

VISVESVARAYA TECHNOLOGICAL UNIVERSITY

“Jnana Sangama”, Belagavi-590 014



A Mini - Project Report

On

“ELECTRICITY BILL MANAGEMENT SYSTEM”

Submitted in partial fulfillment of the requirements for the **MINI PROJECT (BCD586)**

course of the 5th semester

Bachelor of Engineering

In

Computer Science & Engineering (DATA SCIENCE)

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CERTIFICATE

This is to certify that the Mini project work entitled “**ELECTRICITY BILLING MANAGEMENT SYSTEM**” is a bonafied work carried out by **Mr. Hemanth.mk (4AI22CD030), Mr. Gurukiran (4AI23CD400), Mr. Supreeth vs (4AI22CD057), Mr. Harsha M G (4AI22CD024)** in partial fulfillment for the **Mini Project (BCS586)** course of 5th semester Bachelor of Engineering in **Computer Science and Engineering (Data Science)** of the Visvesvaraya Technological University, Belagavi during the academic year **2024-2025**. It is certified that all corrections and suggestions indicated for Internal Assessment have been incorporated in the report deposited in the department library. The Mini project report has been approved as it satisfies the academic requirements in respect of Project Work prescribed for the said Degree.

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ABSTRACT

Electricity consumers are often faced with the problem of inaccuracy and delay in monthly billing due to some drawbacks. Thus, it is essential to have an efficient system for such purposes via electronic platform with consideration to proximity. The proposed system automates the conventional process of paying electricity bill by visiting the Electricity Board which is tiresome and time consuming.

It is also designed to automate the electricity bill calculation and payment for user convenience. The system is developed with JSP SERVLET as the base programming language which can be used to develop websites, web applications and web services. The MYSQL is a relational database management system based on Structured Query Language (SQL) which is used for the purpose of web database. The system would be having two logins: the administrative and user login.

The administrator can view the user's account details and can add the customer's information of consuming units of energy of the current month in their account. The Admin must feed the system with the electricity usage data into respective user's account. The system then calculates the electricity bill for every user and updates the information into their account every month. Users can then view their electricity bill and pay before the month end.

This system aims to improve efficiency, accuracy, and transparency in the electricity billing process, reducing manual effort and minimizing errors.

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We express our humble pranas to his holiness **Divine Soul Parama Poojya Jagadguru Padmabushana Sri Sri Sri Dr.Balagangadharanatha Maha Swamiji** and **Parama Poojya Jagadguru Sri Sri Sri Dr. Nirmalanandanatha Maha Swamiji Pontiff, Sri Adichunchanagiri Maha Samsthana Matt and Sri Sri Gunanatha Swamiji**, Chikkamagaluru branch, Sringeri who have showered their blessings on us.

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Chapter 1

Introduction

1.1 Background

- **Context:** The traditional electricity billing process often involves manual data entry, paper-based records, and time-consuming calculations. This leads to inefficiencies, errors, and delays in bill generation and payment.
- **Problem:** Manual processes are prone to human error, leading to inaccurate billing and customer dissatisfaction. Additionally, paper-based records are difficult to manage and can be lost or damaged.
- **Opportunity:** An automated electricity billing management system can streamline the entire process, from meter reading to bill generation and payment. This can improve efficiency, accuracy, and customer satisfaction while reducing operational costs.

1.2 Problem Statement

- **Overview of the Problem:** The manual system is suffering from a series of drawbacks. Since whole of the bills is to be maintained with hands the process of keeping and maintaining the information is very tedious and lengthy to customer. It is very time consuming and laborious process because, staff need to be visited the customers place every month to give the bills and to receive the payments.
- **Specific Issues:**
 - Manual system are Time-consuming ,error-prone , and inefficient.
 - Difficulty in maintain accurate and up-to-date records.
 - Inefficient handling of customer inquiries and complaints.
 - Potential for inaccuracies in calculating charges.
 - Lack of robust security measures for sensitive customer data.
 - Inefficient collection of payments and reconciliation processes.
 - Difficulty in generating comprehensive reports for analysis.
 - Manual intervention required for many tasks.

1.3 Objective of the System

- The primary objective of the **Electricity Billing Mangement System** is aims to streamline and automate the entire electricity billing process, from meter reading to bill generation and payment. It seeks to improve efficiency, accuracy, and transparency for both electricity providers and consumers.

- **Key Goals:**
 - **Reduced Manual Intervention:** Minimize manual tasks and errors through automation.
 - **Faster Billing Cycles:** Expedite the billing process to ensure timely bill generation and delivery.
 - **Improved Accuracy:** Enhance the accuracy of billing calculations to avoid disputes and discrepancies.
 - **Enhanced Customer Satisfaction:** Provide better customer service through efficient billing processes and transparent communication.
 - **Cost Reduction:** Lower operational costs by automating tasks and reducing paperwork.
 - **Data-Driven Decision Making:** Generate valuable insights through data analysis to optimize operations and improve service delivery.

1.4 Significance of the System

- **Efficiency:** Automates manual processes, reduces paperwork, and streamlines operations.
- **Accuracy:** Minimizes human error in calculations and data entry.
- **Transparency:** Provides clear and detailed billing information to customers.
- **Security:** Protects sensitive customer data with robust security measures.
- **Cost-effective:** Reduces operational costs and improves resource utilization.
- **Customer Satisfaction:** Enhances customer experience through efficient and transparent services.
- **Data-Driven Insights:** Generates valuable insights for informed decision-making.
- **Scalability:** Easily adapts to growing customer bases and evolving business needs.
- **Environmental Impact:** Reduces paper consumption and promotes sustainable practices.

1.5 Significance of the System

- **Efficiency:** Automates manual processes, reduces paperwork, and streamlines operations.
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1.6 Methodology

- **Approach:** The system will be developed using a **web-based platform** (or mobile app), leveraging modern technologies such as **HTML, CSS, JavaScript**, and a backend language like **PHP**. The system will interact with a **relational database** (like **MySQL**) to store and retrieve attendance data.
- **Agile Development:** The system will follow an **Agile development** methodology, involving iterative design and feedback cycles to ensure that the system meets the needs of users at each stage of development.
- **Testing:** The system will be tested through a combination of **unit testing, integration testing**, and **user acceptance testing** to ensure functionality and user satisfaction.

