Smart Meter Firmware for Monitor and Control the Electrical Appliances Consumption

Abstract

Smart cities can enhance our daily lives by providing comprehensive smart services such as smart transportation and energy. Electricity is one of the most popular forms of energy. Currently, the electricity distribution companies are responsible for taking readings to determine the energy consumption of the final consumer, this activity is performed by field personnel contractors, which is exposed to risks to their physical integrity, either by climate or social situation. When the owners of a residential building receive their monthly electric energy bill, the information does not discriminate the consumption behaviour of household appliances and loads. If consumers were able to identify those devices which have a higher consumption based on historical consumption data or baseline consumption, they could take actions that effectively impact its electrical energy consumption. The electricity information of each equipment can help to manage electrical system supply and demand in view of electricity supplier and user. The aim of this project is to develop a Web App for smart energy meter reading and appliance usage monitor and control system. Its architecture is built on a centralized principle; interaction with users is carried out through a web interface. Custom-tailored data visualization dashboard, which is usually created inside the user interface offered by a Cloud platform. This project is proposed to automate the collection of electricity consumption data and do an analysis with the ability to visualize and detail certain indicators for minimizing the costs of electricity consumption. It provides authorization for connected smart meters, collection and storage of their data, device management, software management, alerts, and other functions. Analytics module that allows monitoring of trends, creation of rule-based alerts, generation of comparative reports, etc..

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CHAPTER 1
INTRODUCTION

1.1. OVERVIEW

Electricity is one of the vital requirements for sustainment of comforts of life. IT should be used very judiciously for its proper utilization. But in our country we have lot of localities where we have surplus supply for the electricity while many areas do not even have access to it. Our policies of its distribution are also partially responsible for this because we are still not able to correctly estimate our exact requirements and still how much of power units are used at a particular home appliances is prevailing.

On the other hand consumers are also not satisfied with the services of power companies. Most of the time they have complaints regarding statistical errors in their monthly bills. Thus we are trying to present an idea towards the minimization of technical errors and to reduce human dependency at the same time. With the help of this project we are aiming to receive the monthly energy consumption from a remote location directly to a centralized office. In this way we can reduce human efforts needed to record the meter readings which are till now recorded by visiting every home individually. This results in considerable loss of human hours and also provides considerable details regarding the average consumption of a locality so that power supply can be made according to these data. This will help the officials in deciding the specifications of transformers and other instruments required in power transmission.

This idea is economically efficient as well because we can get the meter reading at a very low cost. The implementation is done in such a way that a SMS is delivered to the Modem whose reading is to be noted and then that meter replies to the server in the SMS format and it is known that SMS costs are very low.The purpose of this project is to remote monitoring and control of the Domestic Energy meter. This system enables the Electricity Department to read the meter readings regularly without the person visiting each house. This can be achieved by the use of Microcontroller unit that continuously monitors and records the Energy Meter readings in its permanent (non-volatile) memory location.

This system is made to keep the records about the bills of the customers. The admin can manage all the accounts and the registered users like employees and customers can only manage their own accounts. This system helps in maintaining the bills and the payments. A different module is there for employees to check the customer's details if their job requires. Admin, employees, and customers all have a different interface and different privileges according to their need. Like a customer can only manage his account and cannot see any details of other customers, employees can see the details of all the customer's accounts and admin can manage all the accounts including the customers and employees account. This system also has the option for customers to pay their electricity bills by online mode. Either through internet banking or by debit card.

This system also has the feature to add and delete customer and employee's accounts in case a customer wants to cut the connection or an employee wants to leave the job. All the employees are divided into different departments according to their job profile and the customers are divided according to their wards. The rest of the modules are explained in the further sections with the detailed explanation.

1.2. PROBLEMS STATEMENT

The identified problem revolves around the manual and inefficient process of hostel registration in universities. The current system requires students to physically visit the Students' Affairs Office to fill out forms, provide payment receipts, and then wait for hostel allocation. This process is not only time-consuming but also prone to errors and inefficiencies due to its reliance on pen and paper.

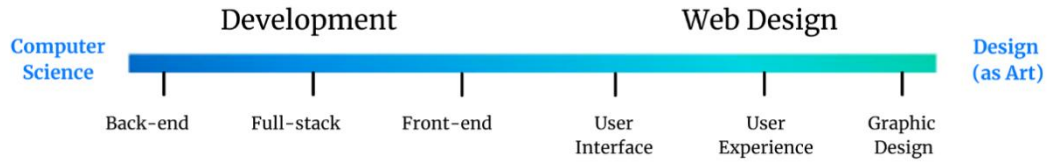
Moreover, the manual system leads to challenges such as:

- **Time wastage**: Both students and administrative staff spend significant time on paperwork and processing, which could be better utilized elsewhere.
- **Error-prone**: Manual data entry increases the likelihood of errors, leading to inaccuracies in student records and hostel allocations.
- **Limited scalability**: As the university population grows, the manual system becomes increasingly cumbersome and difficult to manage.

