UNIVERSITI MALAYA

FACULTY OF COMPUTER SCIENCE AND INFORMATION TECHNOLOGY
UNIVERSITI MALAYA

SEMESTER 2, SESSION 2023/2024
WIA1002 DATA STRUCTURE
GROUP PROJECT REPORT

Occ	8		
Group Name	Riders Assemble		
Topic	Topic 1 - E-Gringotts		
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	4.	TAN ZHEN YU	23004952/1
	5.	LIM JIAN CHUEN	23005005/1
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Demo	1. ZHENG WU BANG		
	2. NAFEES SADAT		

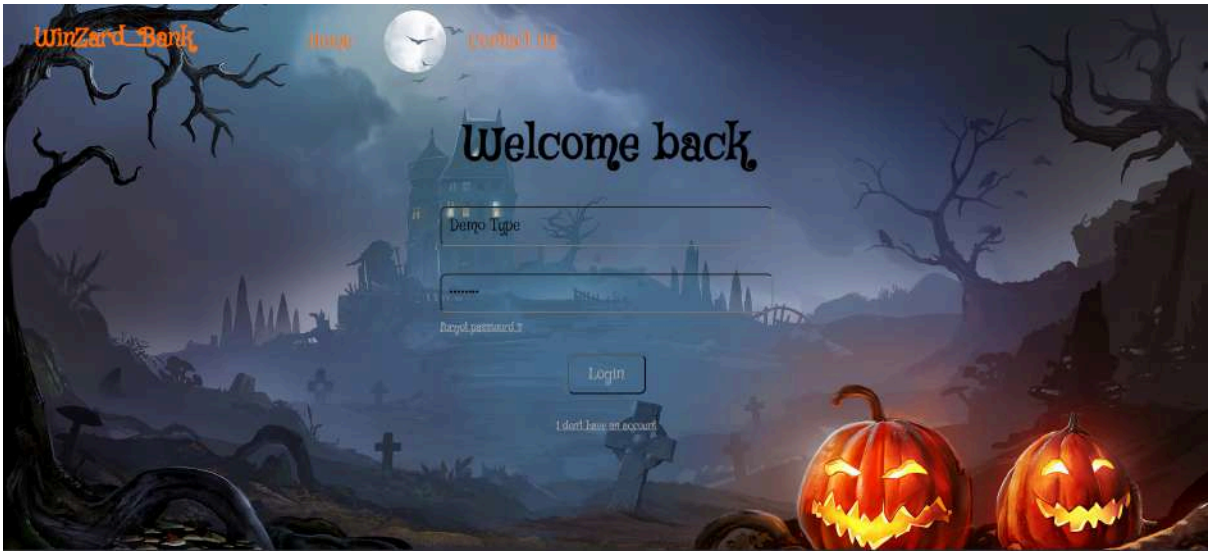
1.0 Basic Requirements

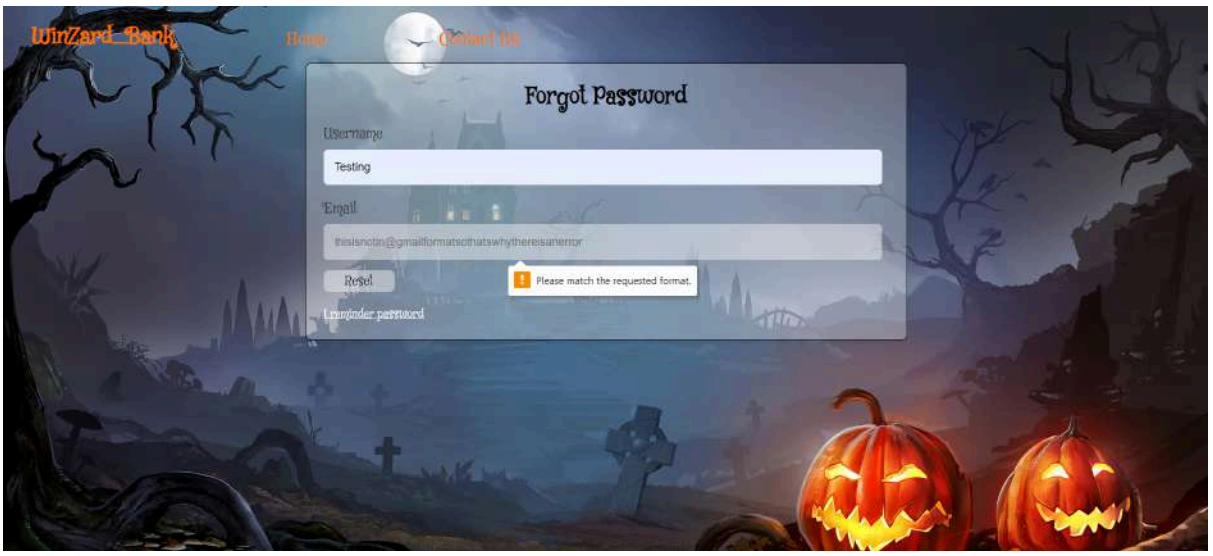
For E-Gringotts, there are various basic requirements that would make up a functional online banking application with a different design based on the Harry Potter theme. All the basic features of E-Gringotts were done in Java language which is the back end of the program. Meanwhile, the front end of the program was done in JavaScript, HTML, CSS, Java and jQuery. Basic requirements of E-Gringotts include account creation, transaction and user types, transaction history, transfer filter, find friends for transfer based on phone number or name, currency conversion, analytics of expenditure through category and use of database.

The source code of all the basic features is uploaded on Github and it is accessible in this link: https://github.com/RWong09/RidersAssemble

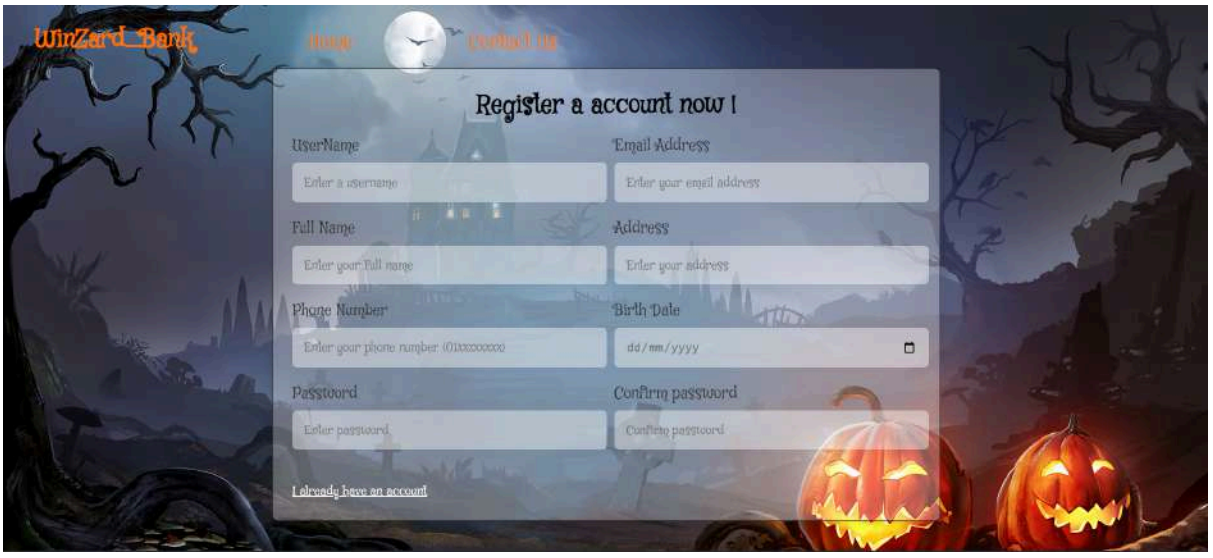
a. Account Creation, Transactions & User Types (3%):

First of all, to start any financial activities with a bank, a user would need to register an account. We have made a login page which includes the login and password section, along with the options to register for a new bank account and to recover forgotten passwords.

