

# [DEVELOPING NATIONS FOREX(/FINTECH) DASHBOARD]

Final Report



Information Technology Capstone Project

COMP5703

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## CONTRIBUTION STATEMENT

Our group, taking project CS28-1, with group members Wufeng Ding, Ruochen Pi, Liyuan Shi, Guang Zhu, Pan Tang, Yuetlee Chan, would like to state the contributions each group member has made for this project during semester 1 2023:

- [Wufeng Ding]: As the group leader, UI designer, and front-end developer, I made significant contributions to our collaborative project. My responsibilities included identifying project requirements, creating sketches, and designing various pages such as the registration page, resend email page, market rate page, cryptocurrency page, and financial technology page. I also developed the front-end code for these pages, ensuring their functionality and user-friendliness. Additionally, I played a role in completing group proposal reports, group progress reports, and the final report by contributing to sections such as milestones and reporting, abstract, and results. Throughout the project, I actively participated in usability testing, conducting six think aloud sessions to gather valuable user feedback. Moreover, I implemented language switching functionality and successfully integrated the local database into the cloud.
- [Pan Tang]: According to the requirements, make design sketches that meet the needs of customers; Collaborate with team members, participate in front-end development work, write code and realize design effect; According to project requirements, research and search for suitable APIs to obtain the required data or functions; Responsible for completing the development of the front-end page "market exchange rate", ensuring that the page meets the design requirements and can operate normally; Finish part of the front-end code of the market exchange rate page, responsible for realizing the interaction and function of the page; Work closely with backend developers to assist with data interaction and communication between backend and frontend; Work with users and help them go through 3 "think aloud" processes to get user feedback and opinions on the system; According to the project requirements, write a complete proposal document with the team members, describing in detail the goals, scope, methods and plans of the project; Complete a progress report documenting the current status of the project, work completed and next steps planned; Participate in project demos to show client and tutor the functions and results of the project; Complete part of the final report.
- [Yuet Lee Chan]: Design the UI for "financial technology"; design the UI for "Compare Exchange Rate"; complete sections 1, 3, 5.1, and 6.2 of the proposal; develop the "Join Us" web page; collaborate with team members to develop the "Compare Rate" page and the "Historical Rate" page; redesign the "Market Rate" page; collaborate with team members to develop the "Cryptocurrency Platform" web page; complete the "Obstacles" and "Progress and Achievement" sections of the group progress report; collaborate with team members to develop the "Market Rate" web page; recruit volunteers for the think-aloud process; resolve compatibility issues with the dashboard; create a comprehensive progress document for the think-aloud session; conduct small interviews with users after the think-aloud process; address the non-responsive issues with the translation functionality; present the "Motivation and Objective of Work" during the presentation; complete the "Introduction" and "Discussion" sections of the final report.

- [Guang Zhu]: As the primary back-end developer, he held several critical responsibilities in the project. First, he was entrusted with the design and maintenance of the project's database. Recognizing the importance of a correctly structured database as the backbone of the application, he constructed robust and scalable database schemas and performed regular maintenance and optimization. Secondly, he was responsible for implementing vital functionalities, such as user login, logout, registration, and profile updates, using Node.js. Through clean and modular code, he ensured these functionalities were secure, efficient, and offered a seamless experience to the users. Furthermore, he undertook the task of integrating the frontend and backend of the application, ensuring the smooth exchange of data and overall coherence of the system. This involved careful coordination with the front-end team, reviewing their requirements, and providing appropriate endpoints. Moreover, he handled the deployment of the application on Heroku, configuring the server settings to optimize performance and maintain high availability. He also set up the Continuous Integration and Continuous Delivery (CI/CD) pipelines for seamless updates and bug fixes. Finally, he was the primary troubleshooter for any bugs that arose during development and post-deployment. Using systematic debugging techniques, he made sure that the application ran smoothly and provided consistent service to its users. His problem-solving skills and diligence played a crucial role in the successful completion of the project.
- [Liyuan Shi]: In this project, as the project manager of the team, I was responsible for communicating with the tutor and client. I checked in with the team members on a weekly basis to see if they were behind for the week and to give help to our team members when appropriate. I am the main person responsible for reporting to the tutor and client at the weekly meetings, communicating the progress of our project, answering questions from the teachers and giving feedback on our queries and difficulties. I also collate suggestions and new requirements from tutors and clients after the meetings and communicate them to the group. In terms of code, I was mainly responsible for implementing functions on the front-end and integrating the front-end work with the back-end. During the project I worked on the exchange rate calculator, watermark, background music player, QR codes, historical exchange rate charts, etc. I also made significant changes to the UI in the later stages of the project to bring the whole project together.
- [Ruochen Pi]: As a front-end developer, firstly, assist UI designer to design UI and give feedback and modification according to the actual achievable situation; secondly, front-end page programming implementation, mainly responsible for the front-end page implementation of forget password function. As a tester, responsible for the smooth running of the whole test. Firstly, responsible for drawing up the test plan and purpose as well as the process. Secondly, he was responsible for determining the content to be tested in the three phases, determining the test tools to be found suitable for 6 different test classes, responsible for conducting different tests for each phase, and responsible for writing more than 70 pages of documents on test requirements, test plan, test process, and test results (see Annex 1). Finally, he was responsible for the control of test versions. A total of 4 versions were named for the whole project during the development phase to facilitate the exchange of feedback with developers on testing issues. In addition, also responsible for providing solutions to test problems while they are being raised. In the final report, mainly responsible for 4.5 testing, chapter 5 resources, chapter 8 discussion, chapter 9 limitations and future work

All group members agreed on the contributions listed on this statement by each group member.

Signatures:

Mikey 丁穆基 Lily chan

朱允 Ruochen Pi 史力行

## ABSTRACT

The objective of this project was to create a forex dashboard that would assist individuals residing in developing nations in minimizing expenses and safely conducting financial transactions on online platforms. The project was motivated by the scarcity of transparent and dependable sources of information within the financial industry of these countries, which consequently hindered individuals and investors from making well-informed choices. To address this issue, the dashboard was designed to deliver accurate and timely market data, enabling users to gain a deeper understanding of global forex market trends and fluctuations.

Emphasizing user-friendliness and accessibility, our team set out to develop a dashboard that would grant users swift and precise access to market information. To accomplish this, we devised an intuitive and navigable user interface, employing advanced visualization techniques to effectively present the market data. The adoption of a waterfall development methodology guided our project plan, where we utilized contemporary development technologies and open-source tools such as JavaScript, the Node.js framework, ReactJS, and MySQL. Additionally, we harnessed the power of open data APIs to collect and integrate market data, while leveraging cloud platforms to deliver highly available and scalable services.

By undertaking this project, our team aspired to make a tangible impact on the financial industry of developing nations, equipping individuals and investors with enhanced tools and resources to facilitate more informed decision-making.

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## **1. INTRODUCTION**

Due to the heightened global economic activity, enhanced global trade and investment, and remarkable technological progress, currency trading has become increasingly prevalent within the global framework of financial centers (Federal Reserve Bank of San Francisco, 2001). Developing nations strive for economic growth, often encountering challenges especially high fees and the limited access to financial services, which can impede their ability to engage in internal financial transactions efficiently and cost-effectively. And the fluctuation of exchange currency is primarily attributed to external factors, such as market sentiment or economic indicators. The inherent volatility of the currency market, characterized by notable fluctuations spanning from high to low over frequent time periods, with the potential to render currencies virtually worthless, it is imperative for currency traders to maintain a state of heightened vigilance and remain continuously informed about the substantial shifts transpiring within the currency market. Moreover, since 2012, a cumulative count of 42 currency exchange platforms has experienced compromise as a result of hacking incidents, with the primary cause being inadequate security measures implemented by the platforms. These security vulnerabilities encompass various aspects, including deficiencies in code protection or susceptibility to cross-site scripting attacks, etc. (Hancock, 2020).

The motivation behind the development of the foreign exchange dashboard is to cater to the financial requirements of individuals residing in developing nations. These individuals often lack access to suitable tools that enable them to make informed decisions regarding financial transactions, given the intricate nature of online financial platforms, currency fluctuations, and potential security concerns. Through the implementation of the newly designed dashboard, individuals in developing nations can effectively minimize fees while remaining resilient to the impact of volatile economic changes. Moreover, they can safely use the online platforms for a range of financial tasks.

The dashboard facilitates efficient comparison of real-time currency rates while integrating robust security measures. This empowers individuals in developing

nations to minimize fees associated with currency exchange, money transfers, and other financial transactions. Furthermore, it ensures that users can engage in financial activities securely and confidently. Additionally, the dashboard serves as a centralized location incorporating relevant financial platforms, financial technology, exchange rate comparisons, market rates, and cryptocurrency platforms. This consolidation simplifies the process of financial activities, enabling users to easily compare exchange rates, track currency trends, and transfer money. Moreover, the dashboard equips users with necessary tools and information to maximize their financial opportunities and make well-informed decisions about their finances effectively.

## **2. RELATED LITERATURE**

Financial technology (FinTech) dashboard websites refer to a type of financial system that integrates internet information resources related to FinTech and provides information services. Nowadays, dashboard websites have evolved into application systems that offer various information and services such as news, recommended articles, online chat, exchange rate viewing, online voice calls, cloud services, bulletin boards, weather updates, and address navigation. Exchange rates and FinTech dashboards can provide services to people in developing countries, including exchange rate inquiries, FinTech guidance, and bank recommendations. This chapter will focus on research related to finance, exchange rates, FinTech, and dashboards in developing countries worldwide and provide an introduction and summary of these studies.

### **2.1 Literature Review**

Exchange rates have a significant impact on industries such as export trade, investment, and tourism in developing countries. Cushman (1988) found through research that when exchange rate fluctuations decrease, developing countries prefer trade with other countries rather than investment because they perceive lower exchange rate volatility at that time. Therefore, Cushman believes that exchange rate fluctuations are conducive to expanding foreign investment by developing countries.

De Meza & van der Ploeg (1987) reached a similar conclusion based on the theory of production flexibility. When exchange rate fluctuations increase, the risk associated with exchange rates also increases. As a result, individuals in developing countries tend to be more cautious in choosing their foreign investment strategies and prefer to invest their resources in lower-risk regions. Sung and Lapan (2000) found through literature research that individuals in developing countries use diversified investments and long-term investments to mitigate the exchange rate risks arising from increased exchange rate volatility. Regarding specific countries, Xia et al. (2012) studied the relationship between exchange rate fluctuations and the financial behavior of Chinese nationals. Their empirical analysis revealed a significant effect of exchange rate fluctuations on the financial behavior of Chinese nationals. However, whether this effect is positive or negative cannot be explained solely by exchange rate fluctuations. It depends on the specific circumstances of the country being invested in. In other words, exchange rate fluctuations can impact the financial behavior of Chinese nationals, but it needs to be considered in conjunction with the specific conditions of the invested country to determine whether it is beneficial or detrimental to financial behavior. Dai and An (2018) obtained bilateral investment data between 21 countries and concluded the impact of exchange rate fluctuations on investment behavior using panel analysis. The results suggest that when exchange rates fluctuate within a small range, the relationship between exchange rates and investment behavior is mutually reinforcing. However, when exchange rate fluctuations exceed a certain range, individuals in developing countries perceive higher risks, reduce their financial behavior, and exhibit an opposite effect.

The innovation and development of Financial technology (FinTech) can reduce transaction costs, increase investment opportunities, and better manage risks in developing countries. FinTech injects new vitality into traditional financial models. On the one hand, FinTech significantly reduces transaction costs and improves the efficiency of financial functions. On the other hand, the implementation of financial functions becomes more accessible, no longer relying on specific financial intermediaries or organizations, leading to financial marketization and better resource allocation. For example, widely used third-party payment systems such as Google Pay, Apple Pay, and WeChat Pay offer more convenient and efficient payment

options compared to traditional methods, better meeting consumer needs (Santigo, 2010). FinTech can help traditional financial services overcome geographical, linguistic, and scale limitations, reduce service costs, and provide better services to consumers. Wang Nian and Wang Haijun (2014) found through literature research that FinTech, especially internet finance, can better reduce the cost of financial transactions, bridge the information gap for consumers, increase the possibility of consumption, and save time. Finance is the lifeblood of the real economy, and the significant significance of innovative FinTech lies in its ability to better adapt to market changes and meet the diverse financial needs of society and investors. Cronin (1998) predicted that internet finance would profoundly impact the real economy. Now, electronic finance has evolved beyond being just a medium and can help people in developing countries access financial loans more effectively. Innovative FinTech can better meet the growing financial demands of people in developing countries, promoting their investment behavior and financial growth (Braun & Larraín, 2005).

The construction of a dashboard directly benefits from the development of financial business. Therefore, international research on dashboard construction and operation primarily focuses on aspects related to financial business. Cavazos and Morin (1994) believes that the establishment of a dashboard can reduce the cost of personal financial management, increase management efficiency, provide society with more timely and comprehensive information and financial services, and improve the efficiency of citizens' use of funds. Taylor and Westcott(2002) studied various dashboard platforms and proposed that dashboards should not be isolated but should strengthen cooperation with different dashboards and other websites to facilitate cross-regional and cross-departmental network communication. Li Wenrui (2011) studied the construction of various dashboards, summarized the basic concepts, functions, and models of dashboards, and proposed that integration should be one of the main development directions for future dashboards.

In summary, there have been numerous studies on exchange rates, FinTech, and dashboards, which cover various aspects and hold significant value. However, in these studies, exchange rates, FinTech, and dashboards are often studied separately without integration. Therefore, the project of Developing Nations ForEx(/FinTech)

Dashboard has high practical significance as it can facilitate financial activities for people in developing countries more conveniently.

### 3.

## RESEARCH/PROJECT PROBLEMS

### 3.1 Research/Project Aims & Objectives

The project aims to develop a secure currency exchange platform that provides real-time updates on global exchange rates. The primary goal is to address the challenges associated with minimizing currency losses and mitigating security risks, given the volatile nature of the currency market and the potential for unforeseen security issues.

Project Objective:

The project's main objective is to create a user-friendly dashboard that enables individuals and businesses to easily monitor currency fluctuations, compare exchange rates, and make informed financial decisions. By providing real-time exchange rates, the dashboard will empower users to conduct transactions with confidence and minimize potential financial losses.

Key Features:

1. The dashboard will provide individuals and businesses with up-to-date exchange rates, allowing them to stay informed and make timely financial decisions.
2. By seamlessly integrating with fintech, online banking, and cryptocurrency platforms, the dashboard will enhance the efficiency of financial tasks for individuals and businesses.
3. The dashboard will offer favorable exchange rate information specifically tailored to individuals and businesses in developing nations, helping them minimize fees associated with financial transactions.
4. To ensure the safety of financial tasks, the dashboard will implement robust security measures such as the encryption of sensitive information, multi-factor authentication, and regular testing of configuration codes.
5. The dashboard will provide regular updates on the latest currency trends, enabling individuals and businesses to avoid missing out on potential financial opportunities.

By accomplishing these objectives, the project seeks to empower users with a user-friendly and secure currency platform that facilitates efficient financial decision-making, reduces fees, and maximizes financial opportunities.

### **3.2 Research/Project Questions**

In this section, we need to identify and define the underlying problem or question that the client is facing, as sometimes the client's initial statement may only reflect the symptoms of the issue.

This project aims to investigate several key aspects related to the effectiveness and functionality of the dashboard for individuals in developing nations. The first aspect to be explored is how the dashboard can assist in minimizing fees and mitigating potential financial losses in light of the volatile currency market.

Another area of focus is the seamless integration of fintech, online banking, and cryptocurrency platforms within the dashboard. The project will examine how this integration can streamline financial transactions such as remittances, payments for goods and services, and the utilization of cryptocurrency for digital transactions, aiming to address the inconvenience of these processes being segregated.

The third question to be addressed is how the dashboard can provide easy access to currency tracking and comparison, enabling individuals to stay vigilant about fluctuations and make informed decisions to avoid financial losses.

Additionally, the project will assess the effectiveness of the dashboard in keeping users informed about frequently updated currency trends, ensuring they don't miss out on significant financial opportunities.

To mitigate potential risks and vulnerabilities, the project will prioritize the implementation of robust security measures within the dashboard. This will focus on safeguarding financial transactions and maintaining stability in the financial markets.

Also, privacy and ethical considerations will be thoroughly evaluated. The project will examine how the dashboard can effectively protect sensitive identity information, ensuring the secure and confidential storage of personal data.

The primary issue lies in the fact that our client neglected the project from the outset and failed to furnish us with the necessary API. Consequently, we had to invest significant time and resources in the quest for a suitable API, leading to a deviation from our original projected completion timeframe.

### **3.3 Research/Project Scope**

The scope of the project is to create a user-friendly foreign exchange dashboard which can address the specific needs of users in developing nations. The project was completed by May 29th, with development starting in the second week of March. The dashboard includes essential features and functionalities, such as fee minimization, a secure currency dashboard, real-time exchange rates, integration with multiple digital transaction platforms, and easy currency rate comparison and tracking. Detailed specifications, requirements, and deliverables for the project are provided below:

1. To ensure the usability of the foreign exchange dashboard, various methodologies like think-aloud studies will be employed. This will guarantee that the dashboard is easy to use, effectively integrates with financial transaction platforms, and minimizes fees efficiently.
2. The aim of the dashboard is to empower users in developing nations with access to up-to-date and reliable information regarding currency exchange rates. This will enable users to stay well-informed and make educated financial decisions based on the latest currency trends.
3. Our project strives to differentiate itself from similar foreign exchange platforms by providing seamless integration with multiple financial transaction platforms and a user-friendly interface. This will facilitate effortless comparison and tracking of currency rates, thereby enhancing the overall user experience.
4. Our team places great importance on ethical considerations, particularly in safeguarding the confidentiality and security of sensitive user information stored in the database. To ensure the security and integrity of our dashboard, we have implemented a comprehensive set of robust security measures. These measures include multi-factor authentication, sensitive information hashing, and regular testing. By employing these security protocols, we aim to protect against potential data breaches, unauthorized access, and the identification of any vulnerabilities in the code. Our priority is to provide a secure environment for users, ensuring the confidentiality and privacy of their information.

## **4. METHODOLOGIES**

### **4.1 Methods**

#### **Project Management Methods**

Our project team made an important decision in the beginning to use the waterfall methodology for this project. This is a linear sequential life cycle model, commonly known as a Classic Life Cycle model. It implies a methodical, sequential approach to software development. It starts with system and requirements analysis and moves on to design, coding, testing, and maintenance. This approach emphasizes planning, time schedules, goal dates, budgets, and the simultaneous deployment of a full system.

The decision to choose this model was based on the nature of the project and the client requirements. Right from the project's inception, our team rigorously analyzed the requirements. During frequent meetings with the client, we actively sought confirmation and clarification on these requirements. This was a necessary step due to the client's frequent changes in the early stages of the project. It was important for us to confirm all the requirements upfront, laying a solid foundation for adopting the waterfall development methodology.

The waterfall model requires that each step be completed completely before moving on to the next, and each stage relies on and feeds into the preceding one. This rigidity enabled our team to develop and stick to a solid strategy from the start, which is extremely advantageous when working under tight timelines and financial restrictions.

Furthermore, waterfall development emphasises predictability and strong project management, reducing the chance of requirements changes throughout the development process. Given the client's proclivity for changing needs, this feature was critical for us.

With all of these factors in mind, we decided on the waterfall model as our development process. This decision provided us with a clear strategy to follow and enabled us to efficiently manage our project while adhering to a rigorous timeline and keeping a close watch on our progress. We feel it made a big contribution to the successful completion of our project.

We have learned through the adoption of the waterfall model that meticulous upfront planning and strict adherence to a defined plan can lead to successful project completion, even under the constraints of changing requirements and limited resources.

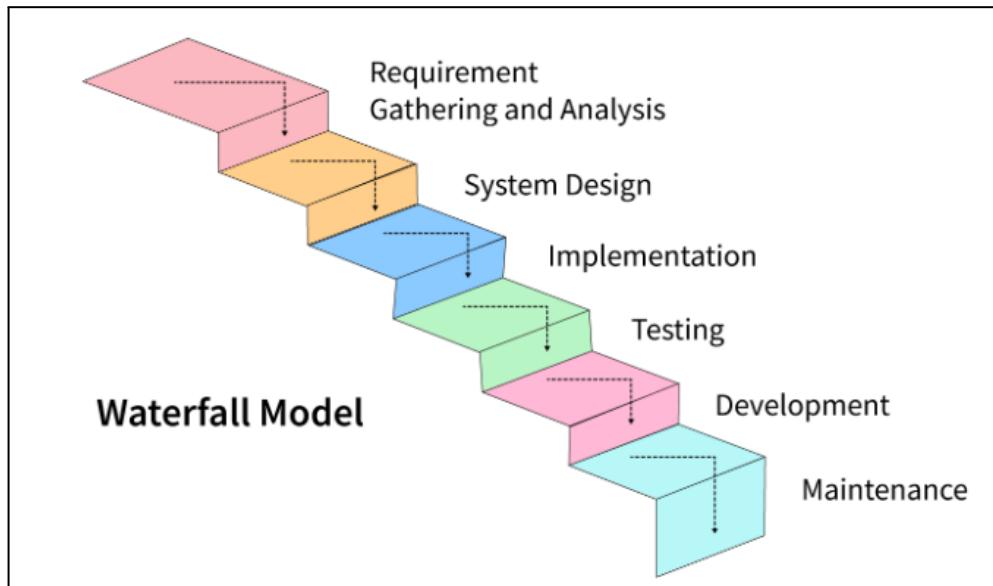


Figure 1: Waterfall Model (Kumar, 2023)

## Project Development Methods

We utilised user stories during the design stage to better understand our users' needs. This insight inspired us to construct paper prototypes of the application, which served as preliminary visual representations. Following the initial feedback, we developed low- and high-fidelity prototypes. Low-fidelity prototypes provided us with an abstract but useful visualisation of the user interface. High-fidelity prototypes, on the other hand, were comprehensive and interactive, offering a near-final product perspective that was useful in performing user testing and enhancing the user experience.

Our development stack was a combination of strong and cutting-edge technologies. Due to its component-based architecture and efficient rendering, React.js was

adopted for front-end development. The framework aided in the development of a highly interactive user interface.

We used Node.js for the backend, which allowed us to use JavaScript, a language that our team was quite familiar with. Our application required real-time data handling and excellent performance, thus Node.js' event-driven, non-blocking I/O approach was ideal.

RESTful APIs were used to connect the frontend and backend, allowing for smooth data flow between the two sides.

We picked MySQL for database administration because of its stability, dependability, and well-established reputation in managing structured data. MySQL's relational design made it suitable for storing and managing our application's data.

## 4.2 Data Collection

Our project required data collecting from many sources, involving both manual and automated methods. User inputs and interactions were manually gathered using our React.js-based user interface. This information consisted mostly of user preferences, historical data queries, and user responses to real-time changes.

The major functionality of our application was dependent on real-time financial data, for which we connected three separate APIs. First, the CryptoCompare API (<https://data-api.cryptocompare.com>) supplied us with current market value, historical trends, and comparisons with other cryptocurrencies. The breadth and depth of data provided by CryptoCompare enabled us to deliver a comprehensive and accurate representation of the current cryptocurrency landscape.

Second, for precise and dependable foreign exchange (Forex) rates, we used the Alpha Vantage API (<https://www.alphavantage.co/>). We were able to compare the exchange rates of multiple currencies using Alpha Vantage, which contributed to the application's overall financial capabilities.

Third, we integrated the Now API, which provided us with market rates in real time. This API proved crucial in providing instant financial updates to our customers, boosting the responsiveness and accuracy of our service.

All APIs were interacted with using automated React.js scripts that retrieved, filtered, and prepared the data as needed.

### 4.3 Data Analysis

Our project's data analysis phase was critical in offering significant insights to our customers. To handle this crucial task, we created a set of React.js scripts. These scripts would take raw data collected from various APIs and user inputs and alter, convert, and analyse it, resulting in insightful easily understood data that could be presented to customers.

