

RV COLLEGE OF ENGINEERING[®]
BENGALURU-560059
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“ELECTRICITY BILLING SYSTEM”

Report

Database Design Laboratory Project

(21CS53)

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in partial fulfillment for the award of degree of

Bachelor of Engineering

in

COMPUTER SCIENCE AND ENGINEERING
2023-24

RV COLLEGE OF ENGINEERING®, BENGALURU - 560059
(Autonomous Institution Affiliated to VTU, Belagavi)

DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING



CERTIFICATE

Certified that the Mini Project work entitled 'Electricity billing system' has been carried out as a part of Database Design Laboratory(21CS53) in partial fulfillment for the award of degree of **Bachelor of Engineering in Computer Science and Engineering** of the Visvesvaraya Technological University, Belagavi during the year **2023-2024** by **Sadiq Wahid(1RV21CS135)**, **Sharath Chandra (1RV21CS150)**, **Samiksha Ranjan(1RV21CS141)** who are bonafide students at **RV College of Engineering®**, Bengaluru. It is certified that all the corrections/suggestions indicated for the internal assessment have been incorporated in the report deposited in the departmental library. The report has been approved as it satisfies the academic requirements in respect of work prescribed by the institution for the said degree.

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DECLARATION

We **Sadiq Wahid, Sharath Chandra, Samiska Ranjan** are students of Fifth Semester B.E Department of Computer Science and Engineering, **RV College of Engineering ®**, bearing **USN: 1RV21CS135, 1RV21CS150, 1RV21CS141** hereby declare that the project titled 'Electricity billing System' has been carried out as a part of Database Design (18CS53) by us and submitted in partial fulfillment of the program requirements for the award of degree in Bachelor of Engineering in Computer Science and Engineering of the **Visvevaraya Technological University, Belagavi** during the year **2023-2024**.

Further we declare that the content of the report has not been submitted previously by anybody for the award of any degree or diploma to any other University.

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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 bills 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. 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 have 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 the 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.

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CHAPTER 1

INTRODUCTION

Electricity Billing System is a software-based application.

- i. This project aims to serve the department of electricity by computerizing the billing system.
- ii. It mainly focuses on the calculation of units consumed during the specified time and the money to be charged by the electricity offices.
- iii. This computerized system will make the overall billing system easy, accessible, comfortable, and effective for consumers.

To design the billing system to be more service oriented and simple, the following features have been implemented in the project. The application has high speed of performance with accuracy and efficiency.

The software provides a facility of data sharing, it does not require any staff as in the conventional system. Once it is installed on the system only the meter readings are to be given by the admin where customer can view all details, it has the provision of security restriction.

The electricity billing software calculates the units consumed by the customer and makes bills, it requires small storage for installation and functioning. There is provision for debugging if any problem is encountered in the system.

The system excludes the need of maintaining paper electricity bill, administrator does not have to keep a manual track of the users, users can pay the amount without visiting the office. Thus, it saves human efforts and resources.

1.1 Preamble

We, the owners of our project, respect all customers and make them happy with our service. The main aim of our project is to satisfy customer by saving their time by payment process, maintaining records, and allowing the customer to view his/her records and permitting them to update their details.

The firm handles all the work manually, which is very tedious and mismatched.

The objectives of our project are as follows:

- i. To keep the information of customer.
- ii. To keep the information of consuming unit energy of current month.
- iii. To keep the information of consuming unit energy of previous month.
- iv. To calculate the units consumed every month regularly.
- v. To generate the bills adding penalty and rent.

- vi. To save time by implementing payment process online.

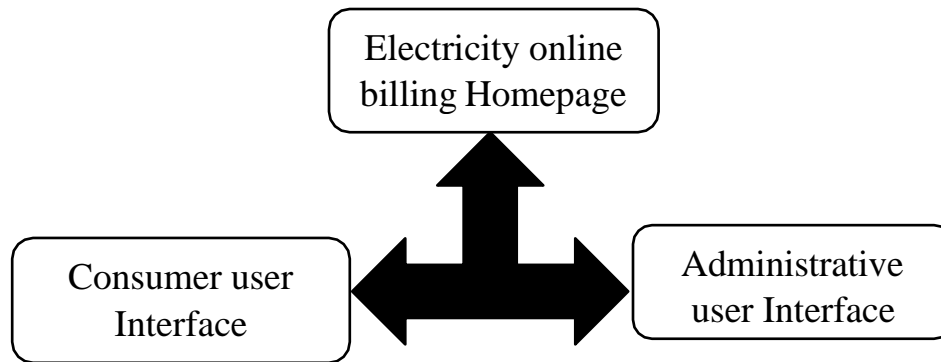


Fig 1.1.1: Block diagram showing the proposed online Electricity billing system.

1.2 Problem Statement

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. For this reason, we have provided features Present system is partially automated(computerized), existing system is quite laborious as one must enter same information at different places.

1.3 Proposed Solution

- This project system excludes the need to maintain paper electricity bills as all the electricity bill records are managed electronically.
- Administrator doesn't have to keep a manual track of the users. The system automatically calculates fines.
- Users don't have to keep a manual track of the users. The system automatically calculates fines.
- There is no need for a delivery boy for delivery bills to user's place. Thus, it saves human efforts and resources.

CHAPTER 2

ANALYSIS AND SYSTEM REQUIREMENT

2.1 Existing and Proposed System

The conventional system of electricity billing is not so effective; one member of staff must visit each customer's house to note the meter readings and collect the data. Then, another member of staff must compute the consumed units and calculate the money to be paid. Again, the bills prepared are to be delivered to customers. Finally, individual customers must go to the electricity office to pay their dues.

Hence, the conventional electricity billing system is uneconomical, requires many staff to do simple jobs and is a lengthy process overall. To solve this lengthy process of billing, a web based computerized system is essential. This proposed electricity billing system project overcomes all these drawbacks with the features. It is beneficial to both consumers and the company which provides electricity.

