Introduction:

Our project "Electricity Billing System" aim to produce online electricity invoices. The manual system is quite difficult, time-consuming, and labor-intensive. The goal is to create a system that will allow the Electricity Board to digitalize tasks including creating monthly bills, storing past customer information, and instantly informing customers of late payments or load shedding schedules. With the rapid digital development of Bangladesh and online payment services, it is possible for the system to be a great alternative to visiting the Board for payment. This aids the government in giving its citizens better electricity management experiences.

Motivation:

After the post-Covid situation in Bangladesh, people have been more cautious in terms of travelling. Paying electricity bills online helps to reduce the hassle to stand in line with possible infected people. Moreover, after the increase in traffic, it would take a normal person 1 to 2 hours to pay bills, which is very tiresome, and time consuming. Although there are online bill payment systems provided by banks, it is complicated to keep track all accounts and bank details for multiple bank accounts. In addition, different banks offer different rules to be followed and different offers of payment. Following multiple of these is a hassle. The solution to all this issues can be solved by having one online billing system which is monitored by the government. Online bill payment has several advantages, one of which is the reduction of paper waste. Online bill payment eliminates the need for paper cheques . It also removes the expense of labor in addition to decreasing paper waste. Nowadays, internet banking is thought to be considerably secure than using a check as payment and lowers the possibility of identity theft. It is easier to pay all of your bills from one spot by using your banking institution's online payment service. Users don't need to remember different passwords or log into multiple websites. Since it is possible to lose track of your funds, electronic bill payments make it easier to keep track of everything. One can quickly determine if something is done improperly or if they entirely forgot to make a payment when all of their bills and payments are conveniently collected in one location.

System Request:

● Project Sponsor:

Mahzabin Yasmin Binte Amin, CEO of DPDC. Nusaiba Ahmed, Head
of Desco. Nafiz Imtiaz Rafin, Mayor of Dhaka North City Corporation.

● Business Need:

Even in this modern age, when practically every aspect of life is mechanized and digitalized, Bangladesh's viewpoint on energy meter reading and billing still falls under the category of manual operations, necessitating additional labor costs in addition to overhead. The main issue is that the billing system is yet to be understood by the people for online payment and needs to be made user friendly. There is a way of online payment through online payment apps such as Bkash,Nagad and banks. However, the DPDC board is yet to have its own dedicated system for online payment without the need of relying indirectly on secondary sources.

● Business Requirements:

1. The system should consider local people to be the user who can register with their unique information and have necessary details such as location, bank details etc.
2. People can see their details for the month of how much electricity consumption had been done, unit of costs per kilowatt and total amount.
3. The user can also see which appliances consumed most of the power .
4. Users can also see their history of bills they had paid before
5. Local people should be able to have a choice to pay through different payment options such as through banks, through Bkash,Nagad , etc.
6. The system will showcase any due remaining as well as make sure to have a due date for bills to be paid per month.
7. If the user does not pay their bills in time it will showcase as unpaid and will provide warnings of powercut.
8. People should be able to check how much balance they have I their accounts if they overpay for any month or have dues.
9. Help section should be provided for any issues faced and queries made should be answered.

● Business Value:

The business value can be categorized as tangible and non-tangible values. These are:

Tangible-

1. The business could profit off BDT 100 million every month in service charge due to high population.
2. Negotiation with payment sources such as different banks, Bkash could result in BDT 40,000-50,000
3. The system could be sold to other private parties or governments with the approval of the Prime Minister to result in 1 million dollar to every sale made.
4. Decrease in employee salary which could decrease about BDT 1 billion annually.

Non-Tangible:

1. The major value would be the decrease of labor work.
2. The government needs only a few people to handle and manage the entire system.
3. Bill payers will find it more convenient to pay anywhere they are with indirect reduction of transport costs, time consumption,etc.
4. No need for offices set up everywhere in the country for payment , no physical maintenance required.
5. No need for hassle of going through difficult procedures and standing in long queues.
6. The payment procedures will be more convenient than paying through online banking as no time is required for verification from the government boards as the system will be regulated with official information.
7. It will be more reliable than any sort of method available for banking.

● Special Issues or Constraints:

1. All people of Bangladesh should be aware of the internet in order to use this billing system. Hence, all physical offices cannot be replaced with it in recent time.
2. Network is not available throughout the country and continuous power cuts or load shedding could limit the idea of paying bills any time.

3. Fake information could lead to troubles hence every registration information such as NID / Passport/customer codes should be verified.

Requirement Analysis:

● Functional Requirements:

➔ Customer Side:

❖ 1.1: New Users will be able to make a new account using an email, a password, and contact number, NID card information and bank account details

❖ 1.2: Old users will be able to log in to the system using an email and a password

❖ 1.3: User has the ability to send request for account deletion to the admin if they require to remove their account from the system

❖ 1.4: Users will have the ability for to send reports to the admin about their complains and queries

❖ 1.5: Users will be able to check balance

❖ 1.6: Users will be able to see due payments and make payments according to the due

❖ 1.7: Users will be able to see their overall electricity consumption in units

❖ 1.8: Users will be able to see previous transactions and bill records

❖ 1.9: Users will be able to see load shedding schedule and get prior notification via sms before any scheduled load shedding in a specific area

❖ 1.10: Users will be able to access notice provided by the system

❖ 1.11: Users will be able to print bill receipt

➔ System Side:

❖ 2.1: The system will store user credentials in cloud server for new user registration

❖ 2.2: The system will be able to verify user login credentials from the cloud database

❖ 2.3: The system will have access to user data from previous transactions

❖ 2.4: The system will provide the user to pay using multiple financial procedures - Bank card, Bkash, Nagad

❖ 2.5: System will be able to check user balance and make updates after transaction

❖ 2.6: The System will be able to send sms to the users after transaction

❖ 2.7: The system will have access to a user's general area based location in real time so that it can notify about any load shedding at that area

❖ 2.8: The system will be able to send automated warnings about power cutoff for longer payment dues via sms

➔ Admin Side:

❖ 3.1: Admin will be able to remove any user account from the cloud database

❖ 3.2: Admin will have access to all user information

❖ 3.3: An admin can make announcements or post notices about events such as change in load shedding schedule that are yet to take place.

❖ 3.4: Admins will be able to respond to users' queries via sms

● Non Functional Requirements:
➔ Operational:
♦ The system is compatible in handheld device and different platforms(PC, android, ios)
♦ The system has a simple User Interface
♦ Admin will continually check site statistics to ensure that users get the best experience possible.
➔ Performance:
♦ The system is functional 24/7 and 365 days a year

♦ The system can handle heavy network traffic of over 1000 users per area at a time

♦ System-user interaction must not exceed 1 second

♦ App and website graphics or digital art must be optimized so that it takes less data and does not require more than 0.5 second to load

♦ Users must be able to see real-time updates to all of their data

➔ Security:

♦ User information in the database must be encrypted so that it cannot be accessed other than verified user and system

♦ When a login attempt is made from an unfamiliar device, the system will warn the user.

♦ For increased security 2 step verification is used by the system

♦ The system will allow users to change password and notify immediately after the change via sms

♦ The payment gateway must be verified and safe

➔ Social and Political:

♦ The software will support both English and Bangla language

♦ The software must abide by the rules and laws mandated by the government

♦ The system will not use icons that could be considered offensive in any of our market countries.

➔ Maintainability:

♦ The system will reboot within 2 minutes after any forms of crash

♦ Update failure of the system will restore previous working condition

➔ Usability:

♦ Maintain constant font size with important points and hyperlinks in bold

♦ When the screen is shrunk, the layout should immediately resize to fit the new dimensions.

Project Usage:

Our system aims to make payment of electricity bills free of hassles and more efficient. A new user will

be able to register with a valid email address and a password. Henceforth, the registered user will be prompted to login to their account with their email and password and if either of the two is wrong, an error message will be displayed. The user will be able to view the electricity bills that are still due and if they wish to, they can pay for it using the same system. Multiple options will be available to make the online payment- pay with card, online banking and bKash. In case of insufficient funds, the user will be notified. Once the payment is made the balance will be updated and so will the electricity bill status. The user will be able to check their balance any time and the history of their own transactions. Users will also be notified for load shedding or any other messages sent by admin.

The admin plays a vital role in keeping the system well maintained. If a new admin is to be appointed, he or she will also have to register through the system and login with valid credentials. The admin has access to all user information and load shedding timings and has the permission to delete any user account if a user requests to. The admin is also responsible for maintaining the load-shedding schedule and has to notify users all time. If any user has any queries or complaints they can ask the admin for assistance and admin will answer to them as well as record complaints and send to system..