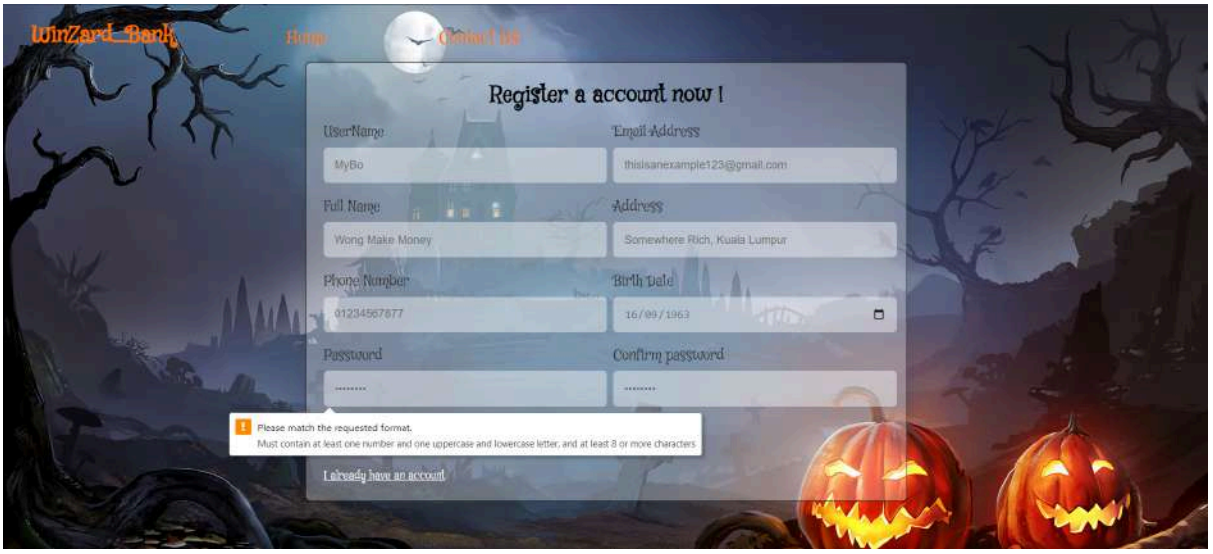




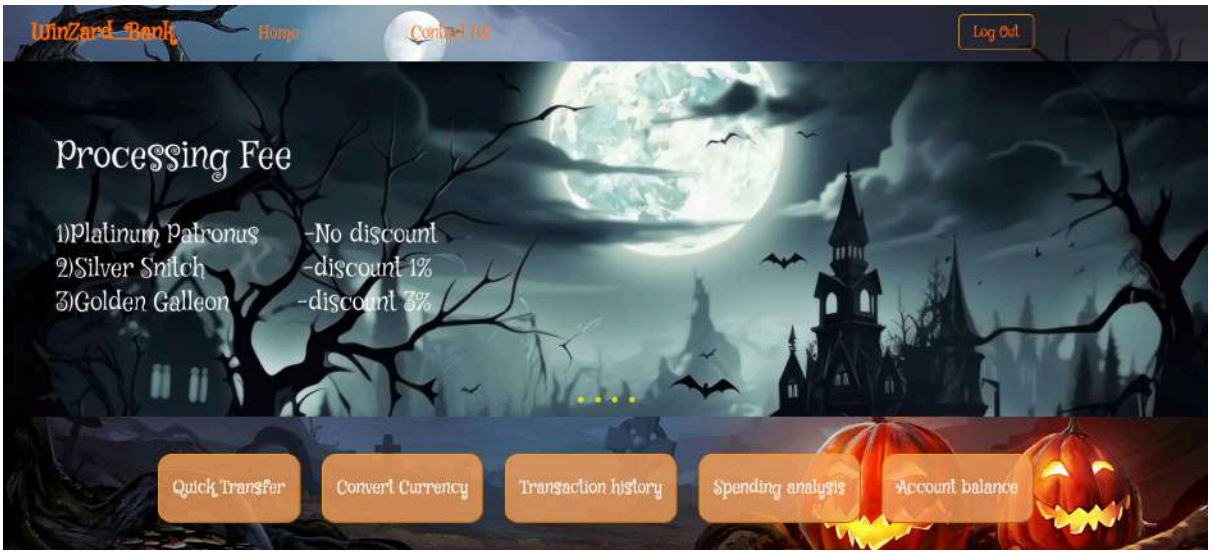
As required by the topic, our account creation should include data like user Id, username and other important information. As shown below, we ask for the user to provide their personal information, desired identification and password.



For security purposes and customer experience, we have implemented that there should not have any duplicate usernames, email addresses and phone numbers. We also made a guideline for the user to provide a password with higher complexity, also for security reasons.

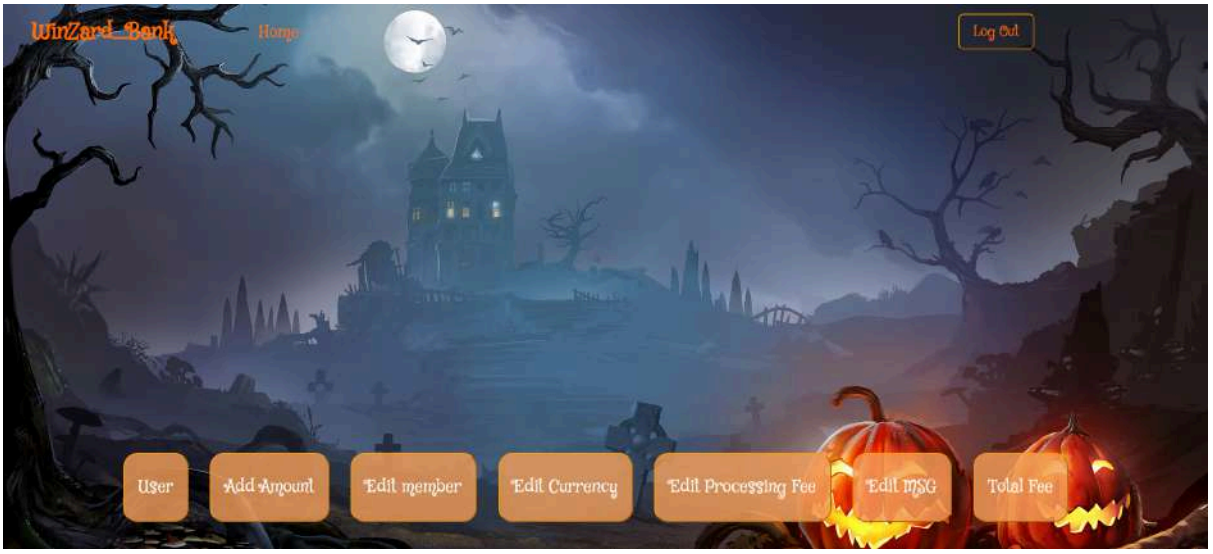


When the user successfully created an account and got approved by an admin, the user will be directed to the user dashboard, where they will have access to the basic features in the dashboard, which we will explain in the other requirements.



Besides that, we have made a Transaction class which we will further explain in the Pensieve Past and Sorting Hat Selection parts. We also made a class to differentiate users by tiers which are “Platinum Patronus” for top-tier users, “Silver Snitch” for mid-tier users and “Golden Galleon” for high-tier users. Each tier has different privileges and higher tier users have more privileges and discounts. We made the admin have the authority to determine the tiers of the users, as part of the admin feature.

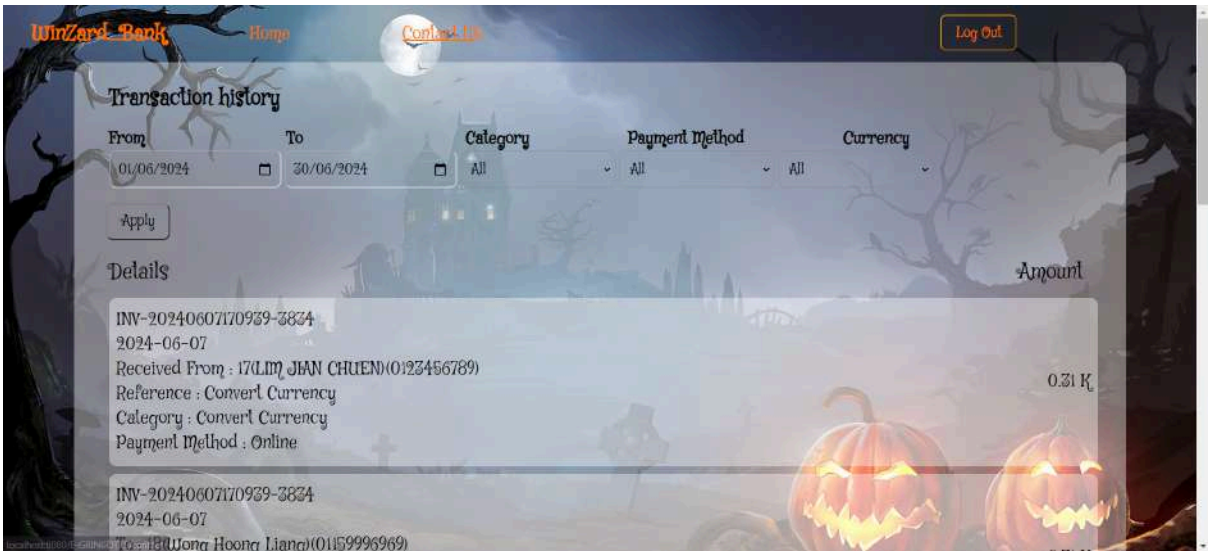
Speaking of the admin features, we also made an admin dashboard as per the topic requirements. The below picture shows the admin page when logging in as an admin, which is different from the user page. Everything from user management to transaction tracking can be done from the admin dashboard.

