HYDERABAD INSTITUTE OF TECHNOLOGY AND MANAGEMENT SCIENCE

DEPARTMENT OF BACHELOR OF SOFTWARE ENGINEERING (2024-BATCH)

PROJECT REPORT

ON

"ELECTRICITY BILLING SYSTEM"

For the course

Data Structure and Algorithm

Submitted By:

MUBASHRA MUHAMMAD YOUSUF(24BSSW005)

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SUBMITTED TO:

ENGR:RASHIDA SUHAIL

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Abstract

This project presents a **DSA Based Electricity Billing System** developed using **Java Swing** for the graphical user interface. The system automates consumer registration, meter management, bill generation, and payment handling. Efficient data handling is achieved through the use of core data structures such as **HashMap**, **ArrayList**, and **Stack**, while sorting techniques are applied to organize billing records. The application demonstrates practical implementation of data structures and algorithms in a real-world billing scenario, providing accuracy, efficiency, and ease of use.

Introduction

Electricity billing systems are essential for managing energy consumption records and generating accurate bills for consumers. Traditional manual billing processes are time-consuming, error-prone, and difficult to maintain as data grows. With the advancement of software technologies, automated billing systems have become necessary to ensure efficiency and reliability.

The objective of this project is to design and implement a **desktop-based electricity billing system** using Java and Data Structures & Algorithms (DSA). The system focuses on efficient storage, retrieval, and processing of billing data while providing a user-friendly interface.

Problem Statement

Manual electricity billing systems suffer from several limitations, including:

- Data redundancy and inconsistency
- Slow processing and calculations
- Difficulty in tracking unpaid bills
- Lack of undo or recovery mechanisms

Therefore, there is a need for an automated system that efficiently manages electricity billing data using appropriate data structures and algorithms.

Scope of the Project

The scope of this project includes:

- Consumer registration and deletion

- Meter reading management
- Slab-based electricity bill calculation
- Bill payment and undo payment functionality
- Sorting and displaying billing records
- Dashboard summary of system statistics

Future enhancements can extend the system with database connectivity, online payments, and reporting features.

Tools & Technologies Used

- **Programming Language:** Java
- **GUI Framework:** Java Swing
- **JDK:** Java Development Kit (JDK 8 or above)
- **IDE:** VScode

Data Structures Used

HashMap

HashMap is used to store and manage **customers** and **meters** using unique keys.

- `HashMap<Integer, Customer>` stores consumer details.
- `HashMap<Integer, Meter>` stores meter information.

This allows fast insertion, deletion, and retrieval of records.

ArrayList

ArrayList is used to store electricity **bills**.

- It supports dynamic resizing and easy traversal.
- Bills are added as they are generated.

Stack

Stack is used to implement the **Undo Payment** feature.

- When a bill is paid, it is pushed onto the stack.
- Undo operation pops the last paid bill and reverts its status.

Sorting (Comparator)