1.7 Target Audience

- **Electricity providers:** This project can help electricity providers automate their billing processes, reduce errors, and improve efficiency.
- **Consumers:** This project can provide consumers with a convenient way to view and pay their electricity bills online.
- **Software developers:** This project can be a valuable learning experience for software developers who are interested in developing web applications.

1.8 Overview of the Report

- This report is structured into several chapters that detail the development and design of the **Electricity billing management System**. The following chapters include:
 - **Chapter 2: System Design** – Describes the architecture and design of the system.
 - **Chapter 3: Implementation** – Discusses the system's development and the technologies used.
 - **Chapter 4: Testing and Validation** – Details the testing process and results.
 - **Chapter 5: Results and Discussions** – Presents and results obtained and discusses the limitations
 - **Chapter 6: Conclusion and Future enhancement** - Summarizes the project and suggests future improvements.

Chapter 2

System Design

This chapter describes the technical design of the Electricity billing management system, explaining its architecture, components, and how website works and customer and admin interface. The design approach aims to make knowing their bills and safe payment ,issues, and user-friendly.

2.1 System Architecture

- **High-Level Overview:** An Electricity Billing Management System (EBMS) automates the entire process of electricity billing, from meter reading to bill generation and payment. The system typically includes the following components:

1. Meter Reading System:

Smart Meters: These devices automatically record electricity consumption and transmit data to the central system.

- **Manual Meter Reading:** In areas without smart meters, meter readers manually record consumption and input data into the system.

2. Data Acquisition System:

- **Data Collection:** Gathers meter reading data from smart meters or manual input.
- **Data Validation:** Verifies the accuracy and completeness of collected data.
- **Data Storage:** Stores the collected data in a central database.

3. Billing System:

- **Bill Calculation:** Calculates electricity charges based on consumption, tariff rates, and other applicable factors.
- **Bill Generation:** Generates detailed bills, including consumption details, charges, and due dates.
- **Bill Distribution:** Distributes bills to customers through various channels (e.g., email, SMS, physical mail).

4. Payment System:

- **Payment Gateway Integration:** Enables online payment options through various payment gateways.
- **Payment Processing:** Processes payments and updates customer accounts accordingly.

- **Receipt Generation:** Generates payment receipts for customers.

5. Customer Portal:

- **Customer Login:** Allows customers to access their account information.
- **Bill View:** Provides access to current and past bills.
- **Payment History:** Displays payment history and transaction details.
- **Online Payment:** Enables online bill payment.
- **Complaint Registration:** Allows customers to lodge complaints and track their status.

6. Administrative Portal:

- **User Management:** Manages user accounts and permissions.
- **Tariff Management:** Updates tariff rates and slabs.
- **Report Generation:** Generates various reports (e.g., revenue reports, consumption trends).

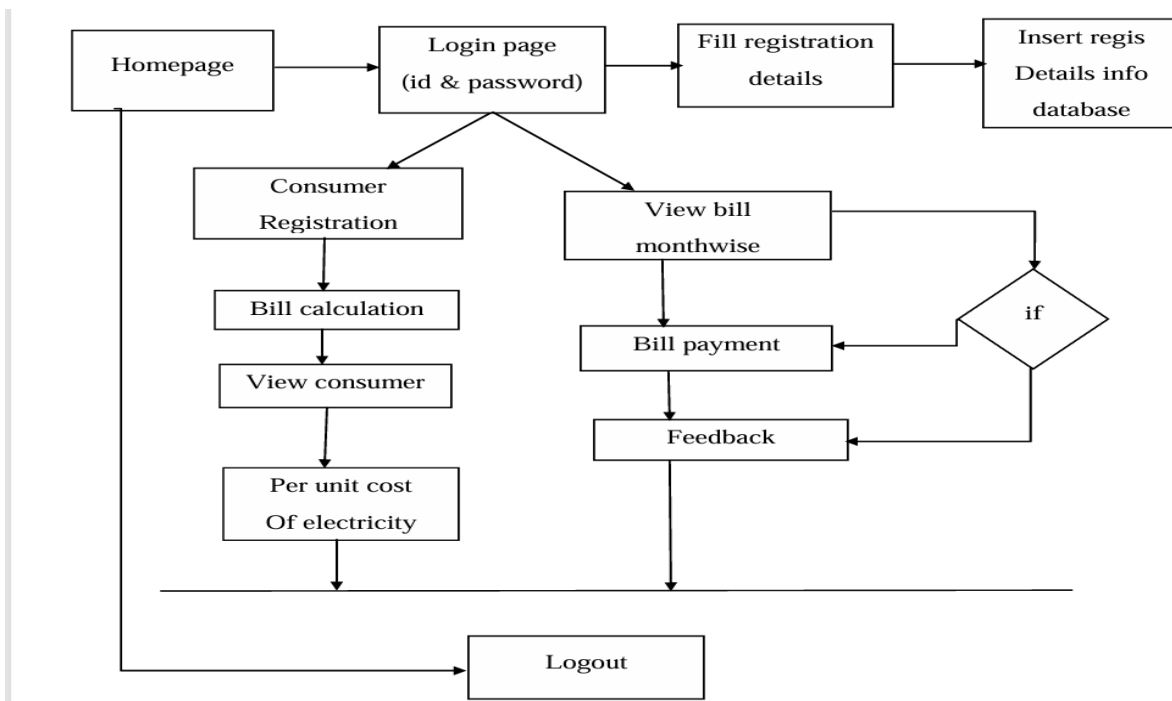


Fig 2.1 :system architecture

- **System Configuration:** Configures system settings and parameters.

- **Architecture Diagram:**
 - Present a diagram showing the key components: frontend (UI), backend server, and database.

- **Components:**
 - **Frontend:** User interface for customers and administrators.
 - **Backend:** Server-side components for data processing, business logic, and database interactions.
 - **Database:** Stores customer information, meter readings, bills, payments, and system configurations.

2.2 Module Design

- The system is divided into functional modules, each handling a specific task.

2.2.1 Admin Module

Administrators to manage the Website and update the content & Updating the Electricity bill, View bill collector, View Customer meter id bill amount and adding deleting or modifying the Bill Collector & customer details etc.

Admin Module Working:

- Able to manage bill collectors.
- Able to view billing status.
- Able to manage customers

2.2.2 Bill Collector Module

Bill collector to manage the bill and update the content & Updating the bill, View customer list, View paid bills etc..