The data from the CryptoCompare API was analysed in order to provide users with insights into cryptocurrency trends, potential investment opportunities, and risk analyses. Similarly, the Alpha Vantage data was analysed in order to present users with the best currency exchange rates and trends. Our scripts were created to highlight the most significant changes in real-time market rates from the Now API and alert users appropriately.

time	open	high	low	close
2023-06-07	0.66786	0.67043	0.66610	0.67040
2023-06-06	0.66165	0.66852	0.66090	0.66682
2023-06-05	0.65998	0.66373	0.65780	0.66167
2023-06-02	0.65710	0.66385	0.65695	0.66042
2023-06-01	0.65014	0.65814	0.64830	0.65699
2023-05-31	0.65162	0.65387	0.64570	0.65011
2023-05-30	0.65373	0.65591	0.65020	0.65160
2023-05-29	0.65198	0.65541	0.65195	0.65380
2023-05-26	0.65056	0.65443	0.64900	0.65170
2023-05-25	0.65458	0.65462	0.64980	0.65067

< 1 2 3 4 5 ... 10 > 10 / page

Figure 2: Historical data about the different currency exchange rate

We chose to visualise the patterns of a certain cryptocurrency over a month to better understand the complexities and volatility of the cryptocurrency industry. For this, we used data collected from the CryptoCompare API, which was chosen due to its extensive cryptocurrency data offerings.

We began by collecting daily pricing data for the chosen cryptocurrency over a one-month period. With this information, we created a price fluctuation chart, with the date on the x-axis and the price value on the y-axis.

The visualization performed several functions. For starters, it allowed us to quickly assess the overall pattern of the cryptocurrency's value during the month - whether it was increasing, decreasing, or remaining relatively stable. It also allowed us to detect any significant price increases or decreases on certain days, which could then be investigated further to determine the underlying causes, such as market news or events.



Figure 3: Visualization of the trend of different cryptocurrency during a month's time

This method of analysis was not only useful for our team to understand the behavior of cryptocurrencies but could also be beneficial to end-users. Users interested in investing in or trading cryptocurrencies could utilize these visualizations to make more informed decisions.

The data analysis scripts were continuously fine-tuned and adjusted based on user feedback and changes in the financial market dynamics, ensuring our users received the most relevant and actionable financial insights.

The consolidation of data from diverse sources into a consistent format enabled our users to examine different financial data points side by side, improving their decision-making process. By delivering more extensive insights, this holistic and thorough approach to data analysis distinguished our product from other financial apps.

The screenshot shows a currency conversion interface. At the top, there is a dropdown menu labeled "Selective exchange rate" set to "Australian dollar" with the flag of Australia. Below it, a text input field contains the number "100". Underneath the input field, the text "Please input your amount:" is displayed. Further down, another dropdown menu is set to "United States dollar" with the flag of the United States. To the left of this dropdown, the text "Market reference:" is shown, followed by the value "67.05199499999999". At the bottom of the interface, a red warning message reads "Please select the exchange rate 0.67051995".

Figure 4: Dashboard's currency calculator

#### 4.4 Deployment

Our application was deployed using Heroku, a popular cloud platform as a service (PaaS) that supports multiple programming languages, including Node.js, which was critical to our project. Heroku was chosen because of its several benefits, including its fast setup process, comprehensive administration tools, and simplicity of growing.

As a platform, Heroku effortlessly accommodates the deployment, management, and scaling of applications, eradicating the requirement for an in-house infrastructure and its associated maintenance responsibilities. This flexibility allowed our development team to concentrate their efforts on enhancing the application's core functionalities rather than being distracted by infrastructure-related concerns. This ease of use, coupled with Heroku's robust ecosystem and reliable uptime, made it an ideal fit for our project.

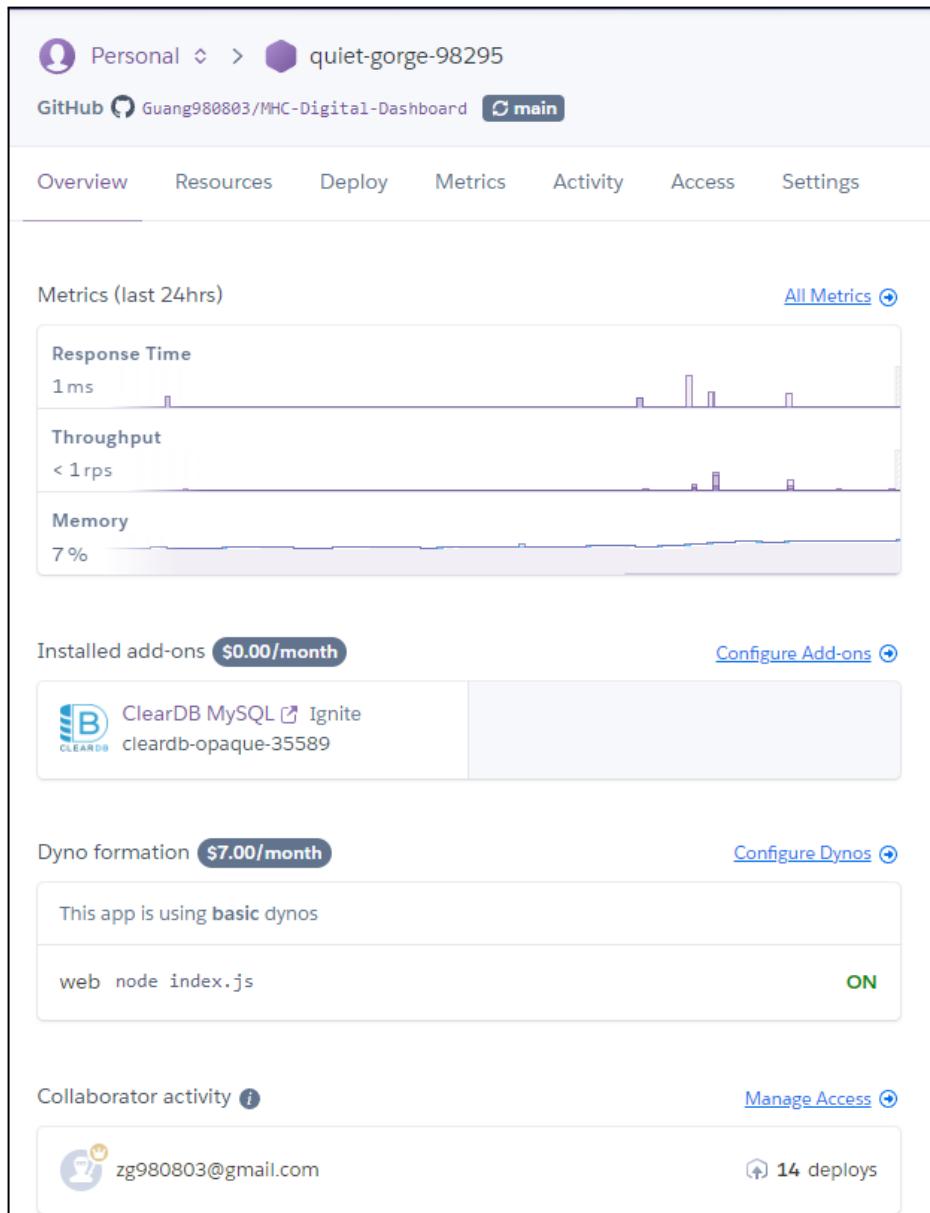


Figure 5: Overview of our deployed application(including Response Time, Throughput, and Memory Usage)



Figure 6: More detailed system metrics

### Distribute updates and fix errors:

Once deployed, managing updates and error fixes was of the utmost importance. Heroku's integrated pipeline made it simple to implement updates and distribute them to our live application.

We utilised GitHub as a version control system to manage and monitor changes to our software. Whenever a modification was committed and uploaded to our repository's main branch, Heroku's automated deployment function would identify these changes and launch a new build of our application.

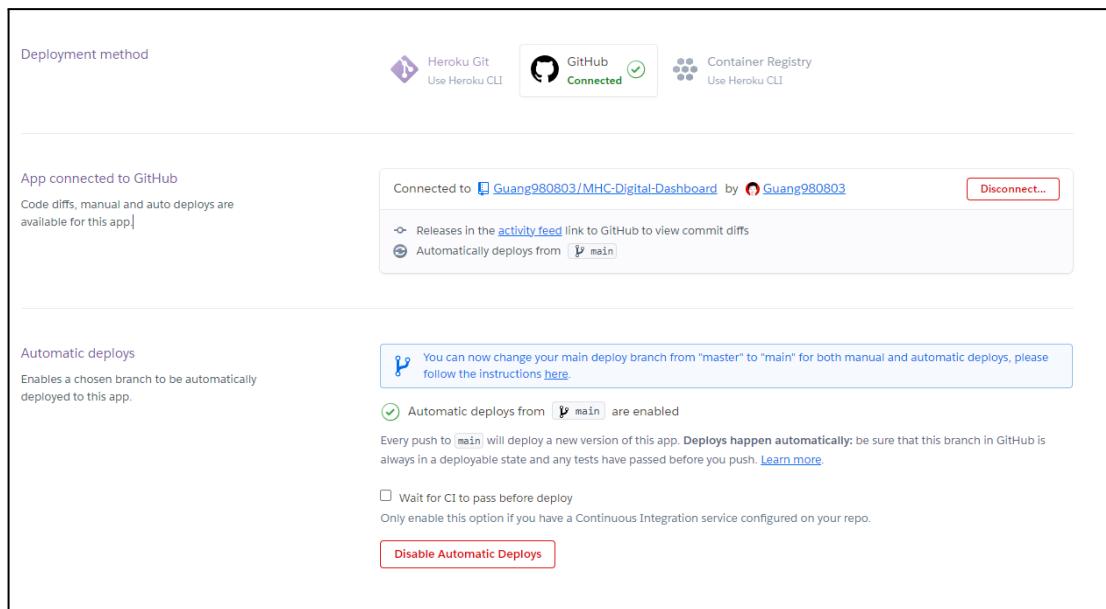


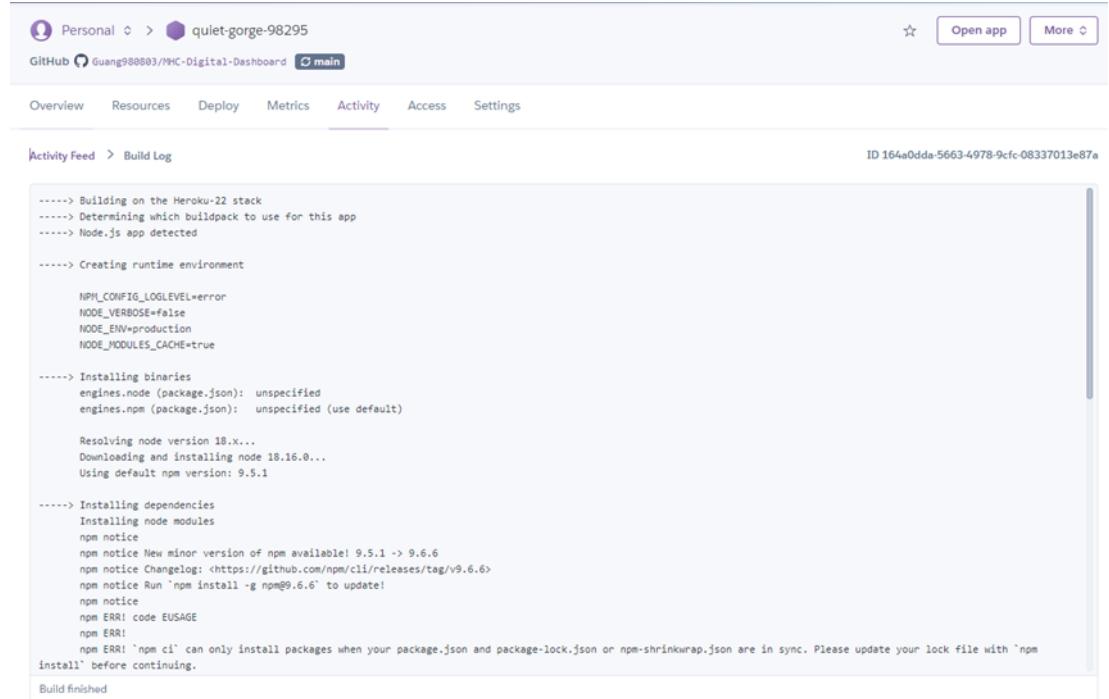
Figure 7: CI/CD pipeline between Heroku and GitHub

The screenshot shows the GitHub Activity Feed for the repository 'Guang980803/MHC-Digital-Dashboard'. It lists several events:

- May 21 at 10:26 PM - zg980803@gmail.com: Deployed 23a40618 (Compare diff)
- May 21 at 10:23 PM - zg980803@gmail.com: Build succeeded (View build log)
- May 20 at 12:12 PM - zg980803@gmail.com: Deployed 5a3ca1d4 (Roll back to here, Compare diff)
- May 20 at 12:09 PM - zg980803@gmail.com: Build succeeded (View build log)
- May 20 at 11:28 AM - zg980803@gmail.com: Deployed 73b53429 (Roll back to here, Compare diff)
- May 20 at 11:25 AM - zg980803@gmail.com: Build succeeded (View build log)
- May 20 at 11:18 AM - zg980803@gmail.com: Deployed 78cf918b (Roll back to here, Compare diff)
- May 20 at 11:15 AM - zg980803@gmail.com: Build succeeded (View build log)
- May 13 at 5:39 PM - zg980803@gmail.com: Deployed 3f73e312 (Roll back to here, Compare diff)

Figure 8: Successful build and deploy after every commit to GitHub Main branch

For error handling, Heroku's error logs provided real-time information about our application. This feature was critical for monitoring our application's performance and fixing any bugs or errors that arose. Whenever an error was detected, we could quickly diagnose the issue using these logs, fix it in our codebase, and push the fix to our live application through our CI/CD pipeline.



The screenshot shows the Heroku dashboard for the app 'quiet-gorge-98295'. The build log tab is selected, displaying the following output:

```
----> Building on the Heroku-22 stack
----> Determining which buildpack to use for this app
----> Node.js app detected

----> Creating runtime environment

  NPM_CONFIG_LOGLEVEL=error
  NODE_VERBOSE=false
  NODE_ENV=production
  NODE_MODULES_CACHE=true

----> Installing binaries
  engines.node (package.json): unspecified
  engines.npm (package.json): unspecified (use default)

  Resolving node version 18.x...
  Downloading and installing node 18.16.0...
  Using default npm version: 9.5.1

----> Installing dependencies
  Installing node modules
  npm notice
  npm notice New minor version of npm available! 9.5.1 -> 9.6.6
  npm notice Changelog: <https://github.com/npm/cli/releases/tag/v9.6.6>
  npm notice Run `npm install -g npm@9.6.6` to update!
  npm notice
  npm ERR! code EUSAGE
  npm ERR!
  npm ERR! 'npm ci' can only install packages when your package.json and package-lock.json or npm-shrinkwrap.json are in sync. Please update your lock file with 'npm
install' before continuing.

Build finished
```

Figure 9: The Build Error Log provides comprehensive information about the error that occurred

Furthermore, Heroku's scalability was critical in supporting our rising user base. Depending on the load on our application, we could quickly alter the amount of dynos (Heroku's lightweight Linux containers for executing applications). This scalability guaranteed that our programme operated well even during high usage hours, with no downtime or latency.

In conclusion, Heroku's versatility, ease of use, and robust suite of features made it the ideal platform for deploying our application. By leveraging Heroku's capabilities, we ensured that our application was stable, efficient, and capable of delivering a superior user experience at all times.

## 4.5 Testing

The testing process for this project consisted of three phases of unit testing and integration testing and system testing, where each phase used a combination of testing methods. The purpose of testing is to find errors during development and adaptation errors after integration as well as the alignment of project requirements between the customer, client and developer for the entire system. Testing is a continuous operation from the beginning to the end of the project. When members develop part of the functionality, it is handed over to the testers for testing, who give feedback on testing issues, and then the developers iterate the code and hand it over to the testers for a second review and verification.

Through continuous debugging to achieve the stability of functionality, performance, security, Usability, Compatibility, Interface. In the testing phase, all team members, including project managers, developers, and testers, are involved to achieve the smooth implementation of all the features.

The following are the test definitions and test class for the three phases of testing for this project:

Test process	Define	Include test classes
unit testing	Test that individual functions, methods, or classes function properly to ensure code reusability and stability.	Functional Testing Usability Testing. Performance Testing  Also, consider the test of input exception operation
integration testing	Test that interactions between different modules or components work properly to ensure the functionality of the entire application.	Interface testing Compatibility testing
system testing	Test that the functionality of the entire application meets user requirements and business needs to ensure the quality of the entire application.	Functional Testing II Performance Testing II Security testing Compatibility testing II

The following is the definition of the different test classes for this project, the methods used for testing, the test platform, and other test details.

Test Classes	Define	objectives	method	platform
Functional Testing	This will cover the features and functions of this project to ensure that they work as expected. This type of test case will cover a variety of scenarios, including both positive and negative test cases.	1. Testing for each function, Designing different application scenarios	Think aloud, Artificial Test	1、Edge;2、Safari;3、Firefox;4、Chrome
Usability Testing.		1. Click smoothly, no bad button 2. Jumping correctly 3. Reasonable page arrangement, in line with common sense	Think aloud	Chrome
Performance Testing	This will involve the performance of the WEB under various load conditions to ensure that it can handle the number of tasks expected during normal operation.	1.Load test, including Concurrent HTTP\Concurrent Browsers\Parallel Testing 2.Response Time Calculation 3. Network performance test	Test tool load view <a href="https://www.loadview-testing.com/">https://www.loadview-testing.com/</a>	1、Edge;2、Safari;3、Firefox;4、Chrome  1.IOS; 2.Android

Security testing	This will involve testing the security features of the WEB sequence to ensure that it is secure from unauthorised access and attacks. Test cases of this type would include penetration testing, vulnerability scanning, and risk assessment.	<ul style="list-style-type: none"> <li>1) Be able to prevent password temptation tools</li> <li>2) Common means to prevent Cookie attacks</li> <li>3) Sensitive data shall not be transmitted in plain text</li> <li>4) Can prevent the file name guess and view html file content to obtain important information</li> <li>5) It can ensure that the website will recover the tool within a given time after receiving it, and the loss of important data will not exceed 1 hour</li> </ul>	immuniweb	Edge
Compatibility testing	This would involve the compatibility features of the WEB to ensure that it works properly on different browsers.	<ul style="list-style-type: none"> <li>1. Click smoothly, no bad button</li> <li>2. Jumping correctly</li> <li>3. Reasonable page arrangement, in line with common sense</li> </ul>	Think aloud	1、Edge;2、Safari;3、Firefox;4、Chrome

Interface testing	This would involve properly using the WEB's interfaces to ensure that all data interactions between modules are working properly and errors are being handled appropriately.	Crawl the api data and compare the data displayed on the web for consistency.	Artificial Test	Chrome
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See Appendix 1 test for additional details

## 5. RESOURCES

### 5.1 Hardware & Software

#### 5.1.1 Hardware

For this project, the development team has decided to employ both Windows and Mac operating systems in the software creation process. The laptops with these operating systems will be used to design and construct the user interface as well as generate the essential codes and scripts for the project's successful execution. In addition, these systems will play a critical role in creating a virtual database server and facilitating the requisite connection between the user data and this server, which is fundamental to the successful construction of the project's dashboard.

Below are the hardware configurations for the laptops using the Windows and Mac operating systems:

Hardware	Description
CPU	Intel(R) Core(TM) i5-7200U CPU @ 2.50GHz 2.70 GHz
Memory	8.00 GB RAM
GPU	Intel(R) HD Graphics 620 & NVIDIA GeForce MX130

<b>Hardware</b>	<b>Description</b>
CPU	2.4 GHz quad-core Intel Core i5
Memory	8 GB 2133 MHz LPDDR3
GPU	Intel Iris Plus Graphics 655 1536 MB

### 5.1.2 Software

**Visual Studio Code:** The team utilized Visual Studio Code (VS Code), a free, open-source code editing platform. This compact yet powerful editor supports a variety of programming languages and development tasks, facilitating the creation of efficient, high-quality code.

**MySQL:** This popular, open-source relational database management system allows efficient storage, organization, and management of vast data volumes. The project team employed MySQL to maintain user credential data and historical exchange rate information, simplifying data handling.

**MySQL WorkBench:** MySQL Workbench is a full-fledged visual tool used for database management. It assists developers and database administrators in efficiently designing, developing, and administering MySQL databases. This software's user-friendly interface allows the team to build and modify database schemas, execute SQL queries, and manage database connections.

**Postman:** This is a widely-used software tool for API testing, development, and documentation. Postman assists backend developers by streamlining the development process. It can also create mock servers, enabling API testing without building a full backend. Its integration with tools like GitHub and Jenkins facilitates automated API testing and deployment.

**GitHub Desktop:** GitHub Desktop is a graphical user interface tool used to manage GitHub repositories. It provides developers an intuitive way to oversee GitHub repositories directly on their desktops. It supports a wide array of functionalities, from viewing and committing changes to merging pull requests, facilitating project collaboration.

**Slack:** As a cloud-based team collaboration tool, Slack simplifies project management, file sharing, and real-time communication. It offers a range of features, including categorization of discussions into channels, contributing to improved organization and productivity.

**Zoom:** This cloud-based video conferencing platform facilitated virtual meetings for the team, providing a reliable platform for remote collaboration. Especially useful for team members located outside of Australia, Zoom enables real-time communication from any global location.

**Telegram:** Telegram is a cloud-based messaging platform offering end-to-end encryption for secure communication. With features such as audio and video chats, file sharing, and group chats, it provides a secure, efficient platform for real-time collaboration and feedback.

**Google Chrome:** Developed by Google, Chrome is a web browser designed to deliver fast, secure, and reliable browsing. Team members often use Chrome for internet access, research, frontend testing, and UI design due to its user-friendly interface and advanced features.

## 5.2 Materials

The construction of the foreign exchange dashboard requires a number of other resources in addition to the software already mentioned. These resources, which often include third-party services and APIs, are essential for acquiring real-time data, interacting with external platforms, and improving the dashboard's overall usefulness.

**Exchange Rate APIs:** To get real-time currency rate information, one can use trustworthy and precise APIs like CryptoCompare API, Alpha Vantage API, and NOW API. These APIs are necessary for the dashboard's core functionality, which depends on managing several base currencies and giving accurate conversion rates for different currencies.

**Deployment and Hosting Services:** The foreign exchange dashboard must be hosted and implemented on a trustworthy platform in order to guarantee consumer accessibility. You can want to take into account well-liked hosting solutions like Amazon, Google Cloud, or Heroku, which are renowned for their scalable architecture and dependable performance.

**Front-end frameworks and libraries:** For the purpose of creating a responsive and interactive user interface, React, a contemporary front-end framework, must be used. React makes it possible to build effective and dynamic web applications, improving user experience in general.

**Back-end development frameworks:** Frameworks like Node.js can be used by development teams to create server-side code quickly. Building a scalable and maintainable back-end infrastructure is made easier with Node.js, allowing team members to concentrate on the essential features.

In conclusion, integrating different APIs, third-party services, and extra tools is crucial when building a foreign exchange dashboard in order to provide a seamless user experience, real-time data access, and secure transactions. These tools offer users a complete financial solution and are crucial to the project's success.

### 5.3 Roles & Responsibilities

The six members of the group, Wufeng Ding, Ruochen Pi , Liyuan Shi , Guang Zhu , Pan Tang , and Yuetlee Chan , have different areas of expertise, so the group members were assigned different roles. After a whole semester, all members have more than one role and may take on different roles at different times. In addition, all members help each other with tasks, so responsibilities are often not fixed.

All roles on the team are described in this section. this section will only explain the specific roles and the roles that each team member has taken on. More specific responsibilities and contributions of team members can be found in the "Contribution Statement" at the beginning of the report.

Statistically, throughout the duration of the project, the team roles included: project manager, product manager, UI designer, developer (front-end/back-end), tester.

The responsibilities of the team roles are described below.

Table x Planned Roles

Roles	Description
Project Manager  [Liyuan Shi]	Project managers are in charge of organising every step of the process, ensuring that it is finished on schedule, and making sure that every component complies with specifications. In this project, the project manager must keep in touch with the mentor and the organisation, provide frequent project updates, and be aware of any recent requirements modifications. The project manager must also interact with the team, monitor project development, and respond to emergencies. In essence, the project manager is in charge of ensuring that the entire project is completed successfully.