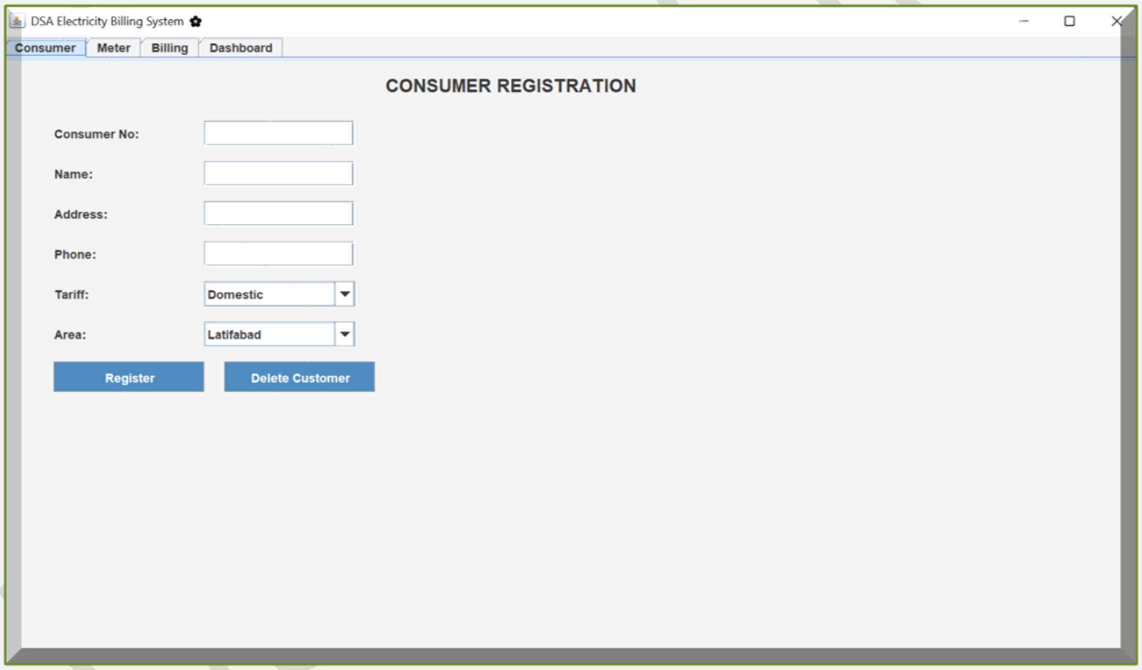
Bills are sorted using a comparator based on the total bill amount. This helps in analyzing high-consumption customers.

System Design & Architecture

The system follows an object-oriented design and consists of the following main classes:

Customer Class

Stores consumer information such as consumer number, name, address, tariff, phone number, area, and associated bills.

