# A Comprehensive Approach to Electricity Billing Management Using Java Swing and SQL

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*Abstract*- Electricity users frequently face inaccurate and delayed monthly billing due to certain limitations. Therefore, it is essential to have a reliable electronic platform that takes proximity into account for such purposes. The suggested approach automates the time-consuming process of paying power bills by visiting the Electricity Board. Additionally, it simplifies the computation and payment of electricity bills for user convenience. Java Swings, a versatile programming language used for creating websites, online applications, and web services, is utilized to develop the system. Structured Query Language (SQL) server is also used to create back-end databases. The system has two logins: an administrator login and a user login. The administrator has access to the user's account information and can also add the customer's information regarding energy usage for the current month. The administrator is responsible for providing the system with information on each user's usage of electricity. The system then determines each user's monthly electricity bill and updates the data in each user's account. Users can view their electricity bills and make payments before the end of the month.

# Index Terms— Automation, Back-end databases, Electricity billing, Energy usage, Java Swing, Power bills, SQL server

# I. INTRODUCTION -

The objective of this research paper is to develop a reliable and user-centric electronic platform for the accurate and timely billing of electricity usage, overcoming the limitations of the traditional billing process. Electricity billing management systems are essential tools for power utilities that aim to enhance the accuracy, effectiveness, and security to their billing procedures. The traditional billing process is often slow, inaccurate, and prone to errors. To overcome these limitations, several existing methods of electricity bill management have been developed using various programming languages such as Java, PHP, Python, and C#. Similarly, MS Access server is also used to create back-end databases. These systems have been successful in automating the process of paying power bills and simplifying the computation and payment of electricity bills for user convenience.

The proposed system aims to develop a more reliable and user-friendly electronic platform for the accurate and timely billing of electricity usage. It uses Java Swings, a versatile programming language, to develop the system, and Structured Query Language (SQL) server to create back-end databases using MySQL Database. The system has two logins: an administrator login and a user login, where the administrator has access to user account information and can add customer information regarding energy usage.

The system determines each user's monthly electricity bill and updates the data in each user's account, and users can view their bills and make payments before the end of the month. The proposed system provides an efficient and comprehensive solution to the challenges faced by electricity users. It demonstrates the importance of reliable electronic platforms in streamlining the billing process and offers an excellent opportunity for power utilities to modernize their billing systems. Overall, this project can significantly improve the accuracy, efficiency, and security of the electricity billing process and benefit both utilities and customers alike.

# II. METHODOLOGY -

#### A. Java:

Java is a versatile programming language employed in creating a wide range of applications, web applications, mobile apps, desktop software, and more. It is known for its portability, meaning that Java code can be written once and run-on multiple platforms without the need for major modifications. This makes it a popular choice for developing cross-platform applications that can be used on different operating systems.

Another key benefit of Java is its platform independence. Since Swing is built on top of the Java Virtual Machine (JVM), the system can be executed on various platforms that are compatible with Java, such as Windows, Mac OS, Linux, and others. This makes it an ideal choice for developing cross-platform desktop applications that can be used by a wide range of users.

# **B.** Java Swing:

Java Swings is a popular programming language used for developing user interfaces and graphical user interfaces (GUIs). It is a foundation programming language for creating websites, online applications, and web services. Java Swings allows developers to create user-friendly and interactive interfaces that are both intuitive and visually appealing.

In the proposed electricity bill management system, Java Swings is used to develop the front-end of the software. The use of Java Swings allows for the creation of a user interface that is easy to handle and understand, making it simple for users to view and clear their electricity bills online. The platform is designed to give users a smooth experience, eliminating the need for physical visits to the Electricity Board.

For instance, it allows for the integration of multimedia elements such as audio and video into the user interface, enhancing the overall user experience. Additionally, it provides a wide range of customizable components such as buttons, labels, and text fields that can be used to create unique and personalized interfaces.

Overall, the use of Java Swings in the proposed electricity bill management system ensures that users have access to a reliable and efficient platform that is both user-friendly and visually appealing.

- Java Swings is a flexible and popular coding language for developing user interfaces and GUIs.
- It offers a range of pre-built components that can be easily customized to create unique and visually appealing interfaces.

• Java Swings is well-suited for developing cross-platform software that can be used on different operating systems and devices.

• Java Swings offers robust error handling and debugging features, which to ensure the software's dependability and errorfree operation.

# C. Model-View-Controller:

The Model View Controller (MVC) architecture is an important feature of the Java Swing framework used in the project. It is a software design pattern that divides the application into the model, view, and controller, three interdependent parts.

- The MVC architecture has three fundamental divisions: model, view, and controller.
- The model component manages the application's business logic and information(data).
- $\cdot$  The data is rendered to the user interface by the view component.
- As a bridge between the model and the view, the controller takes user input from the view and updates the model as necessary.

• The use of the MVC architecture in Swing provides benefits such as improved modularity, reusability, and maintainability of code.

Overall, the implementation of the MVC architecture in the Java Swing framework in the project provides a robust and scalable structure for developing reliable and user-friendly software solutions.