Bill Collector module working:

- Able to generate bills to customer account.
- Able to view billing status.
- Able to view customer details.

2.2.3 CustomerModule

Customer can see the bill & pay bill view generated bills. He can they see view billing statement.

Customer Module Working:

- Able to view generated bills.
- Able to make bill payments.
- Able to view billing statement

2.3 Database Design

Data Base Table

Downloads Cloud computing ppt

Server: 127.0.0.1 Database: eblsystem

Structure SQL Search Query Export Import Operations Privileges Routines Events Triggers Tracking More

Filters

containing the word:

Table	Action	Rows	Type	Collation	Size	Overhead
admin		1	InnoDB	latin1_swedish_ci	16 K18	-
bill		13	InnoDB	latin1_swedish_ci	40 K18	-
complaint		4	InnoDB	latin1_swedish_ci	48 K18	-
transaction		13	InnoDB	latin1_swedish_ci	32 K18	-
unitsrate		0	InnoDB	latin1_swedish_ci	16 K18	-
user		10	InnoDB	latin1_swedish_ci	16 K18	-
6 tables	Sum	41	InnoDB	latin1_swedish_ci	176 K18	0 B

☐ Check all With selected:

Print Data dictionary

Create table

me: Number of columns:

Fig2.2 Data base table

Home Page

E-Billing System

Electricity Billing System

This website at the end of its construction will act as a consumer oriented service for users for easy payment of their respective **Electricity Bill** as well as interact with their providers in case of any queries or grievances.

Sign Up

Full Name

Email

Password

Confirm Password

Contact No.

Address

Fig 2.3 home page

2.4 User Interface (UI) Design

- **Main Screens:**
 - **Background:** Dark blue
 - **Elements:** Title : "E-Billing System"
 - **Login Screen:** Users enter credentials to access the system.
Email: Text fields for user email address.
Password: password field for user password.
Sign In: Button to initiate the login process.
Sign Up: Button to direct users to the registration page.
 - **Dashboard(After login):**
A personalized dashboard tailored to the user's needs.
Displays key information :
 - Current bill amount
 - Payment due date
 - Previous consumption history
 - Complaint/Inquiry

2.5 Technology Stack

- **Frontend:** HTML, CSS, JavaScript
- **Backend:** PHP ,JavaScript
- **Database:** MySQL

Chapter 3

Implementation

This chapter outlines the steps taken to implement the Student Attendance System, covering the backend, frontend, database, and integration processes. It describes the technologies used, the structure of the codebase, and any special development techniques.

3.1 Backend Implementation

- The backend was developed as a RESTful API to handle requests from the frontend, process data, and interact with the database.

API Endpoints

- ****Authentication****:
 - `POST /login``: Authenticates users based on role (Admin, user)
 - `POST /register``: Allows new user registration.
- ****Electricity billing Management****:
 - `GET /classes/:customer_id/user``: Returns a list of students in a class.
 - `POST /data``: Allows user to login, submitting data for each user status .
 - `GET //:customer_id``: Retrieves data records for a specific user.
- ****Report Generation****:
 - `GET /reports``: Generates Electricity bill reports based on specified criteria (e.g., by bills amounts , pending bills, generating bills).

3.2 Frontend Implementation

The frontend provides the user interface for Admin and customer to interact with the system.

User Interface (UI) Components

- ****Login Page****: Allows users to log in with their credentials, validating input before sending data to the backend.
- ****Dashboard****: Displays navigation options tailored to each user role (Admin, user or Customers).
- ****Electricity billing Screen****: Enables user to view a list of payed bills , pending bills and compliants.
- ****Report Screen****: Provides options to filter and view dash board , customers ,billings and complaints enabling users to generate reports.

3.3 Database Implementation

- **Database Setup:** Used MySQL/PostgreSQL as the database system to store user data in a relational structure.
- **Database Schema:**
 - **User Table:** Stores user data, including user_id, username, password_hash, and role.
 - **Admin Table:** Stores customer-specific data, such as user_id, name, email, phone no and address.

Chapter 4

Testing

This chapter covers the testing processes and methodologies applied to the Electricity billing Management System. Testing is essential to identify and correct any issues, validate that the system meets functional and non-functional requirements, and ensure that it performs reliably under various conditions.

4.1 Testing Objectives

- Verify that the system functions as intended by executing a series of test cases.
- Ensure that all user roles (Admin, Customer) can access the intended features without any errors.
- Test the accuracy of customer records and data retrieval.
- Confirm that the system is secure and handles invalid inputs or unauthorized access appropriately.
- Evaluate the system's performance and reliability under load.

4.2 Testing Environment

- **Hardware:** Laptop/PC with minimum 8GB RAM and multi-core processor.
- **Software:**
 - Backend and frontend hosted on local servers (php database for backend, java,css for frontend).
 - Database: MySQL .
 - Testing Tools: Postman for API testing.
- **Operating System:** Windows 11
- **Browser:** Microsoft Edge for cross-browser testing / chrome.

4.3 Types of Testing

4.3.1 Unit Testing

- **Objective:** To test individual components or functions in isolation to verify their correctness.
- **Tools:** php for backend logic testing, and React Testing Library for frontend component testing.
- **Example Test Cases:**
 - **User Authentication:** Verifies that the login function correctly authenticates users based on their credentials.
 - **customer:** Tests data is accurately marked and saved in the database.
 - **Report Generation:** Confirms that the report function generates data correctly for given filters (e.g., by date or user).

4.3.2 Integration Testing

- **Objective:** To test the interaction between different modules of the system (e.g., frontend and backend, backend and database).
- **Example Test Cases:**
 - **Customer Submission:** Ensures that the frontend sends at customer data to the backend, and the backend stores it correctly in the database.
 - **Data Retrieval for Reports:** Verifies that the report module retrieves and displays accurate customer data for specified criteria.
 - **User Access Control:** Confirms that only authorized users can access certain features .

4.3.3 Functional Testing

- **Objective:** To test the system against functional requirements to ensure it meets specified user needs.
- **Test Scenarios:**
 - **Login and Registration:** Tests login and registration processes for all user roles and checks that users are directed to the appropriate dashboard.
 - **CustomerManagement:** Verifies that Admin can mark for each customer and that the system accurately reflects the customer status.
 - **Viewing Reports:** Checks that customer, and admins can access reports and that data displayed matches billing records.