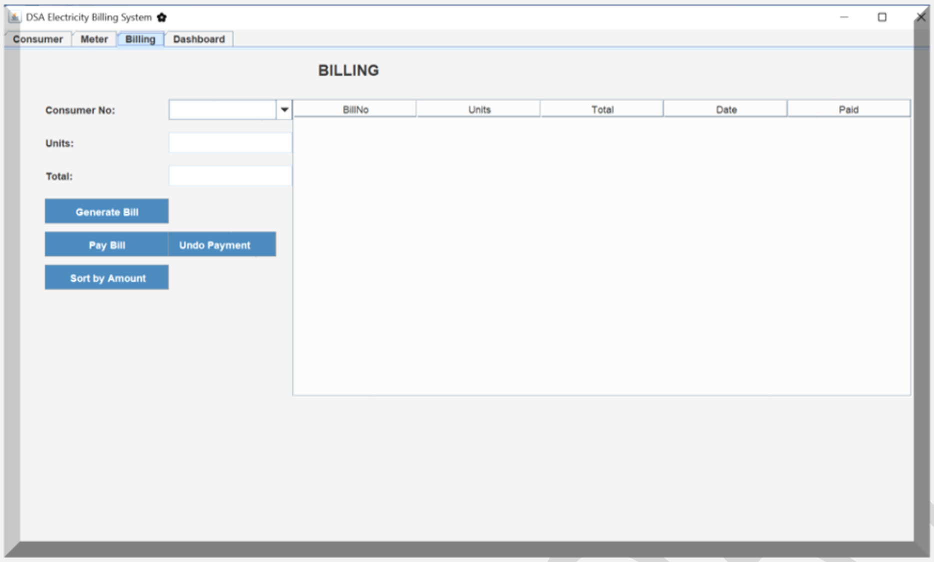


CONSUMER REGISTRATION

Consumer No:	
Name:	
Address:	
Phone:	
Tariff:	Domestic
Area:	Latifabad

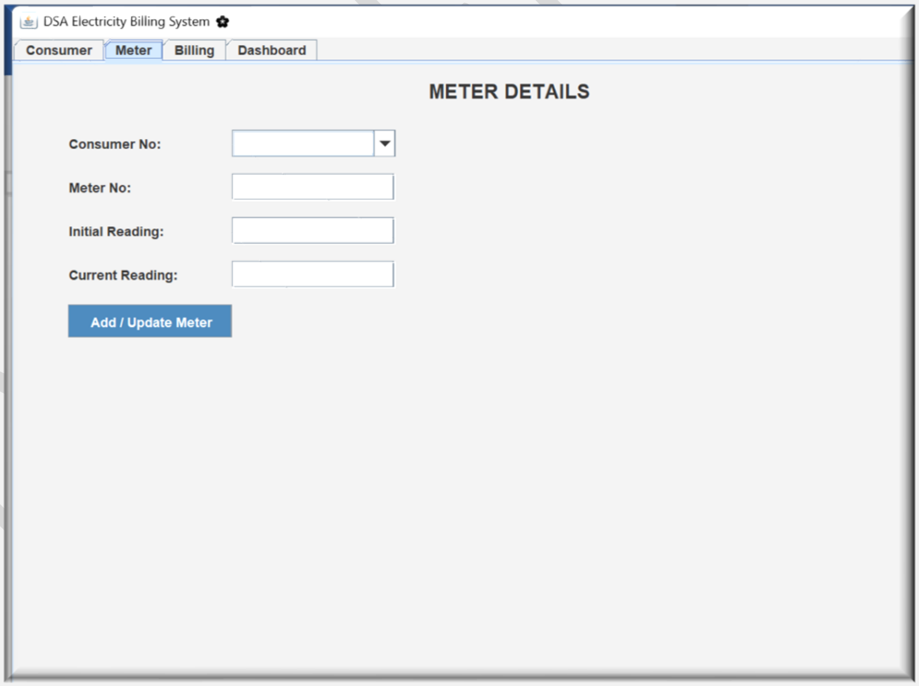
Bill Class

Represents an electricity bill containing bill number, consumed units, total amount, billing date, and payment status.



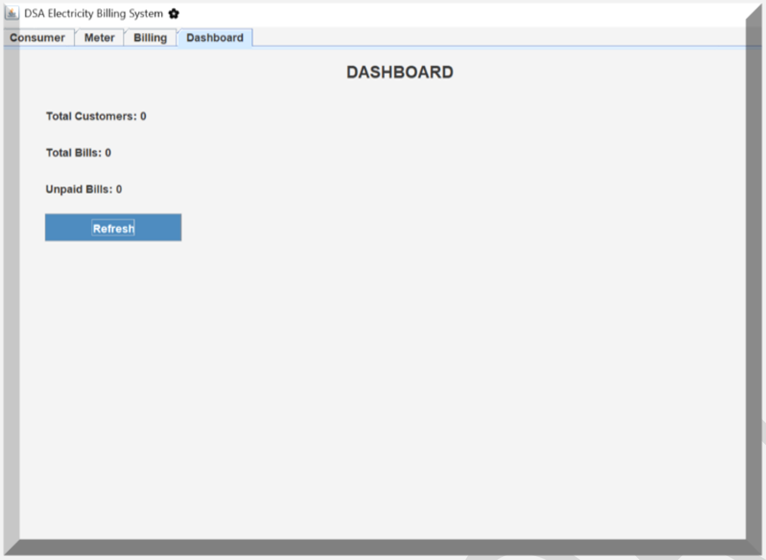
Meter Class

Stores meter details including meter number, initial reading, current reading, and associated consumer number.



Main Class (DSA Proposal Pastel)

This class integrates the GUI and application logic. It handles user interactions, data processing, billing algorithms, and dashboard updates.



DASHBOARD

Total Customers: 0

Total Bills: 0

Unpaid Bills: 0

Algorithms Used

Slab-Based Billing Algorithm

Electricity units are charged based on slabs:

- Up to 100 units: Base rate
- 101–300 units: Increased rate
- Above 300 units: Higher rate

This algorithm ensures fair billing based on consumption.

Sorting Algorithm

Bills are sorted in descending order using Java's built-in sorting with a comparator.