The system is the connection between users and admins which stores information of the databases, checks validations for login or registrations maintaining government guidelines and makes the system more user friendly for users and admins.The system does all the calculations for payment dues , billing histories and also calculates bank credits left after payment.

This way, the entire billing system is made efficient for government monitorization as well as making it easy for citizens of the country to pay their bills on due times in minutes.

Use Case Diagrams:

The system's operations are described in the use case diagram. The three figures below illustrate the main activities of each primary and secondary actor as well as how they interact with the system.
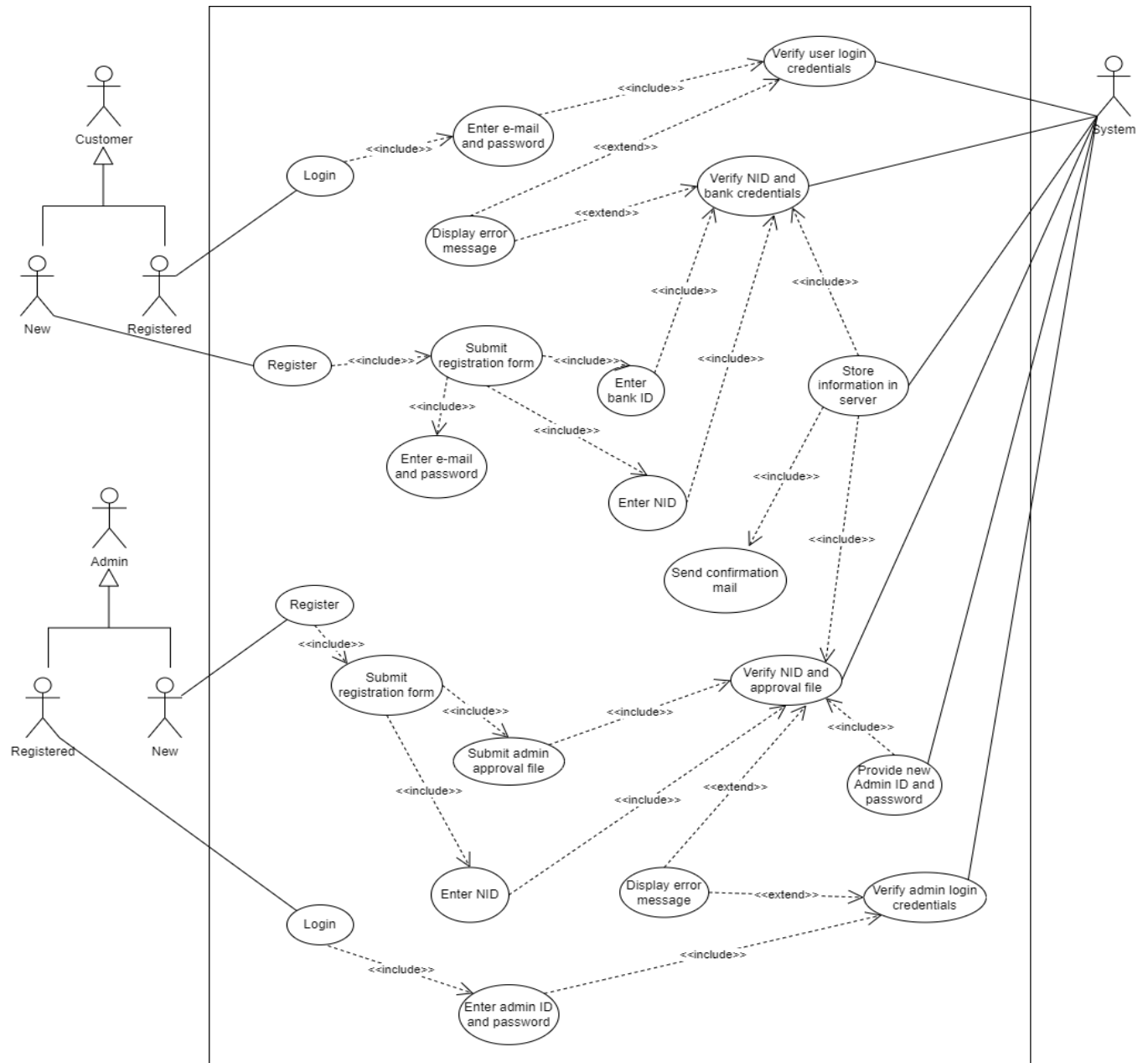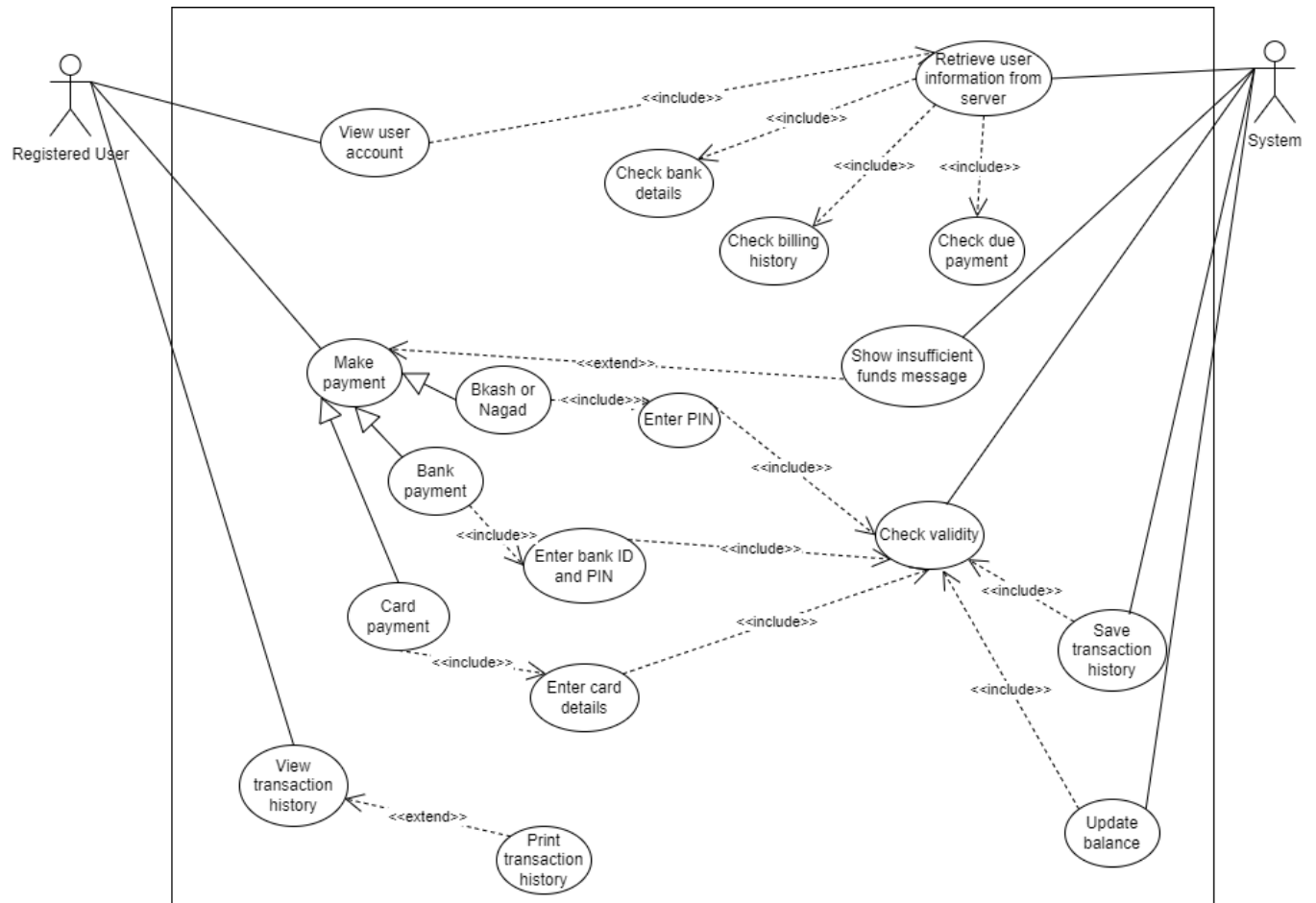
Fig 1: Use Case Diagram- Login and Registration
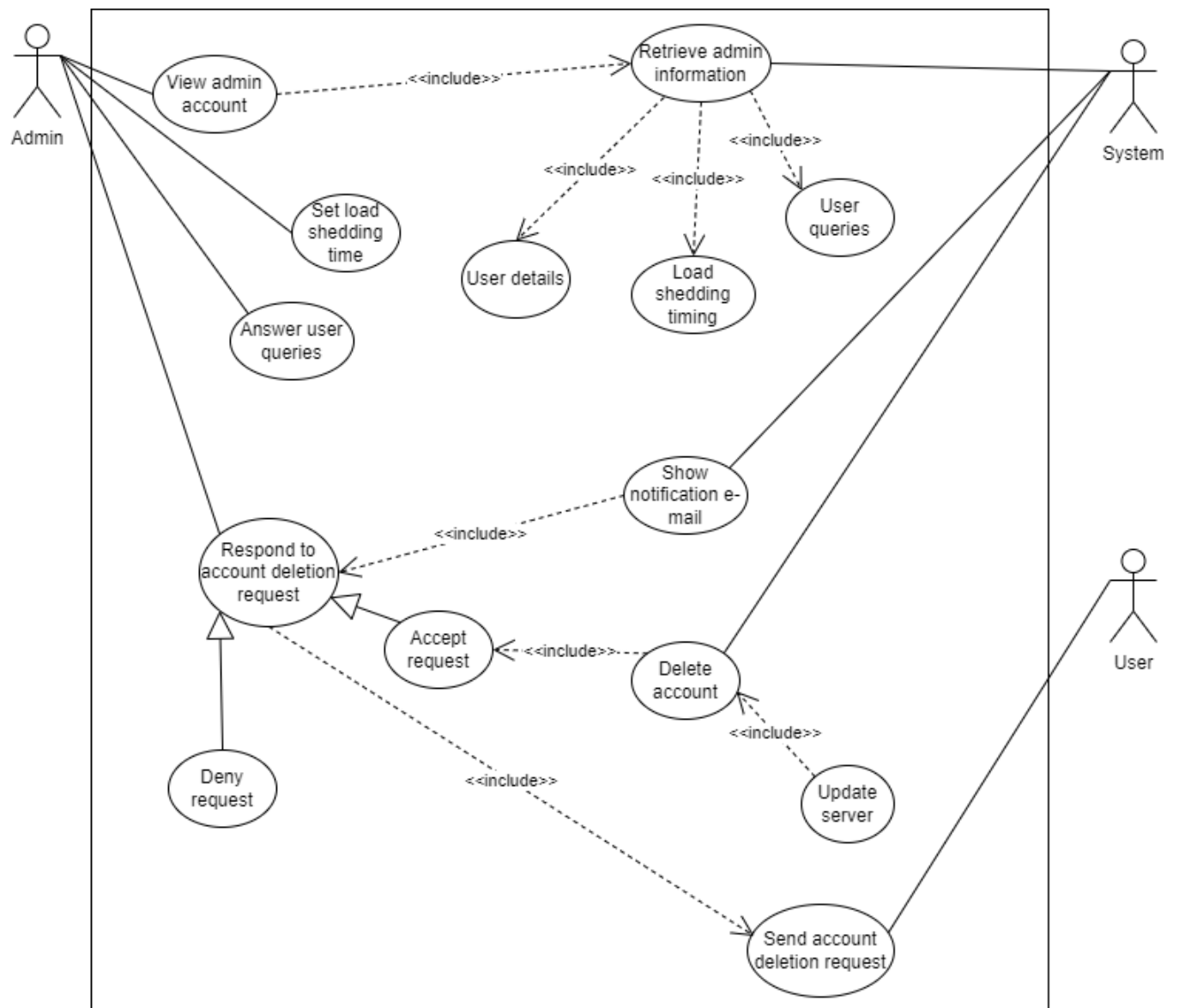
Fig 2: Use Case Diagram- User Billing System