- 4 .**Inefficiency**: With the manual process, there's a lack of real-time updates and tracking, making it challenging to manage hostel occupancy effectively.
- **Resource consumption**: The manual system requires physical storage space for paperwork and additional manpower for data entry and processing.
- Overall, the identified problem is the inefficiency and ineffectiveness of the manual hostel registration process, which negatively impacts both students and administrative staff.

1.3. Web Design and Development

Web design and development is an umbrella term that describes the process of creating a website.



1.3.1. Web Design

Web design governs everything involved with the visual aesthetics and usability of a website color scheme, layout, information flow, and everything else related to the visual aspects of the UI/UX (user interface and user experience). Some common skills and tools that distinguish the web designer from the web developer are:

- Adobe Creative Suite (e.g., Photoshop, Illustrator) or other design software
- Graphic design
- UI design
- UX design
- Logo design
- Layout/format
- Placing call-to-action buttons
- Branding
- Wireframes, mock-ups, and storyboards
- Color palettes
- Typography

Web design is concerned with what the user actually sees on their computer screen or mobile device, and less so about the mechanisms beneath the surface that make it all work. Through the use of color, images, typography and layout, they bring a digital experience to life.

1.3.2. Web Development

Web development governs all the code that makes a website tick. It can be split into two categories—front-end and back-end. The front-end or client-side of an application is the code responsible for determining how the website will actually display the designs mocked up by a designer. The back-end or server-side of an application is responsible for managing data within the database and serving that data to the front-end to be displayed. As you may have guessed, it's the front-end developer's job that tends to share the most overlap with the web designer. Some common skills and tools traditionally viewed as unique to the front-end developer are listed below:

- HTML/CSS/JavaScript
- CSS preprocessors (i.e., LESS or Sass)
- Frameworks (i.e., AngularJS, ReactJS, Ember)
- Web template design
- Libraries (i.e., jQuery)
- Git and GitHub
- On-site search engine optimization (SEO)

Front-end web developers don't usually create mock-ups, select typography, or pick color palettes—these are usually provided by the designer. It's the developer's job to bring those mock-ups to life. That said, understanding what the designer wants requires some knowledge of best practices in UI/UX design so that the developer is able to choose the right technology to deliver the desired look and feel and experience in the final product.

Back-end developers handle the business logic and data management on the back-end of an application. They write the APIs and routing that allow data to flow between the front and back end of an application. Programming languages and tools unique to back-end developers are listed below:

- Server-side programming languages (e.g., PHP, Python, Java, C#)

- Server-side web development frameworks (e.g., Ruby on Rails, Symfony, .NET)
- Database management systems (e.g., MySQL, MongoDB, PostgreSQL)
- RESTful APIs
- Authentication and security (e.g., OAuth, PassportJS)
- Servers (e.g., Linux, Apache, Express)

Web developers who possess a working knowledge across the frontend and backend of a technology stack are called full-stack developers

.CHAPTER 2
PROJECT DESCRIPTION

The Smart Meter Firmware for Monitoring and Controlling Electrical Appliance Consumption project aims to revolutionize energy management in residential and commercial settings. By developing intelligent firmware for smart meters, this project seeks to empower consumers with real-time insights into their energy usage and the ability to remotely monitor and control their electrical appliances.

The primary objective of the project is to design firmware that can be integrated into existing smart meters, enabling them to communicate with a centralized monitoring system. This firmware will collect data on electricity consumption from various appliances in the household or establishment, using advanced sensing and communication technologies.

2.3.NEED FOR COMPUTERIZATION:

Introduction

In the pursuit of efficient energy management and conservation, the integration of smart meter firmware to monitor and control electrical appliance consumption has emerged as a promising solution. This chapter delves into the computerization aspect of smart meter firmware, focusing on its functionalities, implementation, and implications.

Functionality of Computerization

Computerization plays a pivotal role in enabling smart meters to effectively monitor and control electrical appliance consumption. The following functionalities are central to this process:

- Data Acquisition and Processing: Smart meters collect real-time data on energy usage from connected appliances. This data is processed to provide insights into consumption patterns, peak usage periods, and potential areas for optimization.
- Communication Protocols: Computerization facilitates communication between smart meters and external systems, such as utility providers or home

automation platforms. This allows for remote monitoring and control of appliances, as well as the exchange of data for billing and analysis purposes.