Stack-Based Undo Algorithm

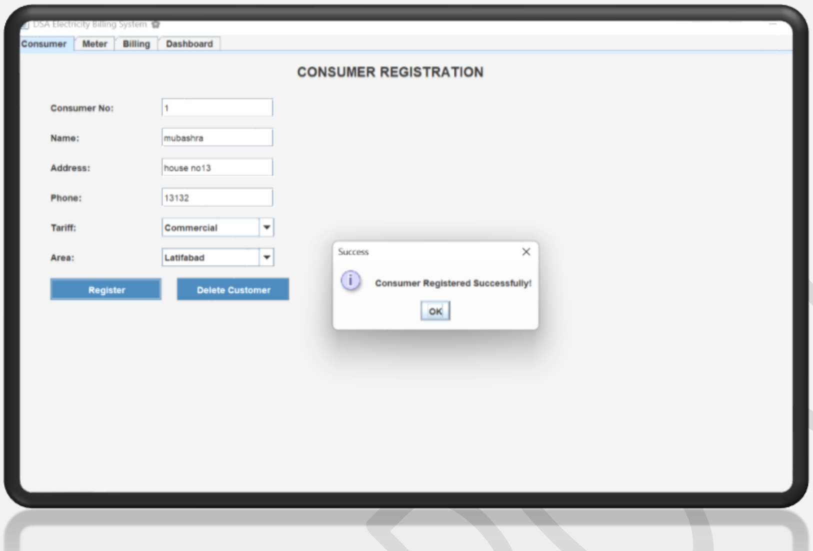
The undo payment feature follows the Last In First Out (LIFO) principle using a stack.

Graphical User Interface (GUI)

The GUI is developed using Java Swing and organized into tabs:

Consumer Panel

Allows registration and deletion of consumers.



CONSUMER REGISTRATION

Consumer No: 1

Name: mubashra

Address: house no13

Phone: 13132

Tariff: Commercial

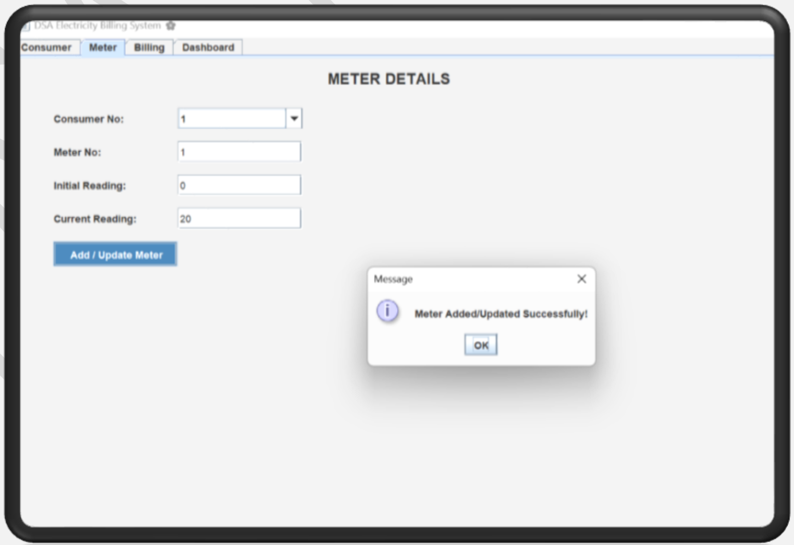
Area: Latifabad

Success

Consumer Registered Successfully!

Meter Panel

Used to add or update meter readings for consumers.



METER DETAILS

Consumer No: 1

Meter No: 1

Initial Reading: 0

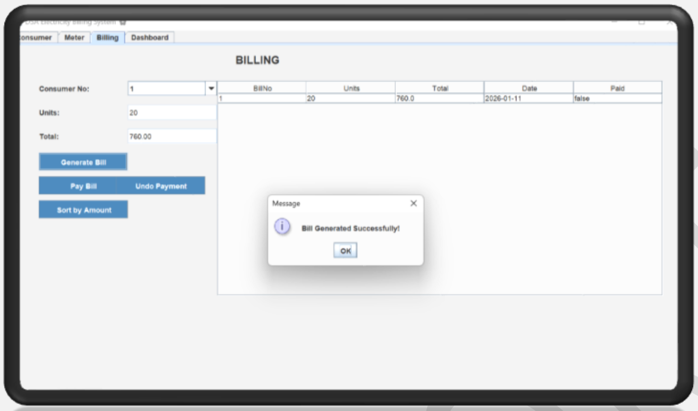
Current Reading: 20

Message

Meter Added/Updated Successfully!