With the new system, there has been a reduction in the number of staff employed by the company. The working speed and performance of the software is faster with high performance, which saves time. Furthermore, there is very little chance of miscalculation and being corrupted by the staff.

2.2 Feasibility Study:

Feasibility study is the phase in which the analyst checks that the candidate system is feasible for the organization or not. This entails identification, description & evaluation of the system. Feasibility study is done to select the best system that meets the performance requirement.

If the feasibility study is to serve as a decision document, it must answer key questions.

- 1.Is there a new and better way to do the job that will benefit the user?
- 2.What are the costs and savings of the alternatives?
- 3.What is recommended?

The most successful system projects are not necessarily the biggest or most visible in the business but rather those truly meet the user's expectations.

Feasibility considerations

Three key considerations are involved in the feasibility study. They are as follows: -

Economic Feasibility:

Economic analysis is the most frequently used method for evaluating the effectiveness of the candidate system.

We analyze the candidate system (computerized system) is feasible as than the manual system because it saves the money, time and manpower. It also feasible according to cost benefits analysis

Technical Feasibility:

Technical feasibility centers around the technology used. It means the candidate system is technically feasible i.e. it doesn't have any technical fault and works properly in the given environment. Our system is technically feasible; it is providing us required output.

Behavioral Feasibility:

Behavioral feasibility is the analysis of behavior of the candidate system. In this we analyze whether the candidate system is working properly or not. If working, then it is communicating properly with the environment or not. All these matters are analyzed, and a good candidate system is prepared. Due to the change of system what is the change in behavior of the users, these factors are also analyzed.

2.3 SYSTEM DEVELOPMENT ENVIRONMENT

System development environment shows the hardware and software requirement, which is necessary for developing the software. Necessary software and hardware requirement, which are necessary for making this software are as follows:

2.3.1 Hardware Requirements:

- Hardware specification: Intel Pentium Processor
- 32 MB RAM or Higher
- 1.2 GB Hard Disk or Greater
- Video Display Unit
- Keyboard
- Mouse

2.3.2 Software Requirements:

- Operating System: Windows 10
- Software: Microsoft SQL Server
- Front End: Jsp Servlet
- Back End: Database – MySQL
- Business Logic- Java

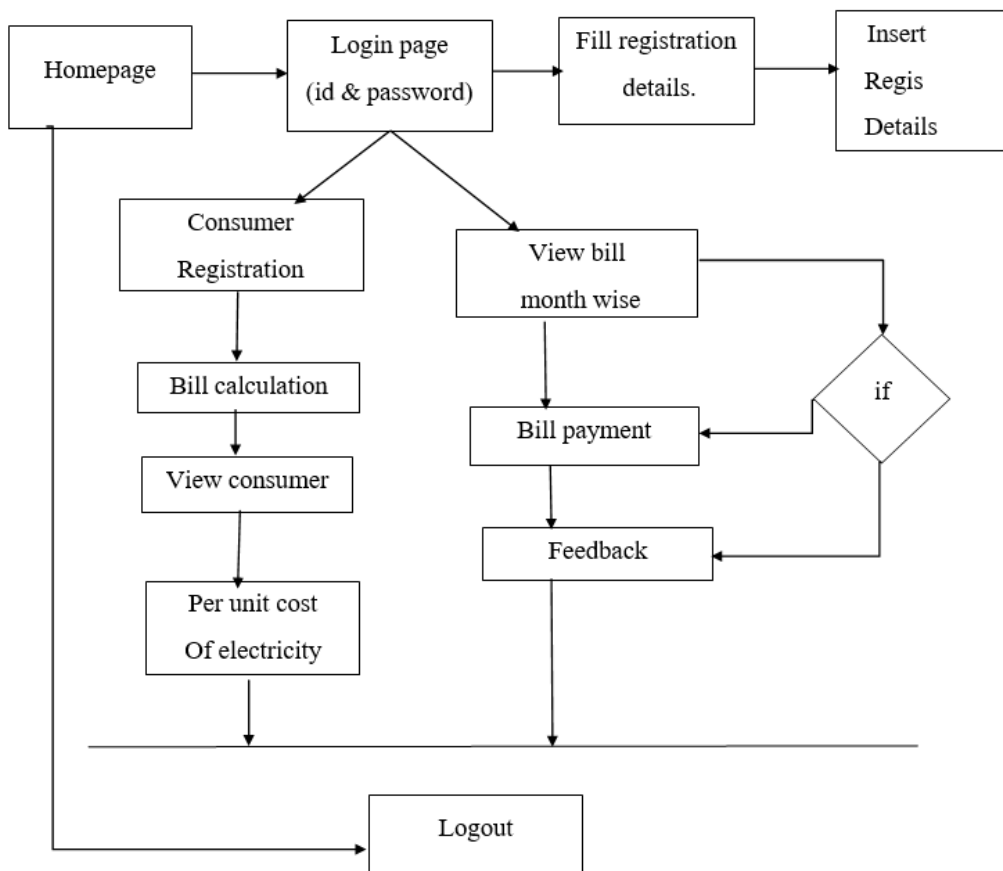
CHAPTER 3

SYSTEM DESIGN AND MODELLING

3.1 System Architecture

The system architecture gives an overview of the organizational system that shows the system boundaries, external entities that interact with the system, and the major information that flows between the entities and the system.

Fig 3.1.1 System Architecture of system



3.2 Preliminary Design

System design is an abstract representation of a system component and their relationship, and which describe the aggregated functionality and performance of the system. It is also the plan or blueprint for how to obtain answer to the question being asked. The design specifies various type of approach.

Database design is one of the most important factors to keep in mind if you are concerned with application performance management. By designing your database to be efficient in each call it makes and to effectively create rows of data in the database, you can reduce the amount of CPU needed by the server to complete your request, thereby ensuring a faster application.

