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(Computer Science & Engineering - Internet of Things)

Faculty of Engineering & Technology

Jain Global Campus, Kanakapura Taluk - 562112
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A Project Report on

"Smart Electricity Billing System using IOT Technology"

Submitted in partial fulfilment for the award of the degree of

BACHELOR OF TECHNOLOGY

IN

COMPUTER SCIENCE AND ENGINEERING - IOT

Submitted by

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CERTIFICATE

This is to certify that the project work titled **"Smart Electricity Billing System using IOT Technology"** is carried out by **Ujjwal Kumar Jha (20BTRCO016), Kishan Kumar Sah (20BTRCO061), Michael Kumar Mandal (20BTRCO062), Preeti Kurmi (20BTRCO071)** a bonafide students of Bachelor of Technology at the School of Engineering & Technology, Faculty of Engineering & Technology, JAIN (Deemed-to-be University), Bangalore in partial fulfillment for the award of degree in Bachelor of Technology in Computer Science and Engineering - IoT, during the year **2023-2024**.

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Date:

Name of the Examiner	Signature of Examiner
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2.	

DECLARATION

We, **Ujjwal Kumar Jha (20BTRCO016), Kishan Kumar Sah (20BTRCO061), Michael Kumar Mandal (20BTRCO062), Preeti Kurmi (20BTRCO071)** student of 8th semester B.Tech in **Computer Science and Engineering (Internet of Things)**, at School of Engineering & Technology, Faculty of Engineering & Technology, **JAIN (Deemed to be University)**, hereby declare that the project work titled **"Smart Electricity Billing System using IOT Technology"** has been carried out by us and submitted in partial fulfilment for the award of degree in **Bachelor of Technology in Computer Science and Engineering - IoT** during the academic year **2023-2024**. Further, the matter presented in the work has not been submitted previously by anybody for the award of any degree or any diploma to any other University, to the best of our knowledge and faith.

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Signature of Students

ABSTRACT

This study introduces a Smart Electricity Billing System leveraging Internet of Things (IOT) technology. The system integrates advanced metering infrastructure with IOT devices to enable real-time monitoring, data collection, and communication between electricity consumers and providers. By utilizing smart meters and sensors, the system enhances accuracy in energy consumption measurement, promotes efficient resource management, and facilitates timely billing. Additionally, the IOT- enabled platform allows consumers to access and analyze their electricity usage patterns, encouraging informed decision-making for energy conservation. The suggested technique offers a clever and sustainable answer for contemporary energy management, marking a substantial progress in the field of electricity billing.

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NOMENCLATURE USED

GUI	Graphical User Interface
SWING	Java Framework
MySQL	My Structured Query Language
JDBC	Java Database Connector
IOT Devices	Internet of Things Devices

Chapter 1

1. INTRODUCTION

1.1 Introduction

Calculating the number of units used within the allotted period and the amount that the power offices will charge is known as the "smart electric billing system." The foundation of revenue collection in the power industry, electricity billing systems are essential to contemporary civilizations. Unfortunately, accuracy, efficiency, and flexibility to shifting consumption patterns are typically problems for older systems. The idea of a Smart Energy Billing System appears as a ground-breaking remedy to these problems. Using current and voltage sensors for accurate power measurements, seamless data transmission to a centralized database.

A smart energy management system is a tool designed to monitor, measure, and cut down on the energy used in industries, residences, and flats. As energy costs keep rising every day and resources grow scarcer. Families and companies should understand how to use power most efficiently and should be conscious of how they use it.

The foundation of modern society rests upon a pillar often taken for granted: the electricity grid. This intricate network powers our homes, businesses, and vital infrastructure, and its smooth operation hinges on the critical process of electricity billing. Traditionally, this system involved calculating electricity usage and applying corresponding charges, but it often faced challenges in accuracy, efficiency, and adaptability.

Enter the Smart Electric Billing System (SEBS), a revolutionary concept brimming with transformative potential. By harnessing the power of cutting-edge technologies, SEBS addresses the limitations of older systems. It utilizes precision sensors and seamless data transmission to ensure accurate real-time measurements

This research paper delves deeper into the transformative power of SEBS. It explores not only its revolutionary impact on billing accuracy and efficiency but also its potential to catalyst a shift towards responsible energy consumption. By examining the synergy between SEBS and smart energy management systems, the paper paves the way for a future where sustainable and responsible energy practices become the norm.

1.2 Objectives

The objectives of the "Electricity Billing System using IoT Technology" project are multifaceted. Firstly, the project aims to automate the process of meter reading through the implementation of IoT technology, thereby eliminating the need for manual meter reading. This automation ensures real-time data monitoring, providing both consumers and utility providers with up-to-date information on electricity consumption. By reducing human errors in meter reading and data entry, the project ensures billing accuracy. Additionally, it provides consumers with insights into their energy consumption patterns, enabling them to make informed decisions to conserve energy. The system allows consumers to remotely monitor and control their energy usage through a web or mobile application, enhancing convenience. Furthermore, by automating meter reading and billing processes, the project reduces operational costs for utility providers. It also ensures billing transparency, detects tampering with the meter, and provides scalability and data security, ultimately aiming to enhance the efficiency, accuracy, and transparency of electricity billing while empowering consumers with better control over their energy usage.

The primary objectives of this project include:

- Transmission of data from Hardware set up to a Centralized Database.
- Automated Meter Reading
- Real-time Data Monitoring
- Improved Accuracy
- Accurate Power Measurement
- Energy Conservation
- Remote Monitoring and Control
- Cost Reduction
- Billing Transparency
- Tamper Detection
- Scalability
- Data Security
- Integration with Existing Systems

Chapter 2

2. LITERATURE SURVEY

2.1 Literature Review

The Real-Time Electricity Bill Management System proposed by Bhushan Chaudhar, Nachiket Shind, Gitesh Yelave, Ganesh Sonawane, and Kushal Borse in their 2023 publication aims to provide a solution for monitoring electricity consumption in real-time using Internet of Things (IoT) technology [1].

The system works by measuring power and current values using voltage and current sensors. These sensors gather data on the electricity consumption, which is then used to calculate the units consumed. By providing real-time data on electricity usage, this system enables users to effectively manage their electricity consumption and optimize their energy usage, ultimately leading to reduced electricity bills [2].

This innovative system has the potential to revolutionize the way electricity consumption is monitored and managed, offering both convenience and cost savings to consumers.