Billing Panel

Handles bill generation, payment, undo payment, sorting, and bill display in tabular form.



BILLING

Consumer No: 1

Units: 20

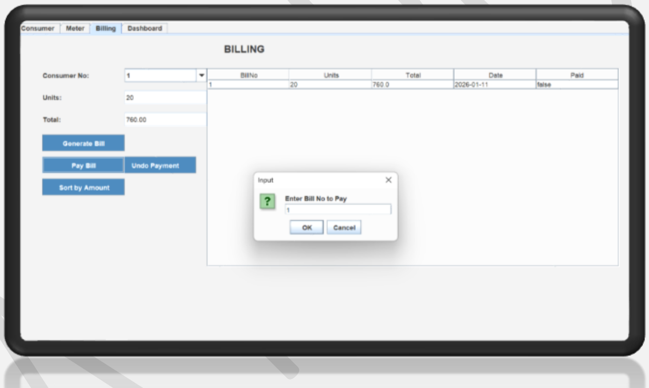
Total: 760.00

BillNo	Units	Total	Date	Paid
1	20	760.0	2026-01-11	false

Message

Bill Generated Successfully!

OK



BILLING

Consumer No: 1

Units: 20

Total: 760.00

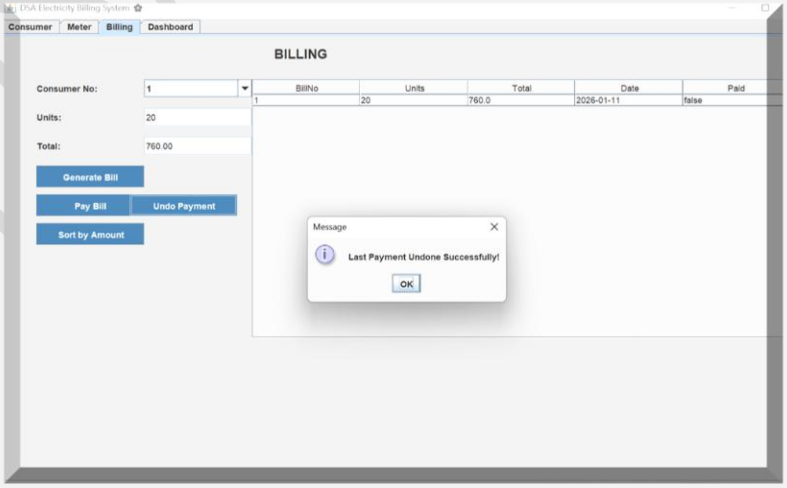
BillNo	Units	Total	Date	Paid
1	20	760.0	2026-01-11	false

Input

Enter Bill No to Pay

1

OK Cancel



BILLING

Consumer No: 1

Units: 20

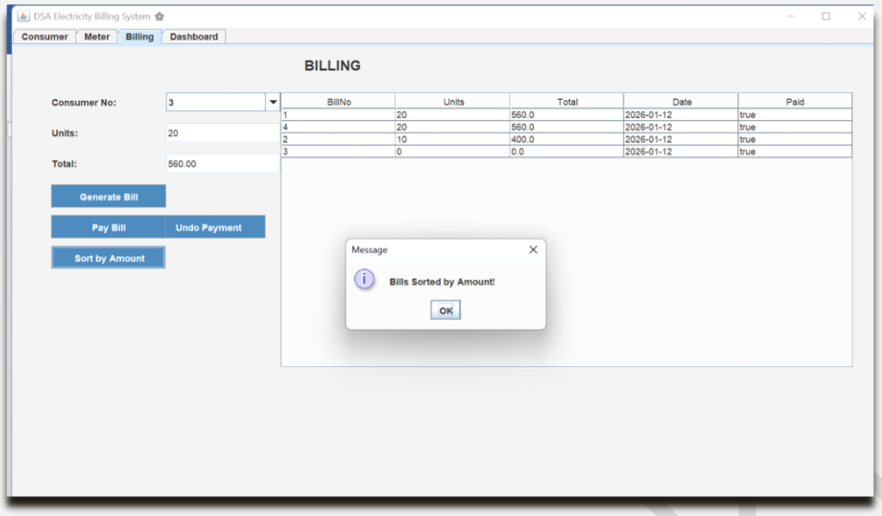
Total: 760.00

BillNo	Units	Total	Date	Paid
1	20	760.0	2026-01-11	false

Message

Last Payment Undone Successfully!