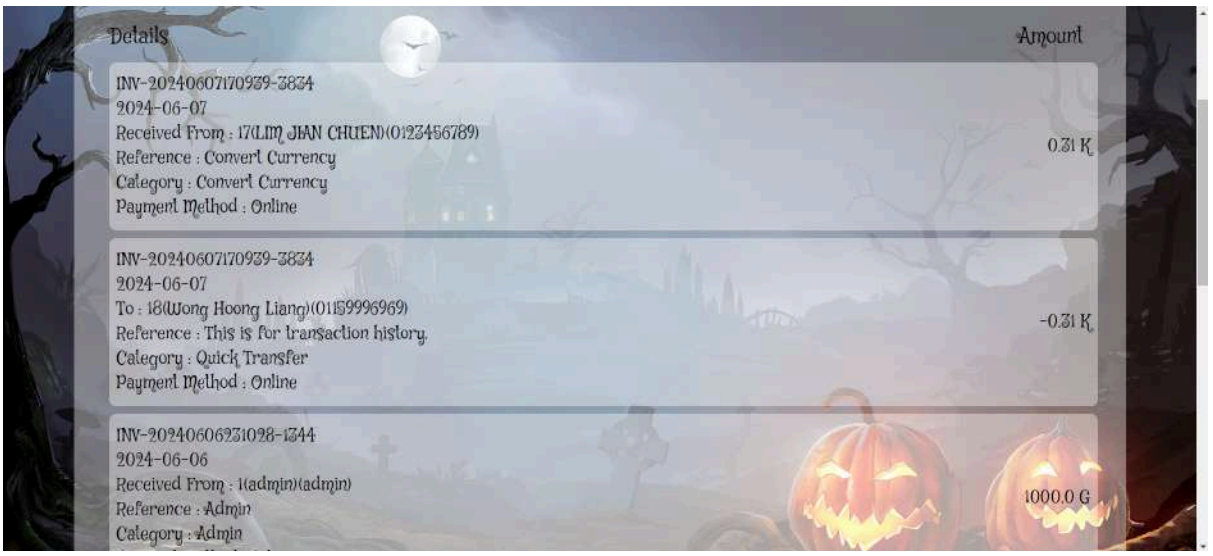


One thing to note is that the initial amount of currency is placed in by the admin after approving the creation of an account, similar to how a deposit is given to a bank when people start a bank account. This, as mentioned, is because we thought the money should be given to the bank offline and later uploaded. The admin can view the balance of each user according to the currency type before adding the amount into their accounts.

b. Pensieve Past (Transaction History - 1%):

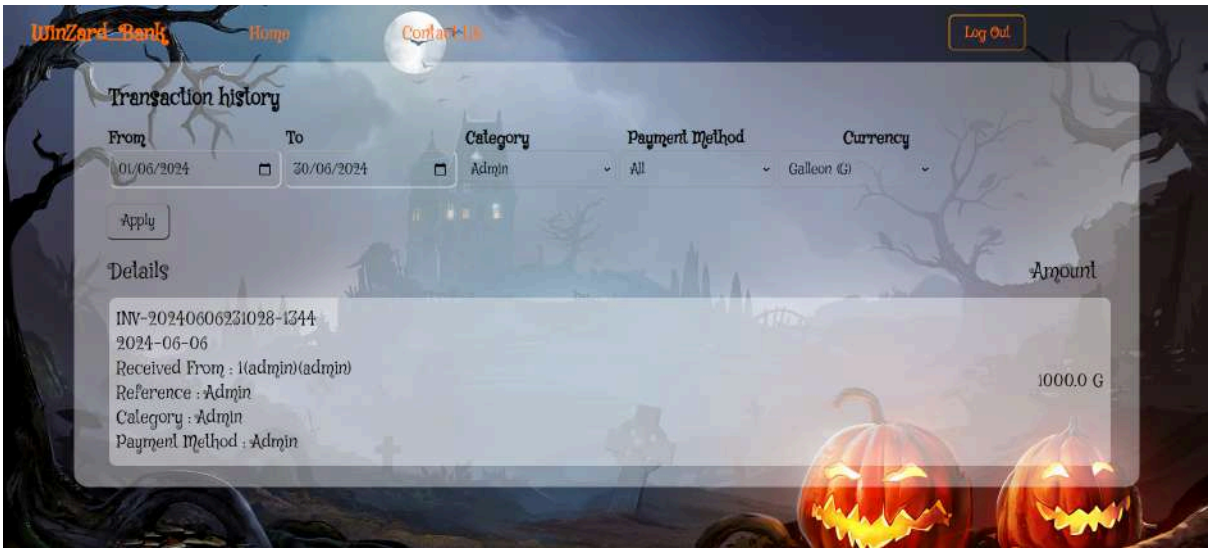
For the transaction history part, we use the data structure of ArrayList to store the history of transactions and display it from most to least recent along with its unique Id. In every transaction, the date of transaction, sender or receiver, reference, category and payment method is stored and shown along with the amount it is transferred.





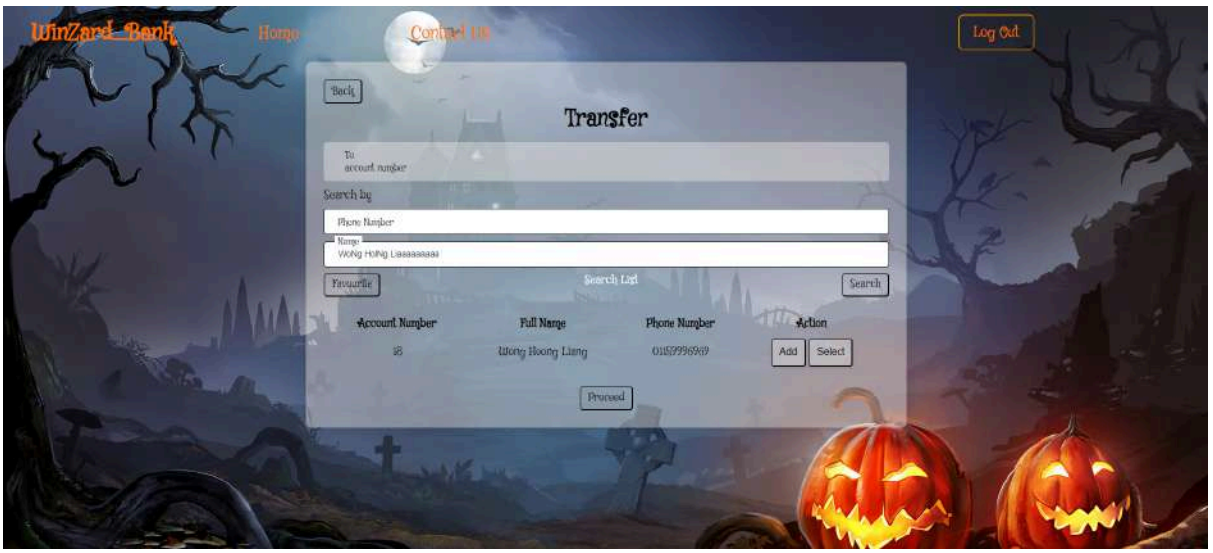
c. Sorting Hat Select (Transfer filter – 1%):

The history of each transaction can be filtered by date, in which the user can choose the date using the calendar by clicking the calendar icon, category(type of financial transaction), payment method and currency.