Fig 3: Use Case Diagram- Maintenance System

Activity Diagrams:

A flowchart used to represent the movement of activities inside a system is called an activity diagram. The following diagrams depict the system's most crucial operations. You can see how logins and registrations are handled in the first picture. The second one shows the actions of a user billing, and the final picture shows how the system and admin work to update data and manage the system.

User Billing System

User	System

User side:
- U → Check info messages → I
- Choose activity
  - [view page] → View User Dashboard
  - [Delete account] → Send Request to admin → D
- Click on Make Payment
  - [No] → Click on Show History
    - [No] → (final node)
    - [Yes] → Retrieve consumption rate
  - [Yes] → Choose payment method
- Print transaction PDF

System side:
- Retrieve server information
- Check Bank Details
- Check Billing History
- Check Due Payment
- Send information to view user page
- Check option
  - [Bank payment] → Enter bank ID and PIN
  - [bKash or Nagad] → Enter PIN
- Valid?
  - [No] → Ask to re-enter details
  - [Yes] → Send transaction SMS → Save transaction to history → Update server

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Activity Diagram for Maintenence

User	System	Admin

System column:
- Retrieve info from admin
- (fork bar)
  - User Details
  - Load shedding timing
  - Queries
- (join bar)
- Show on admin page
- Account info
- Send info to user
- Search accc. on database
- Delete account
- Send confirmation message

Admin column:
- A (start)
- view admin dashboard
- Select option
- Select Load shedding timing
  - Yes → Set load shedding alarm
  - No → Answer queries
- Receive request
- Accept request
  - yes → Search accc. on database
  - No → Send deny message

**User column:**
- I (end)
- D (start)
- Delete account request

Sequence Diagrams:

Sequence diagrams display the messages that go back and forth between objects for a certain use-case across time. The illustrations below show how the items communicate with one another and react to those communications. Below the diagrams represent login and registration, user activities and admin activities.
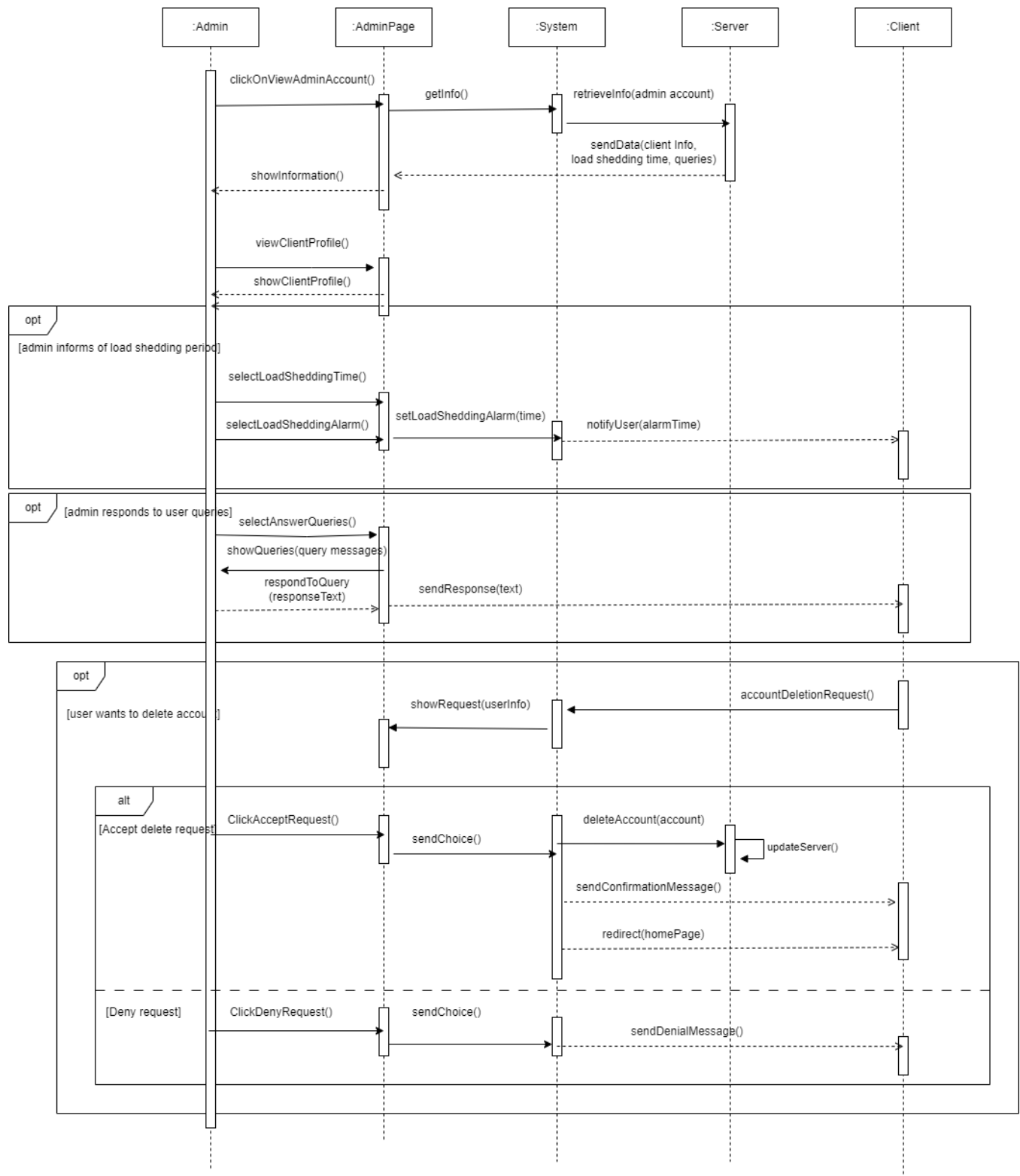
ACCOUNT LOGIN AND RESGISTRATION
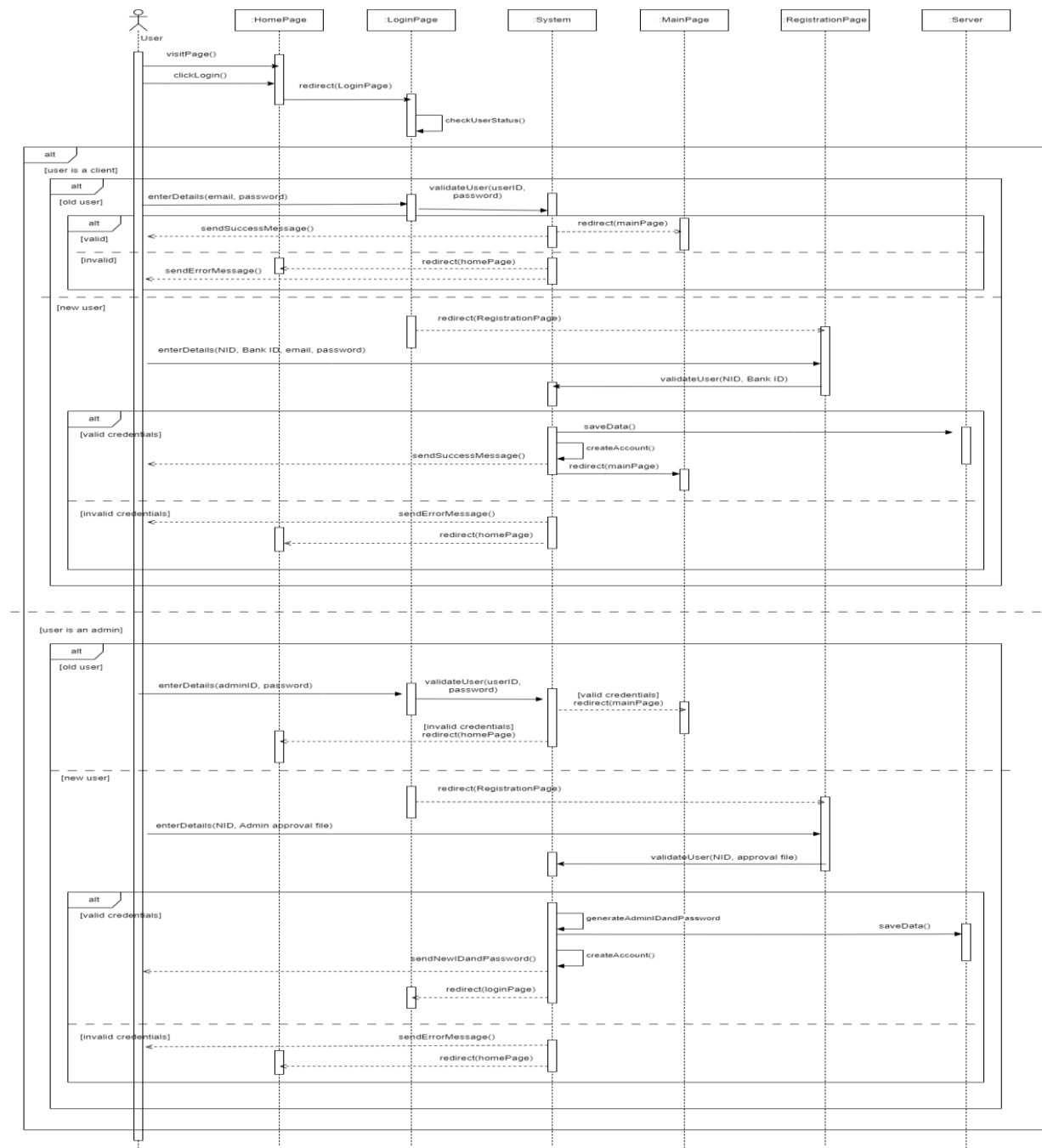
USER/CLIENT ACTIVITIES
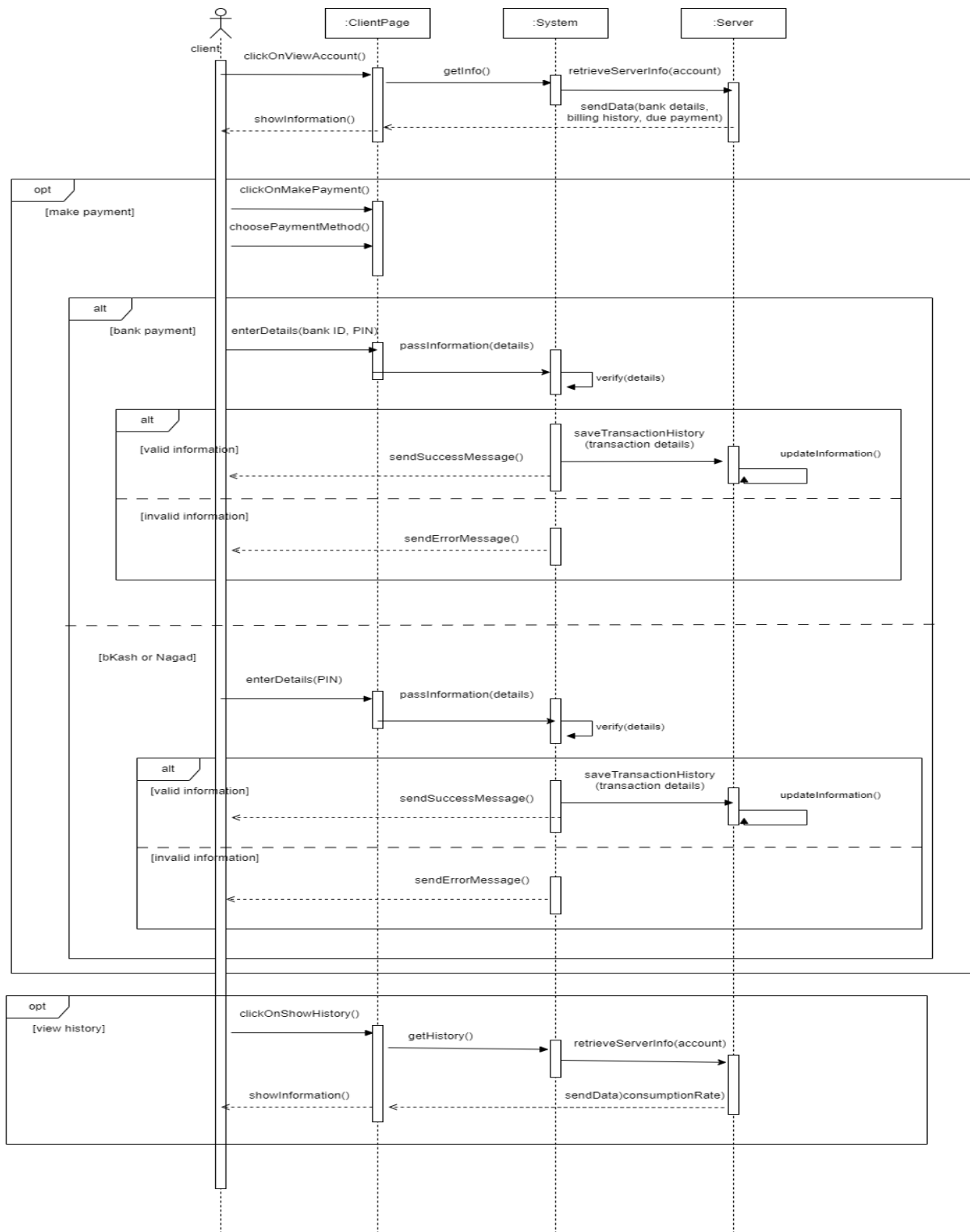
ADMIN ACTIVITIES

Data flow Diagrams:

The visual representation of data flow through a computer system, or data flow diagram, shows how information moves through a system. An overview of our context and a level-1 schematic of key components are shown in the three diagrams below: how account information is handled, how billing system of user is done, and how the system is maintained.