OK



BILLING

Consumer No: 3

Units: 20

Total: 560.00

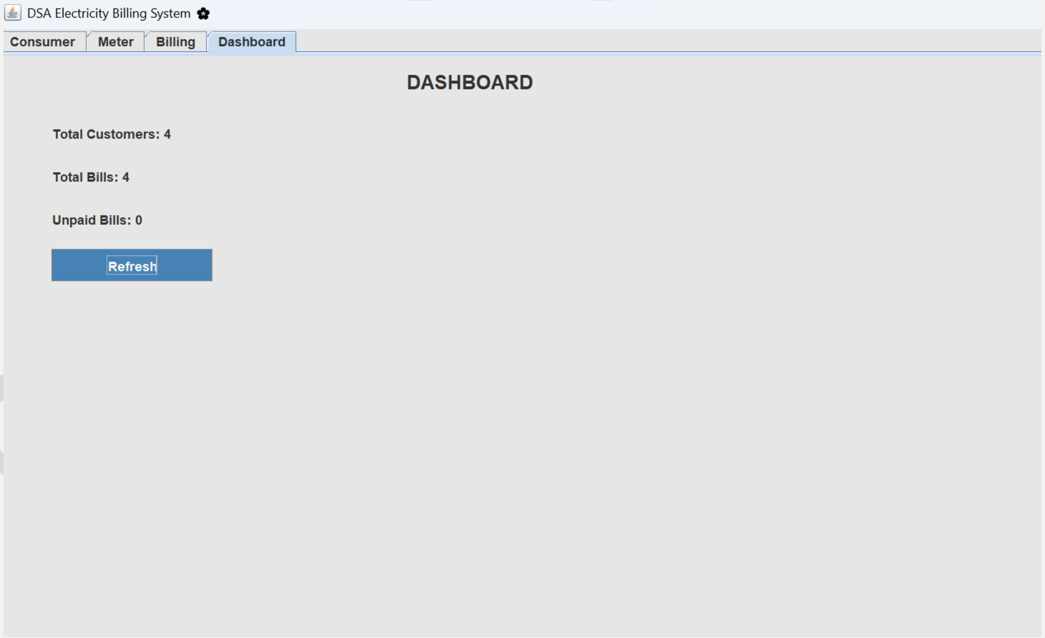
BillNo	Units	Total	Date	Paid
1	20	560.0	2026-01-12	true
4	20	560.0	2026-01-12	true
2	10	400.0	2026-01-12	true
3	0	0.0	2026-01-12	true

Message

Bills Sorted by Amount!

Dashboard Panel

Displays summary information such as total customers, total bills, and unpaid bills.



DASHBOARD

Total Customers: 4

Total Bills: 4

Unpaid Bills: 0

Features of the System

- User-friendly graphical interface
- Accurate slab-based billing calculation
- Efficient data storage using DSA
- Undo payment functionality
- Real-time dashboard updates

Limitations

- No database integration (data is stored in memory)
- Desktop-based application only
- No authentication or role management

. Future Enhancements

- Integration with a relational database
- Online payment gateway
- PDF bill and report generation
- Admin and user login system
- Web-based version of the system

Conclusion

The **DSA Based Electricity Billing System** successfully demonstrates the practical application of data structures and algorithms using Java. The project provides hands-on experience with HashMap, ArrayList, Stack, sorting algorithms, and GUI development. It offers an efficient and reliable solution for managing electricity billing data and serves as a strong foundation for further enhancements.

References

1. Data Structures and Algorithms Totorial
2. Java Swing Tutorials

GITHUB Repository Link

https://github.com/mubashra499/DSA-Project-Electricity-Billing-System/tree/main