In their 2023 publication, V. Samano-Ortega, P. Martinez-Nolasco, H. Mendez Guzman, J. Padilla-Medina, M. Santoyo-Mora, and J. Zavala-Villalpando, who are IEEE members, developed an Electricity Energy Consumption Monitoring System for the Residential Sector using Internet of Things (IoT) technology [3].

Their system offers a method for real-time monitoring of electricity consumption in residential buildings. It provides users with instant power measurements, electrical efficiency calculations, and detailed information on the cost and consumption of energy.

By utilizing IoT devices and technology, this system allows homeowners to track their electricity usage more effectively, helping them to identify energy-efficient practices and optimize their energy consumption patterns [4].

This innovative system has the potential to enhance energy management in residential buildings, leading to reduced energy costs and environmental impact.

In their 2022 publication, Wan Nuraihan Hajidah Wan Abdul Hadi, Rozeha A. Rashid, M. Adib Sarijari, S. Zaleha A. Hamid, and Nor Aishah Muhammad introduced a Machine Learning Bill Prediction system for an Internet of Things (IoT) based Utility Management System [5].

This innovative system utilizes machine learning models to predict future power costs, enabling more accurate planning and budgeting for electricity expenses. By analyzing historical data and various factors influencing power costs, such as usage patterns, weather conditions, and tariff rates, the system can forecast future electricity bills with greater precision [6].

By integrating machine learning into utility management, this system empowers users to make informed decisions about their energy consumption, optimize usage, and ultimately reduce costs. Additionally, it offers a proactive approach to managing energy expenses, allowing users to adjust their consumption behavior based on predicted future costs.

In the "New Home Energy Management using IoT in Smart Family" project completed in 2019, Gabriel Indra W. T1, Paulus Suryanto2, and Suyoto3 introduced an innovative energy management system for homes [7].

The project focuses on leveraging Internet of Things (IoT) technology to create a Smart Family system that effectively regulates electricity usage, particularly for lighting, using smartphones. By connecting lighting systems to smartphones, users can remotely control and manage the amount of electricity used for lighting in their homes.

One of the key findings of the project is that by implementing this system, households can achieve significant energy savings. In fact, the project demonstrates that it is possible to save up to 38.5% on energy bills by effectively managing lighting usage using the Smart Family system [8].

This project represents a significant step forward in home energy management, offering households an efficient and convenient way to reduce energy consumption, lower electricity bills, and contribute to a more sustainable environment.

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Chapter 3

3. PROBLEM FORMULATION AND PROPOSED WORK

3.1 Problem Statement

The proposed Smart Electricity Billing System (SEBS) using IOT technology offers a promising solution, but limitations need to be acknowledged.

Firstly, the research focuses on SEBS functionalities within a controlled environment. Large-scale implementation demands seamless integration with existing diverse power grids and legacy systems. Addressing compatibility and scalability challenges associated with this integration requires further research and development. Additionally, the effectiveness of SEBS relies heavily on the availability and quality of data, which might be limited in the current research, potentially impacting its accuracy. Investigating and implementing strategies to gather robust and comprehensive data sets is crucial for refining the system's effectiveness.

Furthermore, cybersecurity concerns arise due to SEBS' reliance on interconnected systems. Addressing specific cybersecurity concerns and developing robust measures to safeguard against data breaches and cyberattacks requires further research. Additionally, cost and adoption considerations should be addressed by exploring cost-effective approaches and understanding potential consumer concerns regarding data privacy and complexity.

By acknowledging and addressing these limitations, we can refine the SEBS concept and pave the way for its practical and widespread implementation towards a sustainable and intelligent future of energy management.

The current state of electricity billing systems faces several challenges that hinder efficiency, accuracy, and sustainability.

Firstly, traditional manual meter reading systems are susceptible to human error and require significant manpower, leading to inefficiencies and increased operational costs for utility companies. Additionally, these systems often lack real-time data capabilities, resulting in delays in billing and challenges in identifying potential issues like meter tampering or unusual consumption patterns.

Furthermore, limited flexibility in traditional systems makes it difficult to adapt to shifting consumption patterns and implement strategies for peak demand management.

This lack of adaptability can lead to inefficient resource allocation and contribute to increased energy costs for consumers.

Finally, limited consumer engagement with traditional systems hinders awareness and understanding of energy consumption patterns. This lack of transparency can hinder efforts to promote energy conservation and encourage responsible energy use amongst consumers.

Therefore, there is a critical need for a more efficient, accurate, and flexible electricity billing system that can address these challenges. The proposed Smart Electricity Billing System (SEBS)**,** leveraging IOT technology, offers a promising solution to overcome these limitations and pave the way for a more sustainable and informed energy future.

3.2 Proposed Algorithms

The entire monthly cost of electricity is calculated using the suggested technology, which tracks energy consumption in real time. Current and voltage sensors, a GSM module, and an Arduino are all used in this system. Using an Arduino ide, data is calculated, communicated over a GSM module, and published to the database.

The ZMPT-101B sensor is used to measure voltage, and the SCT-013 sensor is used to detect electric current.

The user has access to comprehensive information regarding electric current units, including their costs. Additionally, they can have the option to pay their bills using UPI.

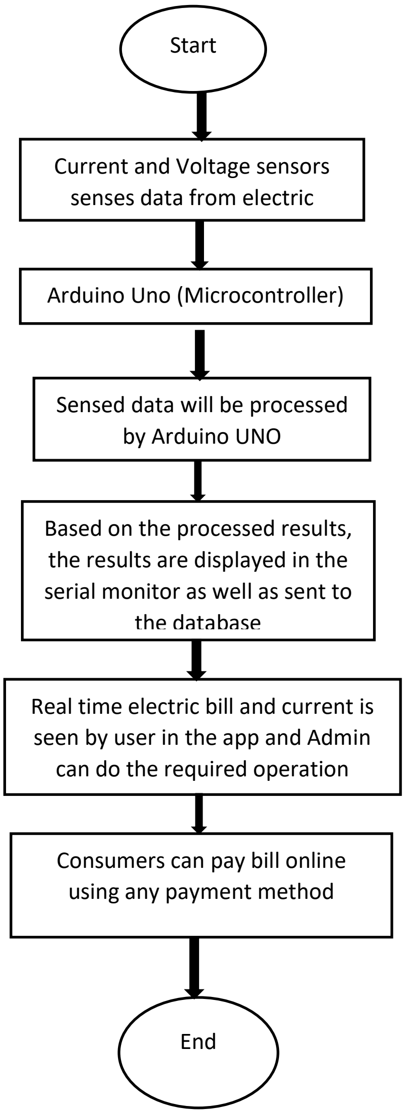

Fig. 3.1. Flowchart of proposed mechanism.