ACCOUNT MANAGEMENT DATA FLOW DIAGRAM
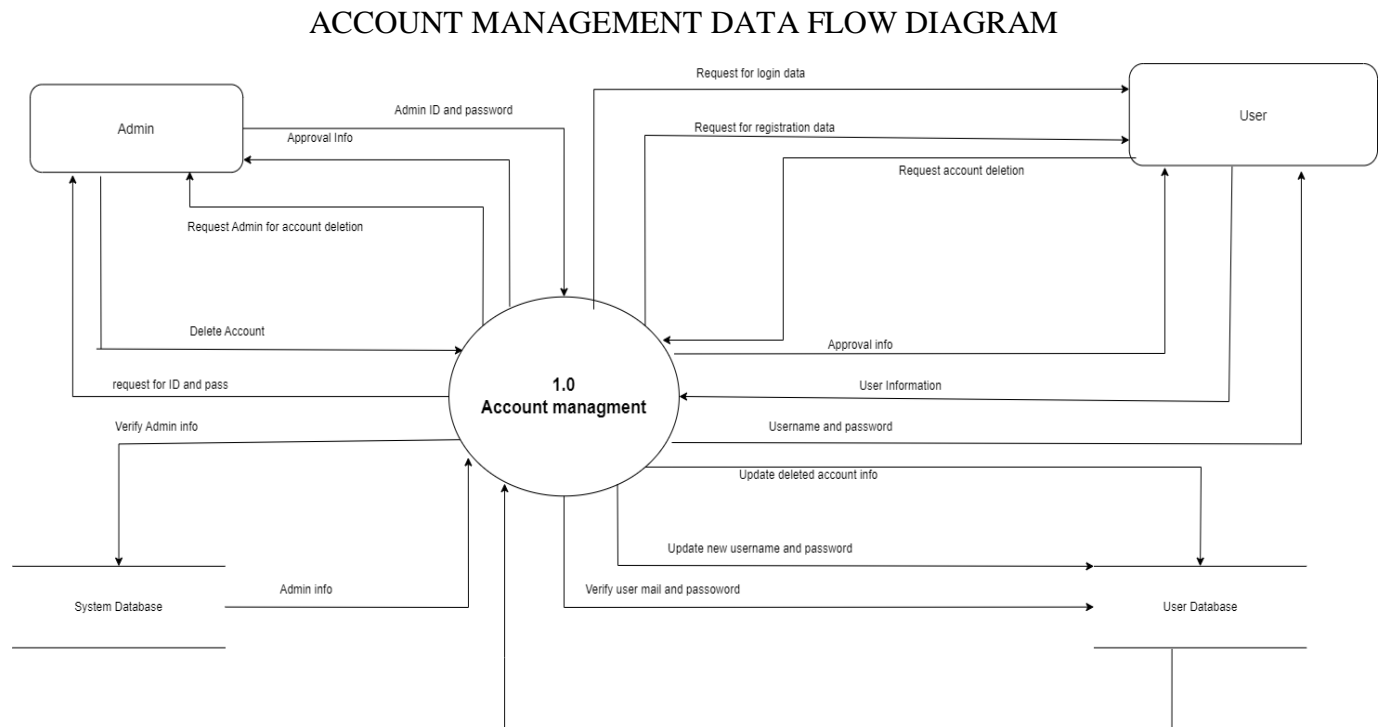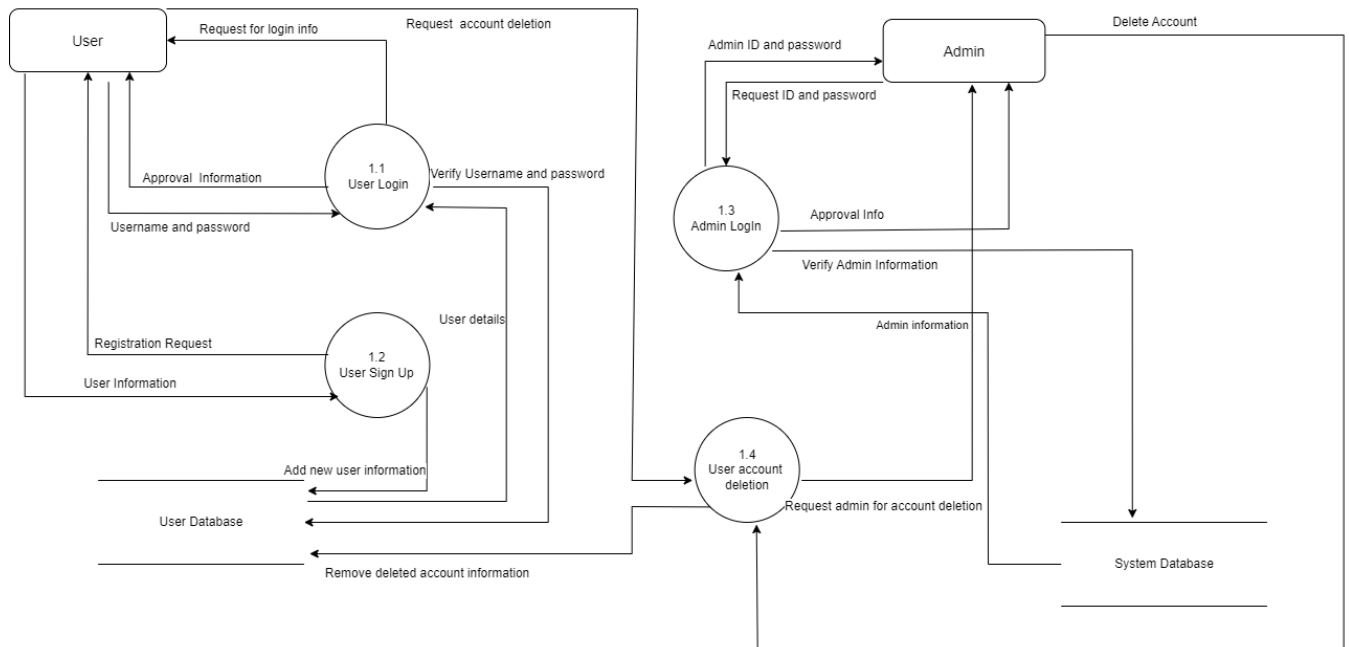
USER BILLING SYSTEM DATA FLOW DIAGRAM