Product Manager  <a href="#">[Pan Tang]</a>	<p>The role directly in charge of the product is product manager. In this project, the product manager must make sure that the Dashboard's features and services are appropriate for both businesses and users. The product manager must carry out market research, choose product strategies based on the market, gather pertinent research materials, comprehend the history of the product, develop product strategies, and promptly update product requirements. The product manager is the creator, producer, and frequently the initial consumer of the product.</p>
UI Designer  <a href="#">[Yuetlee Chan, Wufeng Ding ]</a>	<p>The Dashboard user interface is designed by the UI designer, who is also in charge of interaction design and layout. The user interface (UI) designer must take into account both the aesthetics of interface design and the needs of users, making interface operations straightforward, comfortable, and easy to use. As the project's image designer and beautician, the UI designer must create the best UI scheme for the product depending on the user's qualities.</p>
Front-end Developer  <a href="#">[Pan Tang , Yuetlee Chan, Wufeng Ding, Ruochen Pi ]</a>	<p>To create the front-end portion of the product, front-end developers work together with project managers, product managers, and other engineers. To complete the front-end work of the Dashboard in this project, including the display of exchange rates, the introduction of financial technology, and the integration of financial tools, front-end engineers mostly employ languages like Javascript, HTML, CSS, the React framework, MySQL, and other technologies.</p>

<p>Back-end Developer</p> <p>[Guang Zhu, Liyuan Shi]</p>	<p>To create the back-end portion of the product, back-end developers work together with project managers, product managers, and other engineers. In this project, back-end development engineers will create the back-end technology needed for the Dashboard project using languages like Java, Python, and SQL to guarantee users have a positive product experience. In this project, back-end development must help the product manager define and design the software structure as well as implement numerous product functions.</p>
<p>Tester</p> <p>[Ruochen Pi, Guang Zhu, Yuetlee Chan]</p>	<p>In order to make sure the product functions properly, the test development engineer is essential. Early on in the project, the test development engineer primarily performs manual testing to examine the various project functions and identify project hazards. The test development engineer must create automated testing tools in the middle and end of the project to evaluate the risk resistance of the Dashboard project and fix various issues that users might have while using it. Project engineers are required to design and run test cases, manage multiple defect papers, and have a solid understanding of every aspect of the project.</p>

## 6. MILESTONES / SCHEDULE

### Milestone list:

- Week 2: All team members understand the project requirements and project scope.
- Week 4: The team completes UI sketching.
- Week 5: The team demonstrates the complete UI design for the client, and delivers the proposal of this project.
- Week 8: Team members submit project progress reports.
- Week 10: Team members do all the development of the front-end page

- **Week 11:** Team members complete backend development, and test the entire webpage, check and fix bugs.
- **Week 12:** The team finishes all the work and starts preparing the presentation, writing the final report, designs PPT and records video.
- **Week 13:** The team checked the details of the project and delivered it to the client for acceptance.

### **Project Schedule:**

Schedule	Tasks	Reporting	Date
Week-1 (Analysis)	1) Determine the theme of the project. 2) Initial allocation of responsibilities and tasks to team members. 3) Initial analysis of customer needs	None	20-02-2023
Week-2 (Analysis)	1) Get in touch with clients and tutor to plan meeting times 2) Conduct a requirements analysis to define the functions and needs of the project 3) Establish the scope and limitations of the project.	1) Meetings with tutor, to agree on a date for a subsequent meeting; 2) Meetings with client, to communicate more details about the project requirements	27-02-2023
Week-3 (Analysis & Design)	1) Background research related to the project 2) Begin sketching UI and discussing UI design options. 3) Start collecting APIs and development tools that may be used. 4) Complete weekly individual report	1) Communicate technical details with clients in meetings to discuss and confirm UI sketches and API choices. 2) Show UI sketches to clients and mentors and ask for suggestions.	06-03-2023

Week-4 (Design & Developing)	1) Create database 2) Complete UI sketching 3) Start designing the UI high fidelity model 4) Start a front-end development environment and technology selection. 5) Start technology selection and build an environment for back-end development. 6) Complete weekly individual report	1) Meeting with the client and presenting the final version of the UI sketches	13-03-2023
Week-5 (Design & Developing)	1) Complete Proposal Report; 2) Complete the design and drawing of the UI high fidelity model. 3) Start front-end development and collaborate with back-end development on design. 4) Complete Individual Summary & Report	1) Meeting with clients and presenting UI high fidelity models and collecting feedback. 2) Meeting with tutors to provide an update on progress and obtain feedback.	20-03-2023
Week-6 (Design & Developing)	1) Front-end development continued, implementing front-end pages based on the UI high-fidelity model. 2) Back-end development started to design database structure, build back-end framework and debug API. 3) Product manager and UI designer make UI adjustment and optimization according to the progress of front-end development, and communicate and coordinate with front-end development. 4) Testers start to prepare the test environment. 5) Complete weekly individual report	1) Meeting with clients and mentors to present the developed front-end pages.	27-03-2023

Week-7 (Developing & Testing)	<p>1) Front-end development continued, implementing page interaction logic and debugging in collaboration with back-end development.</p> <p>2) Back-end development continued, improving the design and implementation of the API interface and completing the interaction with the database.</p> <p>3) Testers started writing test cases.</p> <p>4) Complete weekly individual report</p>	<p>1) Meeting with clients and tutors to demonstrate page interaction logic.</p>	03-04-2023
Week-8 (Developing & Testing)(midbreak)	<p>1) Continued development of front-end pages and begins part front-end integration testing.</p> <p>2) Individual Summary &amp; Report completed</p> <p>3) Mid Semester Project Status Checking</p>	<p>1) Presenting test cases in meetings with clients and tutors.</p>	17-04-2023
Week-9 (Developing & Testing & Design)	<p>1) Continued development of back-end function and begins part back-end integration testing.</p> <p>2) Testers start functional testing to check whether the functions of the whole system meet the requirements.</p> <p>3) Product manager and UI designer carry out UI optimization and adjustment according to the test results.</p> <p>4) Complete weekly individual report</p> <p>5) Group Progress Report</p>	None	24-04-2023

Week-10 (Testing)	<p>1) Front-end development completes all pages and continue front-end integration testing.</p> <p>2) After the front-end and back-end integration tests are completed, the front-end and back-end developers work together to solve the existing problems and carry out co-tuning.</p> <p>3) Complete weekly individual report</p>	None	01-05-2023
Week-11	<p>1) Back-end development complete</p> <p>2) Testers carry out system testing to test the performance and stability of the whole system.</p> <p>3) Create the PPT for the presentation and prepare the presentation</p> <p>3) Product manager and UI designer check the UI and UX for compliance one last time.</p> <p>4) Complete the weekly individual report.</p>	None	08-05-2023
Week-12	<p>1) The development team conducts final debugging and testing to ensure the system is stable and reliable.</p> <p>2) Final acceptance by the project manager to confirm that all features and requirements have been met.</p> <p>3) Recorded video of Final Presentation</p> <p>4) Refine the Final report</p> <p>5) Final acceptance by the project manager to confirm that all features and requirements have been met.</p> <p>6) Completion of weekly individual report.</p>	None	15-05-2023
Week-13	<p>1) Submission of final report (thesis)</p>	Final - Dashboard presentation at a	22-05-2023

	<p>2) Completion of personal summary and report</p> <p>3) Submit end semester evaluation form to client</p>	meeting with clients and tutors.	
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## 7. RESULTS

### The nature of the prototype system:

Our team has developed a dashboard as a solution tool. The client's expectation for the dashboard was to function as a website navigation platform, allowing users to compare exchange rates, view interbank surcharges, and provide links to websites related to cryptocurrencies and financial technology to ensure transaction security and reduce transaction fees. Additionally, the dashboard offers other useful information to assist users in understanding market trends.

Our dashboard comprises ten meticulously designed pages, offering customers a comprehensive and streamlined service experience. The dashboard encompasses various essential functionalities, including a sign-up page, login page, forgot password page, and resend confirmation email page, facilitating seamless account management for our esteemed customers. Furthermore, the about us and join us pages serve as invaluable channels for users to connect with MHC Digital and our website administrators.

Login to MHC Digital

Sign Up    Login

Account

Password

Stay logged in    [Forgot Password](#)

[Log In](#)

[Don't have an account?](#)

[Sign Up](#)

About us    Join us

Figure 10: The dashboard login page

For users seeking to compare exchange rates and calculate prices based on real-time data, our compare rate page presents a user-friendly interface, empowering them to make informed decisions. Moreover, the history rate page allows users to delve into the historical exchange rate data of a specific currency against other currencies spanning the past six months.

The screenshot shows the MHC Digital dashboard login page. On the left, a sidebar menu includes 'Compare Rate' (highlighted in yellow), 'History Rate', 'Cryptocurrency Platform', 'Financial Technology', 'Market Rates', 'English', 'China', 'Korean', 'Log in' (highlighted in yellow), and 'Sign up'. The main board area has a blue header with 'Main Board' and 'Logout'. Below the header, there are two sets of input fields. The first set is for 'Selective exchange rate' from 'Chinese yuan' to 'United States dollar' (USD). The second set is for 'Please input your amount' (100) and 'Market reference' (14.048496). A note at the bottom says 'Please select the exchange rate 0.14048496'.

Figure 11: The compare rate page

Catering to the growing popularity of cryptocurrencies, our dashboard features a dedicated platform page that showcases real-time prices, buying and selling rates, as well as price trends over the past week for the top five mainstream cryptocurrencies. To meet the demands of users in the realm of financial technology, our dashboard integrates fintech and online banking seamlessly, providing valuable insights into transaction fees imposed by various institutions.

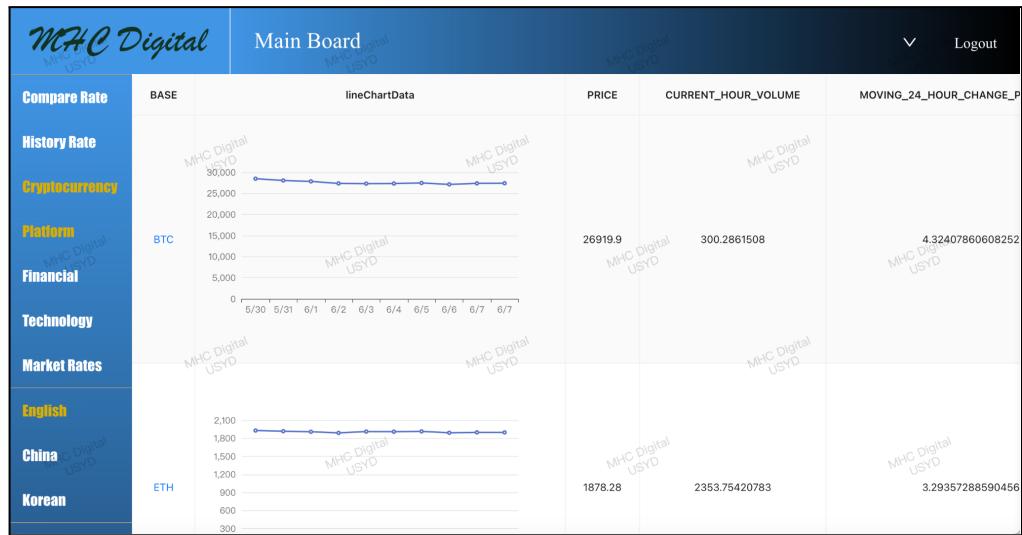


Figure 12: The Cryptocurrency page

To aid customers in selecting the most favorable rates, our market rates page presents the prices of a specific currency across different banks, enabling users to make well-informed choices. Moreover, our dashboard supports seamless language switching functionality, allowing users from diverse countries to effortlessly access and utilize our services in their preferred language.

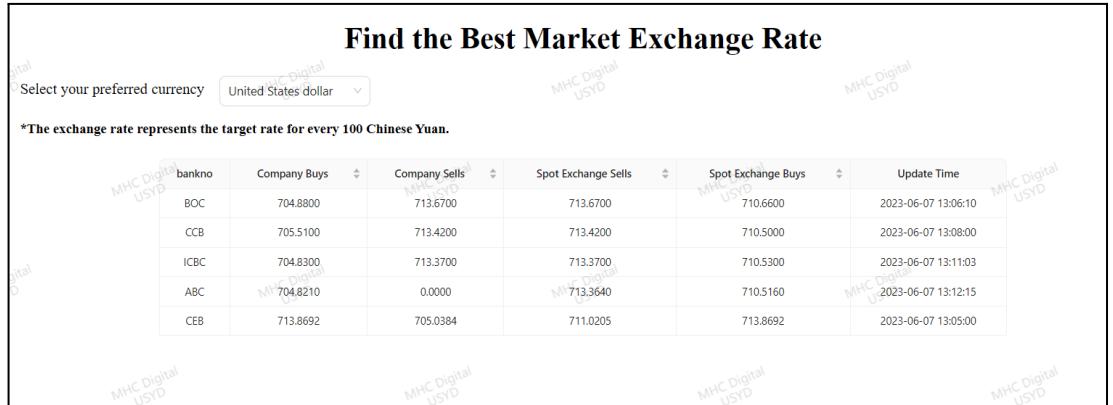


Figure 13: The Market rate page

Through meticulous design and thoughtful implementation, our dashboard delivers an all-in-one solution, providing customers with a seamless and enriching experience.

#### **Describe how the IT artefact (prototype) was developed:**

The team is primarily divided into four key sectors: design, front-end development, back-end development, and testing. To kick-start the project, we began by engaging

in thorough communication with the client, ensuring a clear understanding of their requirements. User stories were then drafted, followed by the creation of a UI design. Concurrently, both front-end and back-end development commenced, and testing was conducted towards the project's conclusion, culminating in the delivery to the client.

Once upon a time, there was a diligent Japanese student studying abroad in Australia. Determined to make the most of his time, he decided to work part-time to support himself and save money. As the months went by, he successfully accumulated a substantial sum and soon found himself faced with a critical decision: how to safely and efficiently send his hard-earned savings back home to Japan. ↵

However, he quickly discovered the perplexing challenge that lay ahead. The various banks in Australia presented different exchange rates and transaction fees, leaving him unsure about the optimal timing and location for currency conversion. With limited knowledge of the intricate workings of the foreign exchange market, he felt overwhelmed and uncertain about how to proceed. His ultimate goal was to maximize the amount of money he could send home to his family. ↵

Determined to find a solution, he embarked on a quest for a reliable and user-friendly platform that could provide him with the necessary tools and information to navigate the complex world of currency exchange. He sought a comprehensive resource that would not only allow him to compare exchange rates across different banks but also provide insights into the additional surcharges imposed by each institution. Realizing that time was of the essence, he yearned for a service that could inform him of the optimal moments to make his currency exchanges, ensuring that he could obtain the most favorable rates and minimize unnecessary expenses. ↵

Figure 14: User story

During the design phase, the team crafted user stories, and for page design, a Paper Prototype was developed as a low-fidelity model. Subsequently, using Modao as the prototyping design tool, high-fidelity UIs were created. For development, we employed the waterfall methodology, which entailed following a structured approach from the project's inception, with a firm focus on meeting the client's requirements and ensuring the development of the prototype system aligns with their expectations. All the Paper Prototypes and high-fidelity UI designs can be found in the appendix.

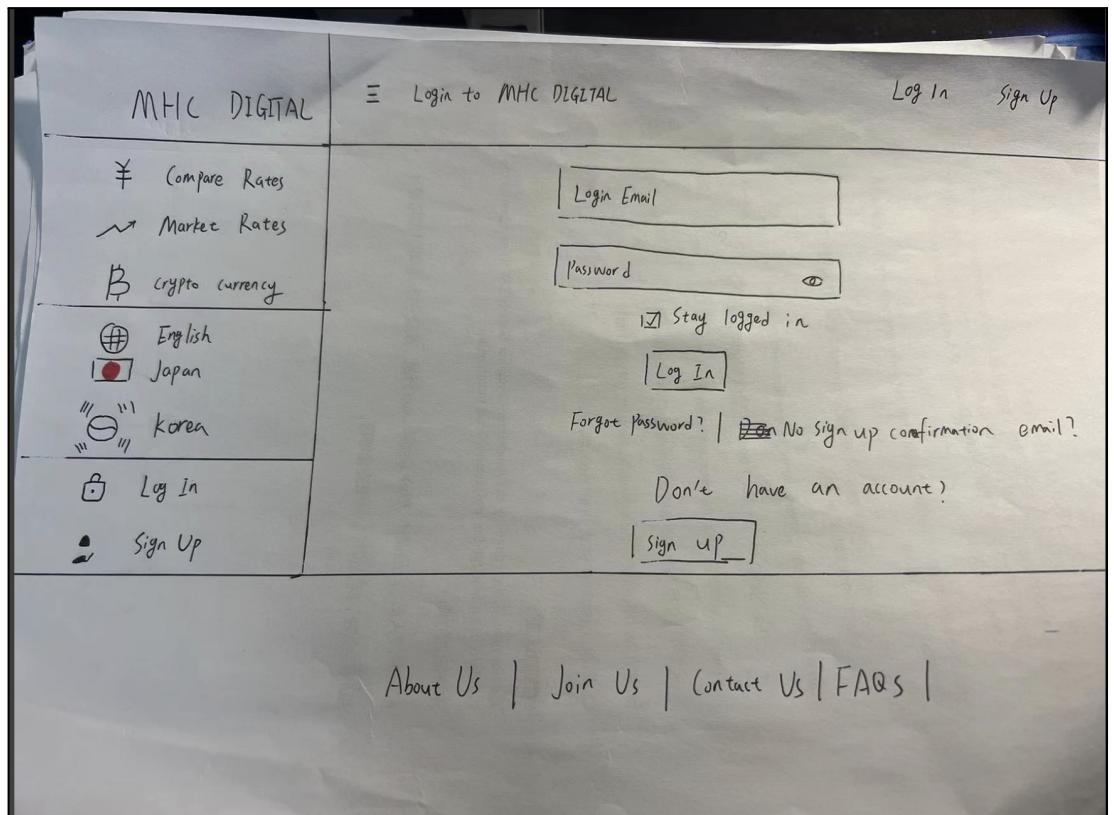


Figure 15: Paper Prototype

Currencies	Market Rate
AUD	4.5898
BRL	1.3096
CAD	5.0269
CHF	7.4284
EUR	7.4041
GBP	8.4153
HKD	0.8753
IDR	0.0004
INR	0.0827
JPY	0.0519
KRW	0.0053

Figure 16: High-fidelity UI

### How it was demonstrated to the client:

The team maintains weekly Zoom meetings with the client to provide regular updates on the project's progress. In addition, the team has extended an invitation to the client to join the Slack workspace, where real-time project updates and issue discussions take place. Formal communication with the client is conducted through our team members' student email accounts to ensure effective collaboration and prompt feedback collection.

To showcase the functionality and potential of our prototype system, we have deployed the dashboard to the cloud. The client is granted access to the dashboard through a provided link, enabling them to explore its features at their convenience. Furthermore, during the final meeting in the thirteenth week, we conducted a comprehensive demonstration of the dashboard's capabilities and addressed any questions or concerns raised by the client.

Overall, these communication and demonstration strategies have facilitated seamless collaboration and ensured that the client remains engaged throughout the development process.

#### **Explain the methods of design, development, testing, evaluation and analysis:**

Our team crafted a user story based on the client's narrative, which helped us establish project requirements in the early stages and later aided in testing and client acceptance. As the client did not provide a specific project budget, we opted for the most cost-effective approach: a paper prototype. This allowed us to achieve initial UI design and validate the client's ideas.

From the project's inception, our team diligently analyzed the requirements and sought confirmation from the client during meetings. Given the client's frequent changes in the early stages, we proactively confirmed all the requirements upfront, laying a solid foundation for adopting the waterfall development methodology. Waterfall development emphasizes predictability and strict control over the project, minimizing the risk of requirements changes during the development process. Hence, we chose waterfall as our development methodology.

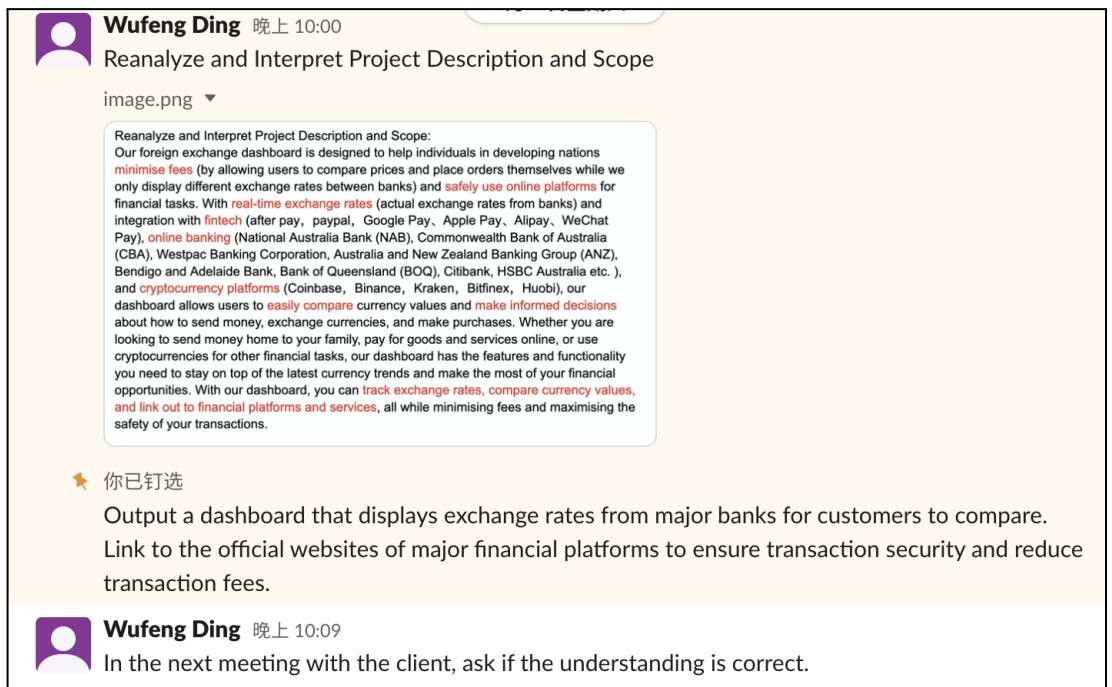


Figure 17: Analysis of project requirements

During testing, our dedicated testers performed various tests at different project stages, including unit testing, integration testing, system testing, functional testing, usability testing, performance testing, security testing, and compatibility testing. These tests ensured that the prototype system delivered to the client was comprehensive, fully functional, interactive, and aligned with all their requirements. Detailed test reports can be found in the appendix.

Due to the significant time investment in defining project details in the early stages and our adoption of the waterfall methodology, we progressed systematically and were confident that our prototype system met the client's expectations. Throughout the development process, we maintained active engagement with the client. Therefore, prior to delivery, we conducted an assessment and analysis to ensure that the dashboard aligned with the client's expectations, which was validated through project personnel and client confirmation.

In validating client expectations, we further collected user experience data through the 'think aloud' technique, which allowed us to capture all the thoughts and insights of users while they interacted with our dashboard. The users we sought were specifically selected to match the background of the protagonist in the user story – international students. Based on user feedback, our dashboard demonstrated seamless

functionality, strong interactivity, and successfully fulfilled the client's specifications outlined in the user story. This further serves as validation that our dashboard meets the client's expectations. Detailed records of the 'think aloud' can be referenced in the appendix for further examination.