# D. MySQL:

Web applications frequently employ MySQL, a well-liked relational database management system that is open-source. It offers a robust and scalable system to store and manage ample amounts of data, making it an ideal choice for the back-end of the electricity billing system, MySQL communicates with the database via SQL, allowing developers to perform complex queries and operations.

- MySQL is used as the back-end database management system for the project.
- · It stores all the data related to user accounts, electricity usage, billing information, and payment details.
- The system uses SQL queries to retrieve and manipulate data stored in the MySQL database.
- Enables several users to access identical info at once, while ensuring data consistency and concurrency control.
- Provides a way to create relationships between tables with foreign keys and referential integrity.

Additionally, MySQL offers a variety of tools and features for ensuring data security, such as user authentication, encryption, and backup and recovery options. Its compatibility with multiple programming languages and platforms, including Java Swing used in this project, make it a versatile choice for web development projects.

# E. Flowchart:



Figure 1: Flow Chart

#### F. User Case Diagram



🔬 Login Pa

# **III. BILLING SYSTEM MODULE -**

# a. Login Screen:

The login screen of the system comprises multiple fields, including username and password, and features two distinct buttons for logging in and signing up. Prior to utilizing the scheme, a user must first register their information. Upon successful registration, the user can login to the system using their unique username and password, and access various features and functionalities provided by the system. The login screen offers the convenience of logging in as either a customer or an admin, each with their respective login credentials and privileges.

#### b. Sign-Up Screen:

To create an account, the user must fill out the necessary details, including their first name, last name, chosen username and password, as well as their meter number, which is automatically fetched from the database based on the username provided by the administrator. The signup screen of the electricity billing management system also offers the flexibility to sign up as either a customer or an administrator, providing distinct access privileges and functionality for each user type.

# Username Password Loging in as Admin Login Cancel Signup LOUT ILL - HEN AMAGELEUTICELESSEUAUET.GELESSE CEMINES OUTCELEMENT. LOUTA

| Create Account As | Customer 🗸 🗸 |   | ~ |
|-------------------|--------------|---|---|
| Meter Num         |              | ( |   |
| Username          |              |   |   |
| Name              |              |   |   |
| Password          |              |   |   |
|                   |              |   |   |

Figure 3: Sign-up Screen

#### c. Admin's Page :

The electricity billing management system's admin screen allows the administrator to access various functionalities, including the capacity to include new clients and see their details and deposit information. When adding a new customer, the admin can enter their email, phone number, address, state, city and name, the meter number is automatically generated and assigned to the customer by the system. This automated process eliminates the need for manual meter number assignment, streamlining the customer registration process.

The admin screen of the electricity billing management system provides the functionality to calculate the electricity bill of customers. The admin can select the customer's meter number and specify the month for which the bill needs to be generated. The system then retrieves the units used by the customer for that month from the database. Additionally, the name and address of the customer are automatically fetched from the database based on the meter number. This streamlined process saves time and ensures accuracy in bill calculation.

In the admin screen of the electricity billing management system, we have included some additional features like notepad, web browser and calculator to enhance the user experience and increase productivity. The notepad feature allows the admin to quickly jot down notes or important information without having to switch to another application, which can save time and improve efficiency.

| <u></u>       |        | - <u></u> |  | × |  |  |
|---------------|--------|-----------|--|---|--|--|
| New Customer  |        |           |  |   |  |  |
| Customer Name |        |           |  |   |  |  |
| Meter No      | 758040 |           |  |   |  |  |
| Address       |        |           |  |   |  |  |
| City          | [      |           |  |   |  |  |
| State         | [      |           |  |   |  |  |
| Email         |        |           |  |   |  |  |
| Phone Number  |        |           |  |   |  |  |
|               |        |           |  |   |  |  |
| Next          | Cancel |           |  |   |  |  |
|               |        |           |  |   |  |  |

|                 |              |       |               | - 🗆 ×      |
|-----------------|--------------|-------|---------------|------------|
| Sort by Meter N | umber 934435 | ~     | Sort By Month | January ~  |
| Search          | Print        |       |               |            |
| meter_no        | month        | units | totalb        | ill status |
| 158836          | January      | 56    | 654           | Paid       |
| 934435          | February     | 78    | 852           | Paid       |
| 148055          | January      | 120   | 1230          | Not Paid   |
| 34435           | February     | 130   | 1320          | Paid       |
| 48055           | March        | 12    | 258           | Not Paid   |
| 34435           | March        | 83    | 897           | Paid       |
| 34435           | June         | 123   | 1257          | Not Paid   |
|                 |              |       |               |            |
|                 |              |       |               |            |
|                 |              |       |               |            |
|                 |              |       |               |            |
|                 |              |       |               |            |

Figure 4: New Customer

**Figure 5: Deposit Details** 

# d. Customer's Page:

The customer screen in the electricity billing management system offers various functionalities to the customers, as:

- Access to their personal information stored in the admin database
- Ability to pay their electricity bill online
- Option to check their bill details for any month up to the current date
- Capability to take printouts of the bill details for their records

Additionally, the customer screen provides access to a notepad, web browser and calculator, which can be used by the customers to perform calculations related to their bill and note down any important information related to their electricity usage. The calculator feature can be particularly useful in ensuring that the customers are able to cross-check their bills and identify any discrepancies, if present. Overall, these features enhance the usability and convenience of the electricity billing management system for the customers.