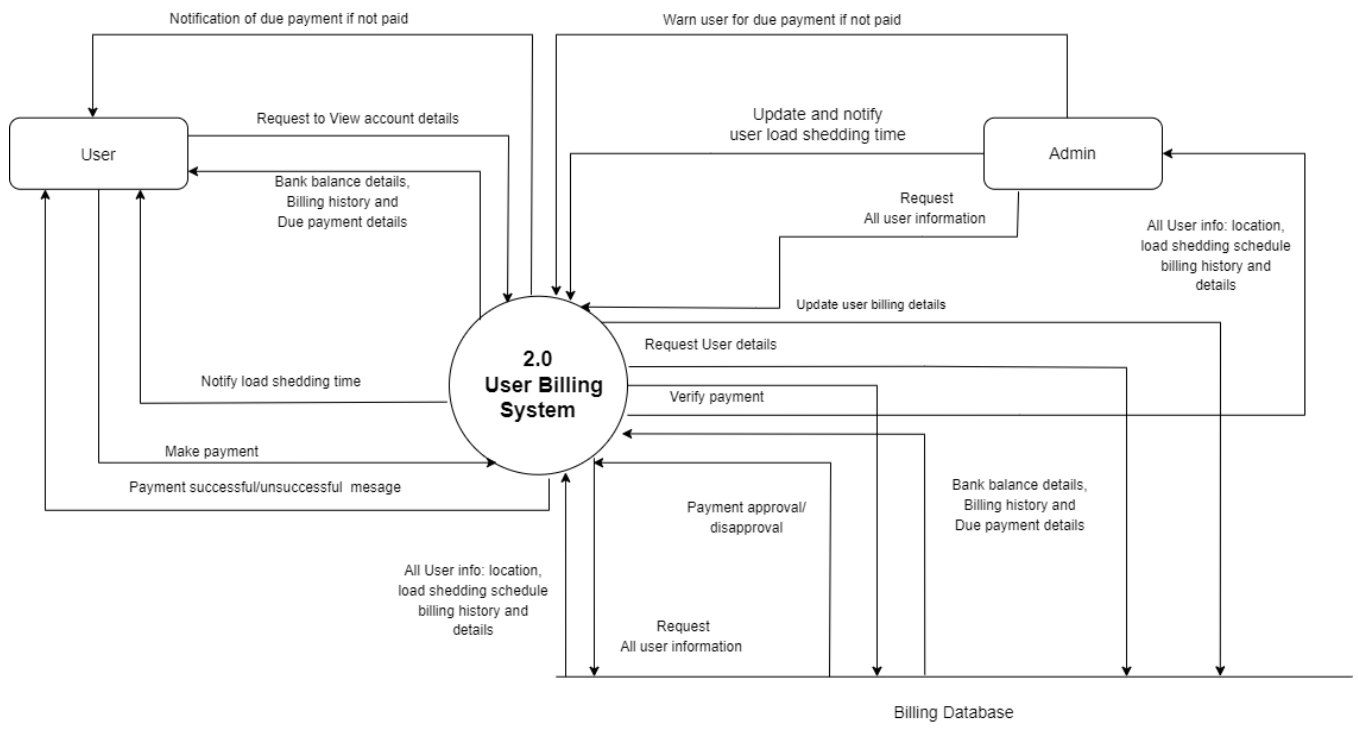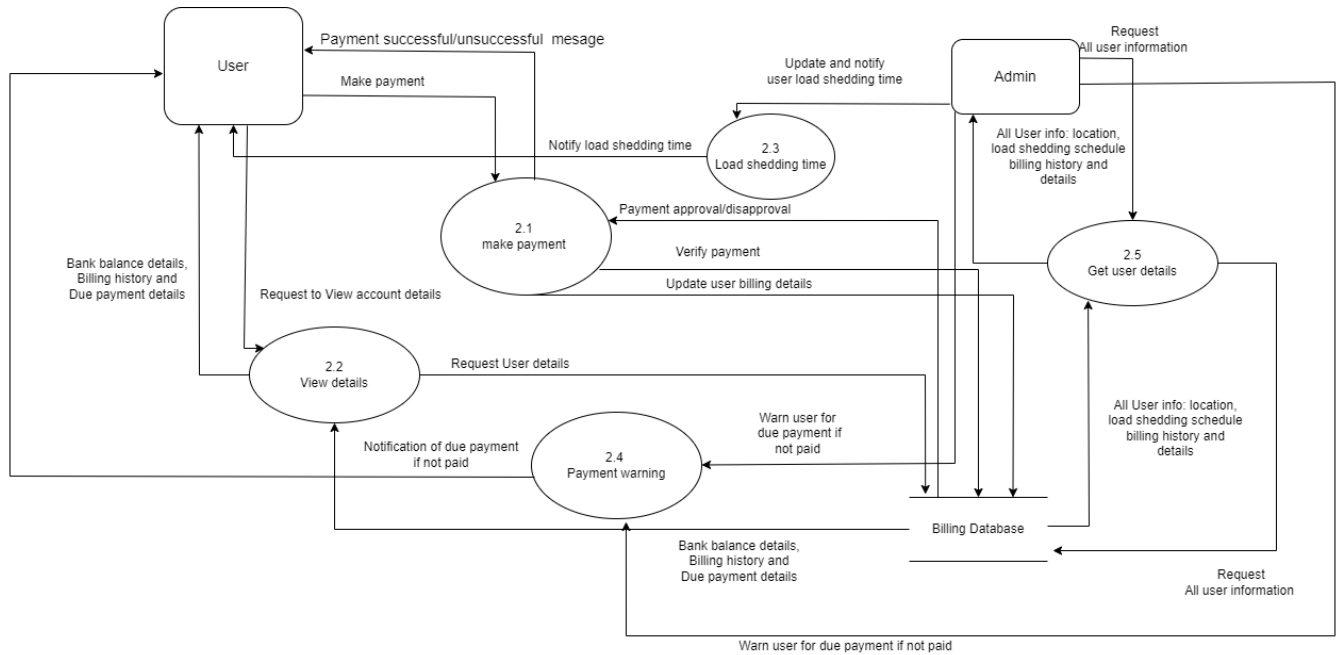
SYSTEM MAINTENANCE DATA FLOW DIAGRAM
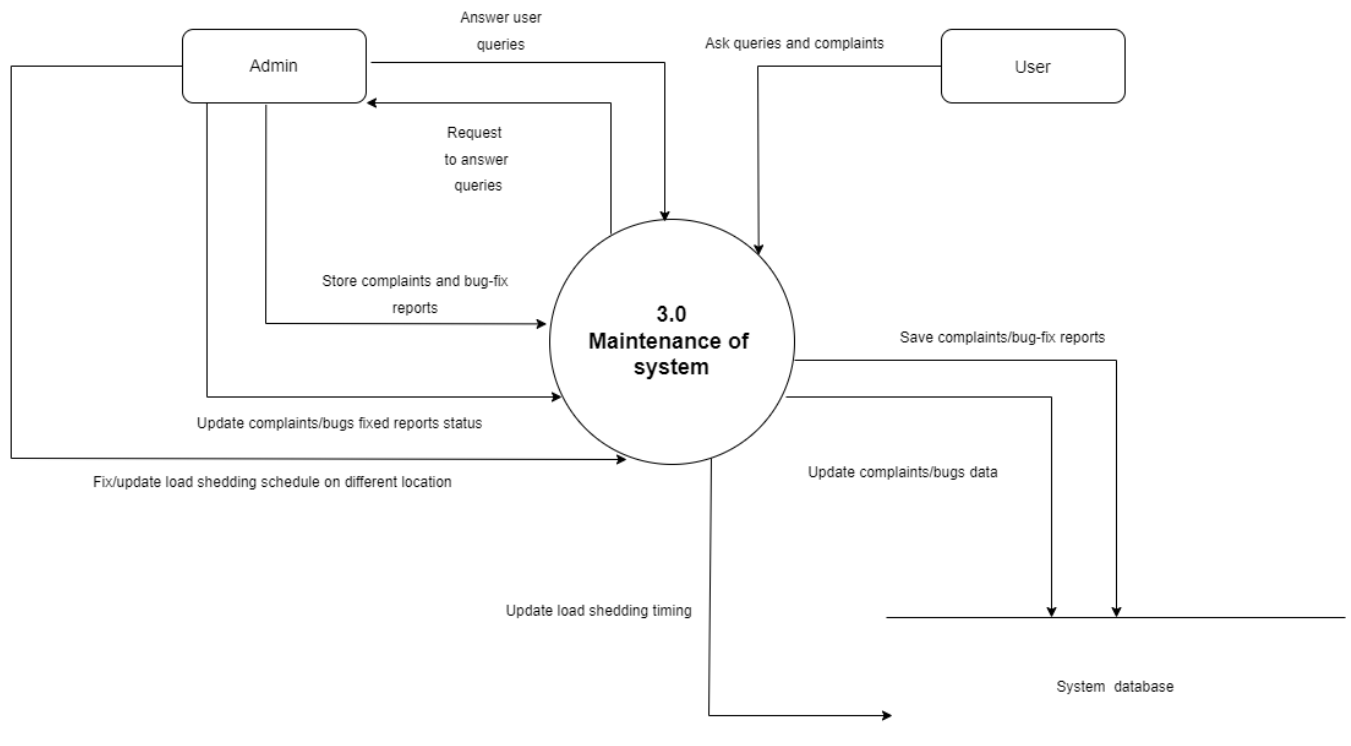
Window Navigation Diagrams:

A window navigation diagram outlines the interface's fundamental organization and the planned user flow between various interfaces. The illustrations below all provide an overview of the user-based system interface. The windows, buttons, hyperlinks, forms, and reports are all depicted in these diagrams.
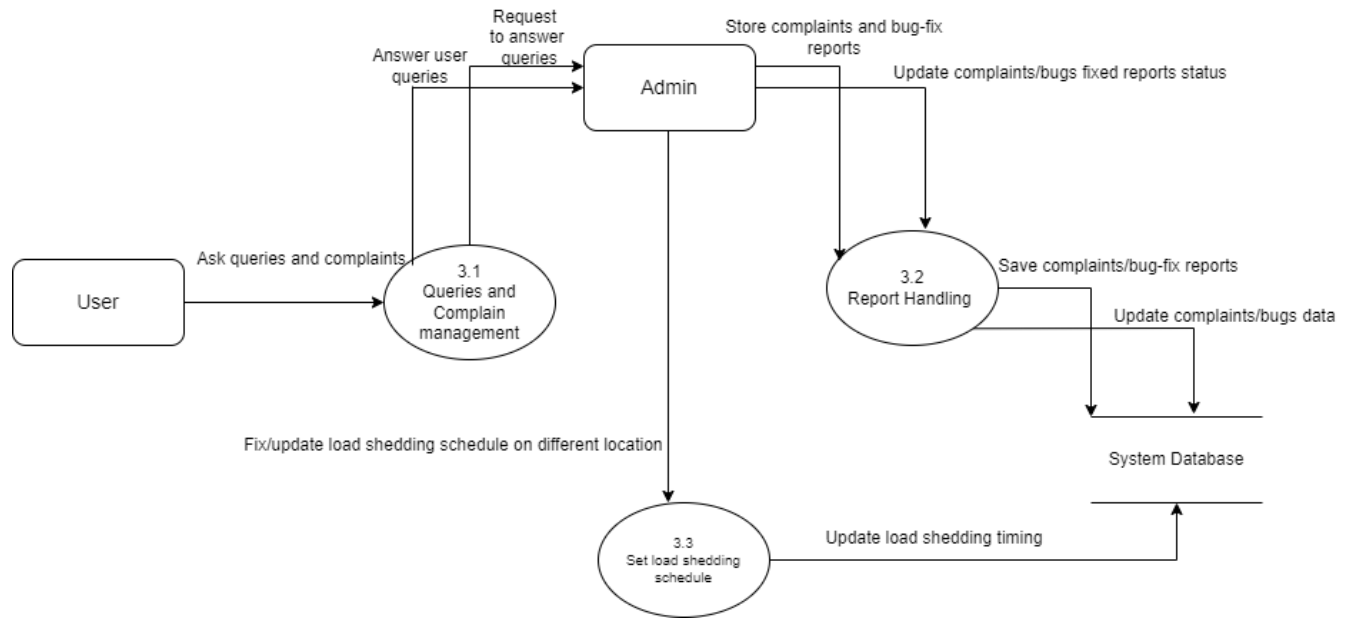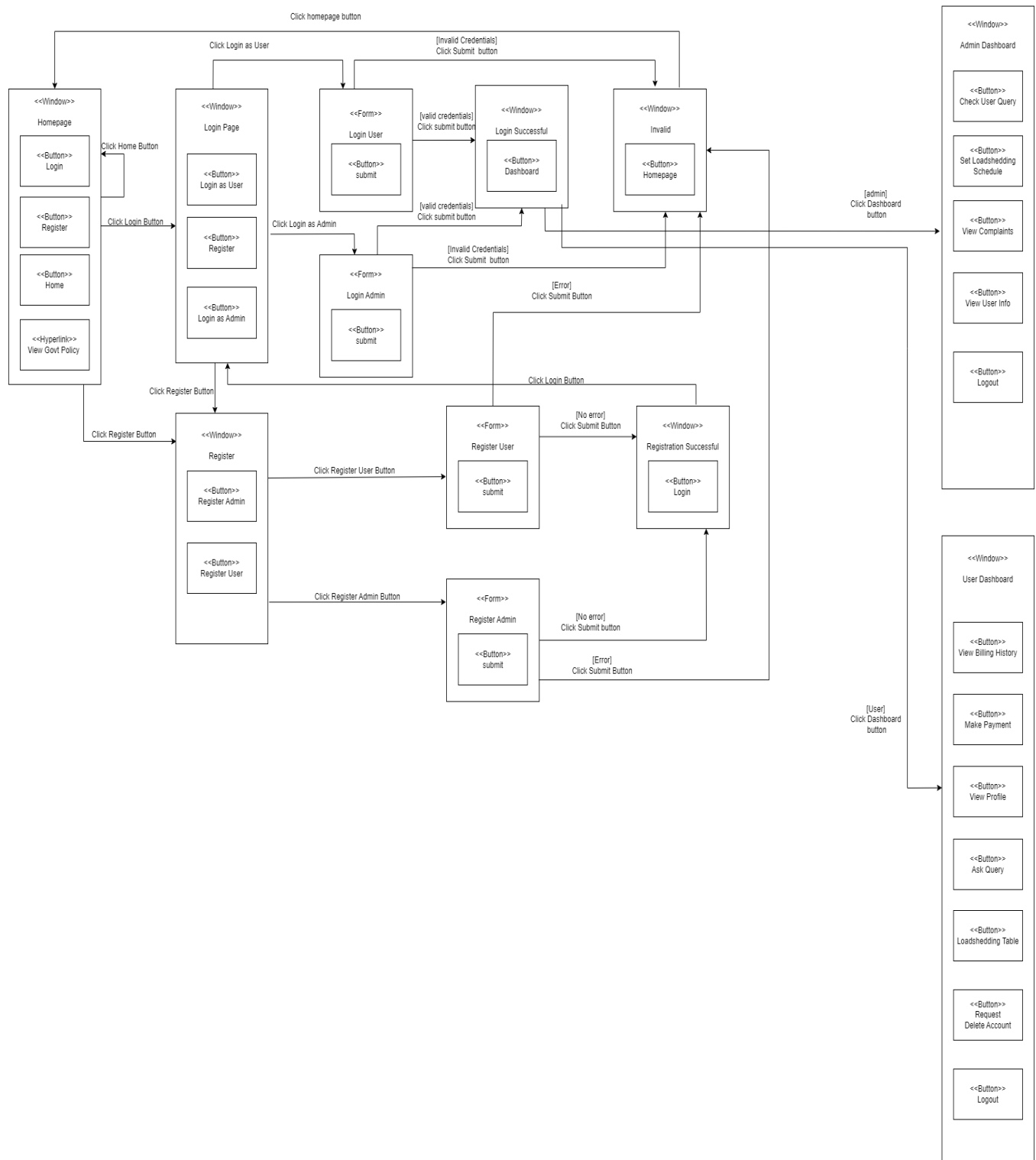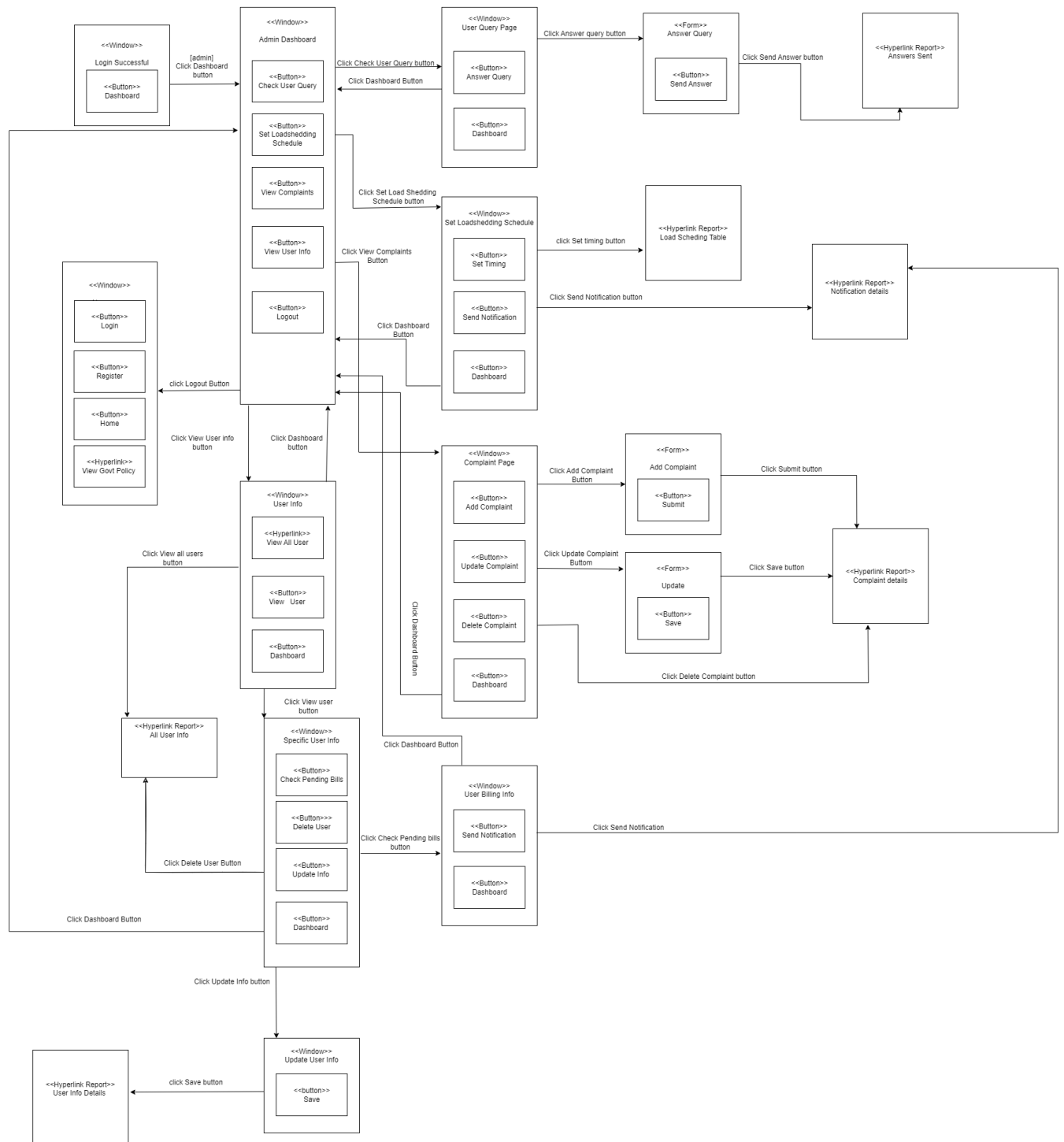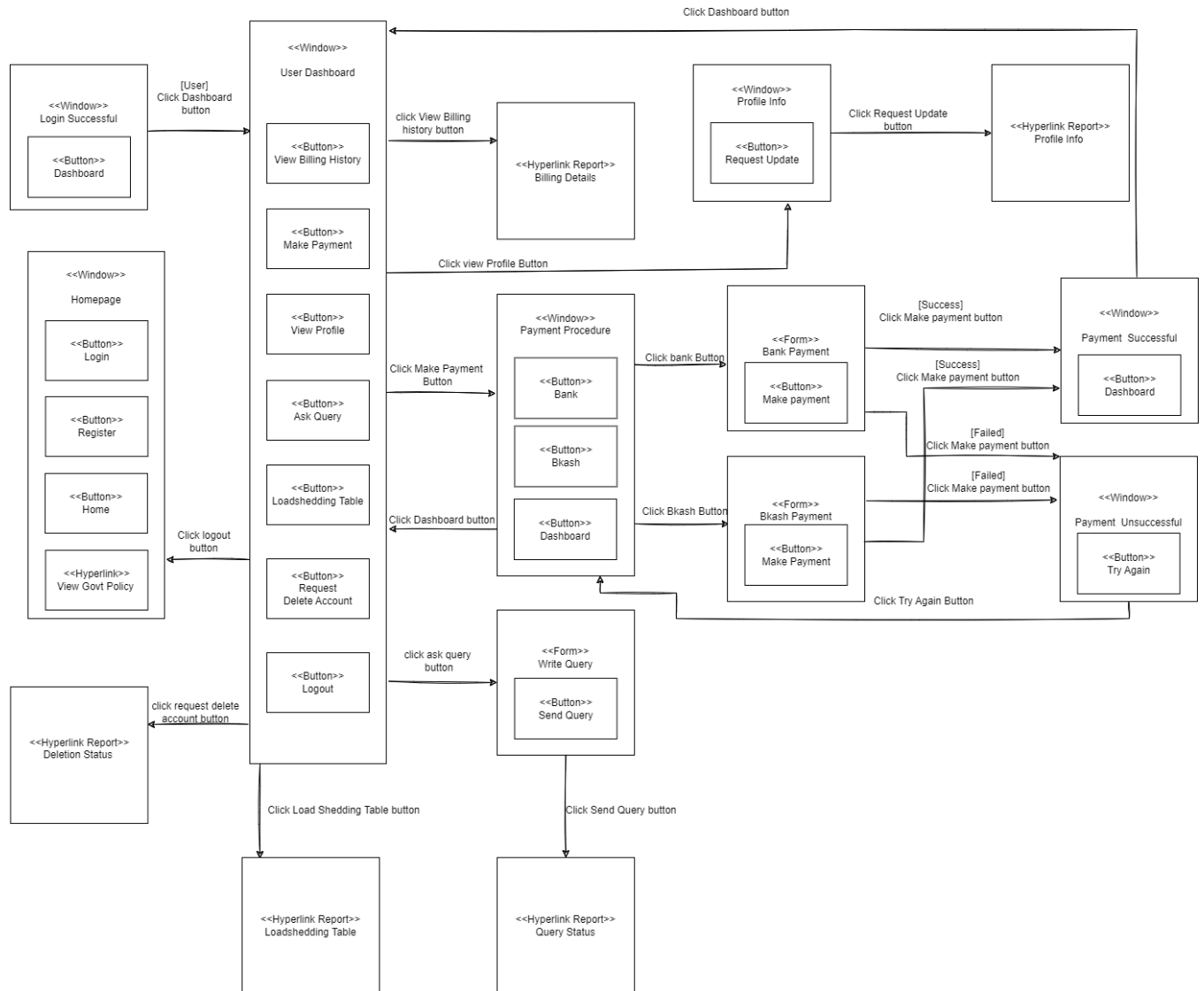
Windows Navigation for Login and Account