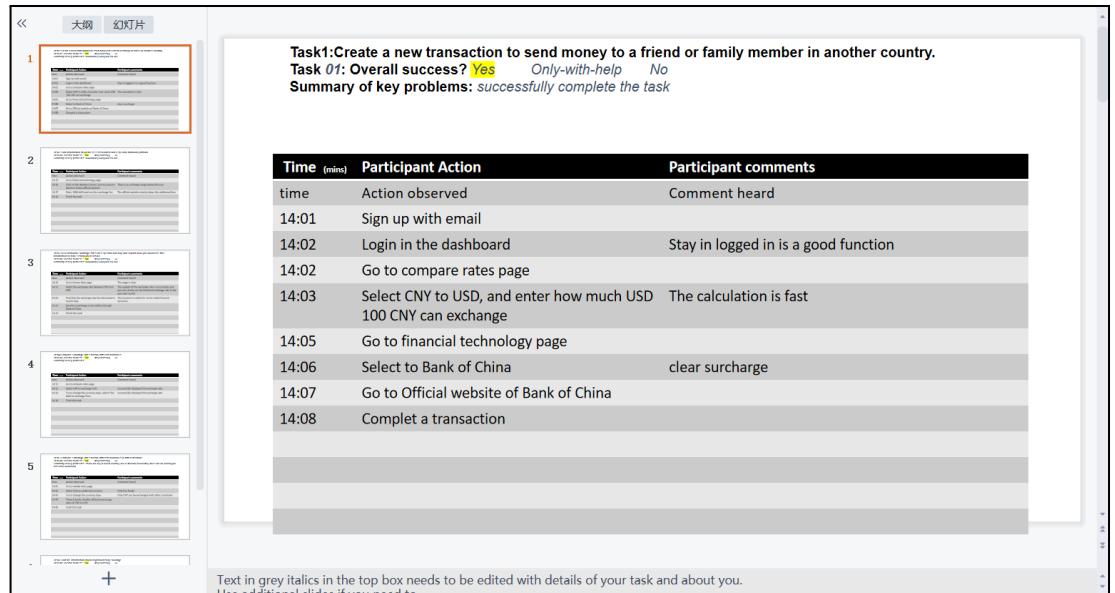


Figure 18: One of think aloud results

## 8. DISCUSSION

Our overarching observation from the results indicates the availability of diverse financial tools that enable individuals from developing nations to make informed decisions in financial tasks. As demonstrated by the integration of real-time exchange rates, fintech, and cryptocurrency platforms within our dashboard, individuals in developing nations can compare currency values in real-time, thereby enhancing their ability to optimize financial opportunities effectively.

The consolidation of a wide range of financial tools within a centralized location implies a streamlined approach to comparing currency values and conducting financial transactions. In the context of conventional foreign exchange platforms, inefficiencies have been identified as key reasons for their failure to attain a competitive advantage. These include the presence of separate financial platforms for distinct services and the absence of integrated, transparent representations of additional costs, such as surcharge information before making an appropriate

decision for financial transactions. Furthermore, our dashboard shows evidence of a specific level of safeguarding measures, enhancing security through the implementation of encryption protocols and data privacy.

We continue our discussion by addressing the financial methods identified in prior work: Western Union, Huobi, Wise and Travelex.

One of the prominent foreign exchange platforms that has gained widespread recognition is Western Union. Western Union acknowledges the inherent challenges it faces in complying with global regulatory changes, particularly in the context of cross-currency money movement and payment facilitation. Similarly, Anderson highlights the increasing regulatory scrutiny and challenges faced by Huobi, a centralized cryptocurrency exchange operating on a global scale. Consequently, our observations indicate that a significant majority of these platforms exhibit complexities in maintaining compliance with global regulatory standards for currency exchange. Moreover, we emphasize that integrating with existing, well-established financial transaction platforms that adhere to formal regulatory requirements can enable users to conduct payments efficiently and reliably.

Individuals in developing nations often encounter challenges related to their limited financial resources and restricted access to global financial services. Minimizing fees becomes a crucial aspect and a significant hurdle in financial transactions. Stehniei proposes the foreign exchange solution, Wise, positioning itself as an alternative to high bank fees. The findings highlight two key areas for fee minimization. Firstly, individuals in developing nations often navigate multiple platforms to understand exchange rates, complicating the process of finding the most cost-effective options and making informed decisions during financial activities. An optimal solution lies in the integration of relevant platforms such as cryptocurrency, foreign exchange currency, and fintech into a foreign exchange dashboard. This integration allows users to easily compare currency values and select the lowest fee options. Secondly, users may lack comprehensive knowledge about the various surcharges imposed by different banks for transaction handling, leading to inefficiencies in minimizing surcharge fees. By providing surcharge fee information for each online bank, users can make optimal decisions to significantly reduce fees during financial transactions and payments.

Security pertaining to the use of online platforms for financial tasks holds significant importance in the development of the foreign exchange sector. Moore highlighted the occurrence of a ransomware attack targeting Travelex, leading to the compromise of sensitive customer data. This incident underscores the crucial need to mitigate cyber risks to safeguard individuals during financial activities. Given individuals' concerns regarding identity theft, data breaches, and financial fraud, it becomes imperative to instill confidence by implementing robust security measures. This is achieved through data encryption and establishing connections with trustworthy financial platforms, ensuring reliable and secure transactions within the foreign exchange platform.

The project emphasizes that the foreign exchange dashboard enhances financial activities by empowering individuals in developing nations to easily send money to family and make online purchases through the selection of cost-efficient banks and seamlessly connect with financial platforms to access reliable financial services. Moreover, the dashboard enables real-time tracking of cryptocurrencies and exchange rates for various financial tasks, facilitating easy comparison of currency values to identify optimal options for fee minimization.

Overall, we propose that the integration of real-time exchange rates, fintech, online banking, and cryptocurrency platforms within a centralized dashboard can be adopted by individuals in developing nations. This implementation facilitates informed decision-making in cost-effective financial transactions by conveniently and easily gathering relevant information. Furthermore, through the incorporation of reliable services and additional security measures in the dashboard, it effectively alleviates individuals' concerns regarding security issues in financial tasks.

## **9. LIMITATIONS AND FUTURE WORKS**

### **9.1 Limitations**

The project has been successfully completed, meeting the requirements set forth by the client and achieving some results that are worth adopting. However, the project has encountered many limitations in its development.

This section will describe the team's constraints in developing the project. And, discuss the possible solutions for this limitation in the future.

- ❖ Funding constraints. The project was unfunded from the very beginning, resulting in more time and effort and technical difficulty required to complete the client's needs.
  1. API use problem. Unable to use the paid api, the team found the open source api, but the quality of this api is far from the paid data quality is good, covering data classes and volume is not full enough.
  2. Testing tool problem. The team used the loadview tool in performance testing to simulate the web page load, test the average response time of the web page, and simulate multiple users transacting on the website at the same time. However, because the normal version of the tool can only simulate 10 users, upgrading to the paid version allows unlimited simulation, and also allows you to measure the maximum load threshold of the site. However, the paid version costs \$199 per month, which the project team could not afford without funding, and finally chose the regular version.
  3. Development problem. The team was unable to purchase a domain name and a paid cloud database for web development, and had to resort to a free intermediate tool called heroku to host our web project. It was less stable and could lead to data loss.
- ❖ Time constraints
  1. Time constraints due to client turnover. As the project changed clients, a larger portion of the project's pre-project time was spent on communicating with the old client and the new client, while the project's as of time remained unchanged. This resulted in a shorter time frame for the project to be put into management, development, and testing.
  2. The lack of communication led to time constraints. Also, during the development of this project, there was insufficient communication between the members, resulting in some duplication of effort. However, the project manager caught it in time and used the

- collaboration tools github and google doc to allow the project team members to iterate on the developed version of the project in time.
3. Difficulties were resolved resulting in schedule delays. In addition, attempts to resolve various technical issues that arose during the development process, the project was also put on hold several times, including api lookup, back-end local database migration to the cloud, and web language conversion.
  4. Team management issues led to schedule delays. The team initially chose to work the three parts of front-end development, back-end development, and testing serially, which wasted some time, and the collaborating development members often had to wait for one person to finish his other tasks before they could start development. The team was then negotiated to separate and work in parallel, and then use github's merge feature to complete the collaboration.

❖ Technical constraints

Because the project was not funded, it needed stronger technical support to meet the client's needs with limited resources. Since some members of the project team had no previous experience in full web development, they had to learn from scratch and make mistakes during the project development. As team members worked on how to implement specific features, they needed to spend time developing and testing repeatedly.

## 9.2 Future work

With the project limitations mentioned earlier, the team had a number of elements that could be maintained and upgraded in the future that could be improved. Although the requirements set forth by Client have been completed, the team came up with a number of options available for optimizing against the limitations. The team compiled what they had summarized as possible improvements at the end of development.

In this section, some of the future work is described in detail, and what project results could be improved and upgraded by these efforts.

❖ The project can continue to expand the scope and add some new features to enhance the user experience. For example, financial forums, etc.

- ❖ After the website is launched, it may face many emergency events. Since issues such as finance and money transactions are involved, the impact of emergencies may be greater than the general website, so the team needs to make risk plans for what may happen. For example, a sharp increase in website visitors for a short period of time leads to server overload.

Furthermore, we plan to incorporate machine learning algorithms into our dashboard, enriching the user experience with enhanced intelligence. These algorithms will leverage historical transaction data, market trends, and relevant factors to analyze and forecast exchange rates, thereby providing users with more precise and dependable forecasts. Additionally, the algorithms will generate tailored trading recommendations by considering individual users' trading habits and preferences.

The dashboard will continuously adapt and refine its recommendations based on real-time market conditions and data. This ensures that users receive timely suggestions aligned with the most favorable trading opportunities. By leveraging these intelligent capabilities, we aim to provide a competitive edge and deliver a more personalized, accurate, and intuitive service to our users.

The integration of machine learning algorithms will empower users to make more informed financial decisions. They will benefit from reliable and accurate exchange rate forecasts, allowing them to navigate fluctuating exchange rates with greater confidence. As a result, users can optimize their trading efficiency and seize advantageous opportunities for better financial outcomes.

We will also develop a mobile application version of the exchange dashboard to enhance accessibility and convenience for traders. This mobile app will empower traders to access vital market information and effectively manage their trades while on the move. The mobile compatibility of the dashboard will provide unparalleled convenience and flexibility, enabling traders to stay connected to the market and make prompt decisions regardless of their location. Traders will have the freedom to monitor market trends, analyze data, and execute trades conveniently from their smartphones through our mobile app.

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## APPENDIX

# Appendix 1

## I. Test process

Unit testing - integration testing - system testing

Test process	Define	Include test classes	Date
unit testing	Test that individual functions, methods, or classes function properly to ensure code reusability and stability.	Functional Testing Usability Testing. Performance Testing  Also, consider the test of input exception operation	W7 2023/4/3
integration testing	Test that interactions between different modules or components work properly to ensure the functionality of the entire application.	Interface testing Compatibility testing	W8-W9 2023/4/17
system testing	Test that the functionality of the entire application meets user requirements and business needs to ensure the quality of the entire application.	Functional Testing II Performance Testing II Security testing Compatibility testing II	W10 2023/5/1

## II. Test Classes

Test Classes	Define	objectives	method	platform	issue
Functional Testing	This will cover the features and functions of this project to ensure that they work as expected. This type of test case will cover a variety of scenarios, including both positive and negative test cases.	1.Testing for each function, Designing different application scenarios	Think aloud, Artificial Test	1. Edge ; 2. Safari ; 3. Firefox ; 4. Chrome	
Usability Testing.		1. Click smoothly, no bad button 2. Jumping correctly 3. Reasonable page arrangement, in line with common sense	Think aloud	Chrome	Shown as Think aloud
Performance Testing	This will involve the performance of the WEB under various load conditions to ensure that it can handle the number of tasks expected during normal operation.	1.Load test, including Concurrent HTTP\Concurrent Browsers\Parallel Testing 2.Response Time Calculation 3. Network	Test tool load view <a href="https://www.loadview-testing.com/">https://www.loadview-testing.com/</a>	1. Edge ; 2. Safari ; 3. Firefox ; 4. Chrome  1.IOS; 2.Android	

		performance test			
Security testing	This will involve testing the security features of the WEB sequence to ensure that it is secure from unauthorised access and attacks. Test cases of this type would include penetration testing, vulnerability scanning, and risk assessment.	<p>1) Be able to prevent password temptation tools</p> <p>2) Common means to prevent Cookie attacks</p> <p>3) Sensitive data shall not be transmitted in plain text</p> <p>4) Can prevent the file name guess and view html file content to obtain important information</p> <p>5) It can ensure that the website will recover the tool within a given time after receiving it, and the loss of important data will not exceed 1 hour</p>	immuniweb	Edge	
Compatibility testing	This would involve the compatibility features of the WEB to ensure that it works properly on different browsers.	<p>1. Click smoothly, no bad button</p> <p>2. Jumping correctly</p> <p>3. Reasonable page arrangement, in line with common sense</p>	Think aloud	<p>1. Edge ; 2. Safari ; 3. Firefox ; 4. Chrome</p>	Shown as Think aloud

Interface testing	This would involve properly using the WEB's interfaces to ensure that all data interactions between modules are working properly and errors are being handled appropriately.	Crawl the api data and compare the data displayed on the web for consistency.	Artificial Test	Chrome	

### III. Project requirement

update

Functional requirements

- 1.remittance, currency exchange and purchase (link to external online bank)
- 2.a line graph of currency trends, tracking exchange rates, comparing currency values

Where there are multiple currencies, the same currency on different platforms with different exchange rates, drop down menu to compare the real-time exchange rates of different platforms

- 1.links to financial platforms and services

Auxiliary function requirements

1. First time to enter the interface of the navigation (newbie help)
2. search function drop-down menu, used to search for a specific bank transfer or search for a specific currency
3. About page, link to fintech website and introduction to our dashboard, etc.
4. User page

#### 5. Toolbar (help)

#### Security requirements

- 1 Multiple devices online at the same time require authorization (e.g., captcha)
- 2 timeout auto-logout
- 3 Anti-sql injection

#### Login (including email/username, password, one-time code)

#### Innovation requirements (TBD)

- 1 Financial forum square
- 2 ai assistant
- 3 Benchmarking with Amoy

## IV. Unit test

Testers simulation

	<b>UID001</b>	<b>UID002</b>	<b>UID003</b>
<b>Age</b>	27	25	23
<b>Gender</b>	Female	Male	Female
<b>Occupation</b>	Accountant	IT	Student
<b>Web Development Literacy</b>	2	5	4
<b>Familiar with financial transactions?</b>	2	3	4
<b>Experience with financial applications</b>	5	4	2

# Table of Qualitative Observations

User Goal	Task	Summary of Observations, Errors and Comments
<p><b>Normal registration, login page.</b> <b>Click any button in the home page has a reasonable response</b></p>	<p><b>Task A.1</b> test the usability of <a href="http://localhost:3000/register">http://localhost:3000/register</a></p>	<ul style="list-style-type: none"><li>● [1.1] Wrong hyperlink.</li><li>● [1.2] Wrong input method</li><li>● [1.3] This can be optimized by giving the user the option to not show the password.</li><li>● [1.4] Wrong typing</li><li>● [1.5] Death button</li></ul>
	<p><b>Task A.2</b> test the usability of <a href="http://localhost:3000/login">http://localhost:3000/login</a> and <a href="http://localhost:3000/resetpassword">http://localhost:3000/resetpassword</a></p>	<ul style="list-style-type: none"><li>● [2.1] The optimization could be done by giving the user the option to not display the password</li><li>● [2.2] Password not detected less than 8 characters</li></ul>

	<p><b>Task A.3</b></p> <p>test the usability of  <a href="http://localhost:3000/home">http://localhost:3000/home</a></p>	<ul style="list-style-type: none"> <li>● [3.1] Dead button</li> </ul>
Test Monetary value function	<p><b>Task B.1</b></p> <p>Compare the value of the yen and the yuan, and calculate how many yen 300rmb equals with the help of the web</p>	
Test Currency Trends function	<p><b>Task B.2</b></p> <p>Select RMB and AUD to view a line chart of the last 7 days of RMB to AUD trend and find the date of the lowest point.</p>	

Test online bank function	<p><b>Task B.3</b></p> <p>Use 500 RMB to exchange AUD through online bank and choose the bank with the lowest exchange rate.</p>	
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## Table of Qualitative Observations

User Goal	Task	Summary of Observations, Errors and Comments
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<p><b>Normal registration, login page. Click any button in the home page has a reasonable response</b></p>	<p><b>Task A.1</b> test the usability of <a href="http://localhost:3000/register">http://localhost:3000/register</a></p>	<ul style="list-style-type: none"> <li>● [1.1] Wrong hyperlink.</li> <li>● [1.2] Wrong input method</li> <li>● [1.3] This can be optimized by giving the user the option to not show the password.</li> <li>● [1.4] Wrong typing</li> <li>● [1.5] Death button</li> </ul>
	<p><b>Task A.2</b> test the usability of <a href="http://localhost:3000/login">http://localhost:3000/login</a> and <a href="http://localhost:3000/resetpassword">http://localhost:3000/resetpassword</a></p>	<ul style="list-style-type: none"> <li>● [2.1] The optimization could be done by giving the user the option to not display the password</li> <li>● [2.2] Password not detected less than 8 characters</li> </ul>
	<p><b>Task A.3</b> test the usability of <a href="http://localhost:3000/home">http://localhost:3000/home</a></p>	<ul style="list-style-type: none"> <li>● [3.1] Dead button</li> </ul>

Test Monetary value function	<p><b>Task B.1</b></p> <p>Compare the value of the yen and the yuan, and calculate how many yen 300rmb equals with the help of the web</p>	
Test Currency Trends function	<p><b>Task B.2</b></p> <p>Select RMB and AUD to view a line chart of the last 7 days of RMB to AUD trend and find the date of the lowest point.</p>	
Test online bank function	<p><b>Task B.3</b></p> <p>Use 500 RMB to exchange AUD through online bank and choose the bank with the lowest exchange rate.</p>	

The following are applied to “1、Edge ; 2、Safari ; 3、Firefox ; 4、Chrome” respectively, and the results are shown below. In case of disagreement, it will be specially marked.

## A. Usability Testing.

Task A.1: test the usability of <http://localhost:3000/register>

User ID	User 1
Task ID	A.1
Overall success?	Yes
Clock Time	<p>Observations and user comments</p> <p>21:33 - Start Task A.1</p> <p>21:34 - User get in to <a href="http://localhost:3000/register">http://localhost:3000/register</a></p> <p>21:34 - clicks “” in Topmost navigation bar the page run to the block page and the url shown “<a href="http://localhost:3000/signup">http://localhost:3000/signup</a>”. [Issue 1.1]</p> <p>21:34 – user wants to type the login password, and finds “login password” </p> <p>[Issue 1.2] wrong typing </p> <p>21:34 - User types  to register. [Issue1.3] </p> <p>21:35 - User wants to click “sign up”, and finds “&lt;img alt="Sign Up button" data-bbox="568 808 738 838”/&gt;”, [issue 1.4]wrong typing</p>

	<p>21:38 - User want to click <a href="#">Forgot Password</a>, No jumps and no changes. [issue 1.5]</p> <p>Task Finished</p>
Summary of key problems Observed and Question Guess	<ul style="list-style-type: none"> <li>[1.1] This should be the wrong hyperlink url to write, the login page should be <a href="http://localhost:3000/register">http://localhost:3000/register</a> and <a href="http://localhost:3000/signup">http://localhost:3000/signup</a> should be invalidated.</li> <li>[1.2] Wrong typing</li> <li>[1.3] The optimization could be done by giving the user the option to not display the password</li> <li>[1.4] Wrong typing</li> <li>[1.5] Dead button</li> </ul>
Other notes	None

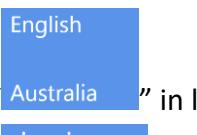
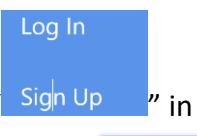
Task A.2: test the usability of <http://localhost:3000/login> and <http://localhost:3000/resetpassword>

Task ID	User 2 A.2
Overall success?	Yes

Clock Time	<p>Observations and user comments</p> <p>21:40 – Start Task A.2</p> <p>21:41 – User get in to http://localhost:3000/login</p>  <p>21:41 – User types [REDACTED] . [issue 2.1][issue 2.2]</p> <p>21:42 – User clicks “ <a href="#">Forgot Password</a> ”, page jump to http://localhost:3000/resetpassword</p> <p>21:43 – The user back to login page to login.</p> <p>Task Finished</p>
Summary of key problems Observed and Question Guess	[2.1] The optimization could be done by giving the user the option to not display the password [2.2] Password not detected less than 8 characters
Other notes	None

Task A.3: test the usability of http://localhost:3000/home

User ID	User 3
Task ID	A.3
Overall success?	Yes

Clock Time	<p>Observations and user comments</p> <p>21:53 - Start Task A.3</p> <p>21:54 - User get in to <a href="http://localhost:3000/home">http://localhost:3000/home</a></p>  <p>21:54 - clicks “<a href="#">Financial Technology</a>” in left navigation bar one by one, find the first and second is dead button, and the third can only useful after click the forth. [Issue 3.1]</p>  <p>21:54 - clicks “<a href="#">Australia</a>” in left navigation bar one by one, find both of them is dead button. [issue3.1]</p>  <p>21:54 - clicks “<a href="#">Sign Up</a>” in left navigation bar one by one, find both of them is dead button. [issue3.1]</p>  <p>21:55 - User clicks “<a href="#">CNY</a>”, “<a href="#">JPY</a>”, “<a href="#">USD</a>” one by one, and chose and arrange different combinations. No problems found in selective exchange rate.</p> <p>Task Finished</p>
Summary of key problems Observed and Question Guess	[3.1] Dead button

Other notes	None
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## B. Function Testing.

Task B.1: Compare the value of the yen and the yuan, and calculate how many yen 300 rmb equals with the help of the web

User ID	User 1
Task ID	B.1
Overall success?	No
Clock Time	Observations and user comments 21:53 - Start Task B.1 21:54 - 21:54 - 21:54 - [issue3.1] 21:54 - [issue3.1] 21:55 - Task Finished
Summary of key problems Observed and Question Guess	[4.1] Dead button
Other notes	None

Task B.2: Select RMB and AUD to view a line chart of the last 7 days of RMB to AUD trend and find the date of the lowest point.

User ID	User 2
Task ID	B.2
Overall success?	No
Clock Time	Observations and user comments 21:53 - Start Task B.1 21:54 - 21:54 - 21:54 - [issue3.1] 21:54 - [issue3.1] 21:55 - Task Finished
Summary of key problems Observed and Question Guess	[4.1] Dead button
Other notes	None

Task B.3: Use 500 RMB to exchange AUD through online bank and choose the bank with the lowest exchange rate.

User ID	User 3
Task ID	B.3

Overall success?	No
Clock Time	<p>Observations and user comments</p> <p>21:53 - Start Task B.3</p> <p>21:54 -</p> <p>21:54 -</p> <p>21:54 - [issue3.1]</p> <p>21:54 - [issue3.1]</p> <p>21:55 -</p> <p>Task Finished</p>
Summary of key problems Observed and Question Guess	[4.1] Dead button
Other notes	None

## V. Unit test (version 2)

# Table of Qualitative Observations

User Goal	Task	Summary of Observations, Errors and Comments
<b>Normal registration, login page. Click any button in the home page has a reasonable response</b>	<b>Task A.1</b> test the usability of <a href="http://localhost:3000/register">http://localhost:3000/register</a>	<ul style="list-style-type: none"> <li>[1.1] Wrong hyperlink. </li> <li>[1.2] Wrong input method </li> <li>[1.3] This can be optimized by giving the user the option to not show the password. </li> <li>[1.4] Wrong typing </li> <li>[1.5] Death button </li> </ul>
	<b>Task A.2</b> test the usability of <a href="http://localhost:3000/login">http://localhost:3000/login</a> and <a href="http://localhost:3000/resetpassword">http://localhost:3000/resetpassword</a>	<ul style="list-style-type: none"> <li>[2.1] The optimization could be done by giving the user the option to not display the password </li> <li>[2.2] Password not detected less than 8 characters </li> </ul>

	<p><b>Task A.3</b></p> <p>test the usability of  <a href="http://localhost:3000/home">http://localhost:3000/home</a></p>	<ul style="list-style-type: none"> <li>• [3.1] Dead button <input checked="" type="checkbox"/></li> </ul>
Test Monetary value function	<p><b>Task B.1</b></p> <p>Compare the value of the yen and the yuan, and calculate how many yen 300rmb equals with the help of the web</p>	
Test Currency Trends function	<p><b>Task B.2</b></p> <p>Select RMB and AUD to view a line chart of the last 7 days of RMB to AUD trend and find the date of the lowest point.</p>	

Test online bank function	<p><b>Task B.3</b></p> <p>Use 500 RMB to exchange AUD through online bank and choose the bank with the lowest exchange rate.</p>	
---------------------------	--	--

## VI. Integration testing(version 2)

### A. Interface testing

#### Interface testing Process :

1. Understand the application architecture and interfaces: Before conducting interface testing, the team used javascript and python programming languages, and the back-end framework was nodejs. also, comb through the interfaces exposed by the application, including API (Application Programming Interface), web services and message queues. api including two Stock market APIs. the other one is not yet fully defined. This round of testing was conducted for the Stock market API.
2. Determine test scope and data: Determine the interfaces and data to be tested, and the expected output. This typically includes identifying test cases and scenarios, including test cases for different inputs and edge cases.
3. Prepare test environment: Prepare a test environment similar to the production environment, including software and hardware configurations, network topology, and test data and tools.
4. Execute test cases: Execute the interface tests based on the test cases and scenarios prepared in advance. Testing should be automated as much as possible, using automated testing tools and frameworks.
5. Analyze and report the results: Analyze the test results and generate detailed reports based on the test results, including successful and failed test cases, as well as the causes and solutions of errors.