3.3 System Architecture / Model

The electricity billing system utilizes IoT technology and is built around components such as Arduino Uno, GSM module, voltage sensor, current sensor, user interface, database, and a mobile application.

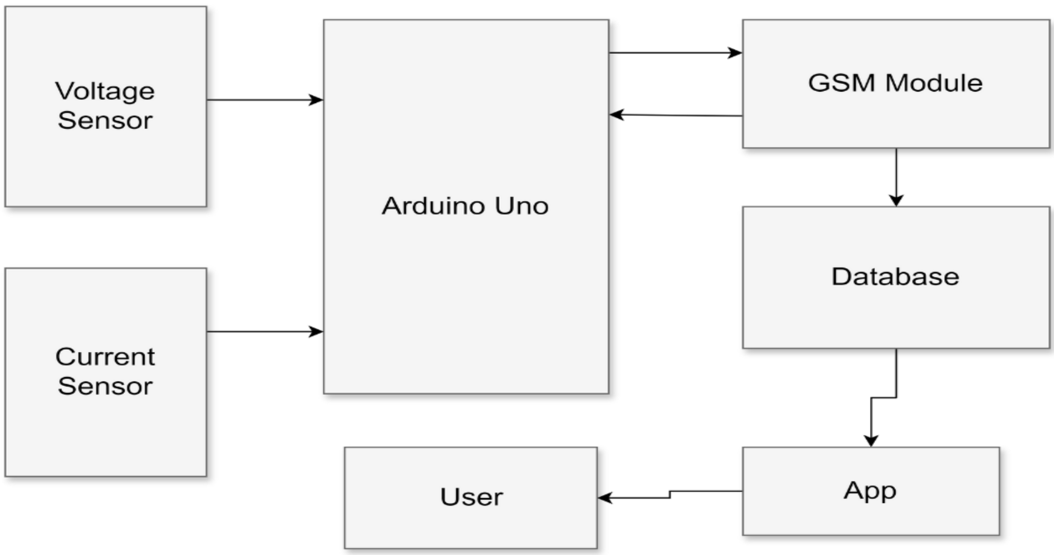

Fig. 3.2. Block diagram.

The system architecture begins with the Arduino Uno, which collects real-time data on voltage and current usage through the sensors. This data is then transmitted to the database via the GSM module. Users can access their electricity usage information and billing details through a mobile application connected to the database. This architecture ensures accurate monitoring and billing of electricity usage, providing users with real-time insights and control over their consumption.

Additionally, the system architecture includes a user interface through which users can set preferences, view real-time consumption data, receive billing notifications, and make payments. The database stores all the user data, consumption history, and billing information securely. The mobile application serves as a user-friendly interface, allowing customers to access and manage their electricity usage data conveniently from their smartphones. This integrated system ensures efficient electricity management, transparency in billing, and empowers users to make informed decisions about their energy consumption.

3.4 Working Mechanisms

The working mechanism of the "Smart Electricity Billing System" relies on the integration of IoT-enabled smart meters at customer locations. These smart meters are equipped with sensors that track energy usage in real-time. The data collected by these sensors, including voltage and current readings, is transmitted securely to a centralized server using IoT communication protocols.

Once the data reaches the server, it undergoes processing. This processing includes tasks such as demand-side management, load forecasting, and dynamic pricing calculations.

Customers are provided with a user-friendly interface, typically accessible through a web or mobile application. Through this interface, customers can monitor their energy usage in real-time. Additionally, they can adjust their energy consumption based on the data provided.

The system also incorporates features aimed at promoting responsible energy use and effective grid operation. This includes dynamic pricing, which incentivizes energy consumption during off-peak hours, load forecasting to anticipate energy demands, and demand-side management strategies to optimize energy distribution.

By providing customers with real-time data and control over their energy usage, and by implementing features that encourage responsible energy consumption, the Smart Electricity Billing System aims to promote sustainability and efficiency in energy management.

Chapter 4

4. IMPLEMENTATION

4.1 Hardware Design and Implementation

The hardware design and implementation of the electricity billing system using IoT involves integrating components such as a current sensor, voltage sensor, Arduino Uno, GSM module, user interface app, and a database.

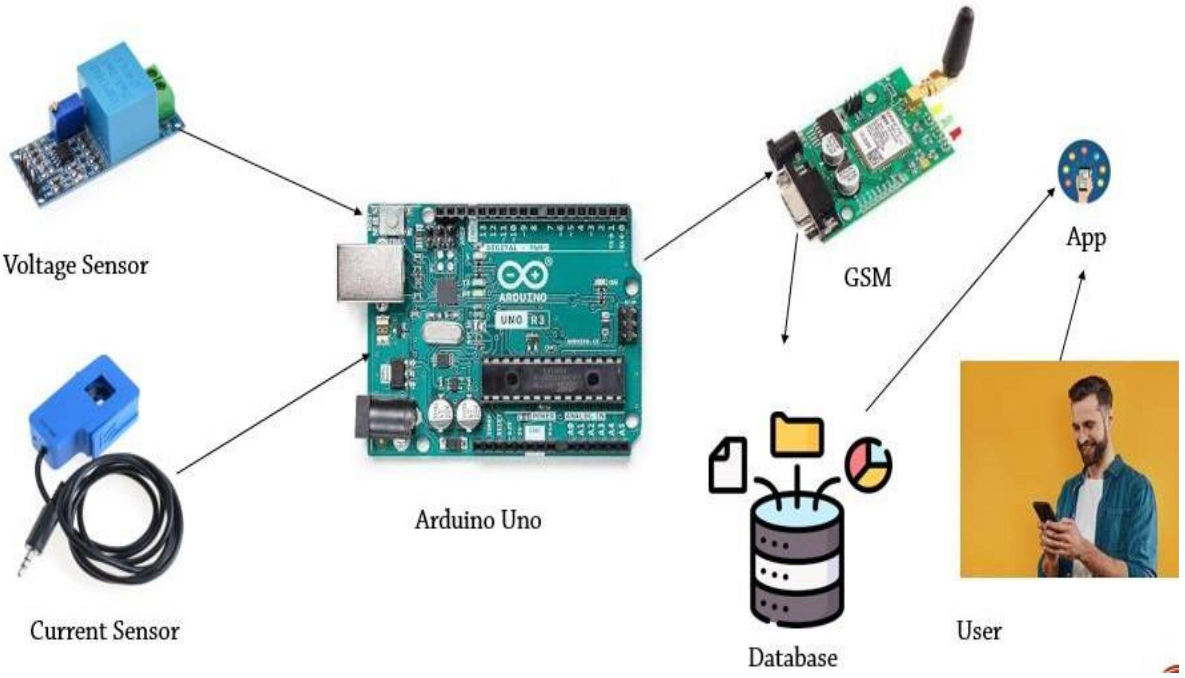

Fig. 4.1. Hardware design.