- Algorithm Implementation: Sophisticated algorithms are employed to analyze energy usage data and optimize appliance control strategies. These algorithms may include demand response algorithms, load balancing algorithms, and predictive analytics algorithms to anticipate future consumption patterns.
- User Interface: Computerization enables the development of user-friendly interfaces for consumers to monitor their energy usage, set preferences, and receive recommendations for energy-efficient practices. This may include web-based portals, mobile applications, or integrated displays on smart appliances.

Implementation of Computerization

The implementation of computerization in smart meter firmware involves several key components and considerations:

- Hardware Integration: Smart meters are equipped with microcontrollers or embedded systems capable of processing and storing energy usage data. These hardware components must be designed to meet the computational and communication requirements of the firmware.
- Software Development: The firmware for smart meters is developed using programming languages such as C/C++, Python, or Java. Software modules are created to handle data acquisition, communication protocols, algorithm implementation, and user interface functionalities.
- Integration with Existing Infrastructure: Smart meter firmware must be seamlessly integrated with existing energy infrastructure, including metering systems, communication networks, and utility databases. Compatibility with industry standards and protocols is essential to ensure interoperability.
- Security Measures: Given the sensitive nature of energy consumption data, robust security measures must be implemented to protect against unauthorized access, data breaches, and cyber-attacks. This includes encryption techniques, authentication mechanisms, and intrusion detection systems.

Implications of Computerization

The computerization of smart meter firmware has significant implications for various stakeholders:

- Consumer Empowerment: By providing consumers with real-time insights into their energy usage and control over their appliances, computerized smart meters empower individuals to make informed decisions and adopt more sustainable energy practices.

- Utility Optimization: Utility providers can leverage the data collected by smart meters to optimize energy distribution, forecast demand, and implement demand-side management strategies. This can lead to improved grid stability, reduced energy waste, and lower operational costs.
- Environmental Impact: The adoption of computerized smart meter firmware contributes to the reduction of greenhouse gas emissions and environmental degradation by promoting energy efficiency and renewable energy integration.
- Policy and Regulation: The widespread deployment of smart meters raises important policy and regulatory considerations regarding data privacy, consumer rights, and energy market dynamics. Policymakers must address these issues to ensure a fair and transparent energy transition.

Conclusion

Computerization is a fundamental aspect of smart meter firmware for monitoring and controlling electrical appliance consumption. By enabling real-time data acquisition, communication, algorithm implementation, and user interface functionalities, computerized smart meters facilitate efficient energy management and empower consumers to contribute to a more sustainable energy future. However, careful attention must be paid to the implementation and implications of computerization to address technical, security, and regulatory challenges effectively.

Module

1. Admin.
2. User Registration and Login.
3. Level of Energy Consumption.
4. Status of User
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Use Case Description

Admin

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User Registration and Login

The users have to register their necessary details to the administrator to gain the access for the system, from which the customer can get the username and password .After accessing the system the customers can get the complete knowledge about the energy usage level, cost, status intimation that has been provided by the administrator.

Level of Energy Consumption

This module provides the detailed statement of the energy consumption level of the customer which helps to maintain their usage level. Whereas it also increases the efficiency of the entire system by maintaining the records of customers and their consumption level involved in the system.

Status of User

The admin receives and holds the status of each and every customers involved in the process, and gain the access control to manipulate them. This module helps the administrator for further process which enhances to complete system with better efficiency.

Intimation of Power Consumption

This module intimates the consumption level of the customers to them through their mobile, so that the customers can gather their day to day consumption level and usage. The customer receives a message if they crossed their daily usage limit, which helps them to maintain their level of usage.

Payment

The payment can be done through online which reduces paper valuation and manual work. Increases the efficient and a time saving procedure for the customers and as well as the administrator.

Report

The complete procedure has been maintain in this module which enhance the system by providing the list and details of the customers and about their energy usages. It helps the administrator to improve the performance evaluation of the system.

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CHAPTER 3

SYSTEM ANALYSIS

3.1. EXISTING SYSTEM

In the presented system all the jobs of the electricity board is prepared by hand, it is very complicated to the operators and needs to keep the objects records of the office and a separate record for the billing and customer details. Many irregularities exist in the present system, which is manually maintained. It requires high processing time.

Errors may also occur in this system. These details are all stored in special records. Though all the most importance, tedious a care needed job is the bill calculation. Any one of mistakes may cause severe consequence. The firm handles all of the work manually, which is very tedious and mismanaged.