4.4 Test Cases

Below are sample test cases for various components:

Table 4.1: Test Cases

Test Case ID	Description	Test Steps	Expected Result	Status
Admin_1	Admin login	Enter valid username and password; click "Login" Input:admin password	Admin password	Pass
Admin_2	Admin login	Enter invalid username or password; click "Login" Input: invalid name,password	Error message displays, login fails	Pass
Admin_3	Admin login	Enter valid username &invalid password & submit enter	Username or password mismatch	Pass
Admin_4	View Customer	View name ,email/address Phone number Input:view customer	Successfully View customer	Pass
Admin_5	Generate bills	User /bill date due date /Generate To add bill Input:view customer	Successfully Add bills	Pass
Customer_1	Customer register	Enter user name email/ password	Successfully register customer	pass

ELECTRICITY BILLING MANAGEMENT SYSTEM

customer	Customer login	Enter invalid user e-mail password & enter login	Wrong user name or password	pass
customer	Customer login	Enter valid user e-mail password & enter login	Login to passenger home page	Pass
customer	View bills	View bill no, bill date/units consumed amount	Successfully View bill	pass
customer	View bills	View bill no Bill date/units Consumed/due date status	View missed Past in bill	pass
customer	View due bills	View bill date units consumed Due date	Successfully View due bills	pass
customer	View due bills	View bill date units consumed Due date	View missed past in due bills	pass
customer	View transactions	View transactions no Bill date	Successfully View transactions	pass
customer	Add complaints	Select your complaints	Successfully Send complaints	pass
customer	Add complaint	You're not select complaints	Please fill out This field	pass

Chapter 5

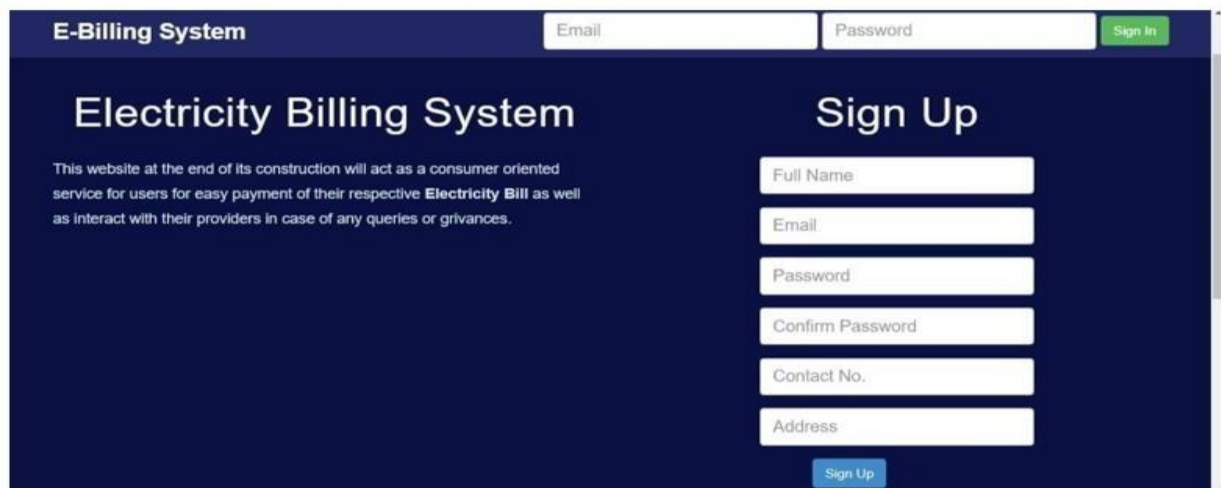
Results and Discussion

This chapter summarizes the results of the project, discussing its effectiveness, reliability, and alignment with the intended objectives. The chapter also covers any challenges encountered, key insights, and recommendations for future improvements.

5.1 Results:

Snapshots of the Project with description

Home Page



The screenshot displays the 'E-Billing System' home page. At the top, there is a navigation bar with the title 'E-Billing System' and two input fields for 'Email' and 'Password', followed by a green 'Sign In' button. The main content area is split into two columns. The left column features the heading 'Electricity Billing System' and a paragraph: 'This website at the end of its construction will act as a consumer oriented service for users for easy payment of their respective Electricity Bill as well as interact with their providers in case of any queries or grievances.' The right column is titled 'Sign Up' and contains a vertical stack of input fields: 'Full Name', 'Email', 'Password', 'Confirm Password', 'Contact No.', and 'Address'. A blue 'Sign Up' button is positioned at the bottom of this stack.

Fig 5.1: Sign up and login page for customers

The screenshot shows the 'E-Billing System' web application. The left sidebar contains navigation links: Dashboard, Customers, Billings, and Complaints. The main content area is titled 'Bills' and features a 'Bills History' table. The table has columns for Bill No., Customer, Date, UNITS Consumed, Amount, Due Date, and Status. The status column uses color-coded labels: 'PROCESSED' in green and 'PENDING' in red. A 'Generate New Bill' button is located at the top right of the table. The footer of the application indicates it was 'Created by BILLING SYSTEM'.

Bill No.	Customer	Date	UNITS Consumed	Amount	Due Date	Status
BN_33	klranks	2024-11-22	6	\$12.00	2024-12-22	PROCESSED
BN_32	harsha mg	2024-11-22	6	\$12.00	2024-12-22	PROCESSED
BN_31	hemanth kumar	2024-11-22	80	\$160.00	2024-12-22	PENDING
BN_30	gurukiran	2024-11-22	45	\$90.00	2024-12-22	PENDING
BN_29	suprith vs	2024-11-22	50	\$100.00	2024-12-22	PROCESSED

Fig 5.2: Bills Reflected on the client side

The screenshot shows the 'E-Billing System' web application with the 'Complaints' section selected. The main content area is titled 'Complaints' and features a table with columns for Complaint No., User, Complaint, Status, and Process. The status column shows 'NOT PROCESSED' for the first entry. A 'PROCESS COMPLAINT' button is visible next to the first row. The footer of the application indicates it was 'Created by BILLING SYSTEM'.