The current and voltage sensors are connected to the Arduino Uno to measure real-time electricity consumption. The Arduino Uno processes this data and sends it to the database through the GSM module. Users can access their electricity usage data and billing information through a user interface app connected to the database. This setup enables accurate monitoring of electricity consumption, transparent billing, and provides users with real-time insights into their energy usage, facilitating informed decision-making and efficient energy management.

4.1.1 Arduino

The open-source hardware and software supplier Arduino, an Italian project, user community, and manufacturer of single-board microcontrollers and microcontroller kits for digital construction, designs and produces these products.

4.1.2 GSM Module

The Global System for Mobile Communications (GSM) standard was developed by the European Telecommunications Standards Institute (ETSI) to specify the protocols for second-generation (2G) digital cellular networks, which are used by mobile devices such as smartphones and tablets.

4.1.3 Voltage Sensor

Single-phase AC voltage can be detected with the compact ZMPT101B voltage sensor. It can measure the levels of AC voltage and is frequently used in do-it-yourself applications where accurate measurements are required. Open-source platforms like ESP8266, Raspberry Pi, and Arduino can be linked to this sensor.

4.1.4 Current Sensor

The SCT-013-000 is a non-invasive AC current sensor that can measure AC current up to 100 amps by using a current transformer. Current transformers, also referred to as CTs, are the sensors used to detect alternating current.

4.1.5 Arduino IDE

To control electronics, you can write code (sketches) and upload it to Arduino boards using the free, user-friendly Arduino IDE software. Arduino IDE is user-friendly Interface where user can easily write and manages the code effectively.

4.1.6 User Mobile

User interact with application installed in Mobile through interactive user interface which are developed using Graphic User Interface Components of Swing. User are allowed to modify or update the information, generate the bills, pay the bills as well as check the bill and payment details. User are not required to visit the Electricity Authority Offices again and again for any activities regarding Electricity Billing System.

4.2 Software Interface

4.2.1 User Interface Development

User Interface development for an Electricity Billing System has been designed and created through which users interact with the system. This interface is user-friendly and efficient allowing users to easily navigate through the system and perform necessary takes such as viewing their electricity usage, checking their bills, making payments and accessing account information.

Key aspects of User Interface Development for an electricity billing system included which are Dashboard Design, Navigation Design, Billing Information Display, Usage Tracking, Payment Processing, Account Management and Accessibility and Responsiveness.

4.2.2 User Authentication and Sign Up page

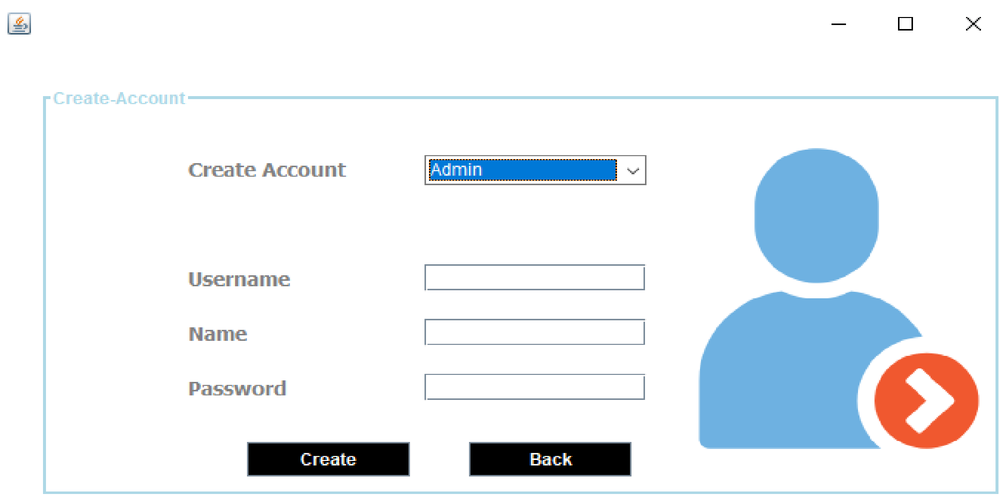

Fig. 4.2. Sign up page

Fig. 4.2. shows the signup page. If the user or Admin is new so they first have to create account and then after login they can use all the services of this System. Customer select user and Admin select admin to create account.

4.2.3 User Authentication and Login Up page

Fig. 4.3 Login page

Fig. 4.3 Shows the login page, where user can login using their login ID and Password. They can check real-time electric units and cost of electric bill. Consumers have to select login as user. Admin can also login through same login page, they have to select login as Admin.

4.2.4 User Home Interface Navigation

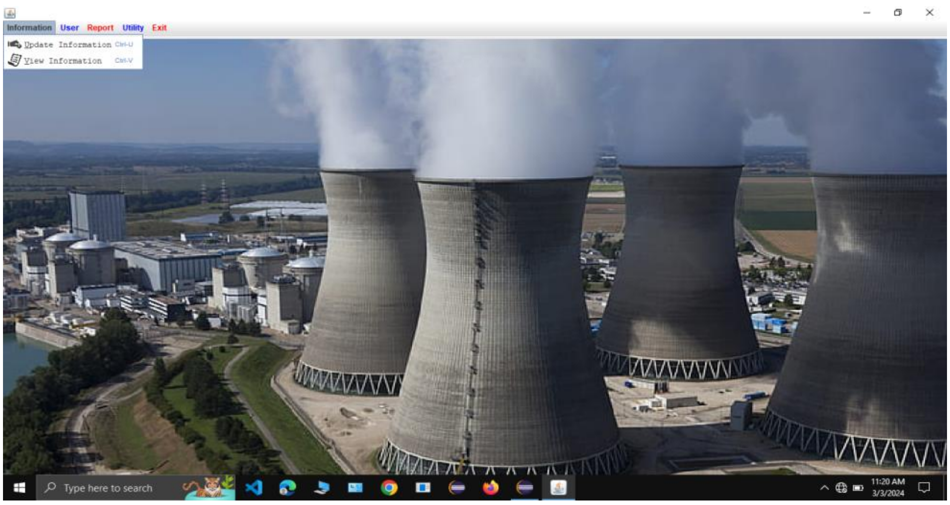

Fig. 4.4. User services

Fig. 4.4. shows the functionality which user can get from this System. They get two functionalities one is bill details which means they can check real time detailed bill. And other is pay bill which means they can pay the bill at the end of months or when they receive bill using any payment method.