#### API testing methods:

1. Determine the request method (GET, POST, PUT, DELETE, etc.) and parameters of the API interface, including the request header, request body, etc.
2. Send the API request and check whether the returned HTTP status code is correct.
3. Verify that the content of the API response is as expected, including the response header, response body, etc.
4. Verify the functionality and performance of the API, such as concurrent requests, load tests, etc.
5. When performing API testing, you can use a variety of tools, such as Postman, SoapUI, Insomnia, etc. These tools provide a visual interface that facilitates testers to create requests, check responses, write scripts, and other operations. In addition, you can also write scripts for API testing using programming languages, such as Python, Java, JavaScript, etc.

## API testing steps:

1. Create a test case or test suite.
2. Configure the URL, request method, request header, request body and other parameters of the API request.
3. Send the API request and check the HTTP status code and response content.
4. Write assertions to verify that the API response meets expectations.
5. You can make data-driven test cases to improve testing efficiency.
6. You can use continuous integration tools, such as Jenkins, Travis CI, etc., to run API test cases automatically.

## B. Compatibility testing

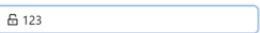
Repeat the usability testing in the unit testing phase, using Think-aloud. run on a different browser

Task A.1: test the usability of <http://localhost:3000/register>

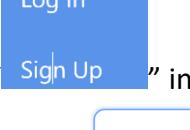
User ID	User 1
Task ID	A.1
Overall success?	Yes

Clock Time	<p>Observations and user comments</p> <p>21:33 - Start Task A.1</p> <p>21:34 - User get in to <a href="http://localhost:3000/register">http://localhost:3000/register</a></p> <p>21:34 - clicks “  ” in Topmost navigation bar the page run to the block page and the url shown “<a href="http://localhost:3000/signup">http://localhost:3000/signup</a>”. [Issue 1.1]</p> <p>21:34 – user wants to type the login password, and finds “login password”</p>  <p>[Issue 1.2] wrong typing</p>  <p>21:34 - User types  to register. [Issue1.3]</p> <p>21:35 - User wants to click “sign up”, and finds “  ”, [issue 1.4]wrong typing</p> <p>21:38 - User want to click <a href="#">Forgot Password</a>, No jumps and no changes. [issue 1.5]</p> <p>Task Finished</p>
Summary of key problems Observed and Question Guess	<p>[1.1] This should be the wrong hyperlink url to write, the login page should be <a href="http://localhost:3000/register">http://localhost:3000/register</a> and <a href="http://localhost:3000/signup">http://localhost:3000/signup</a> should be invalidated.</p> <p>[1.2] Wrong typing</p> <p>[1.3] The optimization could be done by giving the user the option to not display the password</p> <p>[1.4] Wrong typing</p> <p>[1.5] Dead button</p>
Other notes	None

Task A.2: test the usability of <http://localhost:3000/login> and <http://localhost:3000/resetpassword>

Task ID	User 2 A.2
Overall success?	Yes
Clock Time	<p>Observations and user comments</p> <p>21:40 – Start Task A.2</p> <p>21:41 – User get in to <a href="http://localhost:3000/login">http://localhost:3000/login</a></p>  <p>21:41 – User types  . [issue 2.1][issue 2.2]</p> <p>21:42 – User clicks “ <a href="#">Forgot Password</a> ”, page jump to <a href="http://localhost:3000/resetpassword">http://localhost:3000/resetpassword</a></p> <p>21:43 – The user back to login page to login.</p> <p>Task Finished</p>
Summary of key problems Observed and Question Guess	[2.1] The optimization could be done by giving the user the option to not display the password [2.2] Password not detected less than 8 characters
Other notes	None

Task A.3: test the usability of <http://localhost:3000/home>

User ID	User 3
Task ID	A.3
Overall success?	Yes
Clock Time	<p>Observations and user comments</p> <p>21:53 - Start Task A.3</p> <p>21:54 - User get in to <a href="http://localhost:3000/home">http://localhost:3000/home</a></p>  <p>21:54 - clicks “<a href="#">Financial Technology</a>” in left navigation bar one by one, find the first and second is dead button, and the third can only useful after click the forth. [Issue 3.1]</p>  <p>21:54 - clicks “<a href="#">Australia</a>” in left navigation bar one by one, find both of them is dead button. [issue3.1]</p>  <p>21:54 - clicks “<a href="#">Sign Up</a>” in left navigation bar one by one, find both of them is dead button. [issue3.1]</p>  <p>21:55 - User clicks “<a href="#">CNY</a>”, “<a href="#">JPY</a>”, “<a href="#">USD</a>” one by one, and chose and arrange different combinations. No problems found in selective exchange rate.</p> <p>Task Finished</p>

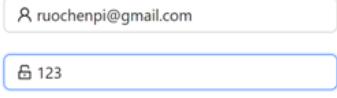
Summary of key problems Observed and Question Guess	[3.1] Dead button
Other notes	None

## VII. Unit test (version 3 final)

### A. Usability Testing.

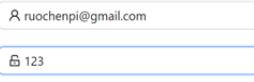
Task A.1: test the usability of <http://localhost:3000/register>

User ID	User 1
Task ID	A.1
Overall success?	Yes

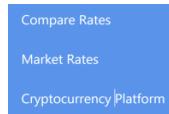
Clock Time	<p>Observations and user comments</p> <p>21:33 - Start Task A.1</p> <p>21:34 - User get in to <a href="http://localhost:3000/register">http://localhost:3000/register</a></p> <p>21:34 - clicks “  ” in Topmost navigation bar the page</p> <p>21:34 - user wants to type the login password.</p>  <p>21:34 - User types  to register.</p> <p>21:35 - User clicks “sign up”</p> <p>21:38 - User clicks <a href="#">Forgot Password</a></p> <p>Task Finished</p>
Summary of key problems Observed and Question Guess	NA
Other notes	None

Task A.2: test the usability of <http://localhost:3000/login> and <http://localhost:3000/resetpassword>

Task ID	User 2 A.2
---------	---------------

Overall success?	Yes
Clock Time	<p>Observations and user comments</p> <p>21:40 – Start Task A.2</p> <p>21:41 – User get in to <a href="http://localhost:3000/login">http://localhost:3000/login</a></p>  <p>21:41 – User types <input type="password" value="123"/> .</p> <p>21:42 – User clicks “ <a href="#">Forgot Password</a> ”</p> <p>21:43 – The user back to login page to login.</p> <p>Task Finished</p>
Summary of key problems Observed and Question Guess	
Other notes	None

Task A.3: test the usability of <http://localhost:3000/home>

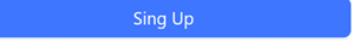
User ID	User 3
Task ID	A.3
Overall success?	Yes
Clock Time	<p>Observations and user comments</p> <p>21:53 - Start Task A.3</p> <p>21:54 - User get in to <a href="http://localhost:3000/home">http://localhost:3000/home</a></p>  <p>21:54 - clicks “<a href="#">Financial Technology</a>” in the left navigation bar one by one, find the first and second is dead button, and the third can only useful after click the forth.</p>  <p>21:54 - clicks “<a href="#">Australia</a>” in left navigation bar one by one.</p>  <p>21:54 - clicks “<a href="#">Sign Up</a>” in left navigation bar one by one.</p>  <p>21:55 - User clicks “<a href="#">CNY</a>” one by one, and chose and arrange different combinations. No problems found in selective exchange rate.</p> <p>Task Finished</p>
Summary of key problems Observed and Question Guess	
Other notes	None

## VIII. Integration testing(version 3 final)

### A. Compatibility testing

Repeat the usability testing in the unit testing phase, using Think-aloud. run on a different browser

Task A.1: test the usability of <http://localhost:3000/register>

User ID	User 1
Task ID	A.1
Overall success?	Yes
Clock Time	<p>Observations and user comments</p> <p>21:33 - Start Task A.1</p> <p>21:34 - User get in to <a href="http://localhost:3000/register">http://localhost:3000/register</a></p> <p>21:34 - clicks “” in Topmost navigation bar the page run to the block page and the url shown “<a href="http://localhost:3000/signup">http://localhost:3000/signup</a>”. [Issue 1.1]</p> <p>21:34 – user wants to type the login password, and finds “login password”</p> <p> [Issue 1.2] wrong typing</p> <p> ruochenpi@gmail.com</p> <p>21:34 - User types  to register. [Issue1.3]</p> <p>21:35 - User wants to click “sign up”, and finds “”, [issue 1.4]wrong typing</p> <p>21:38 - User want to click <a href="#">Forgot Password</a>, No jumps and no changes. [issue 1.5]</p> <p>Task Finished</p>

Summary of key problems Observed and Question Guess	
Other notes	None

Task A.2: test the usability of <http://localhost:3000/login> and <http://localhost:3000/resetpassword>

Task ID	User 2 A.2
Overall success?	Yes
Clock Time	<p>Observations and user comments</p> <p>21:40 – Start Task A.2</p> <p>21:41 – User get in to <a href="http://localhost:3000/login">http://localhost:3000/login</a></p>  <p>21:41 – User types  . [issue 2.1][issue 2.2]</p> <p>21:42 – User clicks “ <a href="#">Forgot Password</a> ”, page jump to <a href="http://localhost:3000/resetpassword">http://localhost:3000/resetpassword</a></p> <p>21:43 – The user back to login page to login.</p> <p>Task Finished</p>

Summary of key problems Observed and Question Guess	
Other notes	None

Task A.3: test the usability of <http://localhost:3000/home>

User ID Task ID	User 3 A.3
Overall success?	Yes
Clock Time	<p>Observations and user comments</p> <p>21:53 - Start Task A.3</p> <p>21:54 - User get in to <a href="http://localhost:3000/home">http://localhost:3000/home</a></p>  <p>21:54 - clicks “<a href="#">Financial Technology</a>” in left navigation bar one by one, find the first and second is dead button, and the third can only useful after click the forth. [Issue 3.1]</p>  <p>21:54 - clicks “<a href="#">Australia</a>” in left navigation bar one by one, find both of them is dead button. [issue3.1]</p>

	<p>Log In</p> <p>Sign Up</p> <p>21:54 - clicks “ <b>Sign Up</b> ” in left navigation bar one by one, find both of them is dead button. [issue3.1]</p>  <p>21:55 - User clicks “ <b>CNY</b> ” one by one, and chose and arrange different combinations. No problems found in selective exchange rate.</p> <p>Task Finished</p>
Summary of key problems Observed and Question Guess	[3.1] Dead button
Other notes	None

## IX. System test(version 3 local)

### A. Functional Testing II(version 3)

Task B.0.3: Register a new user, log in, forget the password, and explore other login interface buttons.

User ID	User 1
Task ID	B.0.3
Overall success?	No
Clock Time	NA
Summary of key problems Observed and Question Guess	[v3.F.0.1] join us page, Dead button "submit"
Other notes	None

Task B.1.3: Compare the value of the yen and the yuan, and calculate how many yen 300 rmb equals with the help of the web

User ID	User 1
Task ID	B.1
Overall success?	No
Clock Time	NA

	Selective exchange rate	Chinese yuan
	Selective exchange rate	Japanese Yen
Market reference 19.48800000		
Summary of key problems Observed and Question Guess	[v3.F.1.11Computer functions not implemented	
Other notes	None	

Task B.2.3: Select RMB and AUD to view a line chart of the last 7 days of RMB to AUD trend and find the date of the lowest point.

User ID	User 2
Task ID	B.2
Overall success?	No
Clock Time	NA

Selective exchange rate

Chinese yu...▼

Selective exchange rate

Japanese Y...▼

## historical rate

time	open	high	low	close
2023-05-05	19.41100	19.50700	19.35500	19.48800
2023-05-04	19.43600	19.49800	19.30400	19.40300
2023-05-03	19.71200	19.71900	19.45600	19.45600
2023-05-02	19.85800	19.90900	19.70500	19.72900
2023-05-01	19.68800	19.86900	19.68400	19.86400
2023-04-28	19.31300	19.71700	19.31300	19.68100
2023-04-27	19.25700	19.34300	19.23000	19.31900
2023-04-26	19.26900	19.31500	19.18800	19.27500
2023-04-25	19.42000	19.45800	19.21500	19.26600
2023-04-24	19.40700	19.51700	19.40400	19.43500

< 1 2 3 4 5 ... 10 > 10 / page ▼

Summary of key problems  
Observed and Question Guess

[v3.F.2.1] The minimum and maximum exchange rates for each of the five days are shown. However, the human eye is required to compare the lowest exchange rate for each of the five days.

Other notes

None

Task B.3.3: Use 500 RMB to exchange Yen through online bank and choose the bank with the lowest exchange rate.

User ID	User 3																																				
Task ID	B.3																																				
Overall success?	No																																				
Clock Time	<p>NA</p> <p><b>Find the Best Market Exchange Rate</b></p> <p>Select your preferred currency <input type="text" value="Japanese Yen"/></p> <table border="1"><thead><tr><th>bankno</th><th>Company Buys</th><th>Company Sells</th><th>Spot Exchange Sells</th><th>Spot Exchange Buys</th><th>Upddate Time</th></tr></thead><tbody><tr><td>BOC</td><td>4.9409</td><td>5.1448</td><td>5.1368</td><td>5.0993</td><td>2023-05-07 10:30:00</td></tr><tr><td>CCB</td><td>4.9629</td><td>5.1480</td><td>5.1480</td><td>5.1091</td><td>2023-05-07 18:27:06</td></tr><tr><td>ICBC</td><td>4.9593</td><td>5.1411</td><td>5.1411</td><td>5.1053</td><td>2023-05-06 04:07:05</td></tr><tr><td>ABC</td><td>4.9450</td><td>0.0000</td><td>5.1380</td><td>5.1020</td><td>2023-05-07 20:44:06</td></tr><tr><td>CEB</td><td>5.1453</td><td>4.9403</td><td>5.1043</td><td>5.1453</td><td>2023-05-06 07:29:00</td></tr></tbody></table> <p>Choose the lowest exchange rate, CEB</p>	bankno	Company Buys	Company Sells	Spot Exchange Sells	Spot Exchange Buys	Upddate Time	BOC	4.9409	5.1448	5.1368	5.0993	2023-05-07 10:30:00	CCB	4.9629	5.1480	5.1480	5.1091	2023-05-07 18:27:06	ICBC	4.9593	5.1411	5.1411	5.1053	2023-05-06 04:07:05	ABC	4.9450	0.0000	5.1380	5.1020	2023-05-07 20:44:06	CEB	5.1453	4.9403	5.1043	5.1453	2023-05-06 07:29:00
bankno	Company Buys	Company Sells	Spot Exchange Sells	Spot Exchange Buys	Upddate Time																																
BOC	4.9409	5.1448	5.1368	5.0993	2023-05-07 10:30:00																																
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ICBC	4.9593	5.1411	5.1411	5.1053	2023-05-06 04:07:05																																
ABC	4.9450	0.0000	5.1380	5.1020	2023-05-07 20:44:06																																
CEB	5.1453	4.9403	5.1043	5.1453	2023-05-06 07:29:00																																
Summary of key problems Observed and Question Guess	This function is perfect																																				

Other notes

None

## B. Performance Testing II (version 3 local)

1. Test the average response time of transactions(version 3 local)

<1 seconds response, excellent, grand A

<2 seconds response, good, grand B

<5 seconds response, poor, grand C

8 seconds response, beyond tolerable online, grand D

Page	Button	Grand
Open the web	NA	D
login	<input type="checkbox"/> Stay logged in	A
login	<a href="#">Forgot Password</a>	A
login	<a href="#" style="background-color: blue; color: white; padding: 5px 10px;">Sign Up</a>	B
login	<a href="#" style="background-color: blue; color: white; padding: 5px 10px;">Sign Up</a>	A
login	<a href="#" style="background-color: blue; color: white; padding: 5px 10px;">Login</a>	A
login	<a href="#">About us</a>	Dead button

login	<a href="#">Join us</a>	A
register	<a href="#">Sign Up</a>	B
register	<a href="#">Forgot Password</a>	Dead button
register	<a href="#">Resend confirmation email</a>	A
register	<a href="#">Sign Up</a>	Wrong page jump
register	<a href="#">Login</a>	A
register	<a href="#">Log In</a>	A
register	<a href="#">About us</a>	Dead button
register	<a href="#">Join us</a>	A
home	<a href="#">Compare Rates</a>	A
home	<a href="#">History Rate</a>	A
home	<a href="#">Cryptocurrency Platform</a>	A
home	<a href="#">Financial Technology</a>	A
home	<a href="#">Market Rates</a>	A

home		Dead button
home		A
home		A
Home-compare rate	Selective exchange rate 	A
home-compare rate	Selective exchange rate 	A
Home-history rate	Selective exchange rate 	A
Home-history rate	Selective exchange rate 	A
Home-finacial technology		A
home-market rate	Select your preferred currency 	A

## 2. Network performance testing

Show exactly how changes in bandwidth, latency, load, port affect the user's corresponding time

## 3. Load test(version 4)

Performance at a certain load level, including the number of users accessing the Web simultaneously at any given time, and the amount of online data processin.

## C. Security testing

- 1) Be able to prevent password temptation tools
- 2) Common means to prevent Cookie attacks
- 3) Sensitive data shall not be transmitted in plain text
- 4) Can prevent the file name guess and view html file content to obtain important information
- 5) It can ensure that the website will recover the tool within a given time after receiving it, and the loss of important data will not exceed 1 hour

## D. Compatibility testing II

Same result = S

Different result = D

System	Browser	Usability test	Function test
Windows 11	1、 Edge ;	S	S
Windows 11	2、 Safari ;	S	S
Windows 11	3、 Firefox ;	S	S
Windows	4、 Chrome	S	S
Linx	1、 Firefox	S	S
Linx	2、 Viper	S	S

It is concluded that the web development design is compatible and can work well on different browsers. Just modify the unit test and integration test

## X. System test(version 4 heroku)

### A. Performance Test II (version 4)

summary:

Load type	Goal-based curve (Auto adjusts concurrent users to reach a required rate of transactions per time interval.)
Load Start	5/14/2023 4:13:27 AM
Load Stopped at	5/14/2023 4:25:36 AM
Load Duration	00:12:09
Max Users	6
Load Injector Servers	2
Successes Sessions	158
Failures Sessions	0
Cpu Limited Sessions	0
Uncompleted Sessions	1
Total Sessions	159
Max Duration sec	2.416
Average	1.0094
STDDev	0.1998
Errors	0

## Execution Plan

Task Type	Task Name	URL	Status	
BrowserView	<a href="https://quiet-gorge-98295.herokuapp.com/">https://quiet-gorge-98295.herokuapp.com/</a>	<a href="https://quiet-gorge-98295.herokuapp.com/">https://quiet-gorge-98295.herokuapp.com/</a>	OK	^

Task Details		Profile Details	
Task Type	BrowserView	User Behavior	Normal User
Max Load Time	60 Sec	Minimum Delay (secs)	3
Browser Type	Chrome	Maximum Delay (secs)	6
URL	<a href="https://quiet-gorge-98295.herokuapp.com/">https://quiet-gorge-98295.herokuapp.com/</a>		
Ignore Certificate ...	No		
Response Time Ca...	Full Page Load		

Validation Result:  OK [View Details](#) 

[Validate](#)

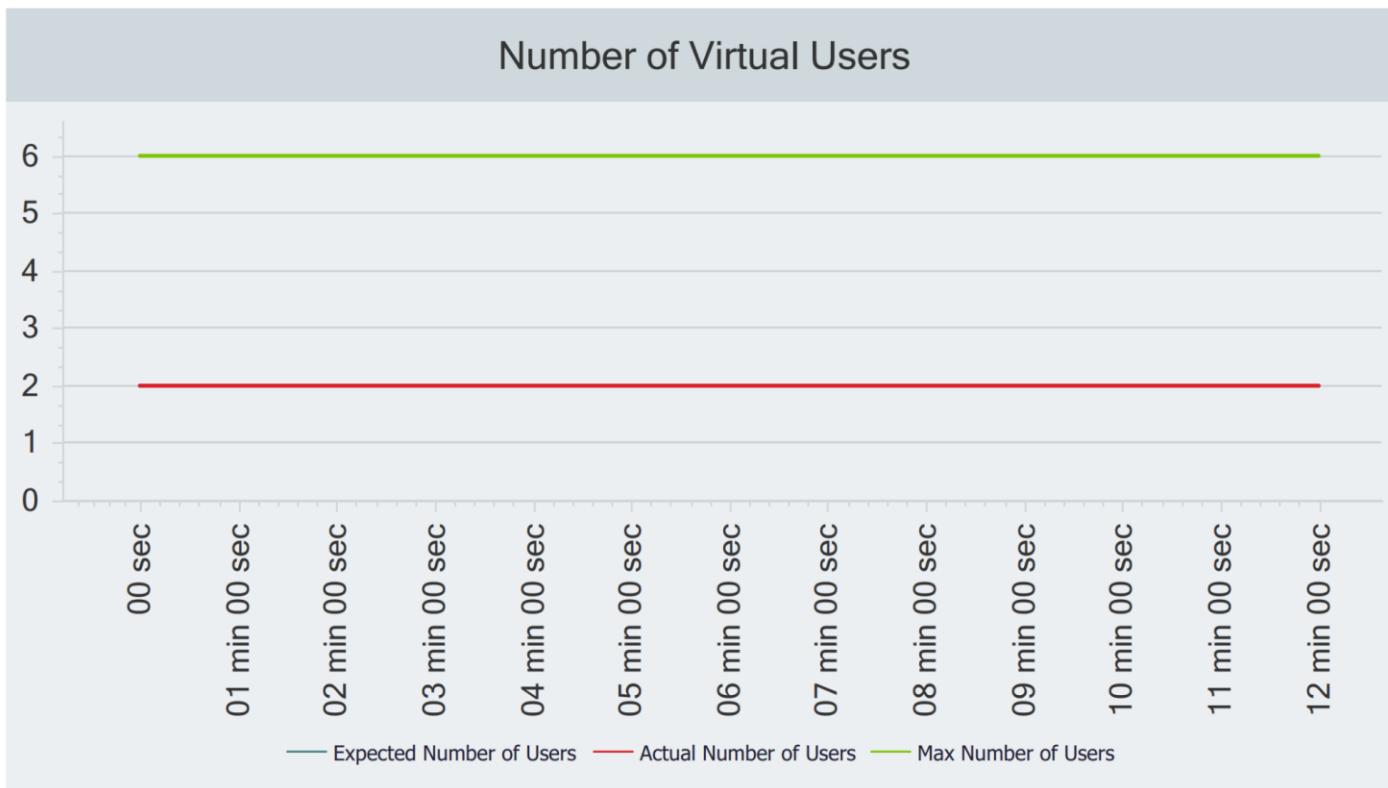
Transaction Goal per min	Start with	Maximum	Test Duration	Adjustment Rate
10	2 users	6 users	12 min	3
Recommended: 2	Recommended: 6	Recommended: 12	Recommended: 12	Recommended: 3

