ooi Yui Theng, 20ACB01720	
Supervisor: Dr. Shakiroh binti Khamis	
Project Title: Visualizing and Forecasting Stocks by using Dash	

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

- Successful fetch real time stocks data into the system by clicking the refresh data button manually in the system.

2. WORK TO BE DONE

- Continue with the development of the rest of the module.
- modify the diagram of the system.
- Write the process of the development in the report.

3. PROBLEMS ENCOUNTERED

- develop the financials module.

4. SELF EVALUATION OF THE PROGRESS

- still following the timeline of the project on time

_____
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_____
Student's signature

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FINAL YEAR PROJECT WEEKLY REPORT
(Project II)

Trimester, Year: T3, Y3	Study week no.: 8
Student Name & ID: Ooi Yui Theng, 20ACB01720	
Supervisor: Dr. Shakiroh binti Khamis	
Project Title: Visualizing and Forecasting Stocks by using Dash	

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

- system diagram
- complete developing the financials module.

2. WORK TO BE DONE
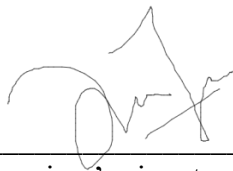
- develop the currencies module and Today's Market module.
- continue to write the process of development.

3. PROBLEMS ENCOUNTERED

- develop currencies module, getting the API

4. SELF EVALUATION OF THE PROGRESS

- Overall good

_____

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_____

Student's signature

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FINAL YEAR PROJECT WEEKLY REPORT
(Project II)

Trimester, Year: T3, Y3	Study week no.: 9
Student Name & ID: Ooi Yui Theng, 20ACB01720	
Supervisor: Dr. Shakiroh binti Khamis	
Project Title: Visualizing and Forecasting Stocks by using Dash	

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

- Today's markets module

2. WORK TO BE DONE

- Develop the currencies module.

3. PROBLEMS ENCOUNTERED

- Developing the currencies module

4. SELF EVALUATION OF THE PROGRESS

- Overall good

_____
Supervisor's signature

_____
Student's signature

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FINAL YEAR PROJECT WEEKLY REPORT
(Project II)

Trimester, Year: T3, Y3	Study week no.: 12
Student Name & ID: Ooi Yui Theng, 20ACB01720	
Supervisor: Dr. Shakiroh binti Khamis	
Project Title: Visualizing and Forecasting Stocks by using Dash	

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

- System had done to develop.

2. WORK TO BE DONE

- Questionnaire for usability testing

3. PROBLEMS ENCOUNTERED

- To write the testing part

4. SELF EVALUATION OF THE PROGRESS

- On the track and good

_____
Supervisor's signature

_____
Student's signature

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FINAL YEAR PROJECT WEEKLY REPORT
(Project II)

Trimester, Year: T3, Y3	**Study week no.: 13**
Student Name & ID: Ooi Yui Theng, 20ACB01720	
Supervisor: Dr. Shakiroh binti Khamis	
Project Title: Visualizing and Forecasting Stocks by using Dash	

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

- Report

2. WORK TO BE DONE

- no

3. PROBLEMS ENCOUNTERED

- no

4. SELF EVALUATION OF THE PROGRESS

- Overall good

_____

Supervisor's signature

_____

Student's signature

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POSTER

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PLAGIARISM CHECK RESULT

OoiYuiTheng_FYP2

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PLAGIARISM CHECK RESULT

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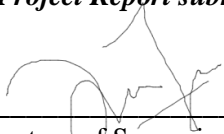| Universiti Tunku Abdul Rahman			
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Full Name(s) of Candidate(s)	Ooi Yui Theng
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