4.2.5 Admin Home Interface Navigation

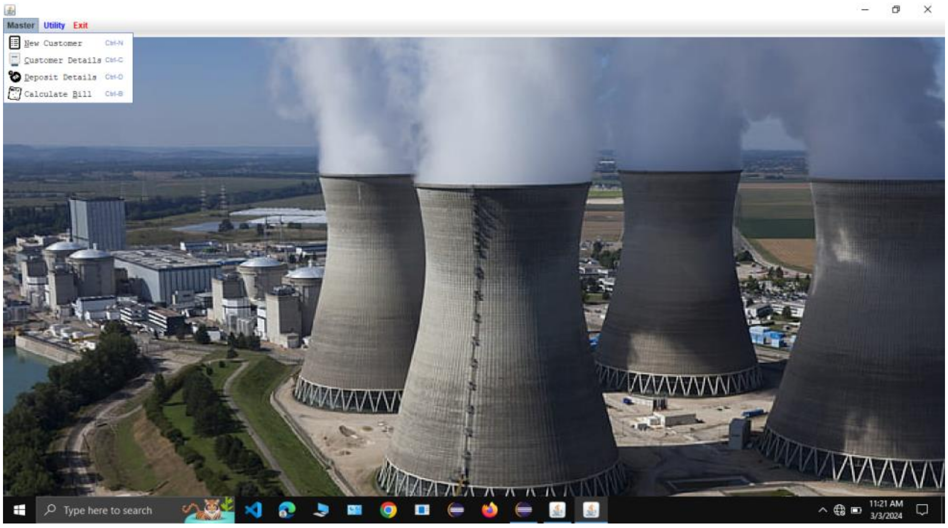

Fig. 4.5 Admin services

Fig. 4.5. shows the functionalities which admin can get from this system. They get 4 functionalities. They can add new customer, check customer details, check deposit details of the customer and calculate bill of the customers.

4.2.6 Calculate Electricity Bill

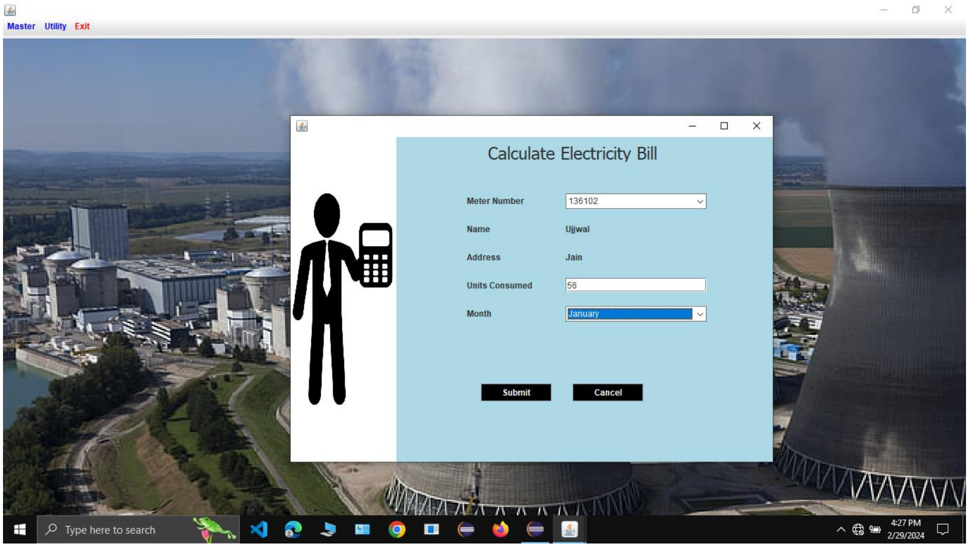

Fig. 4.6 Calculate Electricity Bill

Fig 4.6 shows the Calculation of bills which can be calculated or managed by the Admin in Admin Interface by mentioning the particular Meter Number, User Name, Address, Units consumed by the user of the particular month.

Chapter 5

5. RESULTS AND DISCUSSION

Using Internet of Things (IoT) technology, the Smart Electricity Billing System successfully combines IoT devices with sophisticated metering infrastructure. Real-time data collection, monitoring, and communication between electricity providers and consumers are made possible by this connection. The technology greatly improves the measurement accuracy of energy usage by utilising sensors and smart meters. This guarantees accurate and equitable invoicing and encourages effective resource management by offering comprehensive insights. The capacity of this technology to provide timely billing is one of its main advantages. Through constant real-time monitoring of energy consumption, the system guarantees that bills are appropriately issued to customers based on actual usage. By doing away with the requirement for projected invoices and lowering the possibility of billing disputes, this eventually improves customer satisfaction.

Additionally, customers can view and examine their electricity usage habits via the IoT-enabled platform. The technology facilitates educated decision-making for energy conservation by offering users comprehensive insights into their energy consumption. In the end, consumers can save money and protect the environment by identifying energy-intensive equipment. All things considered, the Smart Electricity Billing System is a noteworthy development in the fields of energy management and electricity billing. Through the use of IoT technology, the system provides a creative and long-lasting answer for modern energy management, taking care of the requirements for precise invoicing, effective resource management, and customer empowerment.