3.2.1 Entity – Relationship Diagram

An entity relationship diagram (ERD) shows the relationships of entity sets stored in a database. An entity in this context is an object, a component of data. An entity set is a collection of similar entities. These entities can have attributes that define its properties.

There are two reasons to create a database diagram. You're either designing a new schema or you need to document our existing structure.

If you have an existing database you need to document, you create a database diagram using data directly from your database. You can export your database structure as a CSV file (there are some scripts on how to do this here), then have a program generate the ERD automatically.

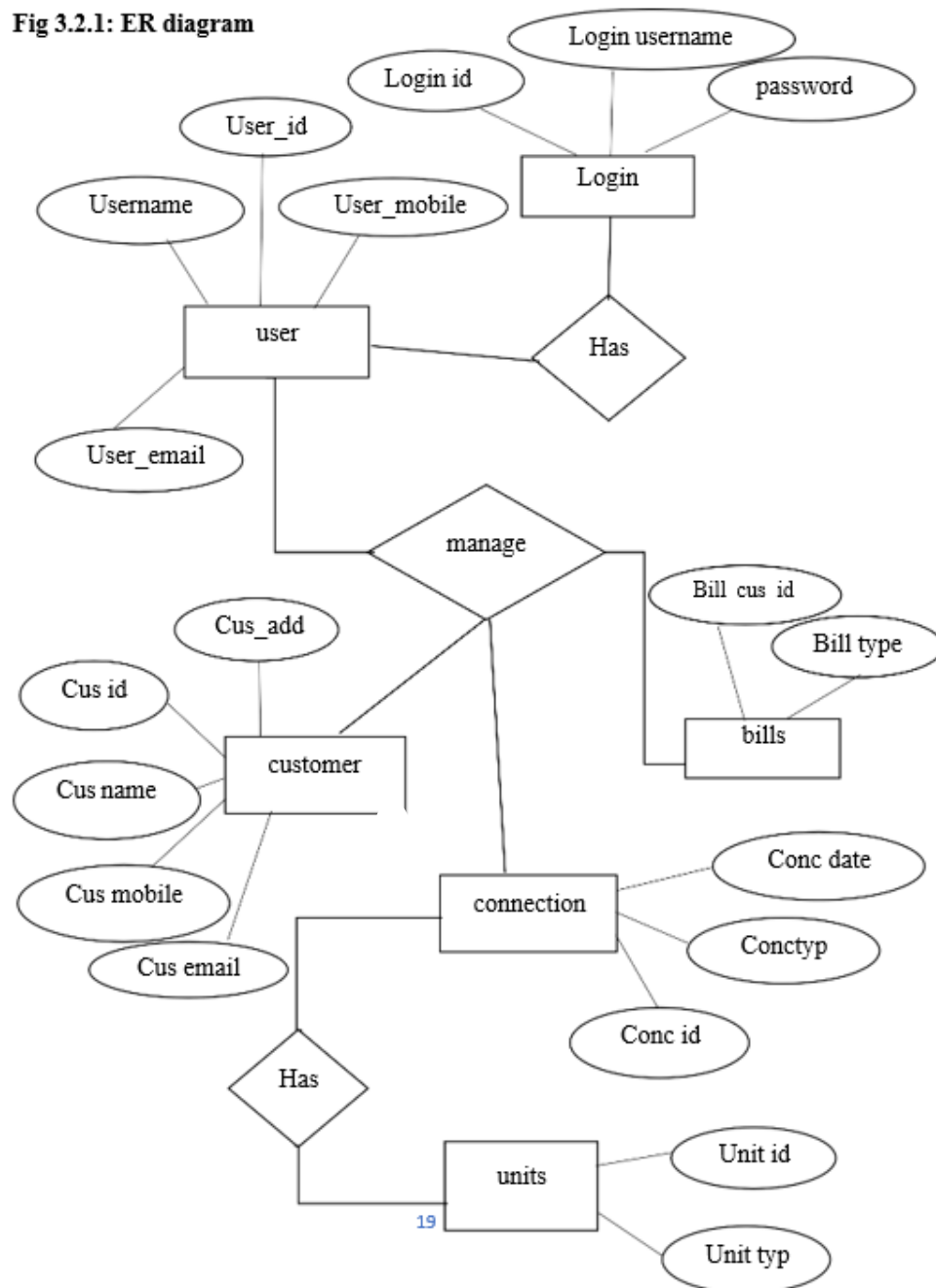
An ER diagram is a means of visualizing how the information a system produces is related. There are five main components of an ERD:

Entities, which are represented by rectangles. An entity is an object or concept about which you want to store information.

- A weak entity is an entity that must be defined by a foreign key relationship with another entity as it cannot be uniquely identified by its own attributes alone.
- Actions, which are represented by diamond shapes, show how two entities share information in the database.
- In some cases, entities can be self-linked. For example, employees can supervise other employees.
- Attributes, which are represented by ovals. A key attribute is the unique, distinguishing characteristic of the entity.
- A multivalued attribute can have more than one value. For example, an employee entity can have multiple skill values.
- A derived attribute is based on another attribute. For example, an employee's monthly salary is based on the employee's annual salary.
- Connecting lines, solid lines that connect attributes to show the relationships of the entities in diagram.
- Cardinality specifies how many instances of an entity relate to one instance of another entity. Ordinality is also closely linked to cardinality.

Figure 3.2.2 describes the ER diagram of Electricity Billing System. It has 5 entities namely login, customer, bill, and meter info. The entities have attributes which are primary and foreign and attributes. The primary attributes are underlined.

Fig 3.2.1: ER diagram



3.3 Normalization

Normalization is a process of organizing the data in database to avoid data redundancy, insertion anomaly, update anomaly & deletion anomaly.

Let's discuss anomalies first, then we will discuss normal forms with examples. Anomalies in DBMS There are three types of anomalies that occur when the database is not normalized. These are –Insertion, update and deletion anomaly.

3.3.1 First normal form(1NF)

As per the rule of first normal form,

- All rows must be unique.
- Each cell must only contain a single value.
- Each value should be non- divisible.