3.1.1. Disadvantages

- That is not user friendly.
- The retrieval and storing of data is slow.
- Data is not maintained efficiently.
- Existing system requires lot of paper work and even a small transaction require many papers fill.

3.2. PROPOSED SYSTEM

This proposed EB Bill Management project overcomes all these drawbacks with the features aforementioned. It is beneficial to both consumers and the electricity board. With the new system, there is reduction in the number of staffs to be 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 staffs.

The proposed system provides managing of huge data effectively and efficiently for efficient results, storing the details of the customers, employees etc. in such a way that the database can be modified. Proposed system supports strategic competitive advantages. Since the proposed systems provide easiness in reports generating it will provide strategic advantages among competitors. Our proposed system is used to monitor the electricity usage of home is monitor easily and also monitor the usage of units and amount at the particular home appliances. Then the amount of electricity usage by that month is previously fixed at admin,then the intimation status has been sent to the user once they reaches the limited level.

3.2.1. ADVANATGES

- The proposed system is user friendly.
- The retrieval and storing of data is fast and data is maintained efficiently.
- All the data is feted into the computer immediately and various bills and reports can be generated through computers.
- All the data is kept in a database no data of the organization can be destroyed. Moreover work becomes very easy because there is no need to keep data on papers.
- Computer operator control will be there no errors. Moreover storing and retrieving of information is easy. So work can be done speedily and in time.

CHAPTER 4

SYSTEM SPECIFICATION

4.1. Hardware Requirements:

- Processors: Intel® Core™ i5 processor 4300M at 2.60 GHz or 2.59 GHz (1 socket, 2 cores, 2 threads per core), 8 GB of DRAM
- Disk space: 320 GB
- Operating systems: Windows® 10, macOS*, and Linux*

4.2. Software Requirements:

- Server Side : PHP
- Client Side : HTML, CSS, Bootstrap
- IDE : Dreamviewer
- Back end : MySQL 5.
- Server : Wampserver 2i