5.1 Customer Details

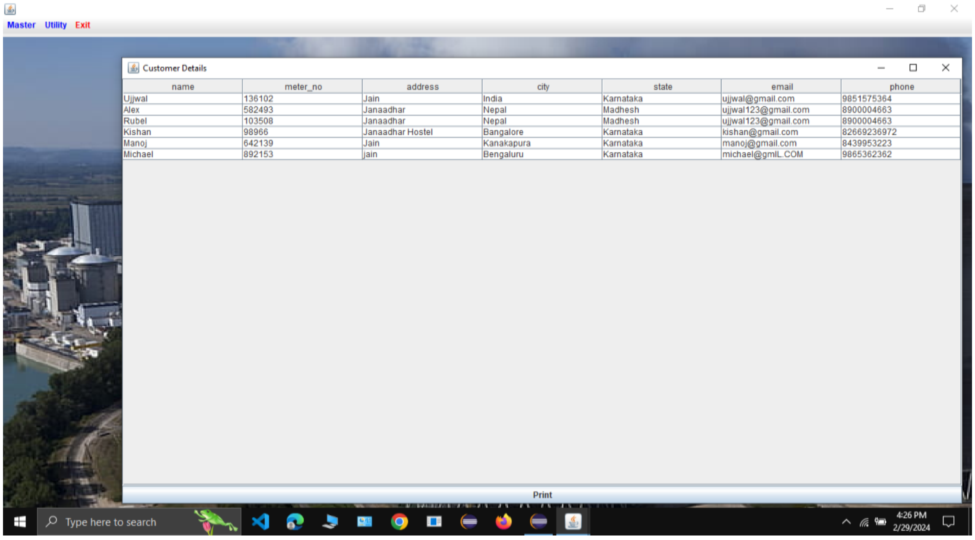

Fig. 5.1. Customer Details

Customer details are securely stored in a database as part of the electricity billing system using IoT. This database contains information such as customer name, address, contact details, and billing preferences.

5.2 Monthly Bill Interface

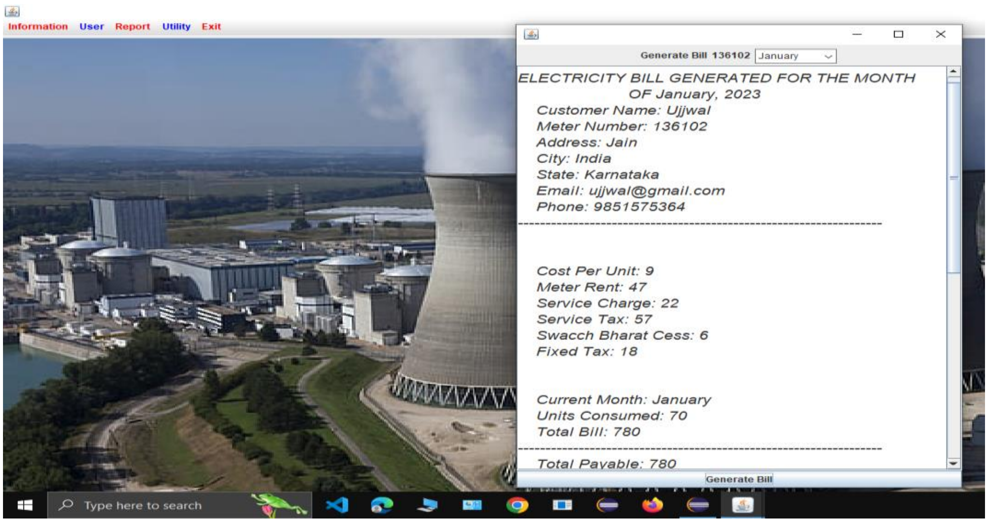

Fig. 5.2. Monthly bill

Fig. 5.2. shows the total bill of a customers of the specific month. Customer are allowed to generate their electricity bill only after admin declares the consumed units.

5.3 Deposit Details

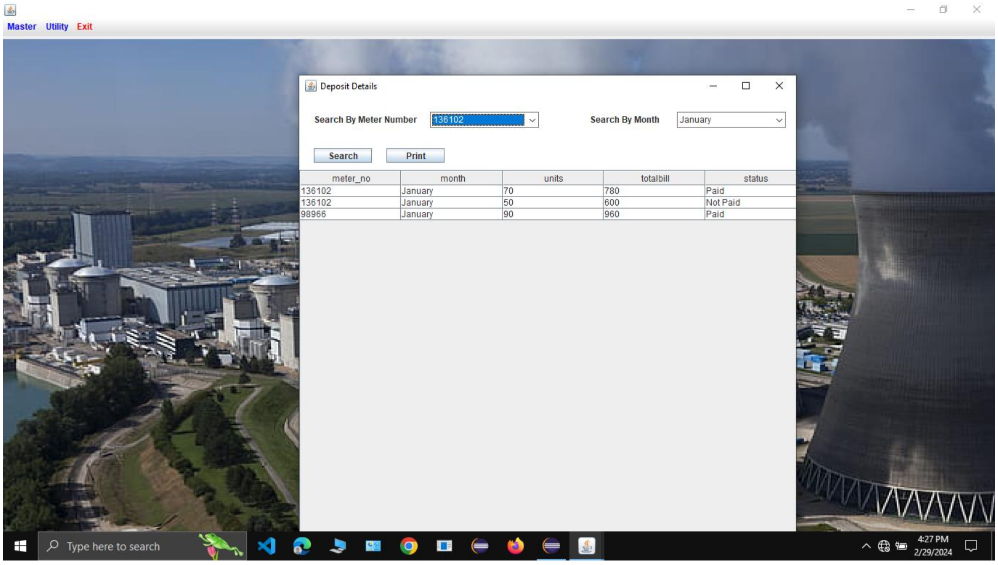

Fig. 5.3. Deposit Details

Deposit details are stored in the system database, including the amount deposited by each customer and the corresponding transaction details. This information ensures transparency in billing and allows customers to track their deposit history.

5.4 View Customer Information

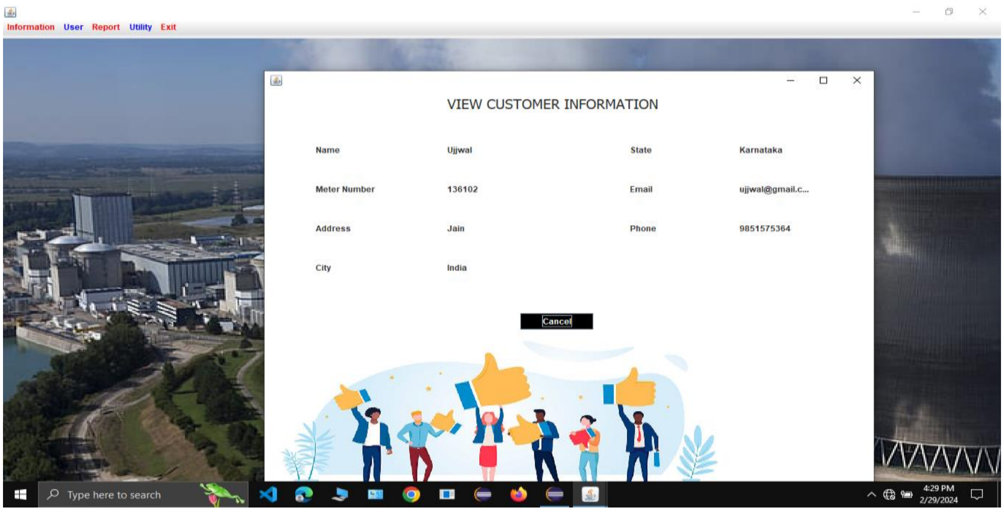

Fig. 5.4. Customer Information

The system provides an interface for users to view their customer information, including personal details, billing preferences, and deposit history. This feature allows customers to easily access and review their account information, ensuring transparency and facilitating efficient management of their electricity usage and billing.