Complaint No.	User	Complaint	Status	Process
CA-16	klranks	Bill Not Correct	NOT PROCESSED	PROCESS COMPLAINT

Fig 5.3: Option for customers to pay the bill

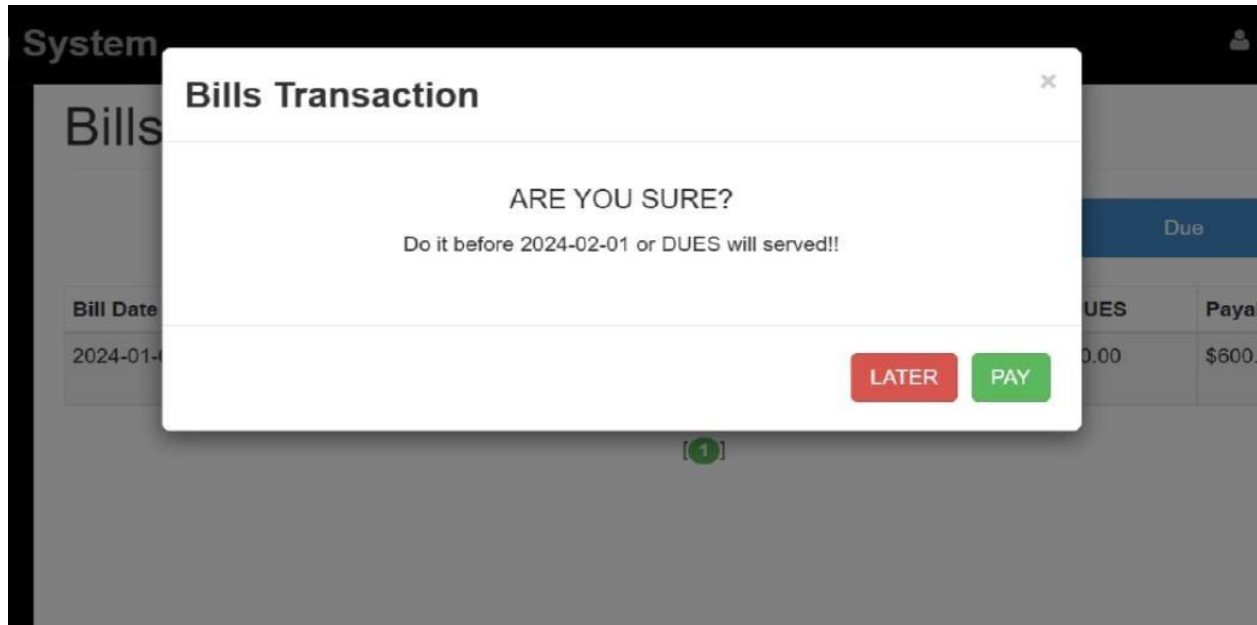


Fig 5.4: Pop up alert for due bills