3.3.2 Second normal form(2NF)

As per the rule of second normal form,

- Database must be in first normal form.
- Non partial dependency All non-prime attributes should be fully functionally dependent on the candidate key.

3.3.3 Third normal form(3NF)

As per the rule of third normal form,

- Database must be in first and second normal form.
- Nontransitive dependency All fields must only be determined by the primary/composite key, not by other keys.

IMPLEMENTATION DETAILS

4.1 Implementation of operations

- Adding customer: Here admin can add new customer list who started using electricity bill system.
- Searching deposit details: Here admin can search according to meter number and month to view deposit details.
- Viewing Details: Here admin and user can view customer details and about details.
- Updating customer: Here customers can update their details by using meter no of the customer.
- Delete customer: Here admin can delete details based on meter number.

4.2 Implementation of SQL statements

Insert statement:

- The INSERT INTO statement is used to insert new records in a table.
- The INSERT INTO syntax would be as follows: INSERT INTO table_name VALUES (value1, value2, value3, ...).
- The following SQL statement insert's a new record in the "customer" table: Insert into customer VALUES ("sai","12345","btm","Bangalore","Karnataka","sai@gmail.com","9876543333").

Update statement:

- An SQL UPDATE statement changes the data of one or more records in a table. Either all the rows can be updated, or a subset may be chosen using a condition.
- The UPDATE syntax would be as follows: UPDATE table_name SET column_name =value, column_name=value... [WHERE condition].
- The following SQL statement update's a new record in the "customer" table: UPDATE TABLE customer SET email= su@gmail.com WHERE meter_no ="12345".

Delete statement:

- The DELETE statement is used to delete existing records in a table.
- The DELETE syntax would be as follows: DELETE FROM table_name WHERE condition.
- The following SQL statement delete's a record in the "customer" table: delete from customer where meter_no=12345.

Create statement:

- The CREATE TABLE Statement is used to create tables to store data. Integrity Constraints like primary key, unique key, foreign key can be defined for the columns while creating the table.
- The syntax would be as follows: CREATETABLE table_name (column1datatype, column2datatype, column3 datatype, columnN datatype, PRIMARY KEY (one or more columns)).

➤ The following SQL statement creates a table "customer" table: create table customer (name varchar (30), meter no varchar (20) primary key, address varchar (50), city varchar (20), state varchar (30), email varchar (30),

phone varchar (30));

➤ The following SQL statement creates a table “login” table: create table login (meter no varchar (30), username varchar (30), password varchar (30), user varchar (30), question varchar (40), answer varchar (30));

➤ The following SQL statement creates a table “bill” table: create table bill (meter no varchar (20), foreign key(meter no) references customer(meter no) on delete cascade, month varchar (20), units int (20), total bill int (20), status varchar (40));

4.3 Algorithm of implementation

Explanation of Algorithm:

- ✓ Start system
- ✓ Enter login name and password
- ✓ On clicking the login button
- ✓ Connect to database
- ✓ Query database to know whether user credentials are correct
- ✓ If not, deny access and return login page with an error message
- ✓ If correct, check if credentials for administrator
- ✓ If yes, allow login
- ✓ Set admin session, re-direct administrator to admin login page
- ✓ If no, allow login set user session
- ✓ Re-direct user to user home page

4.3.1 Algorithm of admin:

Login:

- This program will allow the admin to enter the username and password.
- If the entered credentials are correct, then the login will be successful otherwise need to be signup.
- If admin forgets password, it can be retrieved by giving username and answer for security question.
- After successful login the admin will be redirected to admin portal page where he/she can do following activities.

NewCustomer:

This program will allow the admin to enter the customer details and automatically generates unique meter number. If customer name, address, city, state, email and phone number is entered, insert the values into customer. else print error while next=true

enter the meter info details else print meter info error

Submit the details of customer that has been entered by clicking onto next button.

- If we need to cancel the particulars that has been entered click onto cancel option.

CustomerDetails:

- This program will allow the admin to view customer details.
- If we need to print the particulars that has been viewed click onto print option.

CalculateBill:

- This program will allow the admin to calculate total bill when units consumed are inserted where meter no and month is selected.
- insert the values into bill else print error.

Submit the details of tax that has been entered by clicking onto submit button.

- If we need to cancel the particulars that has been entered click onto cancel option.

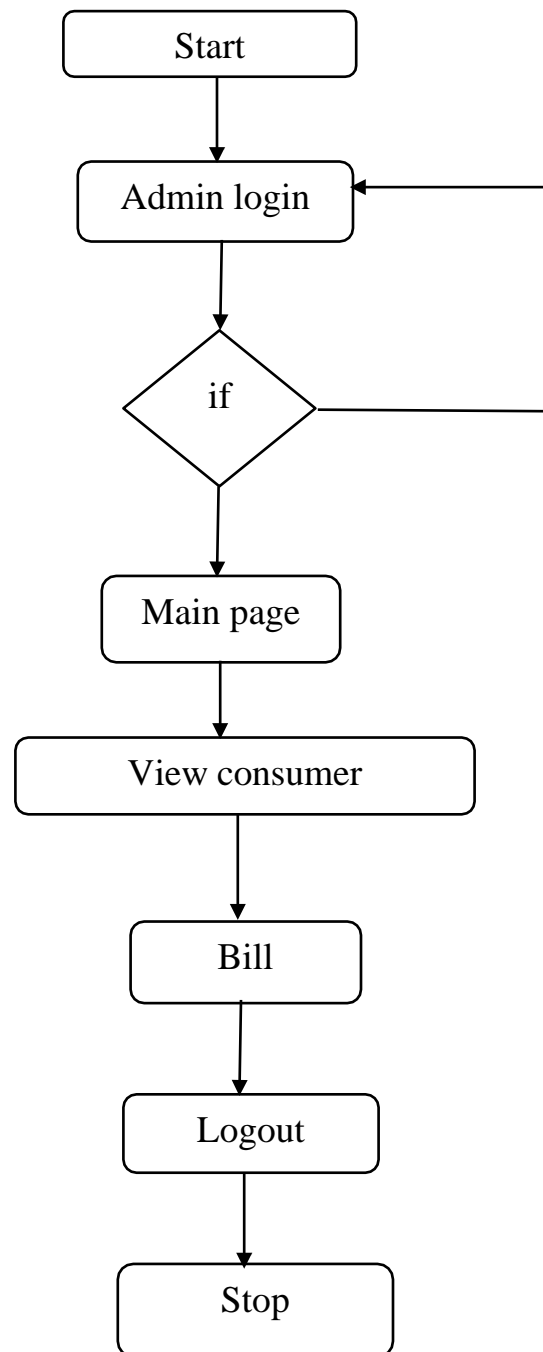
DeleteBill:

- This Program will allow the admin to delete the customer info when meter no is selected.
- If we need to delete the particulars that has been saved click onto delete option.
- If we need to cancel the particulars that has been entered click onto back option.

About:

- This program will allow the admin to view details of the project in short.
- If we need to exit the particulars that has been viewed click onto exit

Fig 4.3.1: Activity Flow chart of Administrator



4.3.2 Algorithm or of Customer:

Login:

- This program will allow the customer to enter the username and password. If the entered credentials are correct, then the login will be successful otherwise need to be signup with the meter_no which is given by admin.
- If customer forgets password, it can be retrieved by giving username and answer for security question. After successful login the customer will be redirected to customer portal page where he/she can do following activities.

UpdateInfo1:

This program will allow the customer to update the customer details. If customer address, city, state, email and phone number is updated,
update the values into customer else print error

update the details of customer that has been updated by clicking onto update button.

If we need to cancel the particulars that has been updated, click onto back option.

ViewInfo:

- This program will allow the customer to view his/her own details.
- If we need to go back from the particulars that has been viewed click onto back option.

PayBill:

- This program will allow the customer to view bill details and redirects to pay
- the bill where status will be updated.
- If we need to cancel the particulars that has been viewed click onto back option.
- If we need to pay the bill amount that has been viewed click onto pay option.

BillDetails:

- This program will allow the customer to view bill details.
- If we need to print the particulars that has been viewed click onto print option.

GenerateBill:

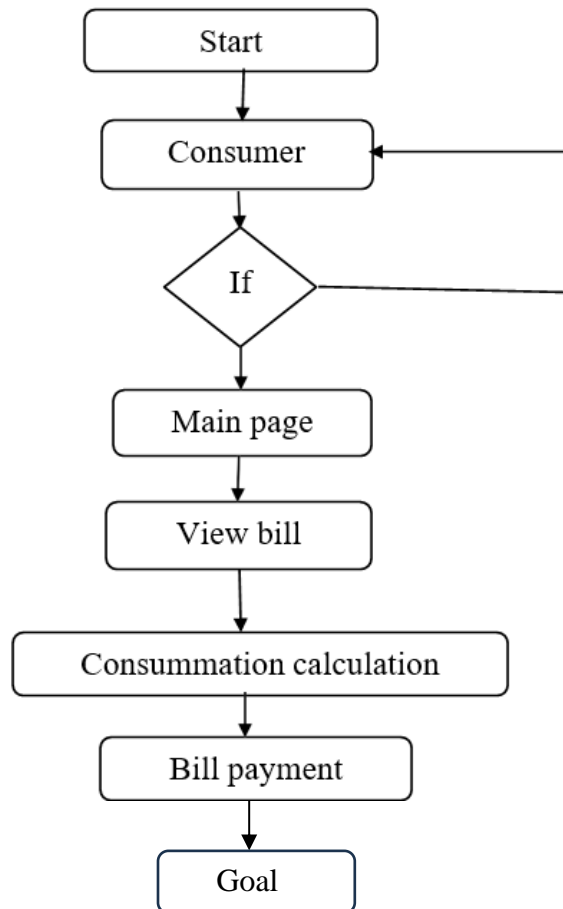
- This program will allow the customer to generate bill when meterno and month is selected.
- Generate the details by clicking on generatebill button.

About:

- This program will allow the customer to view details of the project in short.
- If we need to exit the particulars that has been viewed click onto exit option.

NOTE: Utility (notepad, browser, calculator), query and logout is given to both customer and admin portals.

Fig 4.3.2 Activity Flow chart of consumer

**4.4 DFD(Data Flow Diagram)**

They are the versatile diagramming tools used for structured system analysis. They are specifically used for process modelling which involves graphically representing the function or process, which captures, manipulate, store, and distribute data between a system and its environment and between components within a system.