CONCLUSIONS AND FUTURE WORK

To conclude, the deployment of the Smart Electricity Billing System represents a major advancement towards an accurate, efficient, and intelligent method of billing electricity. The solution not only improves billing process accuracy but also fosters real-time monitoring, cost savings, and higher customer happiness by integrating current and voltage sensors, enabling secure data transmission, and utilizing AI for billing forecasts. The project's success depends on its capacity to upend established billing models and provide a flexible and scalable response to the changing nature of energy management and use.

Furthermore, researchers could focus on integrating AI technology to enhance the performance of the system. With AI technology, System is capable to predict the future bill of the customers. If the predicted bill is more than usual, then system will give some warning messages that the bill in upcoming month will be more. System will also capable to suggest some solution or tips to reduce electric consumption so that the electric bill will not come more than usual

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APPENDIX - I

SOURCE CODE

Here we have shared some code snippet from our project work.

```
package electricity.billing.system;

import javax.swing.*;
import java.awt.*;
import java.awt.event.*;

public class Project extends JFrame implements ActionListener {
String atype, meter;

Project(String atype, String meter) {
this.atype = atype;
this.meter = meter;

setExtendedState(JFrame.MAXIMIZED_BOTH);

ImageIcon i1 = new ImageIcon(ClassLoader.getSystemResource("icons/desktop1.jpg"));
Image i2 = i1.getImage().getScaledInstance(1550, 850, Image.SCALE_DEFAULT);
ImageIcon i3 = new ImageIcon(i2);
JLabel image = new JLabel(i3);
add(image);

JMenuBar mb = new JMenuBar();
setJMenuBar(mb);


JMenu master = new JMenu("Master");
master.setForeground(Color.BLUE);


JMenuItem newcustomer = new JMenuItem("New Customer");
newcustomer.setFont(new Font("monospaced", Font.PLAIN, 12));
newcustomer.setBackground(Color.WHITE);
ImageIcon icon1 = new ImageIcon(ClassLoader.getSystemResource("icons/icon1.png"));
Image image1 = icon1.getImage().getScaledInstance(20, 20, Image.SCALE_DEFAULT);
newcustomer.setIcon(new ImageIcon(image1));
newcustomer.setMnemonic('N');
newcustomer.addActionListener(this);
newcustomer.setAccelerator(KeyStroke.getKeyStroke(KeyEvent.VK_N,
ActionEvent.CTRL_MASK));
master.add(newcustomer);

JMenuItem customerdetails = new JMenuItem("Customer Details");
customerdetails.setFont(new Font("monospaced", Font.PLAIN, 12));
customerdetails.setBackground(Color.WHITE);
ImageIcon icon2 = new ImageIcon(ClassLoader.getSystemResource("icons/icon2.png"));
Image image2 = icon2.getImage().getScaledInstance(20, 20, Image.SCALE_DEFAULT);
customerdetails.setIcon(new ImageIcon(image2));
customerdetails.setMnemonic('C');
```

```
customerdetails.addActionListener(this);
customerdetails.setAccelerator(KeyStroke.getKeyStroke(KeyEvent.VK_C,
ActionEvent.CTRL_MASK));
master.add(customerdetails);

JMenuItem depositdetails = new JMenuItem("Deposit Details");
depositdetails.setFont(new Font("monospaced", Font.PLAIN, 12));
depositdetails.setBackground(Color.WHITE);
ImageIcon icon3 = new ImageIcon(ClassLoader.getSystemResource("icons/icon3.png"));
Image image3 = icon3.getImage().getScaledInstance(20, 20, Image.SCALE_DEFAULT);
depositdetails.setIcon(new ImageIcon(image3));
depositdetails.setMnemonic('D');
depositdetails.addActionListener(this);
depositdetails.setAccelerator(KeyStroke.getKeyStroke(KeyEvent.VK_D,
ActionEvent.CTRL_MASK));
master.add(depositdetails);

JMenuItem calculatebill = new JMenuItem("Calculate Bill");
calculatebill.setFont(new Font("monospaced", Font.PLAIN, 12));
calculatebill.setBackground(Color.WHITE);
ImageIcon icon4 = new ImageIcon(ClassLoader.getSystemResource("icons/icon5.png"));
Image image4 = icon4.getImage().getScaledInstance(20, 20, Image.SCALE_DEFAULT);
calculatebill.setIcon(new ImageIcon(image4));
calculatebill.setMnemonic('B');
calculatebill.addActionListener(this);
calculatebill.setAccelerator(KeyStroke.getKeyStroke(KeyEvent.VK_B,
ActionEvent.CTRL_MASK));
master.add(calculatebill);

JMenu info = new JMenu("Information");
info.setForeground(Color.RED);


JMenuItem updateinfo = new JMenuItem("Update Information");
updateinfo.setFont(new Font("monospaced", Font.PLAIN, 12));
updateinfo.setBackground(Color.WHITE);
ImageIcon icon5 = new ImageIcon(ClassLoader.getSystemResource("icons/icon4.png"));
Image image5 = icon5.getImage().getScaledInstance(20, 20, Image.SCALE_DEFAULT);
updateinfo.setIcon(new ImageIcon(image5));
updateinfo.setMnemonic('U');
updateinfo.addActionListener(this);
updateinfo.setAccelerator(KeyStroke.getKeyStroke(KeyEvent.VK_U, ActionEvent.CTRL_MASK));
info.add(updateinfo);

JMenuItem viewinfo = new JMenuItem("View Information");
viewinfo.setFont(new Font("monospaced", Font.PLAIN, 12));
viewinfo.setBackground(Color.WHITE);
ImageIcon icon6 = new ImageIcon(ClassLoader.getSystemResource("icons/icon6.png"));
Image image6 = icon6.getImage().getScaledInstance(20, 20, Image.SCALE_DEFAULT);
viewinfo.setIcon(new ImageIcon(image6));