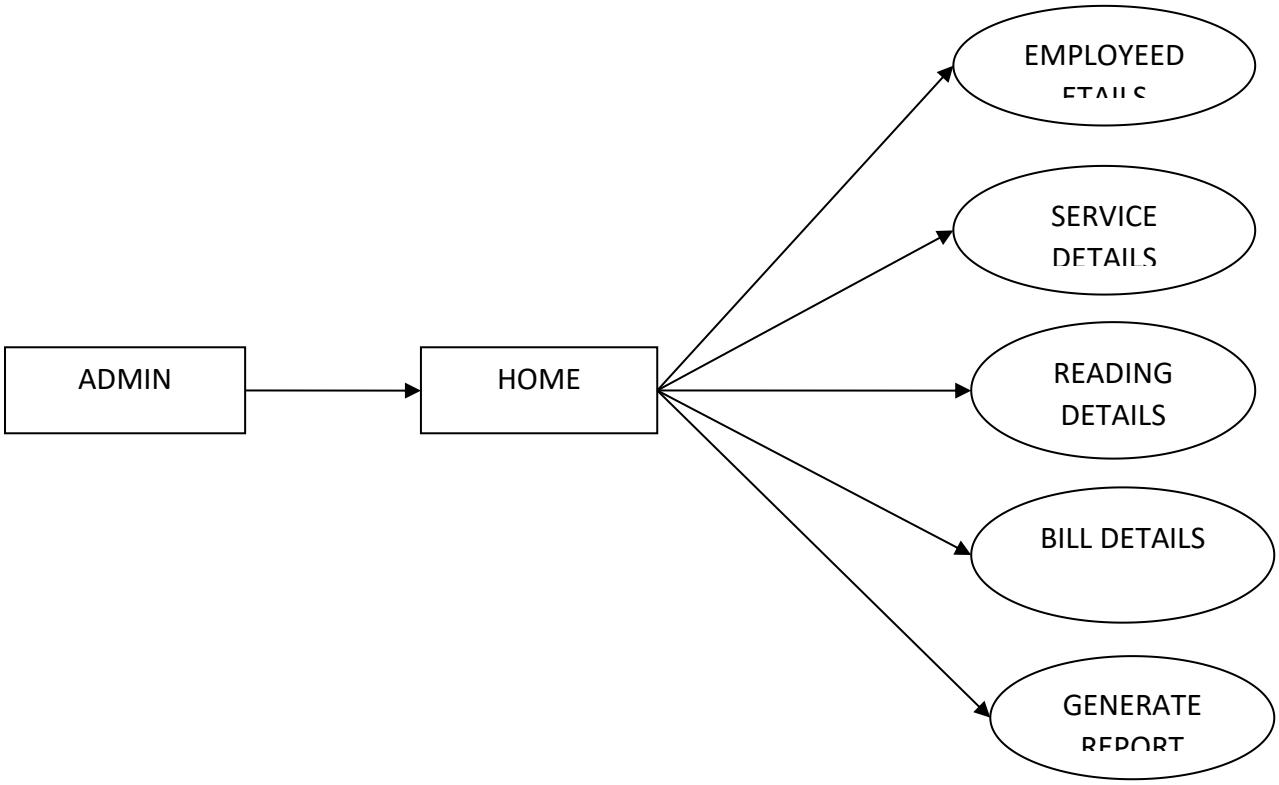
CHAPTER 5
SYSTEM DESIGN

5.2. DATA FLOW DIAGRAM

5.2.1. LEVEL 0

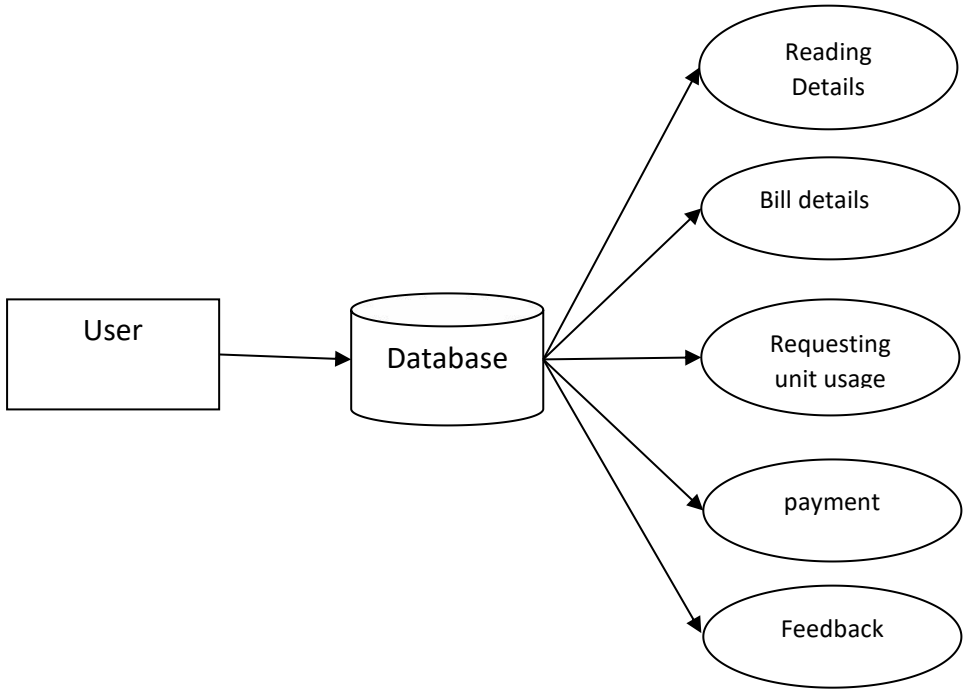
5.1. Fig 1: Data Flow Level Zero Diagram

5.2.2 LEVEL 1



5.2. Fig 2 : Data Flow Level One Diagram

5.2.3 LEVEL 2



5.3. Fig 3: Data Flow Level Zero Diagram

5.3. DATABASE DESIGN

Table structure for table admin

Field	Type	Null	Default
username	varchar(20)	Yes	NULL
password	varchar(20)	Yes	NULL

Table structure for table eb_bill

Field	Type	Null	Default
id	int(11)	Yes	NULL
uname	varchar(20)	Yes	NULL
Start_date	varchar(20)	Yes	NULL

End_date	varchar(20)	Yes	NULL
unit	double	Yes	NULL
amount	double	Yes	NULL
Register_date	varchar(20)	Yes	NULL

Table structure for table eb_data

Field	Type	Null	Default
id	int(11)	Yes	NULL
uname	varchar(20)	Yes	NULL
year	int(11)	Yes	NULL
month	varchar(20)	Yes	NULL
fan	int(11)	Yes	NULL
tubelight	int(11)	Yes	NULL
television	int(11)	Yes	NULL
refrigerator	int(11)	Yes	NULL
washing_machine	int(11)	Yes	NULL
microwave_ovan	int(11)	Yes	NULL
water_purifier	int(11)	Yes	NULL
ac	int(11)	Yes	NULL
water_heater	int(11)	Yes	NULL
motor_pump	int(11)	Yes	NULL
air_cooler	int(11)	Yes	NULL
computer	int(11)	Yes	NULL
electric_stove	int(11)	Yes	NULL