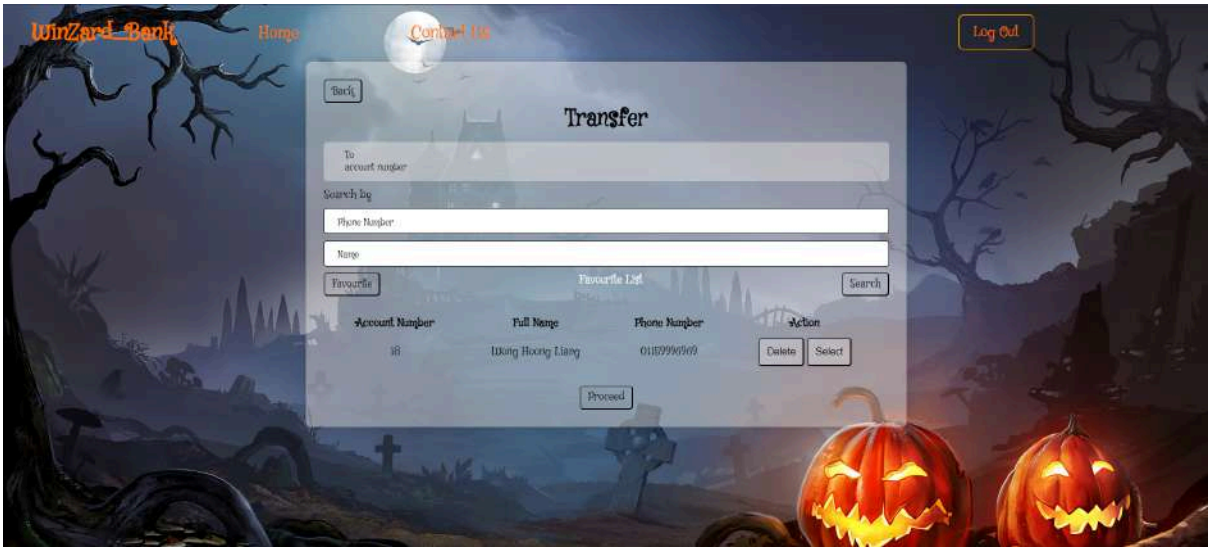


d. Marauder's Map (Find friends for transfer based on phone or name – 1%):

This part of the topic requirements asks for us to implement a search functionality. We have decided that for transactions, using just the name and phone number as search fields is sufficient, as we typically don't remember other details and we prefer the search function to be user-friendly. To ensure the speed and efficiency of our system, we find the person's account that matches the input of the user from the database. This function should be better than O(n) time complexity.

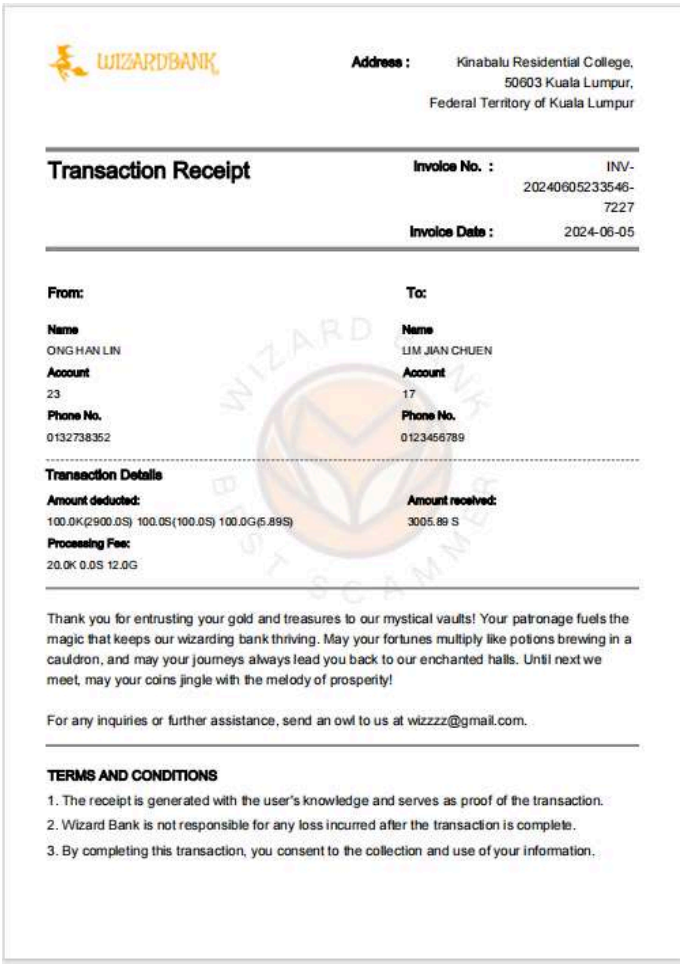


Instead of using different fields, we decided that the user could just place their friends or relatives into a “Favourite” list which they can add upon searching for them. In the “Favourite” list, the user can select their friend’s or relative’s account straight away without needing to search for them via name or phone number.



For the transaction details, it can be referred to at the additional features part as we added few things to our transaction functions. (e. Other Extra Features)

We also made a transaction receipt that is automatically generated and sent to the parties involved when a transaction is complete to keep track of the users' finances. As seen below, the transaction receipt includes vital details including the unique transaction ID, date of transaction and amount of transaction. The transaction receipt is converted into PDF form and is sent to the user via their email(will be explained in extra features).



WIZARDBANK

Address : Kinabalu Residential College,
50603 Kuala Lumpur,
Federal Territory of Kuala Lumpur

Transaction Receipt

Invoice No. : INV-20240605233546-7227

Invoice Date : 2024-06-05

From:

Name
ONG HAN LIN
Account
23
Phone No.
0132738352

To:

Name
LIM JIAN CHUEN
Account
17
Phone No.
0123456789

Transaction Details

Amount deducted:
100.0K(2900.0S) 100.0S(100.0S) 100.0G(5.89S)
Processing Fee:
20.0K 0.0S 12.0G

Amount received:
3005.89 S

Thank you for entrusting your gold and treasures to our mystical vaults! Your patronage fuels the magic that keeps our wizarding bank thriving. May your fortunes multiply like potions brewing in a cauldron, and may your journeys always lead you back to our enchanted halls. Until next we meet, may your coins jingle with the melody of prosperity!

For any inquiries or further assistance, send an owl to us at wizzzz@gmail.com.

TERMS AND CONDITIONS

1. The receipt is generated with the user's knowledge and serves as proof of the transaction.
2. Wizard Bank is not responsible for any loss incurred after the transaction is complete.
3. By completing this transaction, you consent to the collection and use of your information.

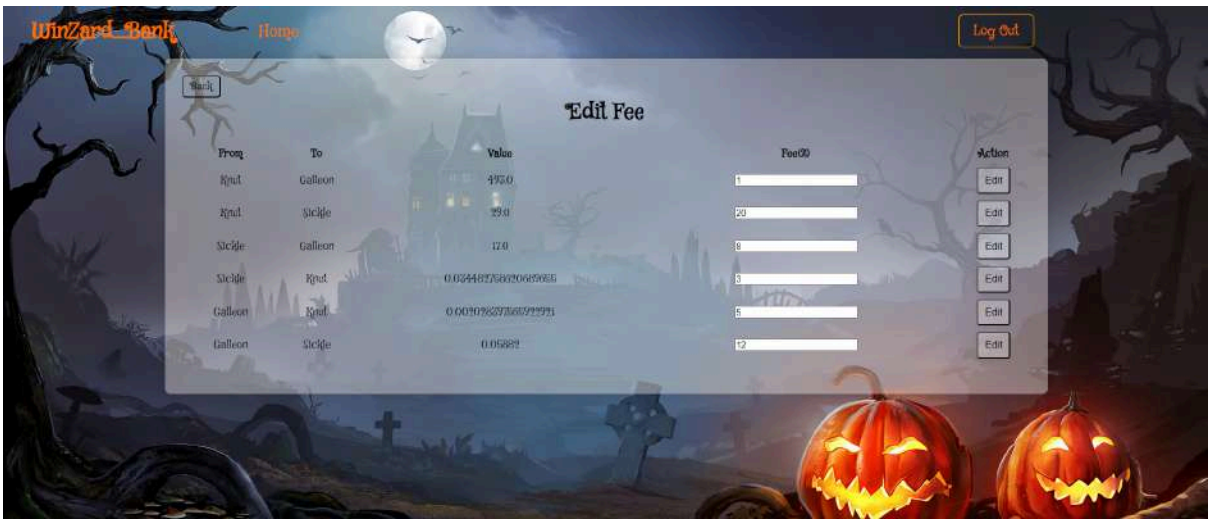
e. Gringotts Exchange (Currency conversion – 3%):

For the Gringotts Exchange booth, there are many currencies available to be exchanged. The change of currencies are dynamic in nature but the change of currencies and its value can be made by admin only to avoid users providing any misinformation about the currencies. All the information of the currencies and how it is exchanged to other currencies are stored in a graph. This graph has all the vertices which represent each currency whereas it has the edges which represent the exchange of a currency to another currency. In the exchange of the currency, there will be processing fees and its exchange value which is stored in the edge of the graph.