viewinfo.setMnemonic('V');
viewinfo.addActionListener(this);
viewinfo.setAccelerator(KeyStroke.getKeyStroke(KeyEvent.VK_V, ActionEvent.CTRL_MASK));
info.add(viewinfo);
```

```
JMenu user = new JMenu("User");
user.setForeground(Color.BLUE);


JMenuItem paybill = new JMenuItem("Pay Bill");
paybill.setFont(new Font("monospaced", Font.PLAIN, 12));
paybill.setBackground(Color.WHITE);
ImageIcon icon7 = new ImageIcon(ClassLoader.getSystemResource("icons/icon7.png"));
Image image7 = icon7.getImage().getScaledInstance(20, 20, Image.SCALE_DEFAULT);
paybill.setIcon(new ImageIcon(image7));
paybill.setMnemonic('P');
paybill.addActionListener(this);
paybill.setAccelerator(KeyStroke.getKeyStroke(KeyEvent.VK_P, ActionEvent.CTRL_MASK));
user.add(paybill);

JMenuItem billdetail = new JMenuItem("Bill Details");
billdetail.setFont(new Font("monospaced", Font.PLAIN, 12));
billdetail.setBackground(Color.WHITE);
ImageIcon icon8 = new ImageIcon(ClassLoader.getSystemResource("icons/icon6.png"));
Image image8 = icon8.getImage().getScaledInstance(20, 20, Image.SCALE_DEFAULT);
billdetail.setIcon(new ImageIcon(image8));
billdetail.setMnemonic('B');
billdetail.addActionListener(this);
billdetail.setAccelerator(KeyStroke.getKeyStroke(KeyEvent.VK_B, ActionEvent.CTRL_MASK));
user.add(billdetail);


JMenu report = new JMenu("Report");
report.setForeground(Color.RED);


JMenuItem generatebill = new JMenuItem("Generate Bill");
generatebill.setFont(new Font("monospaced", Font.PLAIN, 12));
generatebill.setBackground(Color.WHITE);
ImageIcon icon9 = new ImageIcon(ClassLoader.getSystemResource("icons/icon7.png"));
Image image9 = icon9.getImage().getScaledInstance(20, 20, Image.SCALE_DEFAULT);
generatebill.setIcon(new ImageIcon(image9));
generatebill.setMnemonic('G');
generatebill.addActionListener(this);
generatebill.setAccelerator(KeyStroke.getKeyStroke(KeyEvent.VK_G, ActionEvent.CTRL_MASK));
report.add(generatebill);


JMenu utility = new JMenu("Utility");
utility.setForeground(Color.BLUE);


JMenuItem notepad = new JMenuItem("Notepad");
notepad.setFont(new Font("monospaced", Font.PLAIN, 12));
notepad.setBackground(Color.WHITE);
ImageIcon icon10 = new ImageIcon(ClassLoader.getSystemResource("icons/icon12.png"));
Image image10 = icon10.getImage().getScaledInstance(20, 20, Image.SCALE_DEFAULT);
notepad.setIcon(new ImageIcon(image10));
notepad.setMnemonic('N');
```

```
notepad.addActionListener(this);
notepad.setAccelerator(KeyStroke.getKeyStroke(KeyEvent.VK_N, ActionEvent.CTRL_MASK));
utility.add(notepad);

JMenuItem calculator = new JMenuItem("Calculator");
calculator.setFont(new Font("monospaced", Font.PLAIN, 12));
calculator.setBackground(Color.WHITE);
ImageIcon icon11 = new ImageIcon(ClassLoader.getSystemResource("icons/icon9.png"));
Image image11 = icon11.getImage().getScaledInstance(20, 20, Image.SCALE_DEFAULT);
calculator.setIcon(new ImageIcon(image11));
calculator.setMnemonic('C');
calculator.addActionListener(this);
calculator.setAccelerator(KeyStroke.getKeyStroke(KeyEvent.VK_C, ActionEvent.CTRL_MASK));
utility.add(calculator);


JMenu mexit = new JMenu("Exit");
mexit.setForeground(Color.RED);



JMenuItem exit = new JMenuItem("Exit");
exit.setFont(new Font("monospaced", Font.PLAIN, 12));
notepad.setBackground(Color.WHITE);
ImageIcon icon12 = new ImageIcon(ClassLoader.getSystemResource("icons/icon11.png"));
Image image12 = icon12.getImage().getScaledInstance(20, 20, Image.SCALE_DEFAULT);
exit.setIcon(new ImageIcon(image12));
exit.setMnemonic('W');
exit.addActionListener(this);
exit.setAccelerator(KeyStroke.getKeyStroke(KeyEvent.VK_W, ActionEvent.CTRL_MASK));
mexit.add(exit);


if(atype.equals("Admin")) {
mb.add(master);

} else {
mb.add(info);
mb.add(user);
mb.add(report);
}

mb.add(utility);
mb.add(mexit);


setLayout(new FlowLayout());
setVisible(true);
}

public void actionPerformed(ActionEvent ae) {
String msg = ae.getActionCommand();

if(msg.equals("New Customer")) {
new NewCustomer();
```

```
} else if(msg.equals("Customer Details")) {
new CustomerDetails();

} else if(msg.equals("Deposit Details")) {
new DepositDetails();

} else if(msg.equals("Calculate Bill")) {
new CalculateBill();

} else if(msg.equals("View Information")) {
new ViewInformation(meter);

} else if(msg.equals("Update Information")) {
new UpdateInformation(meter);

} else if(msg.equals("Bill Details")) {
new BillDetails(meter);

} else if(msg.equals("Notepad")) {

try {
Runtime.getRuntime().exec("notepad.exe");

} catch (Exception e) {
e.printStackTrace();
}

} else if(msg.equals("Calculator")) {
try {
Runtime.getRuntime().exec("calc.exe");
} catch (Exception e) {
e.printStackTrace();
}

} else if(msg.equals("Exit")) {
setVisible(false);
new Login();

} else if(msg.equals("Pay Bill")) {
new PayBill(meter);

} else if(msg.equals("Generate Bill")) {
new GenerateBill(meter);
}
}

public static void main(String[] args) {
new Project("", "");
}

}
```

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PHOTOGRAPH ALONG WITH GUIDE

"Our guide played a crucial role in supporting and helping us complete the project. Their guidance was invaluable, providing us with the direction and assistance we needed every step of the way."