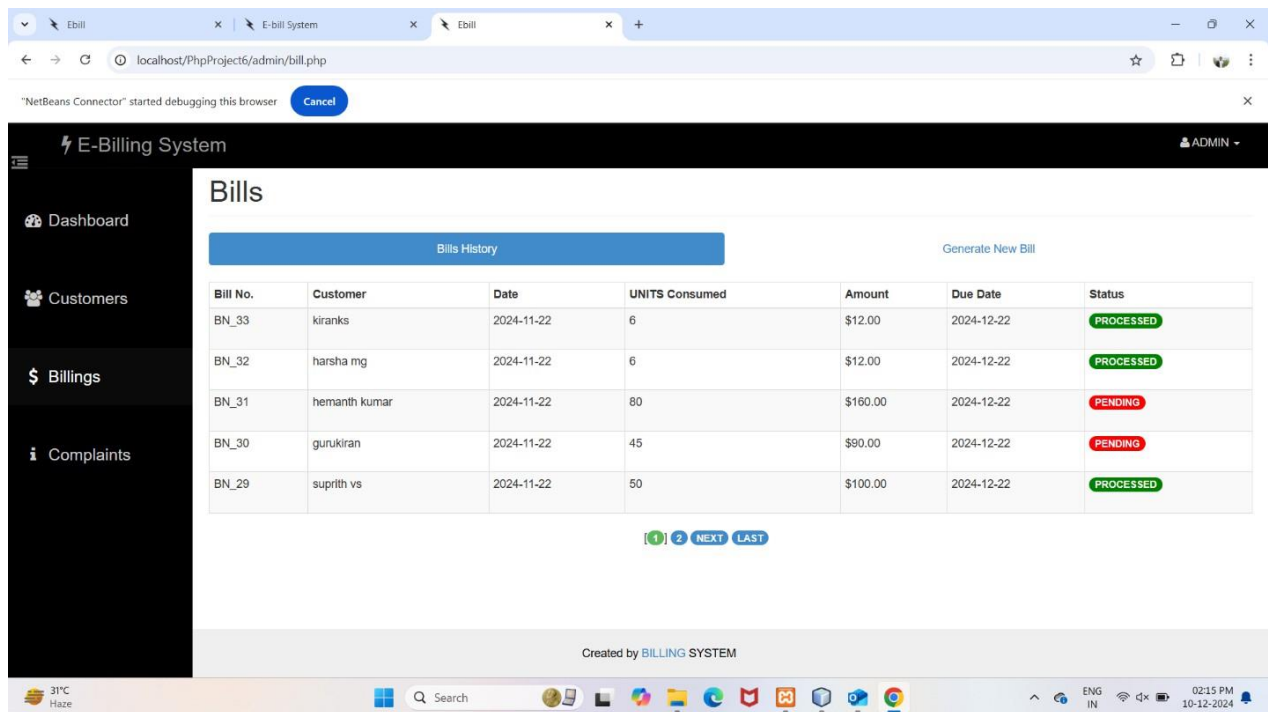


Fig 5.5: Status updates to processed after bill has been paid

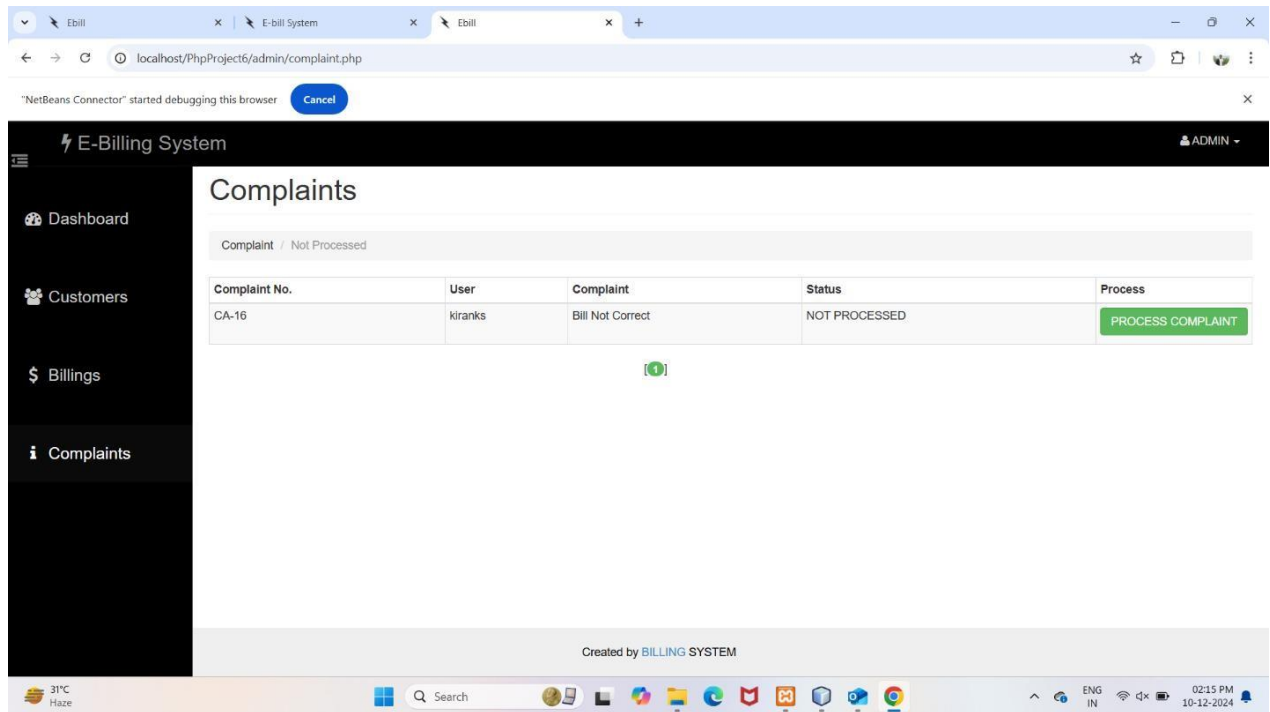


Fig5. 6: Clients can log complaints

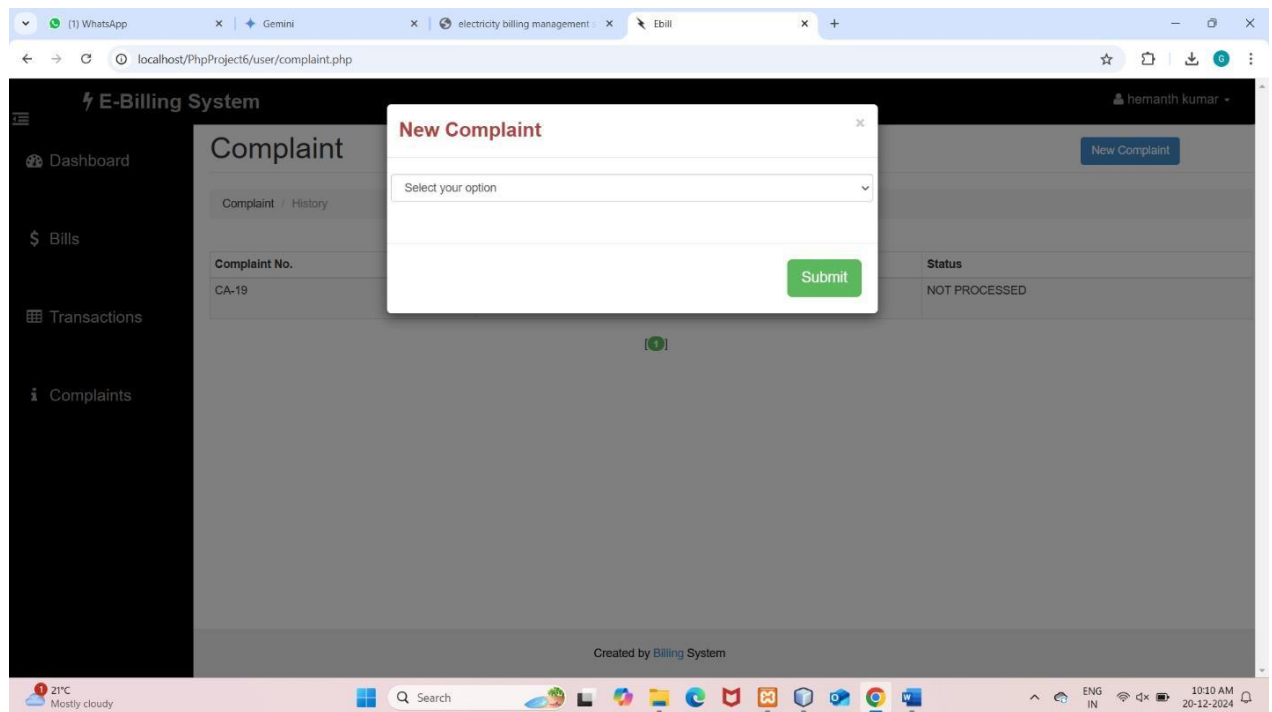