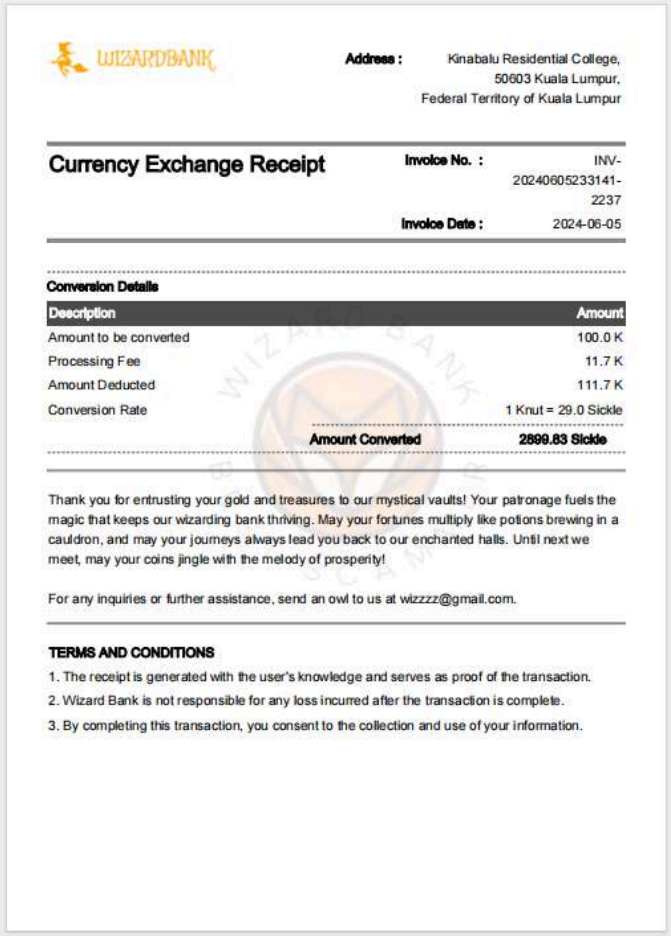
Users are required to input any currency that they want to exchange from, provided that their account has sufficient balance, and they can choose the currency that they want to exchange to. Other than that, the user has to input the amount that they want to exchange. After all the input, the system will calculate the amount of the currency that they will exchange to and find its processing fees. Since the data of all the currencies are stored into a graph form, we implemented a depth-first search method where the system will try to find all the possible currencies that they can exchange to until they reach the destination

currency that the user wants. Although it might require some extra processing fees, this is to ensure that the system has found the destination currency that can be exchanged to which the input currency can be exchanged to the correct amount for the destination currency. As a result, the amount of currency exchanged will be shown on the dashboard which is shown below. And it will show the amount of the destination currency that the user can exchange to for every unit of input currency, and its processing fee. As shown below, it would provide a discount depending on which tier the user belonged to as mentioned from the account class.

As mentioned before, the change of currency can be made by admin. Therefore, in the admin dashboard, admin can choose to edit the fee page and the system will show all the required details and functions for admin to edit the currency info and also the fees. In the fee edit page, admin can change the processing fee which is a rate to be calculated based on the amount of currency that the user wants to exchange. Other than that, admin can edit the value of a currency which will affect all the exchange values of the related currency exchange.



After the user has successfully exchanged the currency that they wanted to, the system will convert the currency and each of the currency balances will be updated from the user's account. A receipt will be sent to the user's email in PDF form as a proof that the exchange of the currency has been done successfully.



WIZARDBANK

Address : Kinabalu Residential College,
50603 Kuala Lumpur,
Federal Territory of Kuala Lumpur

Currency Exchange Receipt

Invoice No. : INV-20240605233141-2237

Invoice Date : 2024-06-05

Conversion Details

Description	Amount
Amount to be converted	100.0 K
Processing Fee	11.7 K
Amount Deducted	111.7 K
Conversion Rate	1 Knut = 29.0 Sickle
Amount Converted	**2899.83 Sickle**

Thank you for entrusting your gold and treasures to our mystical vaults! Your patronage fuels the magic that keeps our wizarding bank thriving. May your fortunes multiply like potions brewing in a cauldron, and may your journeys always lead you back to our enchanted halls. Until next we meet, may your coins jingle with the melody of prosperity!

For any inquiries or further assistance, send an owl to us at wizzzz@gmail.com.

TERMS AND CONDITIONS

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3. By completing this transaction, you consent to the collection and use of your information.

f. Divination Data (Analytics of expenditure through category – 2%):

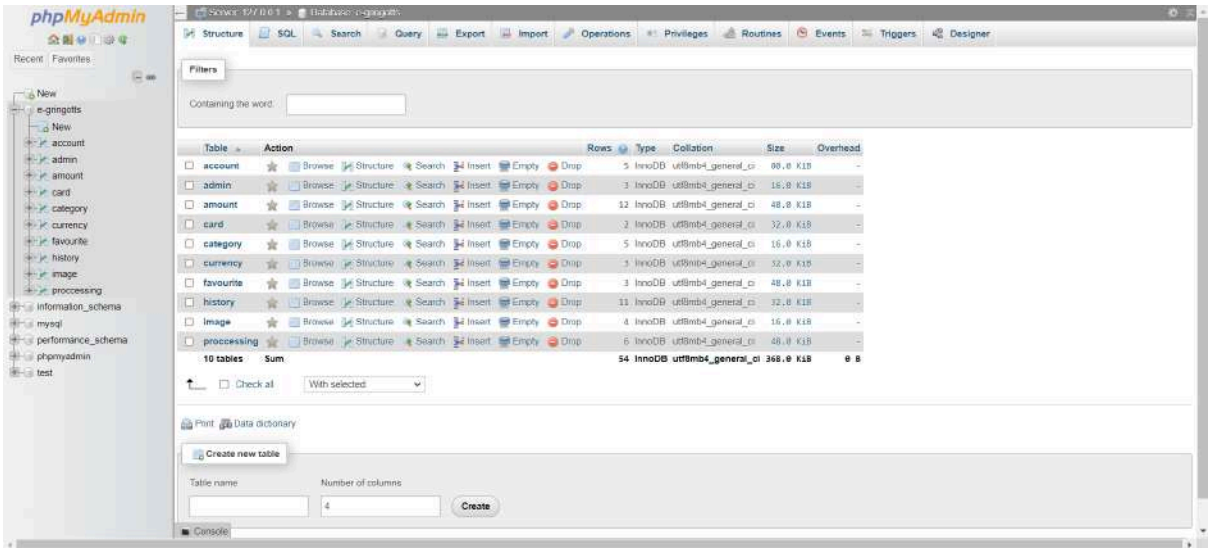
Only keeping track of individual transactions is not enough for users to analyse where their money went. As such, an analytics program is made to let users see the cash flow occurring in each month for a monthly review. The spending analysis is split between admin funds, converted currency, fees, food, entertainment and money transferred.

In the spending analysis, a pie chart is shown for the total expenditure of the users. The percentage of expenditure for each category is illustrated with different colours and proportions according to their respective percentage.

Users can also choose to see the spending for each currency and payment method, as different ways of paying and different kinds of funds call for different types of conveniences, leading to distinct spending habits that users might want to be aware of. Besides, users can choose the month and year of the expenditure so that the user understands the monthly or annual spending clearer.

g. Hogwarts Library (Usage of Database – 1%):

As we need to store all the information required for the E-Gringotts, from users' account information, to currency information and expenditure, we used MySQL database to store all the data to make sure all the information can be stored into this database and also easy to find when the application is running. This is to ensure that the information extraction process does not affect the running time of the application in which users have to wait for the query to be executed for a long time.