Fig 4.4.1 zero level DFD

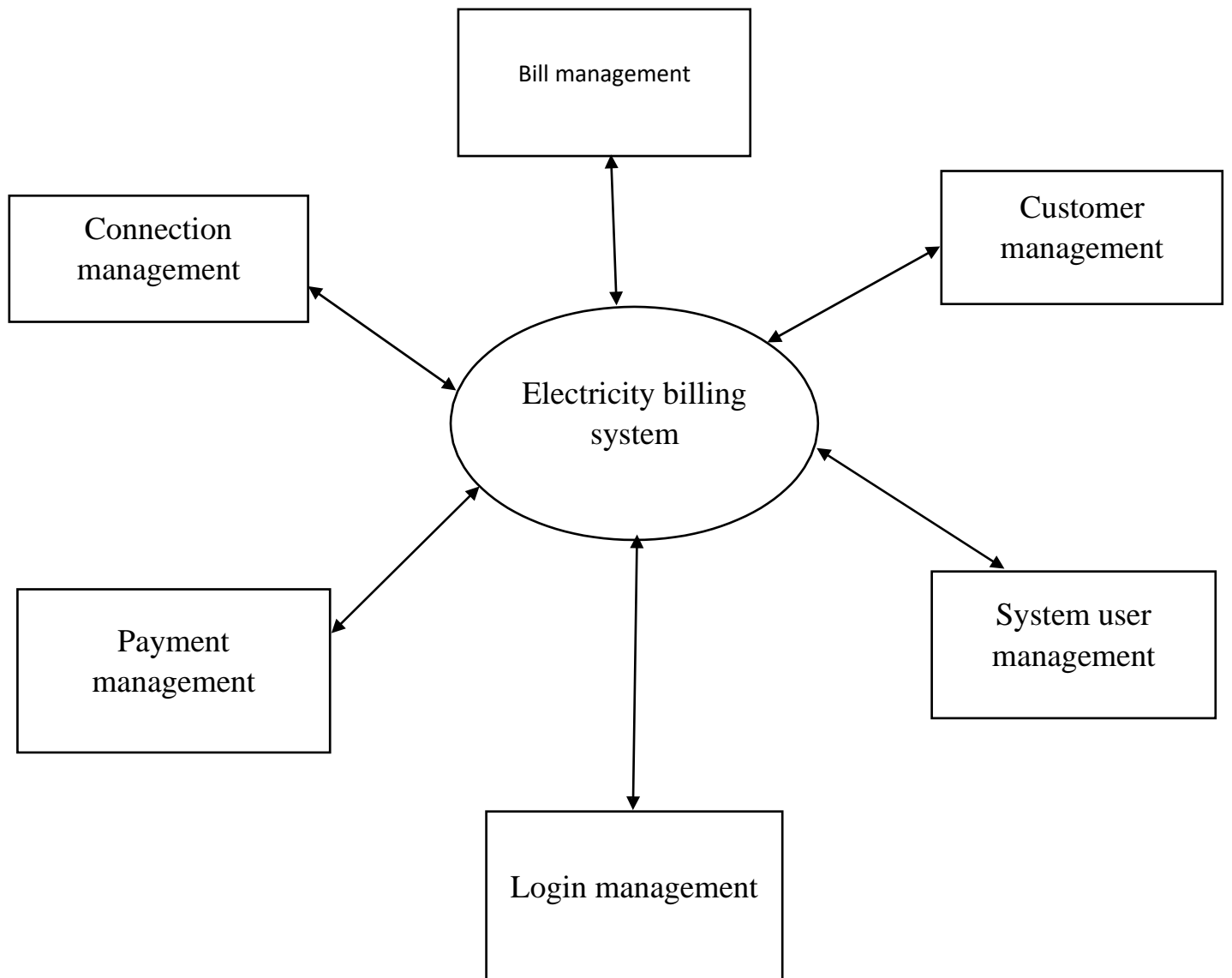


Fig 4.4.2 First level DFD

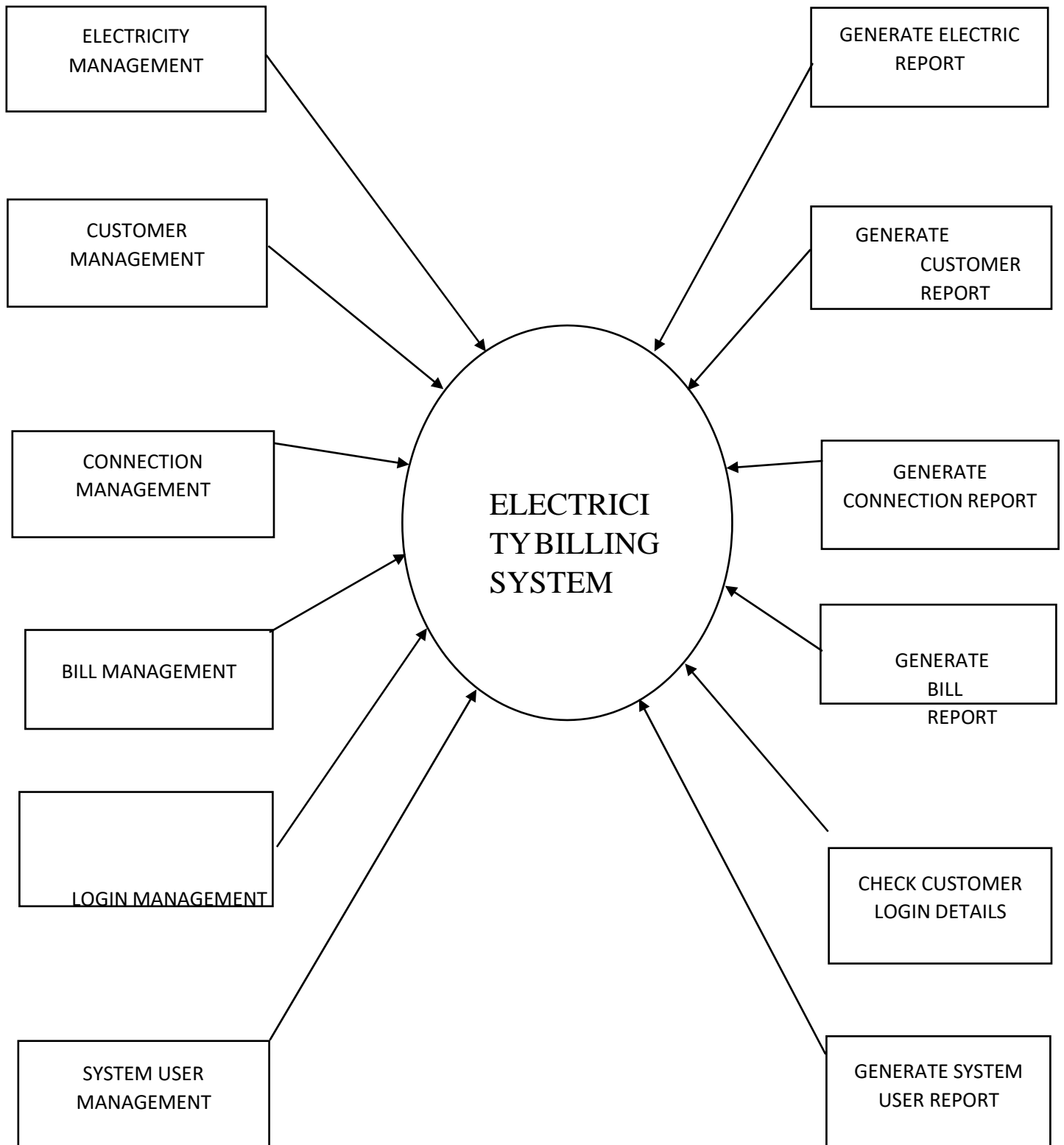
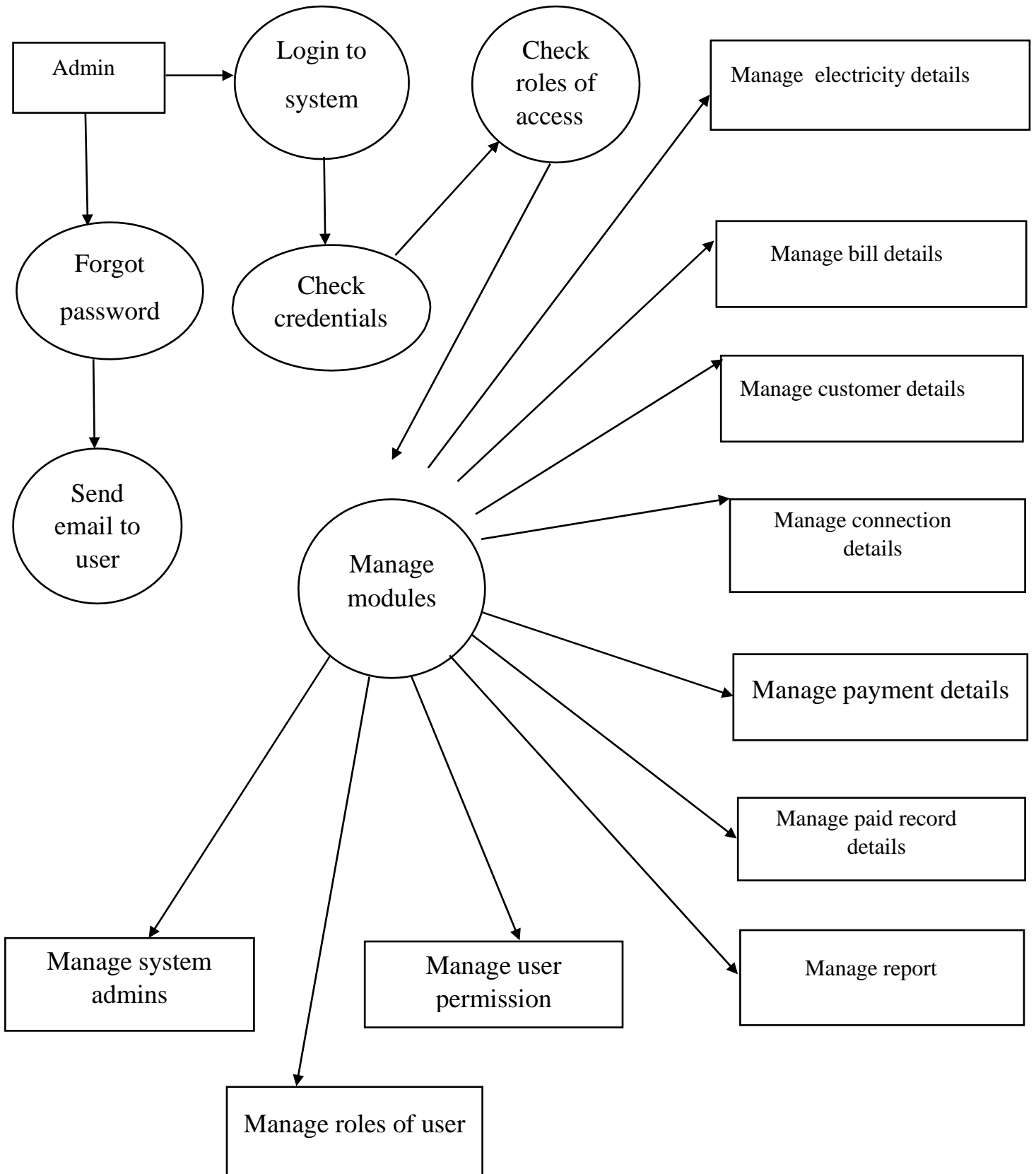


Fig 4.4.3 Second level DFD



CHAPTER 5

TESTING

This chapter gives the outline of all the testing methods that are carried out to get a bug free application.

5.1 Testing process

Testing is an integral part of software development. Testing process, in a way certifies, whether the product, that is developed, compiles with the standards, that it was designed to. Testing process involves building of test cases, against which, the product has to be tested. In some cases, test cases are done based on the system requirements specified for the product/software, which is to be developed.

5.2 Testing objectives

The main objectives of testing process are as follows:

- Testing is a process of executing a program with the intent of finding an error.
- A good test case is one that has high probability of finding an as yet undiscovered error.
- A successful test is one that uncovers an as yet undiscovered error.

5.3 Levels of Testing

Different levels of testing are used in the testing process; each level of testing aims to test different aspects of the system. The basic levels are unit testing, integration testing, system testing and acceptance testing.

5.3.1 Unit Testing

Unit testing focuses verification effort on the smallest unit of software design the module. The software built, is a collection of individual modules. In this kind of testing exact flow of control for each module was verified. With detailed design consideration used as a guide, important control paths are tested to uncover errors within the boundary of the module.