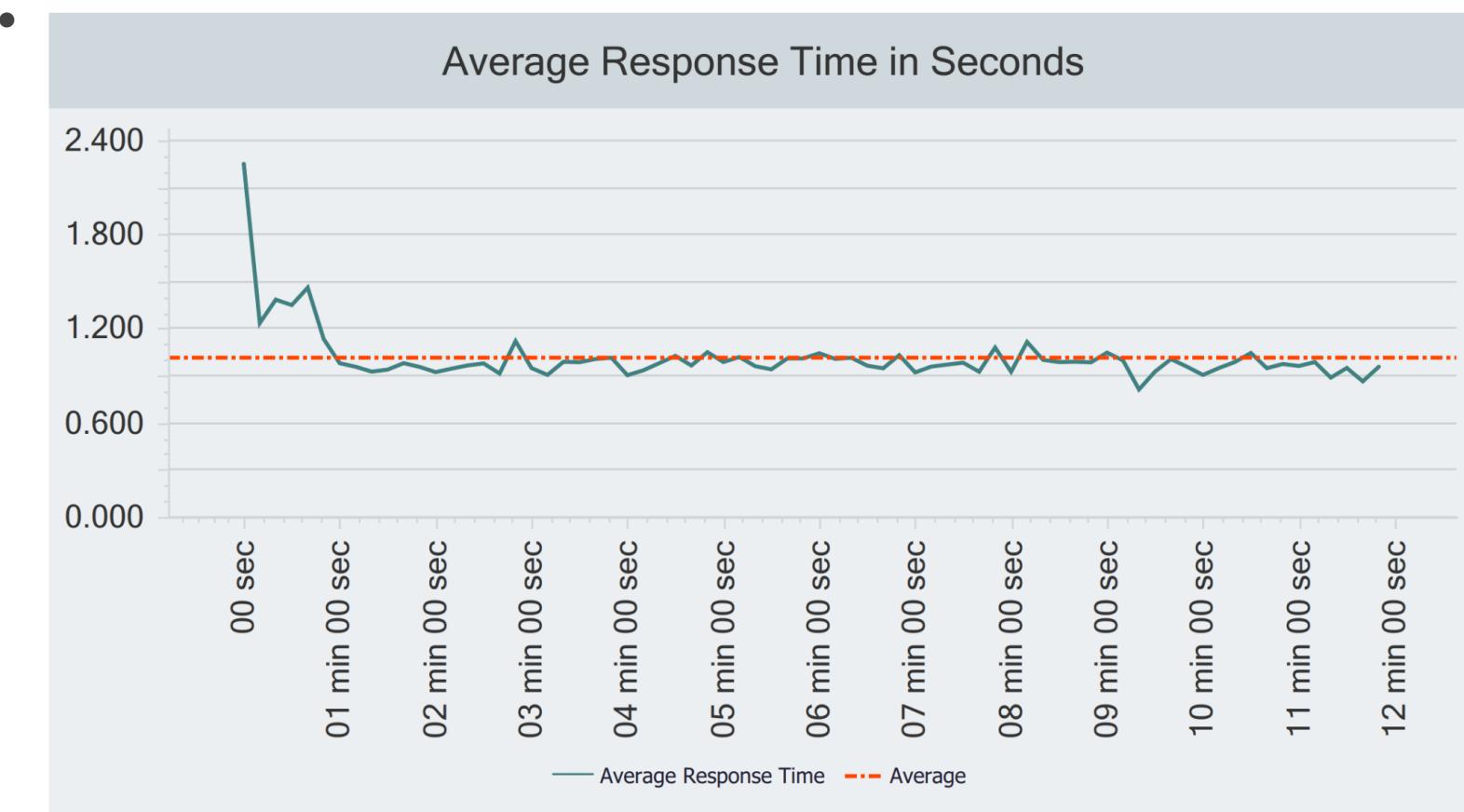
 **6**  
 Maximum Virtual Users

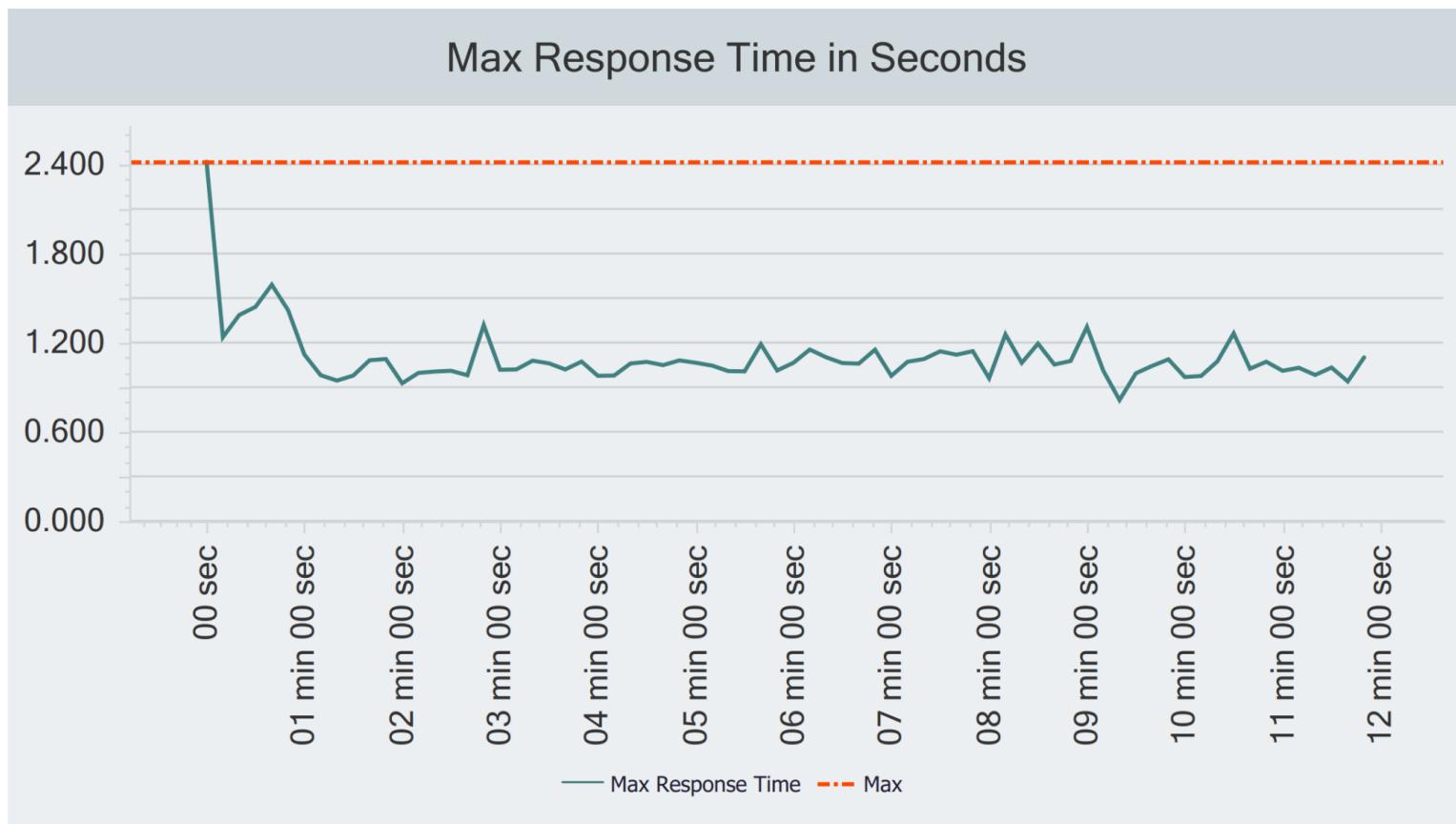
 **12 min**  
 Test Duration

 **102**  
 Estimated Sessions

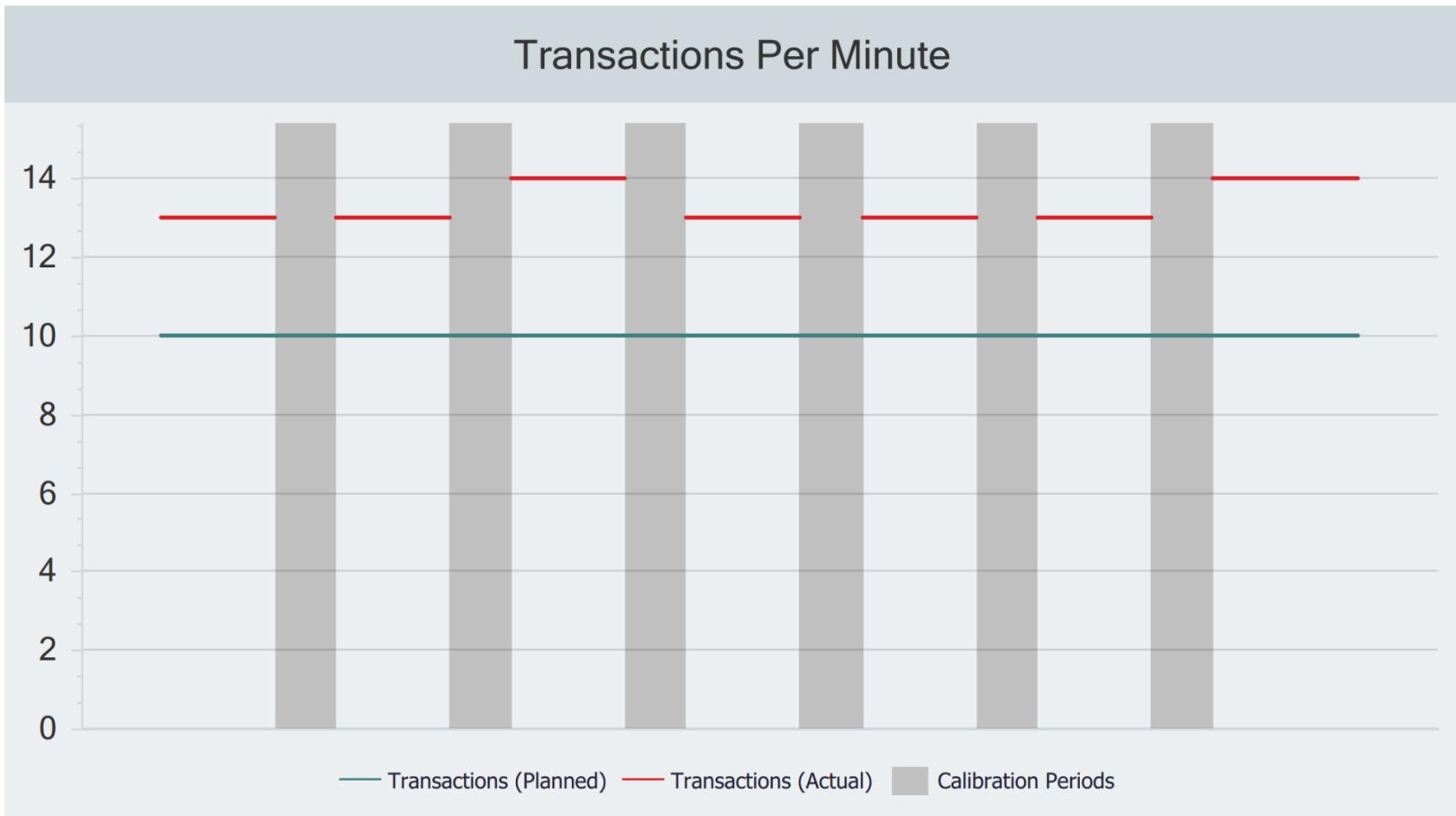
Enable Limit Sessions



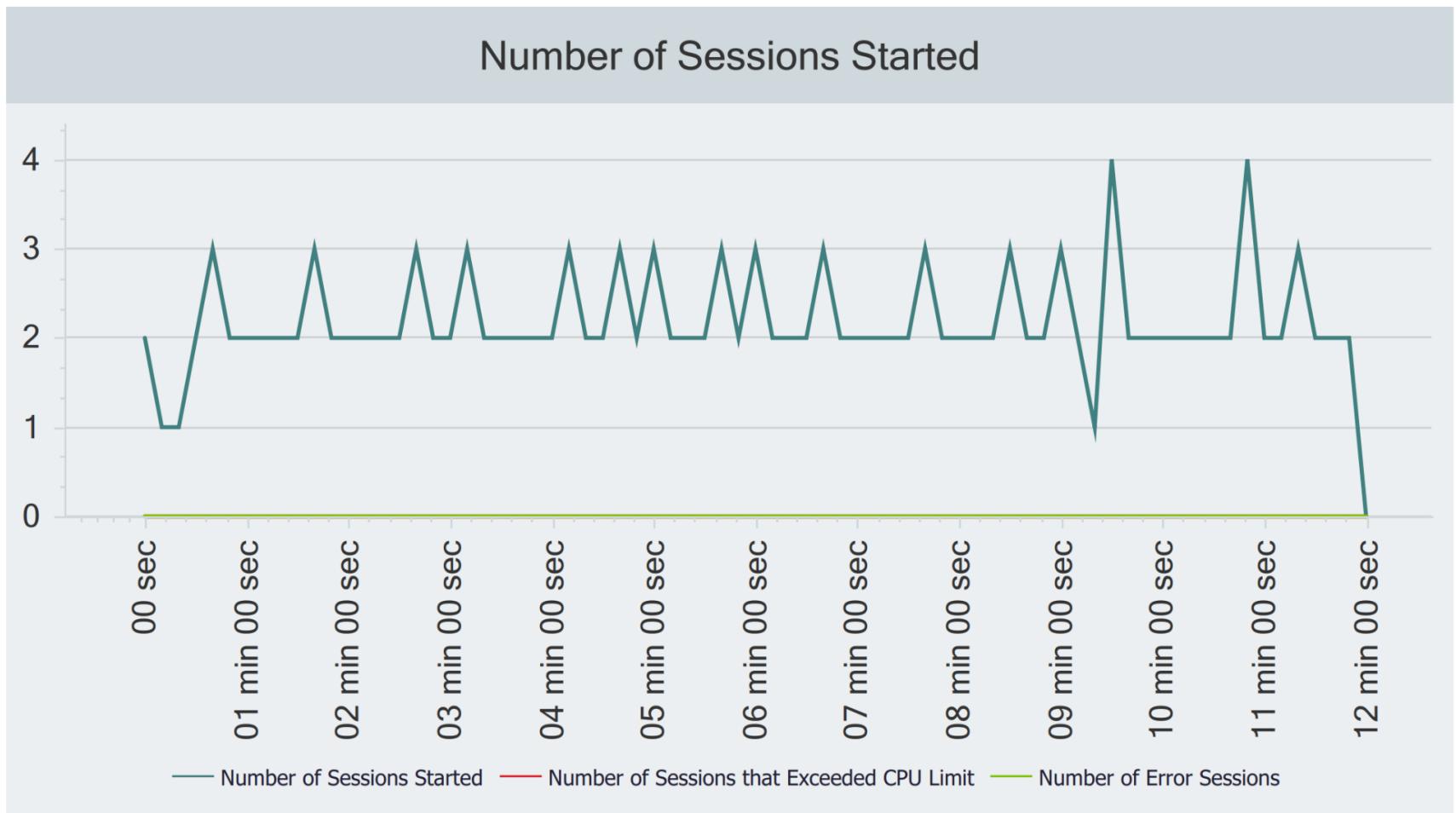




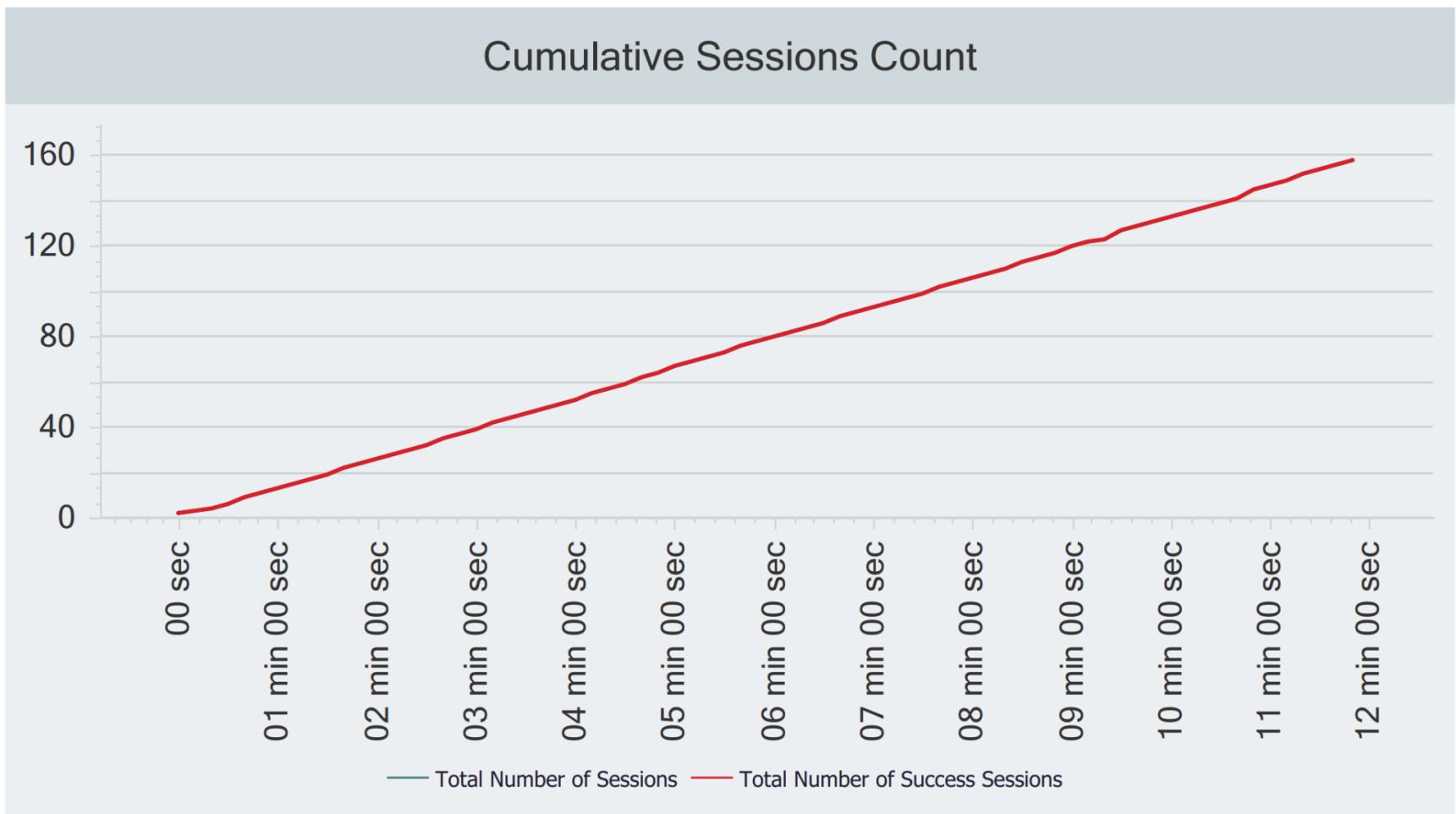
- Transactions Per Minute



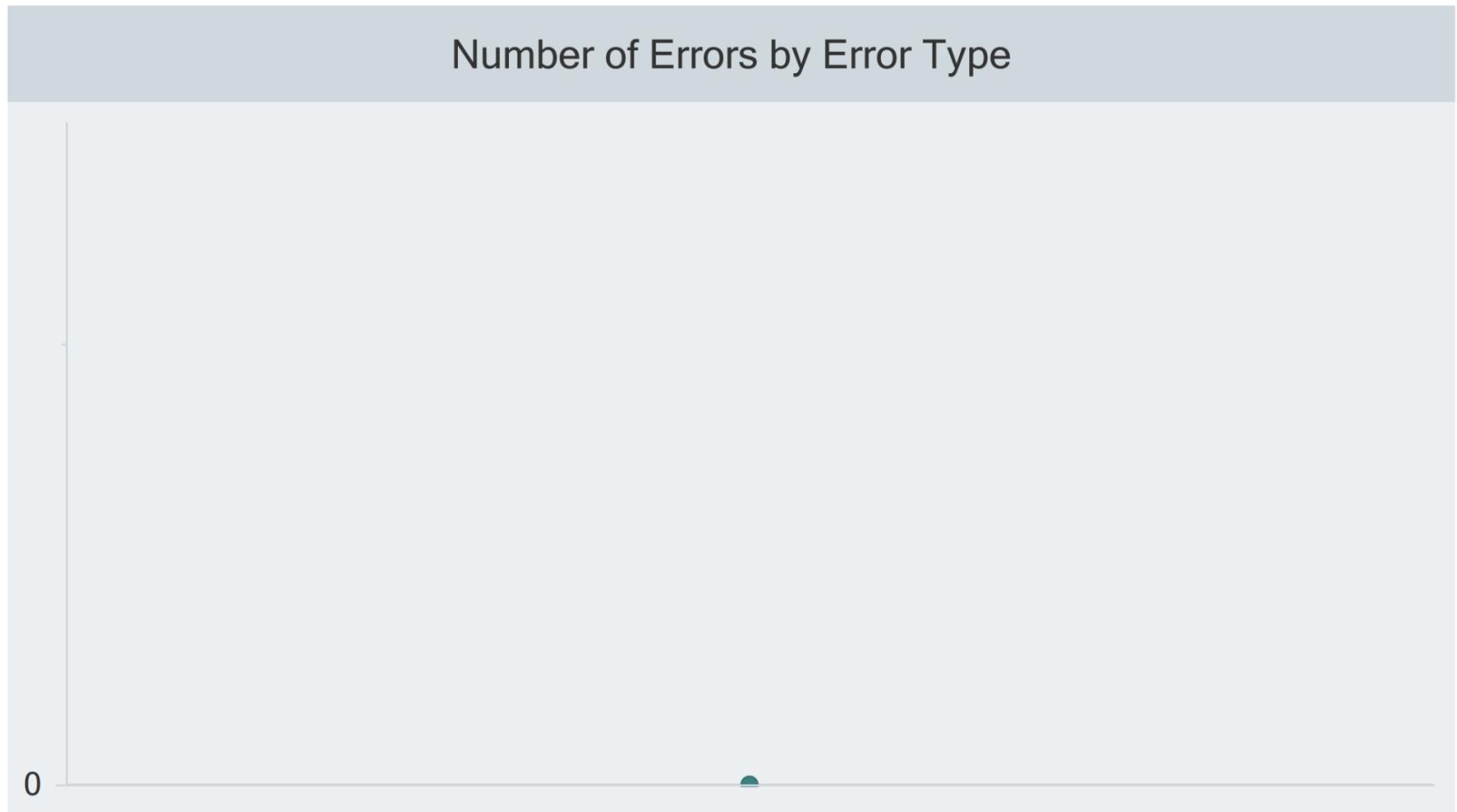
- Number of Sessions Started



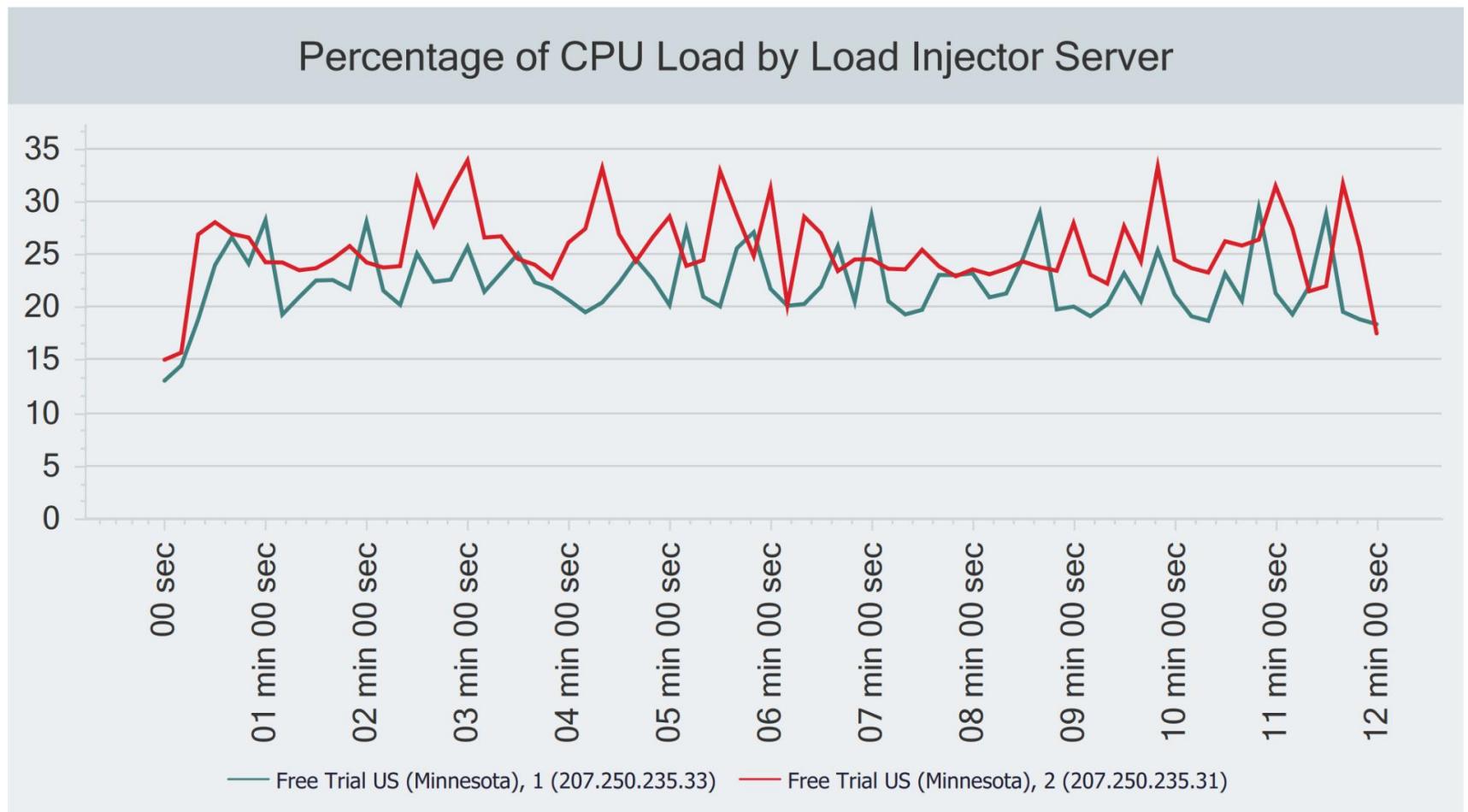
- Cumulative Number of Sessions Started



- Number of Errors by Error Type



- Virtual Load Injectors



## B. Security Test (version 4)

### Summary

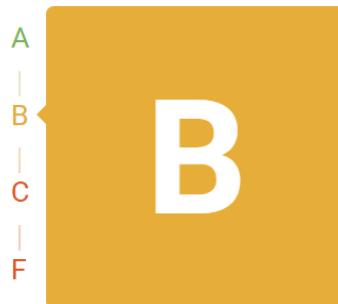
Test name	content	result
Website security and compliance testing	Check WEB applications on the sixth floor, website configuration requirements. Enhance website security, improve WEB server resiliency and enhance applicable privacy and compliance requirements.	B
Dark Web Exposure and Phishing Detection Testing	Perform a comprehensive dark web snapshot, Pastebin leaks, ongoing phishing campaigns, domain name robocalls (web and typo robocalls), and even fake accounts that tamper with your identity in social networks.	PASS
SSL Security and Compliance Testing	Tests not only the ubiquitous HTTPS, but also any form of TLS encryption, including email servers and SSL VPNs. for email servers, the test will also check that SPF, DMARC and DKIM are properly configured. the test scrutinizes all currently known SSL / TLS implementations or encryption vulnerabilities, including Heartbleed, ROBOT, BEAST, POODLE and many other flaws that could result in the interception or decryption of data in transit.	A

### 1. Website security and compliance testing

Check WEB applications on the sixth floor, website configuration requirements. Enhance website security, improve WEB server resiliency and enhance applicable privacy and compliance requirements.