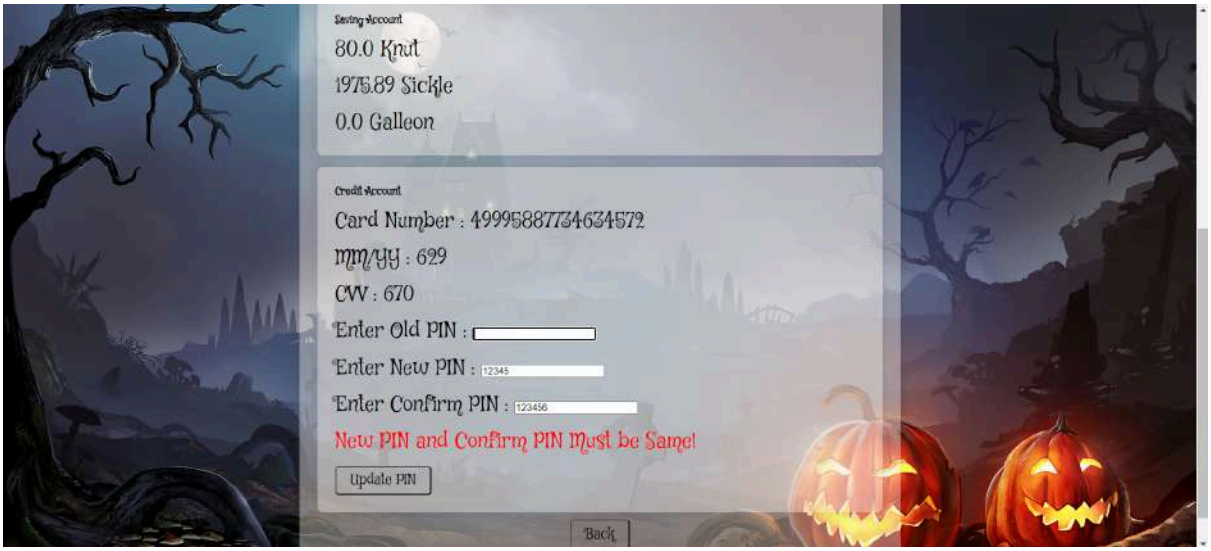
2.0 Extra Features

a. Enchanted Interface (Graphical User Interface, GUI):

A creative design of the Graphical User Interface(GUI) is important for application illustration and user-friendly. In this GUI, we decided to make it as a web application where the page design is based on the Harry Potter theme. We decided to use our creativity and name the bank as 'Winzard_Bank'. This is done by integrating our design into the HTML and the buttons are made to be functional to execute the function that the user wants. With the GUI, our application is much more user-friendly compared to the CLI.

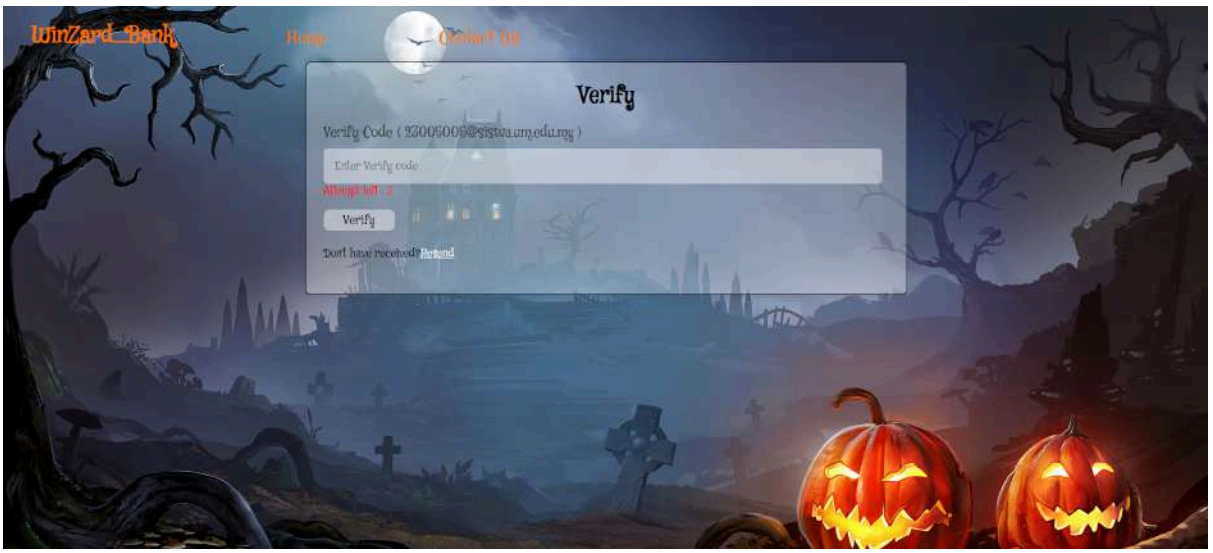
b. Gringotts Guard Key (Integrate Security OTP):

It is noticeable that we have used OTPs instead of PINs for this specific extra feature. We have come to a consensus that a random OTP would be safer than a PIN that is fixed. We have decided that PINs will only be used for debit cards, which can be accessed via the Account Balance portal in the user interface.



We also made a debit card that can be removed from the system by an admin after being contacted by a user(refer e. Other Extra Features). In the User portal of the admin page, the admin can add, reset or remove the debit card from a particular user(refer a. Account Creation, Transactions & User Types) .

The OTP is implemented for practically every action the user performs, from creating accounts to resetting passwords and performing transactions. The OTP will be sent via email (refer d. Gringotts Glimpse) and the user will need to type it in as shown at the bottom, with three attempts provided for security reasons.


WinZard Bank
Verify
Verify Code (2300500@siswa.um.edu.my)
Enter Verify code
Verify
Don't have received? Resend

c. Fidelius Charm (Password Salting):

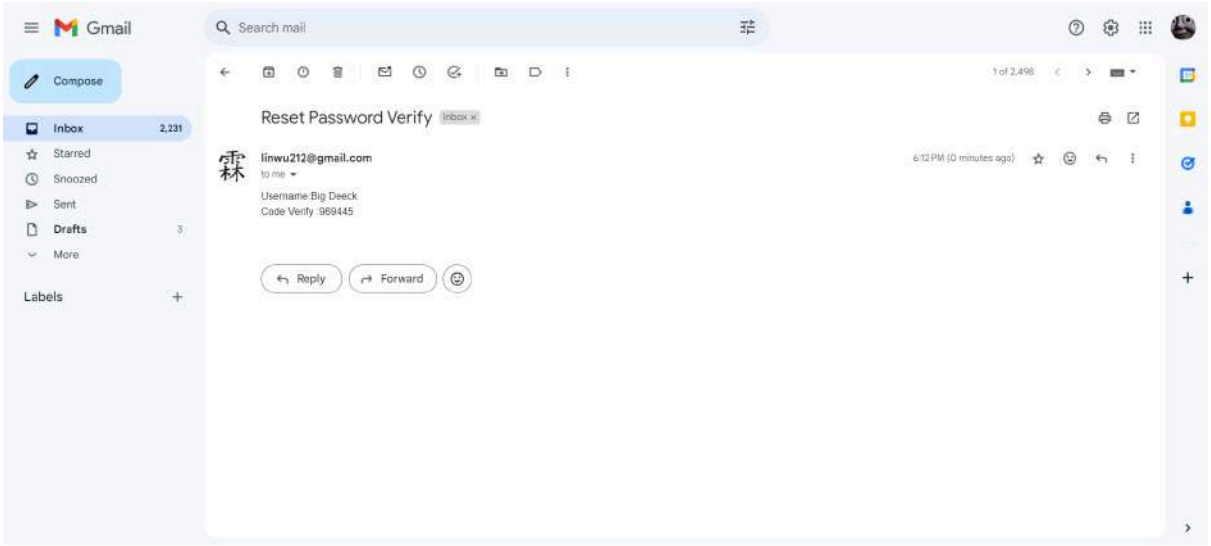
We made a salt generating method as well as a password hashing method to ensure even identical passwords can be differentiated as a security measure. A random string is generated and assigned to each password as a salt, and it is hashed after ensuring there are no duplicates. This is done for the account passwords and the PINs for the debit cards.

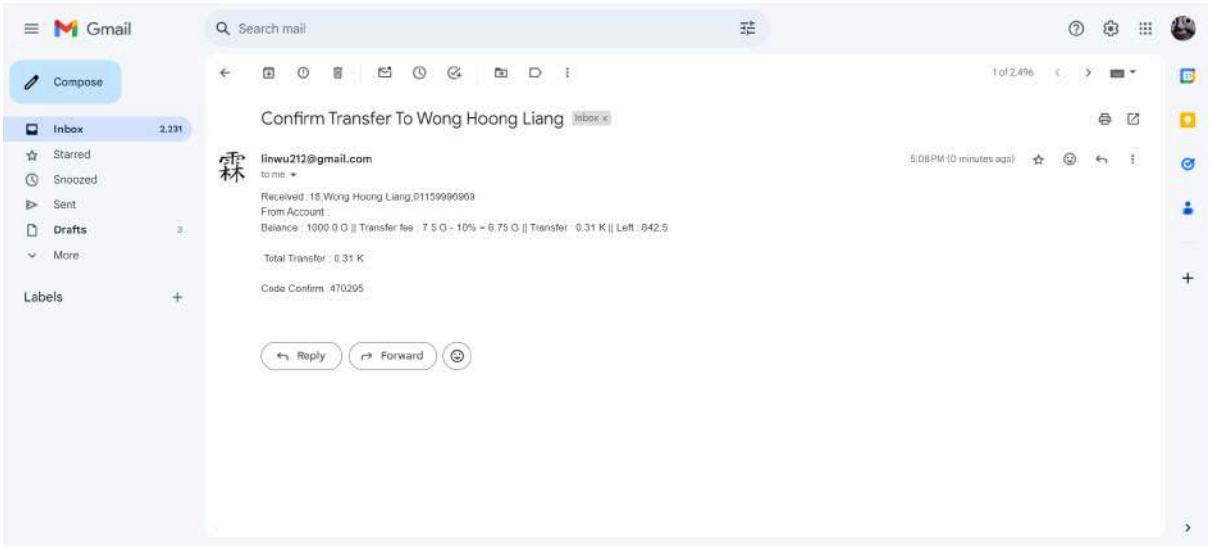
The below accounts have the same passwords, but the implemented salt and encryption methods makes the password data in the database for both accounts unique.