Table structure for table eb_device

Field	Type	Null	Default
id	int(11)	Yes	NULL
device	varchar(30)	Yes	NULL

Table structure for table eb_monitor

Field	Type	Null	Default
id	int(11)	Yes	NULL
username	varchar(20)	Yes	NULL
edevice	int(11)	Yes	NULL
status	int(11)	Yes	NULL
seconds	int(11)	Yes	NULL
unit	double	Yes	NULL
month	int(11)	Yes	NULL
year	int(11)	Yes	NULL
device	varchar(30)	Yes	NULL
alert_st	int(11)	Yes	NULL

Table structure for table eb_predict

Field	Type	Null	Default
id	int(11)	Yes	NULL
edevice	varchar(50)	Yes	NULL
eb_usage	double	Yes	NULL

Table structure for table eb_staff

Field	Type	Null	Default
id	int(11)	Yes	NULL
name	varchar(20)	Yes	NULL
mobile	bigint(20)	Yes	NULL
email	varchar(40)	Yes	NULL
area	varchar(40)	Yes	NULL
city	varchar(40)	Yes	NULL
username	varchar(20)	Yes	NULL
password	varchar(20)	Yes	NULL

Table structure for table eb_unit

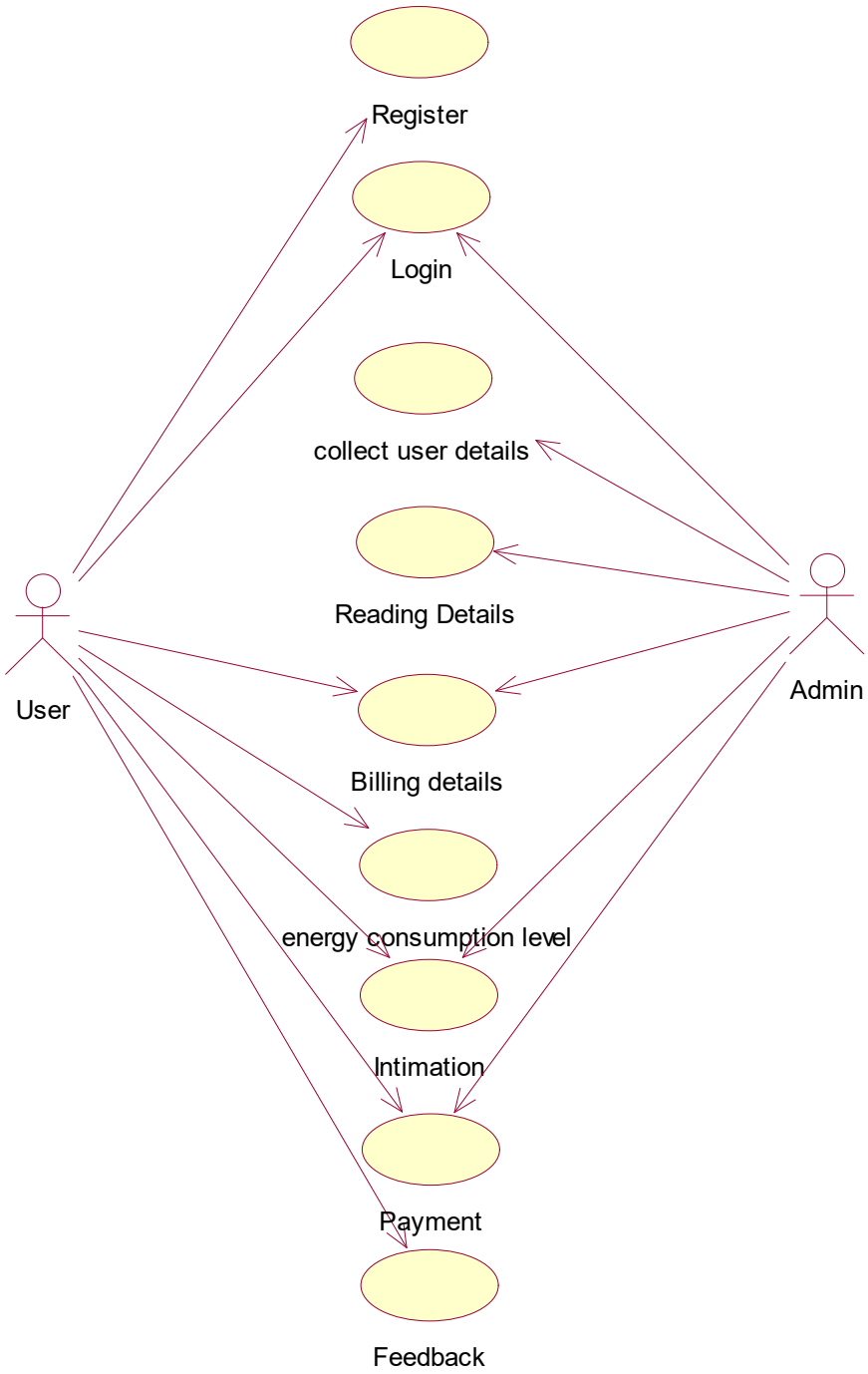
Field	Type	Null	Default
id	int(11)	Yes	NULL
username	varchar(20)	Yes	NULL
seconds	int(11)	Yes	NULL
unit	double	Yes	NULL
amount	double	Yes	NULL
Store_date	varchar(20)	Yes	NULL
status	int(11)	Yes	NULL
month	int(11)	Yes	NULL
year	int(11)	Yes	NULL