Fig 5.7: Admin can process the complaints

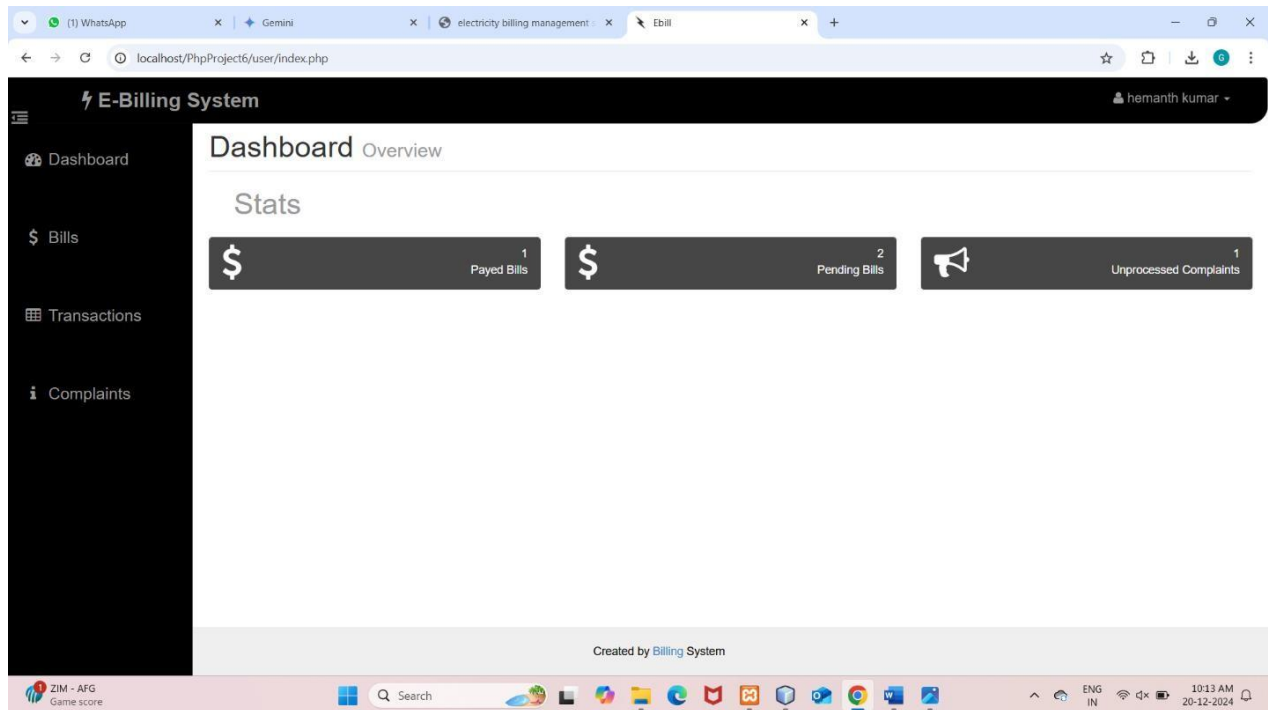


Fig5.8:Statistics/overview in user dashboard and updates

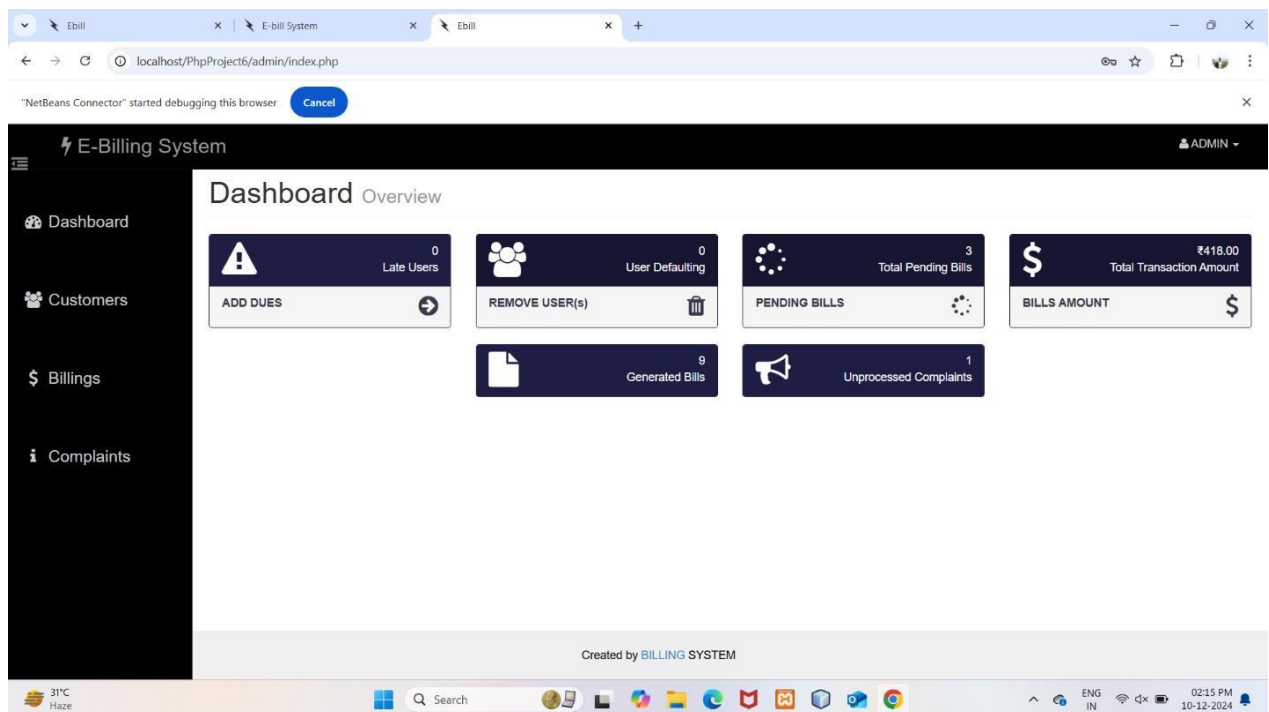
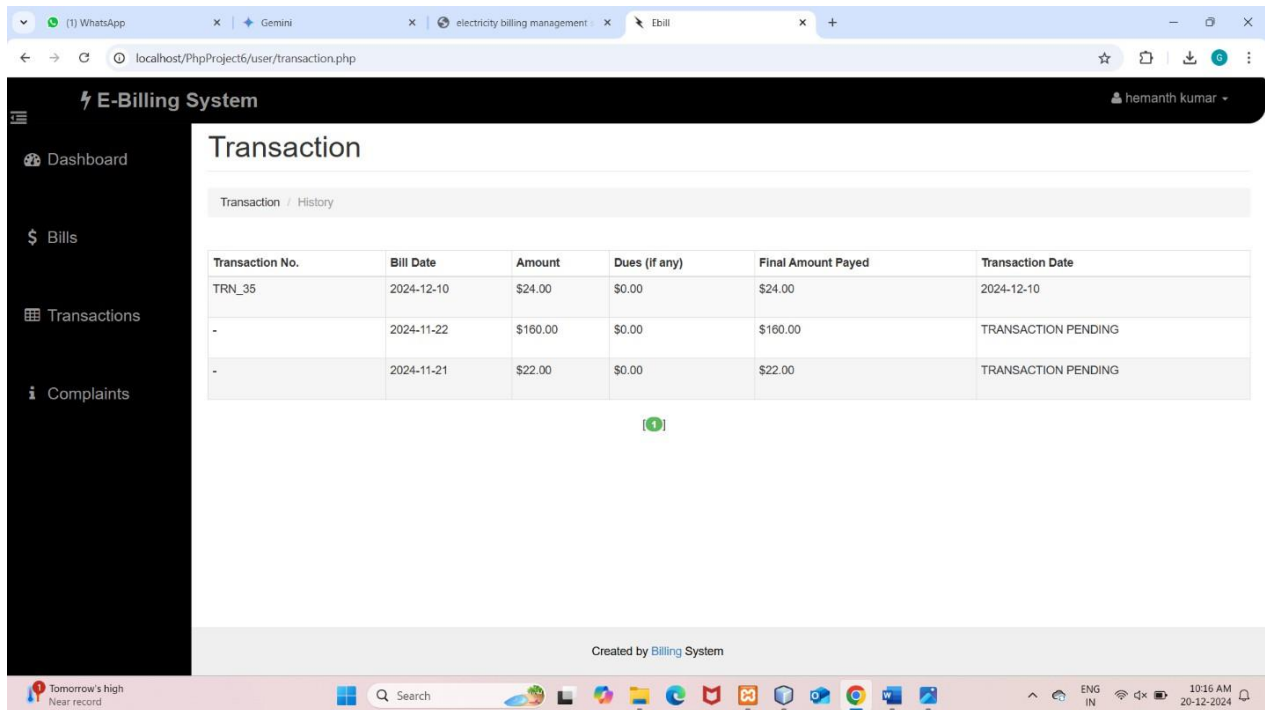