MyBoy	Wong Hoong Liang	0xef8032fb05a1b3a32645ed4696cc4815	0xf37cc2c9f989501d10c00e50a4b9b377bc4c69568284d3a5...	hoon
um	University Malaya	0x18b4083a078039e9b2cc87dcc655b1ae	0xd36c376103ca1f98f2263b41d0e67b3cb0ca8fd74d5faff2...	2300

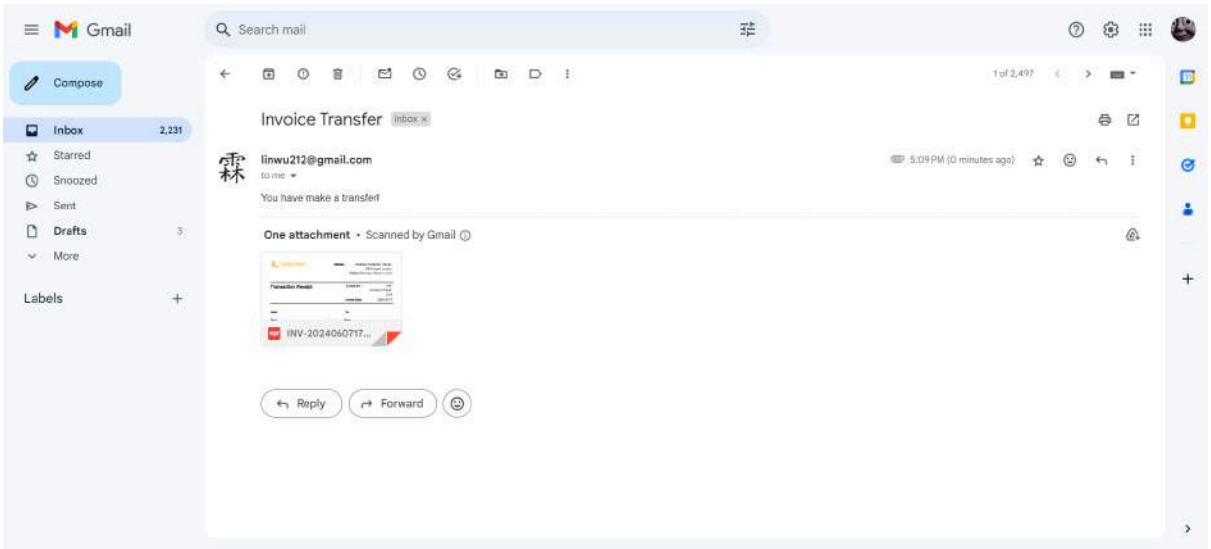
d. Gringotts Glimpse (Email Notification):

As the topic requirement stated, email notifications keep users informed about their account activities. We implement email notifications mainly to provide sensitive information, such as providing verification codes for password resetting, transaction confirmation and currency conversion.



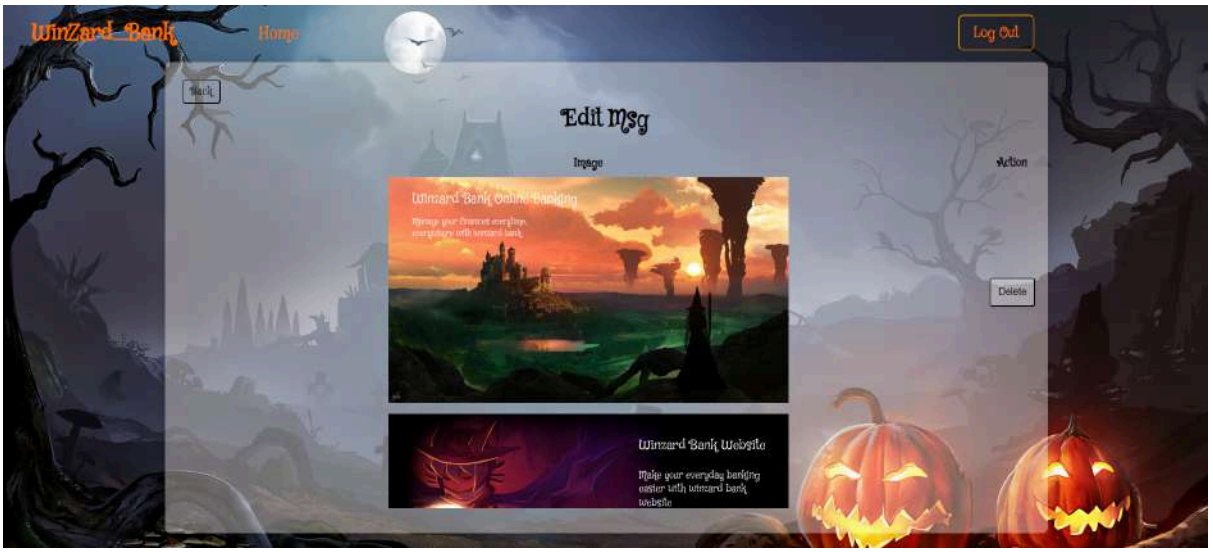


Besides that, we also send any confidential files through email only. This includes the receipts for transactions and currency conversion.

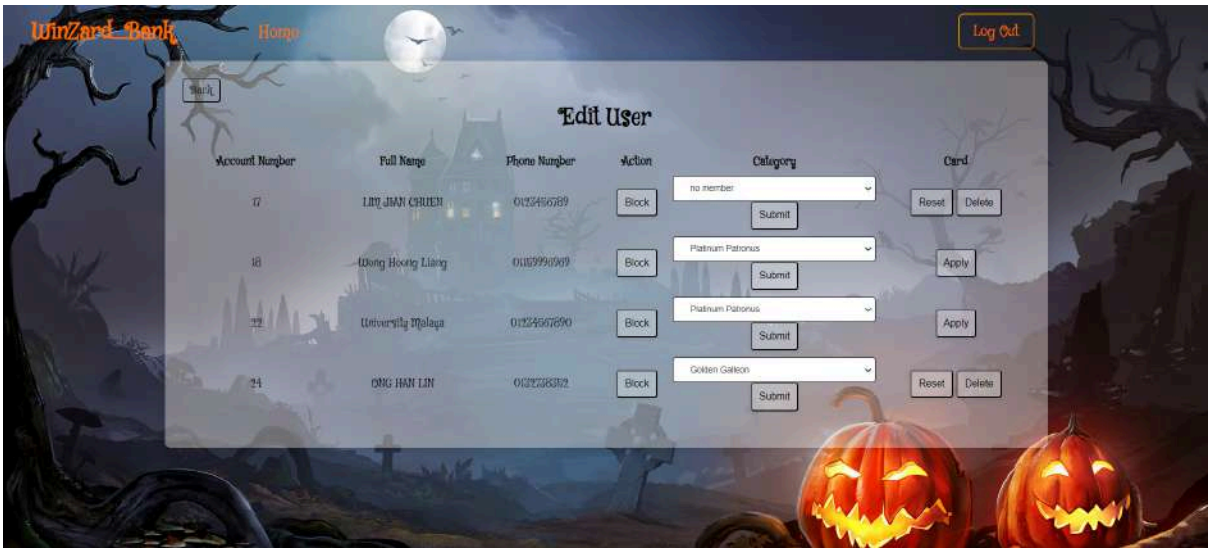


e. Other Extra Features:

One of the extra features that is not included in the question is the slide messages and posters on the home page. This is to increase the user's experience in using 'Winzard_Bank' just like conventional online banking. And the posters and also the messages can be added or removed by admin only.