## Your final score

Tested on: May 21st, 2023 03:57:09 GMT+8  
Server IP: 54.243.238.66  
Reverse DNS: ec2-54-243-238-66.compute-1.amazonaws.com  
Location: Ashburn   
Client: Desktop version



## Discovered Subdomains

Hostname	Protocol/Port	Certificate(s)	Tested on	Compliances	Grade
herokuapp.com	<a href="#">HTTP / 80</a>	No SSL certificate found	Dec 6th, 2019 20:32:41 GMT+8	<a href="#">PCI DSS</a>	

## Web Server Security Test

### HTTP RESPONSE

200 OK

### HTTP VERSIONS

HTTP/1.0  
HTTP/1.1  
HTTP/2

### NPN i

N/A

### ALPN i

N/A

### CONTENT ENCODING

None

### SERVER SIGNATURE

Cowboy

### WAF i

No WAF detected

### LOCATION

Amazon.com, Inc.

### HTTP METHODS ENABLED

GET HEAD OPTIONS

## Web Software Security Test

Web Software Found

1

Web Software Outdated

0

Web Software Vulnerabilities

0

### Fingerprinted CMS & Vulnerabilities i

No CMS were fingerprinted on the website.

Information

### Fingerprinted CMS Components & Vulnerabilities i

React 18.2.0

The fingerprinted component version is up2date, no security issues were found.

## GDPR Compliance Test

If the website processes or stores personal data of the EU residents, the following requirements of [EU GDPR](#) may apply:

### PRIVACY POLICY i

Privacy Policy was not found on the website or is not easily accessible.

Misconfiguration or weakness

### WEBSITE SECURITY i

No publicly known vulnerabilities were found in the website CMS or its components.

Good configuration

### TLS ENCRYPTION i

HTTPS encryption is present on the web server.

Good configuration

### COOKIE PROTECTION i

No cookies with personal or tracking information seem to be sent.

Information

### COOKIE DISCLAIMER i

No third-party cookies or cookies with tracking information seem to be sent.

Information

## PCI DSS Compliance Test

If the website falls into a CDE (Cardholder Data Environment) scope, the following Requirements of [PCI DSS](#) may apply:

### REQUIREMENT 6.2 i

Website CMS and its components seem to be up2date. Implement continuous monitoring for new security updates.

Good configuration

### REQUIREMENT 6.5 i

No publicly known vulnerabilities seem to be present in the fingerprinted versions the website CMS and its components.

Good configuration

### REQUIREMENT 6.6 i

No WAF was detected on the website. Implement a WAF to protect the website against common web attacks.

Misconfiguration or weakness

# HTTP Headers Security

Some HTTP headers related to security and privacy are missing or misconfigured.

Misconfiguration or weakness

## MISSING REQUIRED HTTP HEADERS [i](#)

Strict-Transport-Security [i](#) X-Frame-Options [i](#) X-Content-Type-Options [i](#)

## MISSING OPTIONAL HTTP HEADERS [i](#)

Permissions-Policy [i](#)

## SERVER [i](#)

Web server does not disclose its version.

Good configuration

### Server

Server: Cowboy

## X-POWERED-BY [i](#)

Web server does not disclose its version.

Good configuration

### X-Powered-By

X-Powered-By: Express

## ACCESS-CONTROL-ALLOW-ORIGIN [i](#)

The header is properly set.

Good configuration

### Access-Control-Allow-Origin

Access-Control-Allow-Origin: \*

## Content Security Policy Test

### CONTENT-SECURITY-POLICY i

The header was not sent by the server.

Misconfiguration or weakness

### CONTENT-SECURITY-POLICY-REPORT-ONLY i

The header was not sent by the server.

Information

## Cookies Privacy and Security Analysis

No cookies were sent by the web application.

Good configuration

## External Content Privacy and Security Analysis

No external content found on tested page.

Information

## 2. Dark Web Exposure and Phishing Detection Testing

Perform a comprehensive dark web snapshot, Pastebin leaks, ongoing phishing campaigns, domain name robocalls (web and typo robocalls), and even fake accounts that tamper with your identity in social networks.

### Dark Web Exposure

No mentions (e.g. stolen credentials) detected on the Dark Web

### Potential Phishing Websites and Pages

No mentions (e.g. stolen credentials) detected on the Dark Web

### Potential Cybersquatting Domain Names

#### DETAILS

- i Domains appear to be registered or operated by [quiet-gorge-98295.herokuapp.com](#)
- ⚠ Domains do not appear to be registered or operated by [quiet-gorge-98295.herokuapp.com](#)

Potential Squatting Domain	Action	Server	Location / Server IP	Domain Registry	Created
<span style="color: #c00000;">⚠</span> <a href="#">quiet-gorge-98295.herokuapp.co</a>			 185.107.56.192	.CO Internet S.A.S.	10.09.2018

## Potential Typosquatting Domain Names

### DETAILS

- i Domains appear to be registered or operated by [quiet-gorge-98295.herokuapp.com](#)
- ! Domains do not appear to be registered or operated by [quiet-gorge-98295.herokuapp.com](#)

Potential Squatting Domain	Action	Server	Location / Server IP	Domain Registry	Created
<span style="color: #e67e22;">!</span> <a href="#">quiet-gorge-98295.herokuapp.com</a>			45.33.2.79	VeriSign Global Registry Services	07.01.2014
<span style="color: #e67e22;">!</span> <a href="#">quiet-gorge-98295.herokuapp.com</a>			37.48.65.144	VeriSign Global Registry Services	14.10.2013
<span style="color: #e67e22;">!</span> <a href="#">quiet-gorge-98295.herokuup.com</a>			185.107.56.59	VeriSign Global Registry Services	08.11.2016
<span style="color: #e67e22;">!</span> <a href="#">quiet-gorge-98295.herokuapp.com</a>			45.33.2.79	VeriSign Global Registry Services	02.01.2021
<span style="color: #e67e22;">!</span> <a href="#">quiet-gorge-98295.herkouapp.com</a>			216.245.214.85	VeriSign Global Registry Services	01.08.2019
<span style="color: #e67e22;">!</span> <a href="#">quiet-gorge-98295.herokaupp.com</a>			45.33.23.183	VeriSign Global Registry Services	13.09.2012
<span style="color: #e67e22;">!</span> <a href="#">quiet-gorge-98295.herokuspp.com</a>			77.247.183.154	VeriSign Global Registry Services	04.04.2020
<span style="color: #e67e22;">!</span> <a href="#">quietgorg98295.herokuapp.com</a>			45.33.2.79	VeriSign Global Registry Services	07.01.2014
<span style="color: #e67e22;">!</span> <a href="#">quietgorge98295.herokuapp.com</a>			95.211.219.67	VeriSign Global Registry Services	31.07.2013
<span style="color: #e67e22;">!</span> <a href="#">quietgorge98295.herokuapp.com</a>			173.255.194.134	VeriSign Global Registry Services	25.04.2017
<span style="color: #e67e22;">!</span> <a href="#">quietgorge98295.herokaupp.com</a>			96.126.123.244	VeriSign Global Registry Services	13.09.2012

## Potential Fake Social Media Accounts

No squatted social network accounts found

### 3. SSL Security and Compliance Testing

Tests not only the ubiquitous HTTPS, but also any form of TLS encryption, including email servers and SSL VPNs. for email servers, the test will also check that SPF, DMARC and DKIM are properly configured. the test scrutinizes all currently known SSL / TLS implementations or encryption vulnerabilities, including Heartbleed, ROBOT, BEAST, POODLE and many other flaws that could result in the interception or decryption of data in transit.

Your final score

Date/Time: May 21st, 2023 04:26:21 GMT+8

Source IP/Port: 54.243.238.66:443 

Type: HTTPS



Hostname	Protocol/Port	Certificate(s)	Tested on	Compliances	Grade
herokuapp.com	<a href="#">HTTPS / 443</a>	No SSL certificate found	Nov 22nd, 2020 19:54:05 GMT+8	<a href="#">PCI DSS</a>	<a href="#">A+</a>

### Discovered Subdomains

## SSL Certificate Analysis

### RSA CERTIFICATE INFORMATION

<b>Issuer</b>	Amazon RSA 2048 M01
<b>Trusted</b>	Yes
<b>Common Name</b>	*.herokuapp.com
<b>Key Type/Size</b>	RSA 2048 bits
<b>Serial Number</b>	20263961756361839687560653532859997791
<b>Signature Algorithm</b>	sha256WithRSAEncryption
<b>Subject Alternative Names</b>	DNS:*.herokuapp.com
<b>Transparency</b>	Yes
<b>Validation Level</b>	DV
<b>CRL</b>	<a href="http://crl.r2m01.amazontrust.com/r2m01.crl">http://crl.r2m01.amazontrust.com/r2m01.crl</a>
<b>OCSP</b>	<a href="http://ocsp.r2m01.amazontrust.com">http://ocsp.r2m01.amazontrust.com</a>
<b>OCSP Must-Staple</b>	No
<b>Supports OCSP Stapling</b>	No
<b>Valid From</b>	April 02, 2023 00:00 CET
<b>Valid To</b>	April 30, 2024 23:59 CET

## CERTIFICATE CHAIN

<p> Root CA <b>Amazon Root CA 1</b></p> <p>Type/Size RSA 2048 bits</p> <p>Serial Number 0x066C9FCF99BF8C0A39E2F0788A43E696365BCA</p> <p>Signature sha256WithRSAEncryption</p> <p>SHA256 8ecde6884f3d87b112...4fe1cb97c6ae98196e</p> <p>PIN ++MBgDH5WGvL9Bcn5B...f50+NyoXuWtQdX1al=</p> <p>Expires in 5,355 days</p> <p>Comment <b>Self-signed</b></p>	<p> Intermediate CA <b>Amazon RSA 2048 M01</b></p> <p>Type/Size RSA 2048 bits</p> <p>Serial Number 0x077312380B9D6688A33B1ED9BF9CCDA68E0E0F</p> <p>Signature sha256WithRSAEncryption</p> <p>SHA256 5338ebec8fb2ac6099...7ac8f6f1361f484b33</p> <p>PIN DxH4tt40L+eduF6szp...ZhBd+pJ9wbHIQ2fuw=</p> <p>Expires in 2,652 days</p> <p>Comment -</p>
<p> Server certificate <b>*.herokuapp.com</b></p> <p>Type/Size RSA 2048 bits</p> <p>Serial Number 20263961756361839687560653532859997791</p> <p>Signature sha256WithRSAEncryption</p> <p>SHA256 b73697a54d1a54e771...f5f638f987f0ff3483</p> <p>PIN 1dxt48cOUWg3KQJiKc...30jKSamqYXRjsBu54=</p> <p>Expires in 346 days</p> <p>Comment -</p>	<p> Root CA <b>Starfield Services Root Certificate Authority - G2</b></p> <p>Type/Size RSA 2048 bits</p> <p>Serial Number 0</p> <p>Signature sha256WithRSAEncryption</p> <p>SHA256 568d6905a2c88708a4...e5290fcbae63edab5</p> <p>PIN KwccWaCgrnaw6tsrrS...NgG2MMLq8GE6+oP5I=</p> <p>Expires in 5,339 days</p> <p>Comment <b>Self-signed</b></p>
<p> Intermediate CA <b>Amazon Root CA 1</b></p> <p>Type/Size RSA 2048 bits</p> <p>Serial Number 0x067F944A2A27CDF3FAC2AE2B01F908EEB9C4C6</p> <p>Signature sha256WithRSAEncryption</p> <p>SHA256 87dcfd4dc74640a322c...544986b4850bc72706</p> <p>PIN ++MBgDH5WGvL9Bcn5B...f50+NyoXuWtQdX1al=</p> <p>Expires in 5,338 days</p> <p>Comment -</p>	<p> Root CA <b>Starfield Technologies, Inc./Starfield Class 2 Certification Authority</b></p> <p>Type/Size RSA 2048 bits</p> <p>Serial Number 0</p> <p>Signature sha1WithRSAEncryption</p> <p>SHA256 1465fa205397b876fa...c2c8677521fb5fb658</p> <p>PIN FfFKxFycfalz00eRZO...OK6FgYPwhBDqgqxLQ=</p> <p>Expires in 4,058 days</p> <p>Comment <b>Self-signed</b></p>
<p> Intermediate CA <b>Starfield Services Root Certificate Authority - G2</b></p> <p>Type/Size RSA 2048 bits</p> <p>Serial Number 12037640545166866303</p> <p>Signature sha256WithRSAEncryption</p> <p>SHA256 28689b30e4c306aab5...482ca84bcd1ecac996</p> <p>PIN KwccWaCgrnaw6tsrrS...NgG2MMLq8GE6+oP5I=</p> <p>Expires in 4,057 days</p> <p>Comment -</p>	

# PCI DSS Compliance Test

Reference: [PCI DSS 3.2.1](#), Requirements 2.3 and 4.1

## CERTIFICATES ARE TRUSTED i

All the certificates provided by the server are trusted.

Good configuration

## SUPPORTED CIPHERS

List of all cipher suites supported by the server:

### TLSV1.2

TLS\_ECDHE\_RSA\_WITH\_AES\_128\_GCM\_SHA256  
TLS\_ECDHE\_RSA\_WITH\_AES\_128\_CBC\_SHA256  
TLS\_ECDHE\_RSA\_WITH\_AES\_128\_CBC\_SHA  
TLS\_ECDHE\_RSA\_WITH\_AES\_256\_GCM\_SHA384  
TLS\_ECDHE\_RSA\_WITH\_AES\_256\_CBC\_SHA384  
TLS\_ECDHE\_RSA\_WITH\_AES\_256\_CBC\_SHA  
TLS\_RSA\_WITH\_AES\_128\_GCM\_SHA256  
TLS\_RSA\_WITH\_AES\_128\_CBC\_SHA256  
TLS\_RSA\_WITH\_AES\_128\_CBC\_SHA  
TLS\_RSA\_WITH\_AES\_256\_GCM\_SHA384  
TLS\_RSA\_WITH\_AES\_256\_CBC\_SHA256  
TLS\_RSA\_WITH\_AES\_256\_CBC\_SHA

Good configuration

## SUPPORTED PROTOCOLS

List of all SSL/TLS protocols supported by the server:

TLSv1.2

Good configuration

## SUPPORTED ELLIPTIC CURVES

List of all elliptic curves supported by the server:

P-256 (prime256v1) (256 bits)

Good configuration

P-384 (secp384r1) (384 bits)

Good configuration

## POODLE OVER TLS i

The server is not vulnerable to POODLE over TLS.

Not vulnerable

## GOLDENDOODLE i

The server is not vulnerable to GOLDENDOODLE.

Not vulnerable

## ZOMBIE POODLE i

The server is not vulnerable to Zombie POODLE.

Not vulnerable

## SLEEPING POODLE i

The server is not vulnerable to Sleeping POODLE.

Not vulnerable

## 0-LENGTH OPENSSL i

The server is not vulnerable 0-Length OpenSSL.

Not vulnerable

## CVE-2016-2107 i

The server is not vulnerable to CVE-2016-2107.

Not vulnerable

**SERVER DOES NOT SUPPORT CLIENT-INITIATED INSECURE RENEGOTIATION** 

The server does not support client-initiated insecure renegotiation.

Good configuration

**ROBOT** 

The server is not vulnerable to ROBOT vulnerability.

Not vulnerable

**HEARTBLEED** 

The server version of OpenSSL is not vulnerable to Heartbleed attack.

Not vulnerable

**CVE-2014-0224** 

The server is not vulnerable to CCS Injection.

Not vulnerable

**CVE-2021-3449** 

The server is not vulnerable to CVE-2021-3449 (OpenSSL Maliciously Crafted Renegotiation Vulnerability).

Not vulnerable

## HIPAA and NIST Compliance Test

Reference: HIPAA, Security Rule (Ref. NIST SP 800-52: "Guidelines for the Selection and Use of TLS Implementations")

X.509 CERTIFICATES ARE IN VERSION 3

All the X509 certificates provided by the server are in version 3.

## Good configuration

## SERVER DOES NOT SUPPORT OCSP STAPLING

The server is not configured to support OCSP stapling for its RSA certificate that allows better verification of the certificate validation status. [Reconfigure or upgrade](#) your web server to enable OCSP stapling.

## Non-compliant with NIST guidelines

## SUPPORTED CIPHERS

## List of all cipher suites supported by the server:

TLSV1.2

TLS_ECDHE_RSA_WITH_AES_128_GCM_SHA256	Good configuration
TLS_ECDHE_RSA_WITH_AES_128_CBC_SHA256	Good configuration
TLS_ECDHE_RSA_WITH_AES_128_CBC_SHA	Good configuration
TLS_ECDHE_RSA_WITH_AES_256_GCM_SHA384	Good configuration
TLS_ECDHE_RSA_WITH_AES_256_CBC_SHA384	Good configuration
TLS_ECDHE_RSA_WITH_AES_256_CBC_SHA	Good configuration
TLS_RSA_WITH_AES_128_GCM_SHA256	Good configuration
TLS_RSA_WITH_AES_128_CBC_SHA256	Good configuration
TLS_RSA_WITH_AES_128_CBC_SHA	Good configuration
TLS_RSA_WITH_AES_256_GCM_SHA384	Good configuration
TLS_RSA_WITH_AES_256_CBC_SHA256	Good configuration
TLS_RSA_WITH_AES_256_CBC_SHA	Good configuration

## SUPPORTED PROTOCOLS

---

List of all SSL/TLS protocols supported by the server:

TLSv1.2

Good configuration

## SUPPORTED ELLIPTIC CURVES

---

List of all elliptic curves supported by the server:

P-256 (prime256v1) (256 bits)

Good configuration

P-384 (secp384r1) (384 bits)

Good configuration

## SERVER DOES NOT SUPPORT TLSV1.3

---

Consider enabling support of TLSv1.3 protocol that is considered to be the most secure and stable version of TLS protocol.

Information

## EC\_POINT\_FORMAT EXTENSION

---

The server supports the EC\_POINT\_FORMAT TLS extension.

Good configuration

# Industry Best Practices Test

## DNSCAA i

This domain does not have a Certification Authority Authorization (CAA) record.

Information

## CERTIFICATES DO NOT PROVIDE EV

The RSA certificate provided is NOT an Extended Validation (EV) certificate.

Information

## SERVER DOES NOT SUPPORT TLSV1.3

Consider enabling support of TLSv1.3 protocol that is considered to be the most secure and stable version of TLS protocol.

Misconfiguration or weakness

## SERVER HAS CIPHER PREFERENCE i

The server enforces cipher suites preference.

Good configuration

## SERVER PREFERRED CIPHER SUITES

Preferred cipher suite for each protocol supported (except SSLv2). Expected configuration are ciphers allowed by PCI DSS and enabling PFS:

TLSv1.2 TLS\_ECDHE\_RSA\_WITH\_AES\_128\_GCM\_SHA256

Good configuration

## SERVER PREFERS CIPHER SUITES PROVIDING PFS i

For TLS family of protocols, the server prefers cipher suite(s) providing Perfect Forward Secrecy (PFS).

Good configuration

## HTTP SITE DOES NOT REDIRECT i

The HTTP version of the website does not redirect to the HTTPS version. We advise to enable redirection.

Misconfiguration or weakness

## SERVER DOES NOT PROVIDE HSTS i

The server does not enforce HTTP Strict Transport Security. We advise to enable it to enforce the user to browse the website in HTTPS.

Misconfiguration or weakness

#### **SERVER DOES NOT SUPPORT CLIENT-INITIATED SECURE RENEGOTIATION** ⓘ

The server does not support client-initiated secure renegotiation.

Good configuration

#### **SERVER-INITIATED SECURE RENEGOTIATION**

The server supports secure server-initiated renegotiation.

Good configuration

#### **SERVER DOES NOT SUPPORT TLS COMPRESSION**

TLS compression is not supported by the server.

Good configuration

#### **External Content Privacy and Security Analysis**

No external content found on tested page.