4.3. System Architecture

5.4. Fig 4: System Architecture Diagram

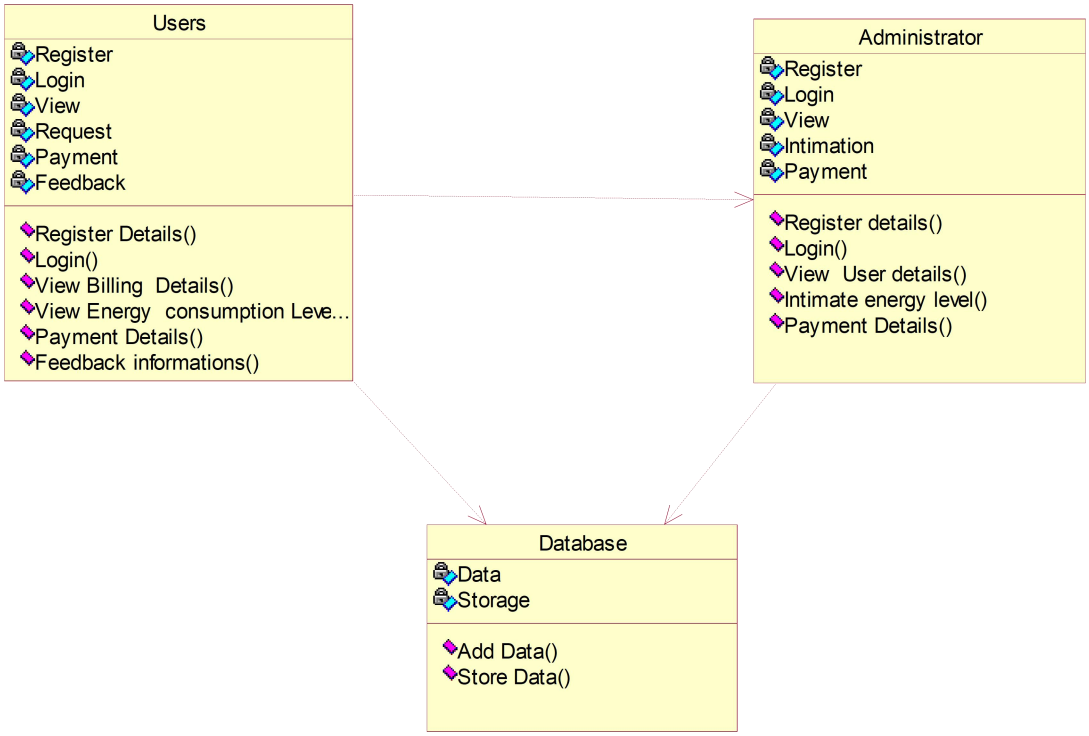
4.4. UML DIAGRAM

4.4.1. USE CASE



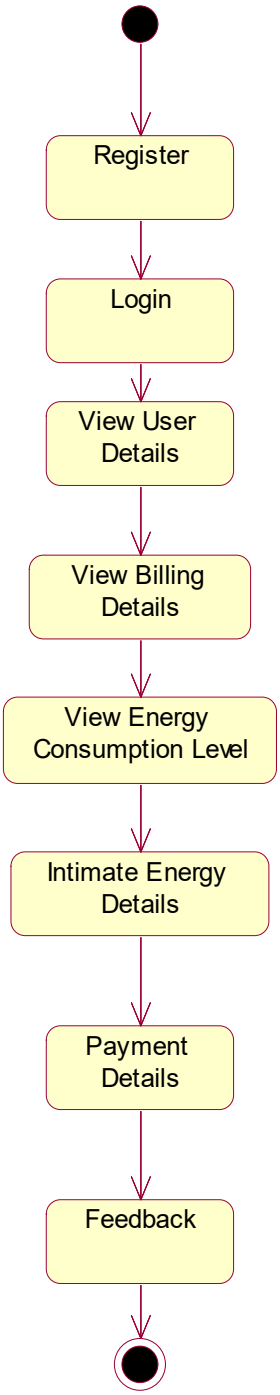