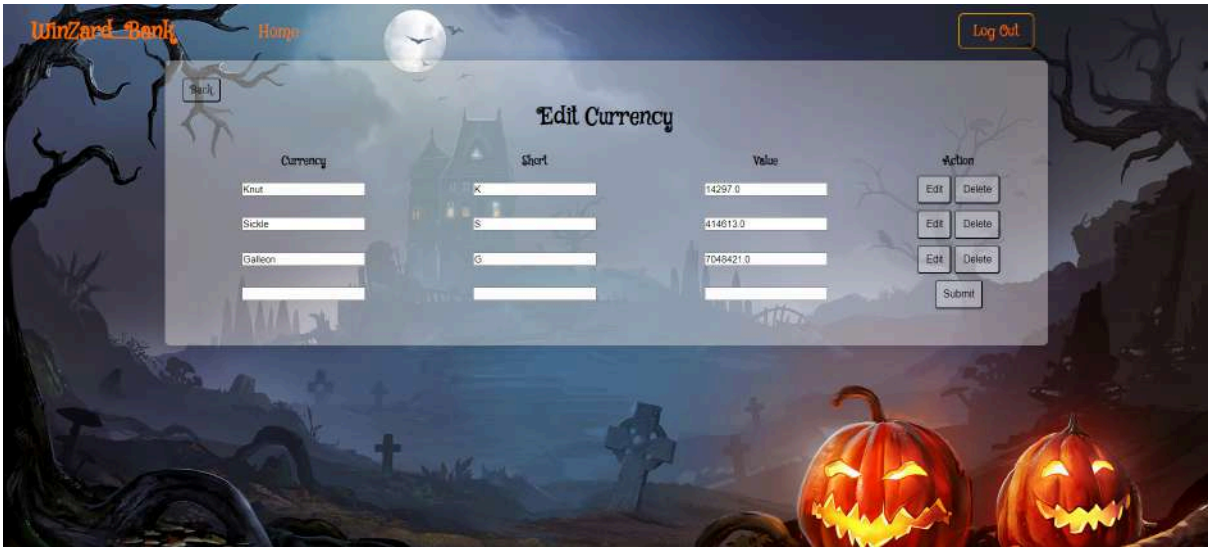
Other than that, admin can choose to provide a debit card to users online. Admin can also choose to upgrade or downgrade a user's member tier based on their spending and activeness on using the online banking.

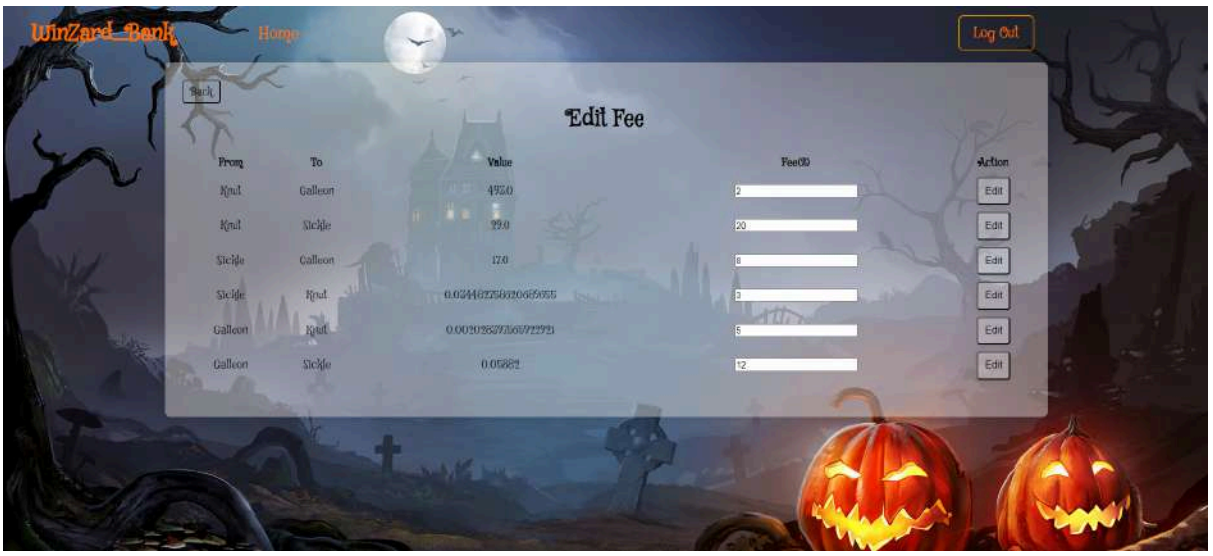


Besides, we have made a Contact Us page in order for the user to contact any of the people in charge of the bank.

Next, we have also enabled users to change their currency during transfer to other accounts. This enables users to transfer to any foreign account that uses other currency to do trading and also transfers. With that, we would charge some processing fee according to the exchanges that users had made. The conversion data would also be written into the generated invoice PDF file, with an example shown in the basic requirements part.(d. Marauder's Map)

Furthermore, admin can add new currency and add a new tier list for the members. Other than that, admin is also able to edit the processing fees to be charged for each currency exchange. This ensures the functionality of the bank to be dynamic and follow up with the trend from time to time. All the changes and additions will be updated to the database to store the data and it will update to all pages of the online banking.





Lastly, the admin is also able to check the total fees collected for each currency. This is to ensure that the processing fees are charged to the users and it is deducted from their accounts during exchange of other currencies, which should be collected by the bank. This is also helpful for the tallying of the bank's revenue from the processing fees.

3.0 Contribution Acknowledgement

Contribution from every member in the group is very important to finish an assignment. Without any contribution from any members, the assignment would be incomplete or would not be able to complete on time. The below table shows all the contributions from all the members in the group.

No	Task	PIC	Contributions
1.	Create all the designs of the page	Soon Ming Hong & Tan Zhen Yu	They designed all the pages for the online bank using Canva and Figma.
2.	Develop the front end and integrate the designs to the page	Tan Zhen Yu & Soon Ming Hoong	They had developed the front end of the web page using jQuery, CSS, HTML and Javascript.
3.	Create a PDF file for the receipt and currency convert reference.	Lim Jian Chuen	A design of the receipts and references were made in a PDF file to be sent to users.
4.	Develop account, transactions and user types	Ong Han Lin and Lim Jian Chuen	Lim Jian Chuen developed the idea of the account and also tiers whereas Ong Han Lin developed the back end codes for account, transactions and user types.
5.	Development of transfer function	Ong Han Lin	Ong Han Lin developed the transfer function and integrated it into the web page on the front end.
6.	Development of currency conversion	Wong Hoong Liang & Ong Han Lin	Wong Hoong Liang developed the function of currency conversion in the currency class and developed a depth first search method in the class. Ong Han Lin integrated the function into the back end and front end of the web page.
7.	Analytics expenditure through category	Ong Han Lin	Ong Han Lin developed the analysis of expenditure through categories using Java and integrated it into the front end of the program.
8.	Find a suitable database	Wong Hoong Liang & Ong Han Lin	They searched for various databases and found a localhost

			database for MySQL which is XAMPP.
9.	Development of extra features	All members	Tan Zhen Yu and Soon Ming Hoong developed GUI whereas Wong Hoong Liang, Lim Jian Chuen and Ong Han Lin developed other extra features for E-Gringotts.
10.	Upload the codes to Github	Soon Ming Hong & Wong Hoong Liang	The codes had been uploaded to github's repository.
11.	Test run and debug the program	Tan Zhen Yu & Ong Han Lin	They tested all the features of the program and debugged all the errors occurring in the program.
12.	Writing the report	Lim Jian Chuen & Wong Hoong Liang	Completed the final report to describe all the features of the programs and also listed all the contributions from every member in the group.
13.	Monitor the progress of the assignment.	Wong Hoong Liang	Asks for updates for the assignment weekly to check for the progress.

4.0 Conclusion

In conclusion, the project is a success where a functional online banking system has been developed through many weeks of efforts and the understanding of each part of the project. Through the use of many programming applications and languages, the members have gained extensive knowledge and experience in developing all the functions required for a basic online banking. We have also understood all the functions needed for an online bank and we also implement some extra features that may or may not be needed in the online banking.

Some notable methodology that we employed is the use of Java Servlet which uses CSS, JavaScript, Java and also HTML to do all the functions required for setting up the online banking. Other than that, we also used JSP to integrate all the designs and also the PDF files to the function of the program. We also decided to use depth first search and graph function in order to make the currency conversion to be better and smooth. Besides, the determination of currency based on its values was another notable methodology which is based on our extensive understanding of the currency.

In a nutshell, the members in the group have gained extensive knowledge in finance and also implementation of data structures in the assignment. The works done by the members have successfully built a functional online banking system.