Click homepage button

Click Login as User

[Invalid Credentials]
Click Submit button

<<Window>>
Admin Dashboard

<<Button>>
Check User Query

<<Window>>
Homepage

<<Button>>
Login

<<Button>>
Register

<<Button>>
Home

<<Hyperlink>>
View Govt Policy

Click Home Button

<<Window>>
Login Page

<<Button>>
Login as User

<<Button>>
Register

<<Button>>
Login as Admin

<<Form>>
Login User

<<Button>>
submit

[valid credentials]
Click submit button

<<Window>>
Login Successful

<<Button>>
Dashboard

<<Window>>
Invalid

<<Button>>
Homepage

<<Button>>
Set Loadshedding Schedule

[admin]
Click Dashboard
button

<<Button>>
View Complaints

Click Login Button

Click Login as Admin

[valid credentials]
Click submit button

<<Form>>
Login Admin

<<Button>>
submit

[Invalid Credentials]
Click Submit button

<<Button>>
View User Info

[Error]
Click Submit Button

<<Button>>
Logout

Click Register Button

Click Login Button

<<Window>>
Register

<<Button>>
Register Admin

<<Button>>
Register User

Click Register Button

Click Register User Button

<<Form>>
Register User

<<Button>>
submit

[No error]
Click Submit Button

<<Window>>
Registration Successful

<<Button>>
Login

Click Register Admin Button

<<Form>>
Register Admin

<<Button>>
submit

[No error]
Click Submit button

[Error]
Click Submit Button

<<Window>>
User Dashboard

<<Button>>
View Billing History

<<Button>>
Make Payment

<<Button>>
View Profile

[User]
Click Dashboard
button

<<Button>>
Ask Query

<<Button>>
Loadshedding Table

<<Button>>
Request
Delete Account

<<Button>>
Logout

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Windows Navigation for Admin

Windows Navigation for User

Conclusion:

People have long been affected with the difficulties of paying their electricity bills in unfriendly environments with the fear of power cuts if not paid in due time. With the help of this web service, this convenient approach to managing your bills saves time, as all of the user's bills appear in one place instead of needing to login to multiple online accounts. One can quickly check account balances and see whether their bill payment has been scheduled and paid when they utilize electronic bill pay. Other advantages include the ability to look up individual payments online, check payment histories, and get notifications to remind them of upcoming payments. This system is convenient for users and well as maintenance managers such as admins as the system is mostly automated.