Information

## XI. Version test notes

Version 1- UI completed

Version 2 - function completed

Version 3 - front-end finished

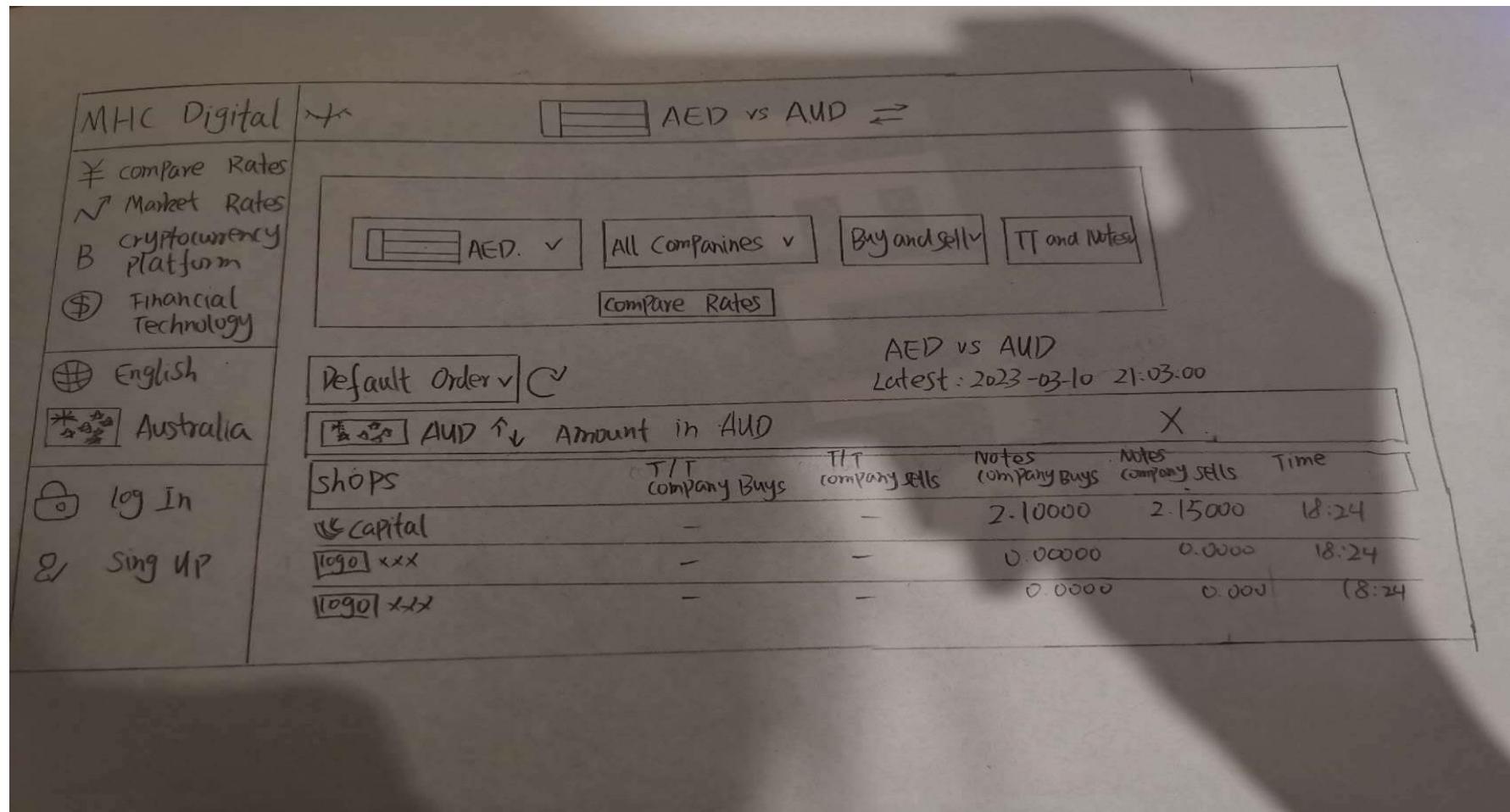
Version 4 - back-end finished

		Version 1	Version 2	Version 3	Version 4
Unit test	Functional Testing	√	√		

	Usability Testing.	√	√	√	
integration testing	Interface testing		√		
	Compatibility testing		√	√	
system testing	Functional Testing II			√	
	Performance Testing II			√	√
	Security testing				√
	Compatibility testing II			√	

## Appendix 2

### I. Paper prototypes



≡ Login to MHC DIGITAL	
MHC DIGITAL	<a href="#">Log In</a> <a href="#">Sign Up</a>
<a href="#"> Compare Rates</a>	<input type="text" value="Login Email"/>
<a href="#"> Market Rates</a>	<input type="password" value="Password"/> <input type="checkbox"/>
<a href="#"> Crypto currency</a>	<input checked="" type="checkbox"/> Stay logged in
<a href="#"> English</a>	<input type="button" value="Log In"/>
<a href="#"> Japan</a>	<a href="#">Forgot Password?</a>   <a href="#">No sign up confirmation email?</a>
<a href="#"> Korea</a>	<a href="#">Don't have an account?</a>
<a href="#"> Log In</a>	<input type="button" value="Sign Up"/>
<a href="#"> Sign Up</a>	

### Register Account

Log In

Sign Up

Email address

Login Password (8 to 16 characters)

Sign Up

Forgot Password | No sign up confirmation email?

Already Signed Up?

Log in to your account

MHC DIGITAL

[Resend Confirmation Email](#)

[Log in](#) [Sign up](#)

Please provide your e-mail to receive the email

[About us](#) | [Join us](#) | [Contact](#) | [FAQs](#)

MHC DIGITAL

= reset Password

Log in sign up

Forgot Password? No worry! Simply provide your logon email.

Your log in email address

Submit

About us | Join us | Contact us | FAQS |

MHC DIGITAL

## AUD Market Rates

[Log in](#) [Sign up](#)

Latest: 2023-03-10 23:59

AUD Amount in AUD

X

currencies

Market Rate

CNY

1.77

BRL

1.33

CAD

1.22

EUR

1.44

JPY

1.66

KRW

1.55

USD

1.88

MHC DIGITAL

Cryptocurrency Platform

Cryptocurrency Market Rates

Latest: 2023-03-10 23:59

AUD Amount in AUD

X

Cryptocurrency	Market Rate
① BTC	\$ 200000
② ETH	\$ 1422
③ USDT	\$ 1
④ BNB	\$ 274
⑤ XRP	\$ 0.3706
⑥ ADA	\$ 0.316
⑦ MATIC	\$ 1.02
⑧ DOGE	\$ 0.06
⑨ BUSD	\$ 1.00
⑩ SOL	\$ 17.77

## II. UI

MHC Digital X

... Market Rates

Log In Sign Up

Compare Rates

Market Rates

Cryptocurrency Platform

Financial Technology

English

Australia

Log In

Sign Up

Wondershare  
Mo Dao

CNH

Currencies	Market Rate
AUD	4.5898
BRL	1.3096
CAD	5.0269
CHF	7.4284
EUR	7.4041
GBP	8.4153
HKD	0.8753
IDR	0.0004
INR	0.0827
JPY	0.0519
KRW	0.0053



← Compare Rates

↖ Market Rates

Ⓑ Cryptocurrency Platform

฿ Financial Technology

🌐 English

🇦🇺 Australia

➡ Log In

👤+ Sign Up

## Find the Best Exchange Rate

Select the country to compare



CNH

Advanced Options

Compare Rates

# Login to MHC Digital

[Sign Up](#)

[Log in](#)

Account

Password

Stay logged in

[Forgot Password](#)

[Log In](#)

[Don't have an account?](#)

[Sign Up](#)

[About us](#)

[Join us](#)

[Contact us](#)

[FAQS](#)

## Resend Confirmation Email

[Sign Up](#)[Log in](#)

Please enter your email address, we will resend the confirmation email to you.

Your email address.

Submit

# Reset Password

[Sign Up](#)[Log in](#)

If you forgot your password, we will send you an email to reset it.

Your email address.

Submit

[About us](#)[Join us](#)[Contact us](#)[FAQS](#)

# Register Account

[Sign Up](#)

[Log in](#)

Email address (used for login)

Login Password (8 to 16 characters)

[Sign Up](#)

[Forgot Password](#)    [Resend confirmation email](#)

Already have a account?

[Log in](#)

[About us](#)

[Join us](#)

[Contact us](#)

[FAQS](#)

MHC Digital X ... Coin Platform Log In Sign Up

Compare Rates Market Rates Cryptocurrency Platform Financial Technology

English Australia

Log In Sign Up

1 Binance	11 Gemini	21 Crypto.com Exchange	31 Pexpay
2 Coinbase Exchange	12 Gate.io	22 Bconomy Exchange	32 CoinW
3 Kraken	13 bitFlyer	23 Korbit	33 WhiteBIT
4 Bitfinex	14 Bitget	24 ProBit Global	34 Binance TR
5 KuCoin	15 Huobi	25 BitMart	35 BitForex
6 Bitstamp	16 Bithumb	26 Zaif	36 Pionex
7 Bybit	17 LBank	27 Cointn Pro	37 Coinsbit
8 OKX	18 Upbit	28 BTCEX	38 P2B
9 Binance.US	19 Coincheck	29 BitMEX	39 Hotcoin Global
10 MEXC	20 BKEX	30 Bitrue	40 Toobit

### III. User Story

Once upon a time, there was a diligent Japanese student studying abroad in Australia. Determined to make the most of his time, he decided to work part-time to support himself and save money. As the months went by, he successfully accumulated a substantial sum and soon found himself faced with a critical decision: how to safely and efficiently send his hard-earned savings back home to Japan.

However, he quickly discovered the perplexing challenge that lay ahead. The various banks in Australia presented different exchange rates and transaction fees, leaving him unsure about the optimal timing and location for currency conversion. With limited knowledge of the intricate workings of the foreign exchange market, he felt overwhelmed and uncertain about how to proceed. His ultimate goal was to maximize the amount of money he could send home to his family.

Determined to find a solution, he embarked on a quest for a reliable and user-friendly platform that could provide him with the necessary tools and information to navigate the complex world of currency exchange. He sought a comprehensive resource that would not only allow him to compare exchange rates across different banks but also provide insights into the additional surcharges imposed by each institution. Realizing that time was of the essence, he yearned for a service that could inform him of the optimal moments to make his currency exchanges, ensuring that he could obtain the most favorable rates and minimize unnecessary expenses.

Fortunately, his search led him to discover a remarkable dashboard tailored to his specific needs. This comprehensive platform not only provided up-to-date and accurate exchange rate comparisons but also offered a wealth of additional features. The dashboard integrated links to reputable websites specializing in cryptocurrencies and financial technology, empowering him to explore alternative investment options and stay informed about the latest market trends. Moreover, it offered valuable insights into the prevailing economic conditions, helping him make well-informed decisions when timing his currency conversions.

Armed with this newfound knowledge and equipped with a user-friendly interface, our determined student no longer felt lost in the labyrinth of exchange rates and fees. He could now confidently strategize and plan his currency conversions, ensuring that he maximized the value of his hard-earned savings when sending them back home.

In the end, our diligent student successfully utilized the dashboard's resources to navigate the complexities of the financial landscape. With its guidance, he managed to exchange his money at the most opportune moments, securing the highest possible amount to be sent back to his family in Japan. Grateful for the invaluable assistance provided by the dashboard, he could now rest assured that his efforts would make a meaningful impact on his loved ones' lives.

This user story serves as a powerful testament to the importance of having a reliable and intuitive platform that empowers individuals, like our diligent student, to make informed financial decisions, regardless of their location or background. By addressing the unique

challenges faced by international students and providing them with the necessary tools to navigate the foreign exchange landscape, the dashboard became an indispensable companion on their journey towards financial success.

## IV. Think aloud results

1. What were your initial thoughts when you first saw the dashboard? Were there any features that stood out to you?

It had a clean and modern design that caught my attention. One feature that stood out to me was the real-time exchange rates, which provided up-to-date information for making financial decisions.

2. What was your experience like comparing currency values on the dashboard? Did you find it easy to understand and navigate?

The interface was well-organized, and the information was presented clearly.

3. How would you rate the overall user experience of the dashboard? Were there any areas where you felt it could be improved?

I would rate the overall user experience of the dashboard as excellent.

- 
4. Were there any features or functionality that you felt were missing from the dashboard?

I think translation function is missing, when I click it, there is no option

5. How did you feel about the security and safety of the transactions you made on the dashboard? Did you feel confident using the platform for financial tasks?

Yes, need to verify email and password has the required format,

6. Any other comments?

I found the dashboard to be a valuable tool for managing financial tasks

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User 2:

1. What were your initial thoughts when you first saw the dashboard? Were there any features that stood out to you?

The user interface was intuitive to navigate. One feature is that I can compare the different currencies between different banks

2. What was your experience like comparing currency values on the dashboard? Did you find it easy to understand and navigate?

The layout was clear, and the currency comparison tools were easy to access and use.

3. How would you rate the overall user experience of the dashboard? Were there any areas where you felt it could be improved?

Overall is good, I think you miss the about page

4. Were there any features or functionality that you felt were missing from the dashboard?

Like I say, the about page

5. How did you feel about the security and safety of the transactions you made on the dashboard? Did you feel confident using the platform for financial tasks?

The system is probably secure, I can only see the password and email verification, I do not know how the inside system operate

6. Any other comments?

The title of your dashboard is always display "Compare Rate".

User 3:

1. What were your initial thoughts when you first saw the dashboard? Were there any features that stood out to you?

The design was clean and user-friendly, making it easy to navigate. The feature "history compare rate" is good

2. What was your experience like comparing currency values on the dashboard? Did you find it easy to understand and navigate?

Comparing currency values on the dashboard was a smooth experience. The layout was intuitive, and the currency comparison tools were easy to locate and use. I found it straightforward to switch between different currencies and quickly assess their values.

3. How would you rate the overall user experience of the dashboard? Were there any areas where you felt it could be improved?

Overall user experience is good. One area need to improve is the translation function is not working.

4. Were there any features or functionality that you felt were missing from the dashboard?

The about page is missing, there is no any content

5. How did you feel about the security and safety of the transactions you made on the dashboard? Did you feel confident using the platform for financial tasks?

I think it is safe, because of the password and email verification functions

6. Any other comments?

No other comments, overall is good.

User 4:

1. What were your initial thoughts when you first saw the dashboard? Were there any features that stood out to you?  
The layout was clean and visually appealing, which made it inviting to explore. One feature that stood out to me was the line chart of cryptocurrency platform
2. What was your experience like comparing currency values on the dashboard? Did you find it easy to understand and navigate?  
The currency comparison feature was well-organized and intuitive to use. I found it easy to switch between different currencies and analyze their values. The clear presentation of exchange rates made it convenient to make informed decisions.
3. How would you rate the overall user experience of the dashboard? Were there any areas where you felt it could be improved?  
The overall system is good, I think the translation function should be improved.
4. Were there any features or functionality that you felt were missing from the dashboard?  
I think nothing is missing
5. How did you feel about the security and safety of the transactions you made on the dashboard? Did you feel confident using the platform for financial tasks?  
Yes, I think I feel confident because the system require the email verification and password

6. Any other comments?

No

User 5:

1. What were your initial thoughts when you first saw the dashboard? Were there any features that stood out to you?

My initial thought is the dashboard is very intuitive. My prefer feature is Market rate which is comparing different currencies in different banks

2. What was your experience like comparing currency values on the dashboard? Did you find it easy to understand and navigate?

The currency comparison tools were well-organized and user-friendly. I found it easy to select the currencies I wanted to compare and quickly view the exchange rates. The intuitive navigation made it a seamless proces

3. How would you rate the overall user experience of the dashboard? Were there any areas where you felt it could be improved?

Good, but I found that the translation function does not have any response

4. Were there any features or functionality that you felt were missing from the dashboard?

I think there is no missing functionalities.

5. How did you feel about the security and safety of the transactions you made on the dashboard? Did you feel confident using the platform for financial tasks?

Yes, I think the password and email verification can be considered as security

6. Any other comments?

No

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User 6:

1. What were your initial thoughts when you first saw the dashboard? Were there any features that stood out to you?  
Overall is good, one feature that stood out to me was the currency converter tool, the computation tool. It made it convenient to quickly convert between different currencies
2. What was your experience like comparing currency values on the dashboard? Did you find it easy to understand and navigate?
3. How would you rate the overall user experience of the dashboard? Were there any areas where you felt it could be improved?  
The interface was intuitive, and I had no trouble locating the currency comparison feature. It was easy to select the currencies I wanted to compare, and the real-time exchange rates were displayed clearly.
4. Were there any features or functionality that you felt were missing from the dashboard?  
I think no function missing

5. How did you feel about the security and safety of the transactions you made on the dashboard? Did you feel confident using the platform for financial tasks?

I think the system is secure because I have to provide the password and also need to pass the email verification

6. Any other comments?

No

Summary:

Overall, the system is good, but there are a few questions that need to be address:

1. the about page does not contain any contents
2. The title of every page is alway "compare rate"
3. the translation button does not have any feedback

« 大纲 幻灯片

**Task1: Create a new transaction to send money to a friend or family member in another country.**  
**Task 01: Overall success? Yes Only-with-help No**  
**Summary of key problems:** successfully complete the task

	Time (mins)	Participant Action	Participant comments
1	time	Action observed	Comment heard
14:01	Sign up with email		
14:02	Login in the dashboard	Stay in logged in is a good function	
14:02	Go to compare rates page		
14:03	Select CNY to USD, and enter how much USD 100 CNY can exchange	The calculation is fast	
14:05	Go to financial technology page		
14:06	Select to Bank of China	clear surcharge	
14:07	Go to Official website of Bank of China		
14:08	Complet a transaction		
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Text in grey italics in the top box needs to be edited with details of your task and about you.

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Time	Participant Action	Participant comments
00:00	Open the Western Union official website	
00:02	Click on the Western Union icon to jump to the Western Union official website	
00:03	Enter 1000 AUD and see the surcharge fee	
00:04	Finish the task	

2

Time	Participant Action	Participant comments
00:00	Open the Western Union official website	
00:02	Click on the Western Union icon to jump to the Western Union official website	
00:03	Enter 1000 AUD and see the surcharge fee	
00:04	Finish the task	

3

Time	Participant Action	Participant comments
00:00	Open the Western Union official website	
00:02	Click on the Western Union icon to jump to the Western Union official website	
00:03	Enter 1000 AUD and see the surcharge fee	
00:04	Finish the task	

4

Time	Participant Action	Participant comments
00:00	Open the Western Union official website	
00:02	Click on the Western Union icon to jump to the Western Union official website	
00:03	Enter 1000 AUD and see the surcharge fee	
00:04	Finish the task	

5

Time	Participant Action	Participant comments
00:00	Open the Western Union official website	
00:02	Click on the Western Union icon to jump to the Western Union official website	
00:03	Enter 1000 AUD and see the surcharge fee	
00:04	Finish the task	

### Task2:Find information about the fees associated with a specific financial platform.

Task 02: Overall success? Yes Only-with-help No  
**Summary of key problems:** successfully complete the task

Time (mins)	Participant Action	Participant comments
time	Action observed	Comment heard
14:15	Go to financial technology page	
14:16	Click on the Western Union icon to jump to Western Union official website	There is a surcharge range below the icon
14:17	Enter 1000 AUD and see the surcharge fee	The official website clearly shows the additional fees
14:18	Finish the task	

Text in grey italics in the top box needs to be edited with details of your task and about you.

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**Task3: View historical exchange rates for a specific currency and explain how you would use this information to make a financial decision.**

**Task 03: Overall success? Yes Only-with-help No**  
**Summary of key problems:** successfully complete the task

Time (mins)	Participant Action	Participant comments
time	Action observed	Comment heard
14:20	Go to history Rate page	This page is clear
14:21	Select the exchange rate between CNY and USD	The update of the exchange rate is very timely, and you can clearly see the historical exchange rate in the past half month
14:22	Find that the exchange rate has decreased in recent days	This function is useful for me to make financial decisions
14:23	Decide to exchange some dollars through Bank of China	
14:24	Finish this task	

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**Task4: Compare exchange rates for two different currencies**  
**Task 04: Overall success? Yes Only-with-help No**

**Summary of key problems:**

Time (mins)	Participant Action	Participant comments
time	Action observed	Comment heard
14:31	Go to compare rates page	
14:32	Select CNY to exchange USD	Successfully displayed the exchange rate
14:33	Try to change the currency type, select Thai baht to exchange Euro	Successfully displayed the exchange rate
14:34	Finsh this task	

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### Task5: Compare exchange rates for two different currencies in different banks

Task 05: Overall success? Yes Only-with-help No

**Summary of key problems:** There are only 5 banks and they are all Chinese banks. Only CNY can be exchanged with other currencies

Time (mins)	Participant Action	Participant comments
time	Action observed	Comment heard
14:41	Go to market rates page	
14:42	Select USD as preferred currency	Only five banks
14:43	Try to change the currency type	Only CNY can be exchanged with other currencies
14:44	These 5 banks all offer different exchange rates of CNY to USD	
14:45	Finsh this task	

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Time (mins)	Participant Action	Participant comments
time	Action observed	Comment heard
14:50	Go to cryptocurrency platform page	
14:51	Swipe and view the exchange rate of each cryptocurrency	The line graph clearly shows the exchange rate
14:53	Try to change the language	This function is not implemented
14:55	This task finish	

### Task6:Find the information about cryptocurrency exchange

Task 06: Overall success? Yes Only-with-help No

Summary of key problems: Can not change the language

Text in grey italics in the top box needs to be edited with details of your task and about you.

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**Task1: Create a new transaction to send money to a friend or family member in another country.**  
**Task 01: Overall success? Yes Only-with-help No**  
**Summary of key problems:** *There is no feedback for 'about us' button*

Time (mins)	Participant Action	Participant comments
time	Action observed	Comment heard
17:01	Sign up with email	
17:02	Try to click about us button	no feedback
17:03	Log in the dashboard	
17:04	Go to compare rates page	
17:03	Select JPY to USD	I can see the exchange rates
17:05	Go to financial technology page	
17:06	Select Commonwealth	
17:07	Go to Commonwealth website	
17:08	Complet a transaction through online bank	
17:10	Finish this task	

Text in grey italics in the top box needs to be edited with details of your task and about you.  
*The dashboard shows a list of actions and their corresponding comments. The first action is 'Action observed' with the comment 'Comment heard'. Subsequent actions are timestamped and describe user interactions such as signing up, trying to click the 'about us' button, logging in, navigating through various pages like compare rates, financial technology, and Commonwealth website, and finally completing a transaction through an online bank. The last action is 'Finish this task'.*

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**Task2:Find information about the fees associated with a specific financial platform.**

**Task 02: Overall success? Yes Only-with-help No**

**Summary of key problems:** successfully complete the task

Time (mins)	Participant Action	Participant comments
time	Action observed	Comment heard
17:15	Go to financial technology page	
17:16	Click on the Western Union icon	There is a surcharge range below the icon
17:17	Go to the Western Union website	
17:17	Enter 100 AUD and see the surcharge fee	surcharge fee is clear
17:18	Finish the task	

Text in grey italics in the top box needs to be edited with details of your task and about you.

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**Task3: View historical exchange rates for a specific currency and explain how you would use this information to make a financial decision.**

**Task 03: Overall success? Yes Only-with-help No**

**Summary of key problems:** No feedback on language function

Time (mins)	Participant Action	Participant comments
time	Action observed	Comment heard
17:20	Go to history Rate page	This page is clear
17:20	Try to use language function	No feedback
17:21	Select the exchange rate between CNY and USD	Real Time Exchange Rates
17:22	Compare exchange rate trends	help me make trading decisions
17:23	Decide to exchange some dollars through commonwealth	
17:24	Finish this task	

+ Text in grey italics in the top box needs to be edited with details of your task and about you.

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Time	Participant Action	Participant comments
17:30	Open the browser	Comment heard
17:31	Open the exchange rate website	
17:31	Do not click on the first page	No Feedback
17:31	Click on the second page	
17:31	Do not click on the second page	
17:31	Click on the third page	
17:31	Do not click on the third page	
17:31	Click on the fourth page	I can see the exchange rates
17:31	Do not click on the fourth page	
17:31	Click on the fifth page	
17:31	Do not click on the fifth page	
17:31	Click on the sixth page	Find the task

2

Time	Participant Action	Participant comments
17:31	Do not click on the first page	
17:31	Click on the second page	Find a exchange rates below the box
17:31	Do not click on the second page	
17:31	Click on the third page	Exchange Rate
17:31	Do not click on the third page	

3

Time	Participant Action	Participant comments
17:31	Do not click on the first page	
17:31	Click on the second page	Change to CNY
17:31	Do not click on the second page	
17:31	Click on the third page	Real Time Exchange Rates
17:31	Do not click on the third page	
17:31	Click on the fourth page	Compare exchange rates
17:31	Do not click on the fourth page	
17:31	Click on the fifth page	Help me make finding decision
17:31	Do not click on the fifth page	
17:31	Click on the sixth page	Find the task

4

Time	Participant Action	Participant comments
17:31	Do not click on the first page	
17:31	Click on the second page	
17:31	Do not click on the second page	
17:31	Click on the third page	Find the task
17:31	Do not click on the third page	

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Time	Participant Action	Participant comments
17:31	Do not click on the first page	
17:31	Click on the second page	
17:31	Do not click on the second page	
17:31	Click on the third page	More banks will offer
17:31	Do not click on the third page	
17:31	Click on the fourth page	Find the task

#### Task4: Compare exchange rates for two different currencies

Task 04: Overall success? Yes Only-with-help No

Summary of key problems: successfully complete the task

Time (mins)	Participant Action	Participant comments
time	Action observed	Comment heard
17:31	Go to compare rates page	
17:32	Select CNY to exchange USD	easy
17:33	Select Thai baht to exchange Euro	easy
17:34	Finsh this task	

Text in grey italics in the top box needs to be edited with details of your task and about you.