Table 5.1: Negative test case for phone number insertion

Function name	Input	Expected error	Error	Resolved
Input phone number	98977	Phone is invalid	Length of phone number is not equal to 10	Consume()
Input phone number	9877avg	Phone number is invalid	Alphabets are being taken as input for phone number	

Table 5.2: Positive test case for phone number insertion

Function name	Input	Expected error	Error	Resolved
Input phone number	8690345678	Expected output is seen		

Table 5.3: Negative test case for email insertion

Function name	Input	Expected error	Error	Resolved
Input email	Sail.in	Email is invalid	Email is not in a format given	Consumer()

Table 5.4: Positive test case for email insertion

Function name	Input	Expected error	Error	Resolved
Input email	Akil23@gmail.com	Expected output is seen		

Table 5.5: Negative test case for customer name insertion

Function name	Input	Expected output	Error	Resolved
Input customer name	Sana123	Name is invalid	Number are being taken as input	Consume()

Table 5.6: Positive test case for customer name insertion

Function name	Input	Expected name	Error	Resolved
Input customer name	Pooja	Expected output		

5.1.1 Integration testing

The second level of testing is called integration testing. In this, many class- tested modules are combined into subsystems, which are then tested. The goal here is to see if all the modules can be integrated properly. We have been identified and debugged.

Table 5.7: Test case on basis of generation of bill

Function name	Input	Expected error	Error	Resolved
Negative searching of total bill	1234(meter no) January(month)	Details seen but not total bill	Output not seen	Consume ()
Positive searching of total bill	1234(meter no) January(month)	Must display full generated bill		

5.3.1 System testing

Here the entire application is tested. The reference document for this process is the requirement document, and the goal is to see IF the application meets its requirements. Each module and component of ethereal was thoroughly tested to remove bugs through a system testing strategy. Test cases were generated for all possible input sequences and the output was verified for its correctness.

Table 5.8: Test cases for the project

Steps	Action	Expected error
Step 1 Choice	The screen appears when the users run the program. 1. If admin login 2. If customer login	A page with different menus appears. 1. Admin panel opens and 2. Customer panel opens.
Step 2	The screen appears when the admin logs in and selects any one of the menus from the click of the mouse	A window for adding new customer, Calculate bill, etc
Selection 1	<ul style="list-style-type: none"> • New customer • Customer details • Delete customer 	
Step 2.1	The screen appears when the customer login and selects any one of the menus from the click of the mouse	A window for generating bill, update Customer details, view details, generating bill
Selection 2	<ul style="list-style-type: none"> • Update details • View details 	
Selection 2a	<ul style="list-style-type: none"> • Generate bills 	
Selection 2b	<ul style="list-style-type: none"> • Pay bills • Bill details 	

CHAPTER 6

CONCLUSION

Usability testing was part of the post implementation review and performance evaluation for the Electricity Online Bill Payment System, in order to ensure that the intended users of the newly developed system can carry out the intended task effectively using real data so as to ascertain the acceptance of the system and operational efficiency. It caters for consumers' bills and also enables the administrator to generate monthly reports. It is possible for the administrator to know the consumers have made payment in respect of their bills for the current month, thereby improving the billing accuracy, reduce the consumption and workload on the Electricity Board employees or designated staff., increase the velocity of electricity distribution, connection, tariff scheduling and eliminates variation in bills based on market demand. The conceptual framework allows necessary adjustments and enhancement maintenance to integrate future demands according to the technological or environmental changes with time. It manages the consumers' data and validates their input with immediate notification centralized in Electricity Board offices across the nation.

6.1 Future Analysis:

We have left all the options open so that if there is any other future requirement in the system by the user for the enhancement of the system then it is possible to implement them. We hope that the project will serve its purpose for which it is developed there by underlining success of process.

6.2 REFERENCES

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Appendix

Source code:

New page:

```
<!DOCTYPE html>
```

```
<html>
```

```
<head>
```

```
<meta charset="ISO-8859-1">
```

```
<title>Electricity Bill</title>
```

```
<link type="text/css" href="css/addStyle.css" rel="stylesheet"></link>
```

```
</head>
```

```
<body>
```

```
<div class="container">
```

```
<h1 id="nav"> Electricity Billing System </h1>
```

```
<div id="bd" >
```

```
<form class = "admin" action = "adminlogin.jsp">
```

```
<button id="own" >Admin</button>
```

```
</form>
```

```
<form class = "user" action = "user.jsp">
```

```
<button id="ownn" >User </button>
```

```
</form>
```

```

```

```
<footer>
```

```
<a href="zsd">Help</a>
```

```
<a href="ds">Support</a>
```

```
</footer>
```

```
</div>
```

```
</div>
```



```

</body>
</html>
New page:
<!DOCTYPE html>
<html>
<head>
<meta charset="ISO-8859-1">
<title>Insert title here</title>
<link rel="stylesheet" href="https://stackpath.bootstrapcdn.com/bootstrap/4.3.1/css/bootstrap.min.css"
integrity="sha384- ggOyR0iXCbMQv3Xipma34MD+dH/1fQ784/j6cY/iJTQUOhcWr7x9JvoRxT2 MZw1T"
crossorigin="anonymous">

</head>
<body>

<form action="newpage.html" method="GET" style="border:1px solid #ccc">
<div class="container">
<h1>Sign Up</h1>
<p>Please fill in this form to create an account.</p>
<hr>

<input type="hidden" name="command" value="NewUser">

<label for="name"><b>Enter a Name</b></label>
<input type="text" placeholder="Enter a Name" name="name" required>
<br>
<label for="id"><b>Consumer Number</b></label>
<input type="text" placeholder="Enter Consumer number" name="id" required>
<br>

<label for="psw"><b>Password</b></label>
<input type="password" placeholder="Enter Password" name="psw" required>

<br>

<div class="clearfix">
<br>

<button type="submit" class="signupbtn">Sign Up</button>

```

</div>

</div>

</form>

</body>

</html>

Result page:

<!DOCTYPE html>

<html>

<head>

<meta charset="ISO-8859-1">

<title>Insert title here</title>

</head>

<body>

<h1>Added Sucessfully!</h1>

</body>

</html>