Fig 5.9:Admin dashboard starts also updated.



The screenshot displays the 'E-Billing System' web application. The left sidebar contains navigation links for 'Dashboard', 'Bills', 'Transactions', and 'Complaints'. The main content area is titled 'Transaction' and shows a table of transaction history. The table has columns for Transaction No., Bill Date, Amount, Dues (if any), Final Amount Payed, and Transaction Date. The data rows show transactions for TRN_35, with dates 2024-12-10, 2024-11-22, and 2024-11-21. The status for the last two transactions is 'TRANSACTION PENDING'. The system is created by 'Billing System' and the user is 'hemanth kumar'.

Transaction No.	Bill Date	Amount	Dues (if any)	Final Amount Payed	Transaction Date
TRN_35	2024-12-10	\$24.00	\$0.00	\$24.00	2024-12-10
-	2024-11-22	\$160.00	\$0.00	\$160.00	TRANSACTION PENDING
-	2024-11-21	\$22.00	\$0.00	\$22.00	TRANSACTION PENDING

Fig 5.10: Bill generated by admin

5.2 Discussion

Effectiveness of the System

- The electricity billing management system can significantly streamline operations, improve customer satisfaction, and reduce costs for utility companies. Here are some key points highlighting its effectiveness.
- The successfully Provides real-time access to customer data, enabling timely decision-making and problem-solving.
- Overall, the system demonstrated reliable performance, accurate data management, and ease of use, making it a valuable tool for society.

Challenges Encountered

- Ensuring data consistency across multiple systems (e.g., meter reading systems, billing systems, customer relationship management systems) can be complex.
- Integrating with third-party systems (e.g., payment gateways, SMS providers) can require technical expertise and coordination.
- Efficiently processing and analyzing real-time meter data is essential for accurate billing and load forecasting.
- Providing mobile access to billing information and payment options is important for customer convenience.

Limitations of the Current System

- Traditional systems often rely on manual payment processing, which can be time-consuming and error-prone.
- Delayed payment processing can impact the revenue cycle and cash flow of the utility company.
- Traditional systems may struggle to scale as the number of customers and complexity of operations increase.
- Manual processes and outdated systems require significant ongoing maintenance and support.

Chapter 6

Conclusion and Future Enhancements

6.1 Conclusion

- The **Electricity Billing Management System** has successfully addressed the inefficiencies and challenges associated with traditional manual billing processes. By automating various tasks such as meter reading, bill generation, and payment collection, the system has significantly improved operational efficiency and accuracy. The user-friendly interface empowers both consumers and administrators to easily navigate the system, leading to a seamless billing experience.
- Furthermore, the implementation of robust security measures ensures the protection of sensitive customer data, maintaining confidentiality and integrity. The system's scalability and adaptability enable it to accommodate future growth and evolving requirements within the electricity distribution sector.
- Overall, the Electricity Billing Management System has proven to be a valuable asset in streamlining the billing process, enhancing customer satisfaction, and contributing to the overall efficiency of electricity distribution organizations.

6.2 Future Enhancements

To further increase the effectiveness and usability of the electricity billing management System, the following enhancements are recommended:

Push Notifications and Reminders

- Integrating push notifications would enable the system to send reminders to customers about bill payment or unpaid dues . For example, notifications could alert customer who pay irregularly or send reminders for reaching deadline for dues.
- Adminer could also receive alerts to mark view at specific times, helping to ensure all issues,payments and customer details are recorded accurately and promptly.

Mobile Application Development

- A dedicated mobile application for Android and iOS devices could enhance accessibility and provide a smoother experience for users on mobile platforms. A mobile app would also enable users to interact with the system seamlessly from their phones, with a design optimized for smaller screens. Allow users to view and pay bills directly from their smartphones.
- Display real-time energy consumption data. Provide visual representations of outage areas. Offer direct communication channels with customer support. Deliver timely alerts and reminders.
- Develop for both iOS and Android platforms. Implement strong authentication mechanisms to protect user data. Enable certain features to work offline for seamless user experience. Design an intuitive and visually appealing interface. Release frequent updates to address bugs and introduce new features.

REFERENCES

Citation Format:

- **Online Resources:** Google ,ChatGPT, Gemini.
Title of the Webpage : Electricity billing management system.
- **Software Tools:** NETBEANS, XAMPP.