The electricity billing management system empowers customers to update their personal information like address, city, state, email, and phone number in case of any change or errors. However, to ensure accurate billing and record-keeping, customers are not authorized to modify their registered name or meter number.

| 🖆 Pay Bill Page |          | - 🗆 X      | 💼 Update Information Page |                        | - 🗆 🗙 |
|-----------------|----------|------------|---------------------------|------------------------|-------|
| Electricity     | y Bill   |            | UPDAT                     | E CUSTOMER INFORMATION |       |
| Meter No        | 934435   |            | Name                      | Name Here              |       |
| Name            | test1    |            | Meter Number              | Meter_No Here          |       |
| Month           | February | 🖗 BILL 📰   | Address                   |                        |       |
| Units           | 130      |            | City                      |                        |       |
| Total Bill      | 1320     | └ <u>(</u> | State                     |                        |       |
| Status          | Paid     |            | Email                     |                        |       |
| Pay             | Back     |            | Phone                     |                        |       |
|                 |          |            | Update                    | Back                   |       |

Figure 6: Pay Bill

**Figure 7: Update Information** 

# **IV. TOOLS USED FOR DEVELOPMENT -**

# A. Netbeans:

Java and other programming languages can be used to create desktop, mobile, and online apps utilising the open-source integrated development environment NetBeans IDE. It offers a user-friendly interface and an extensive set of features, including code editing, debugging, and profiling tools.

NetBeans IDE also supports various frameworks and technologies, such as JavaFX, HTML5, JavaScript, and CSS. It allows developers to build and deploy applications quickly and efficiently, thanks to its robust code generation and project management

capabilities. Additionally, it offers seamless integration with version control systems, such as Git and Subversion, enabling easy collaboration among team members. Overall, NetBeans IDE is a powerful tool for Java development and has been widely used in various industries for many years.

# B. Advantages of Netbeans:

- Maven: Maven is a crucial term that is commonly used in the context of NetBeans around the globe. One of the key advantages that NetBeans users appreciate is the ability to use Maven without requiring any additional plugins. Instead of importing Maven projects, they can be directly opened in NetBeans, making the development process smoother and more streamlined.
- Easy to Use: The quick turnaround time between installing NetBeans and starting to build useful apps is one of its primary advantages. Despite having a large ecosystem of plugins, not much needs to be installed or set up because everything is available as soon as it is launched.
- **Code Editor:** The NetBeans IDE provides a robust and user-friendly code editor that facilitates the development of high-quality and efficient code for the Electricity Billing Management System project. The editor includes tools like code completion, code highlighting, and syntax checking, which help developers to write code faster and with fewer errors.
- **Customizability:** The high degree of flexibility offered by the NetBeans IDE enables developers to adapt it to their unique requirements and tastes. Users can modify the interface layout, keyboard shortcuts, and toolbars, as well as install and configure various plugins and extensions to enhance the functionality of the IDE. This customization capability enables developers to create a personalized and optimized development environment, increasing their productivity and efficiency.

# C. MySQL:

The Electricity Billing Management System was created and is implemented using the robust and dependable open-source MySQL relational database management system. Large volumes of data linked to client accounts and their electricity usage can be stored, managed, and retrieved via the system. It is used as the back-end database to store all the relevant data, including customer information, electricity usage data, billing details, and payment history.

- The system is made to be both scalable and reliable, and MySQL is used to handle large amounts of data efficiently.
- MySQL's performance and reliability are essential to manage the high volume of transactions generated by the electricity billing process.
- The use of MySQL in the Electricity Billing Management System ensures efficient data retrieval and reporting.
- The system can generate various reports related to customer billing, usage trends, and payment history. These reports help administrators to make informed decisions and take appropriate actions.
- MySQL is a crucial component of the Electricity Billing Management System, contributing to its efficiency, scalability, and security.
- Overall, the use of MySQL in the system is critical for ensuring reliable and effective management of electricity billing processes.

In summary, MySQL is a critical component of the Electricity Billing Management System, providing a reliable, scalable, and secure database platform that enables efficient management of customer billing and usage data. Its use aids in increasing accuracy, efficiency, and security of the billing process, ultimately enhancing customer satisfaction and trust.

# V. CONCLUSION

The Electricity Billing System Using Java is an essential tool for power utilities that want to increase precision, correctness, and security of their billing procedure. It is a powerful system that can help utilities to reduce costs, increase customer satisfaction, and build trust with their customers. With its scalability, security, and cross-platform compatibility, the Electricity Billing System Using Java is an excellent choice for power utilities looking to modernize their billing systems and offers an efficient and convenient way to manage electricity billing processes for both customers and administrators. The system's user-friendly interface enhances the user experience. Overall, the electricity billing management system project is an excellent example of how technology can streamline and simplify complex processes.

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