5.5. Fig 5: Use Case Diagram

4.4.2. CLASS DIAGRAM



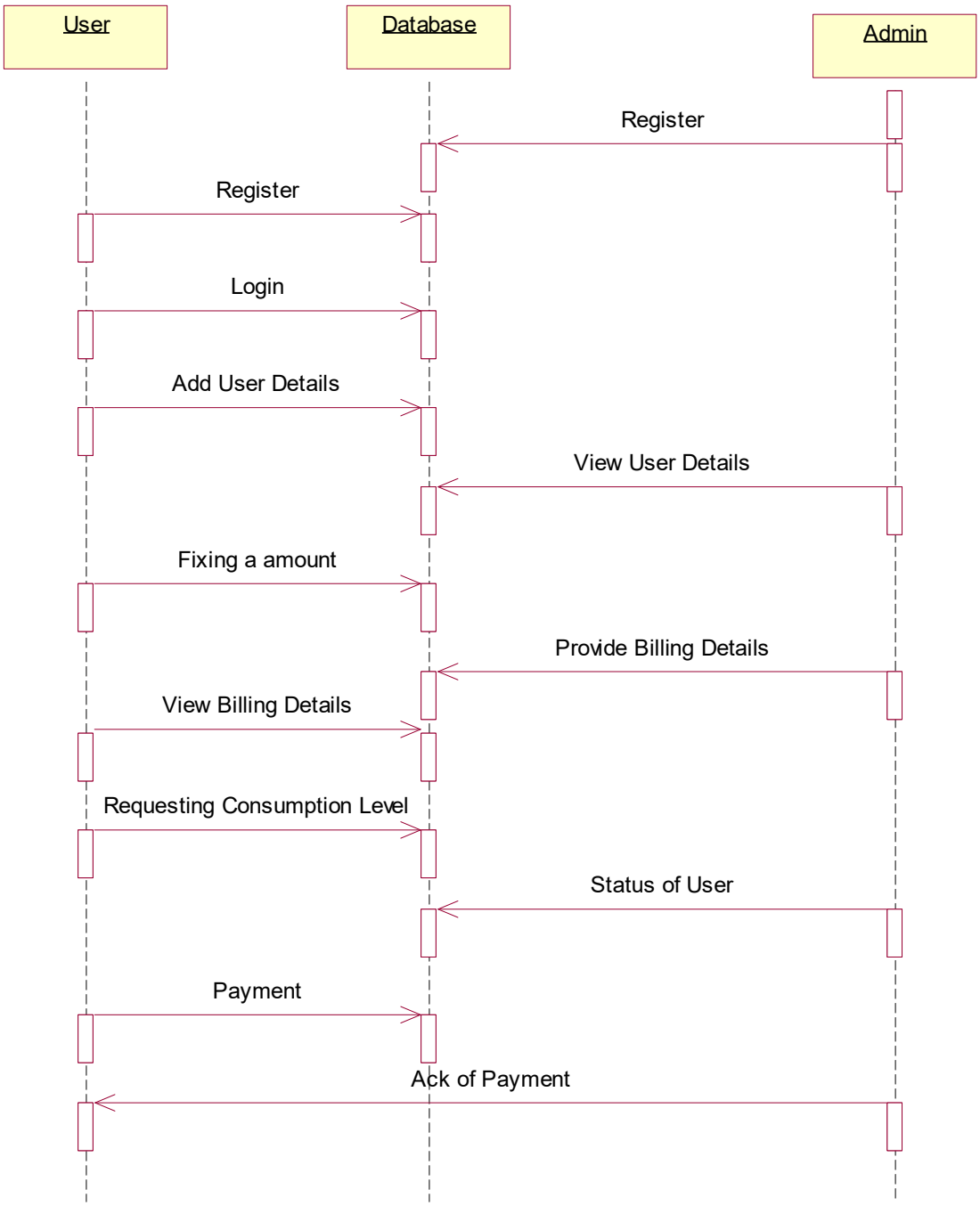
5.6. Fig 6: Class Diagram

4.4.3. ACTIVITY DIAGRAM



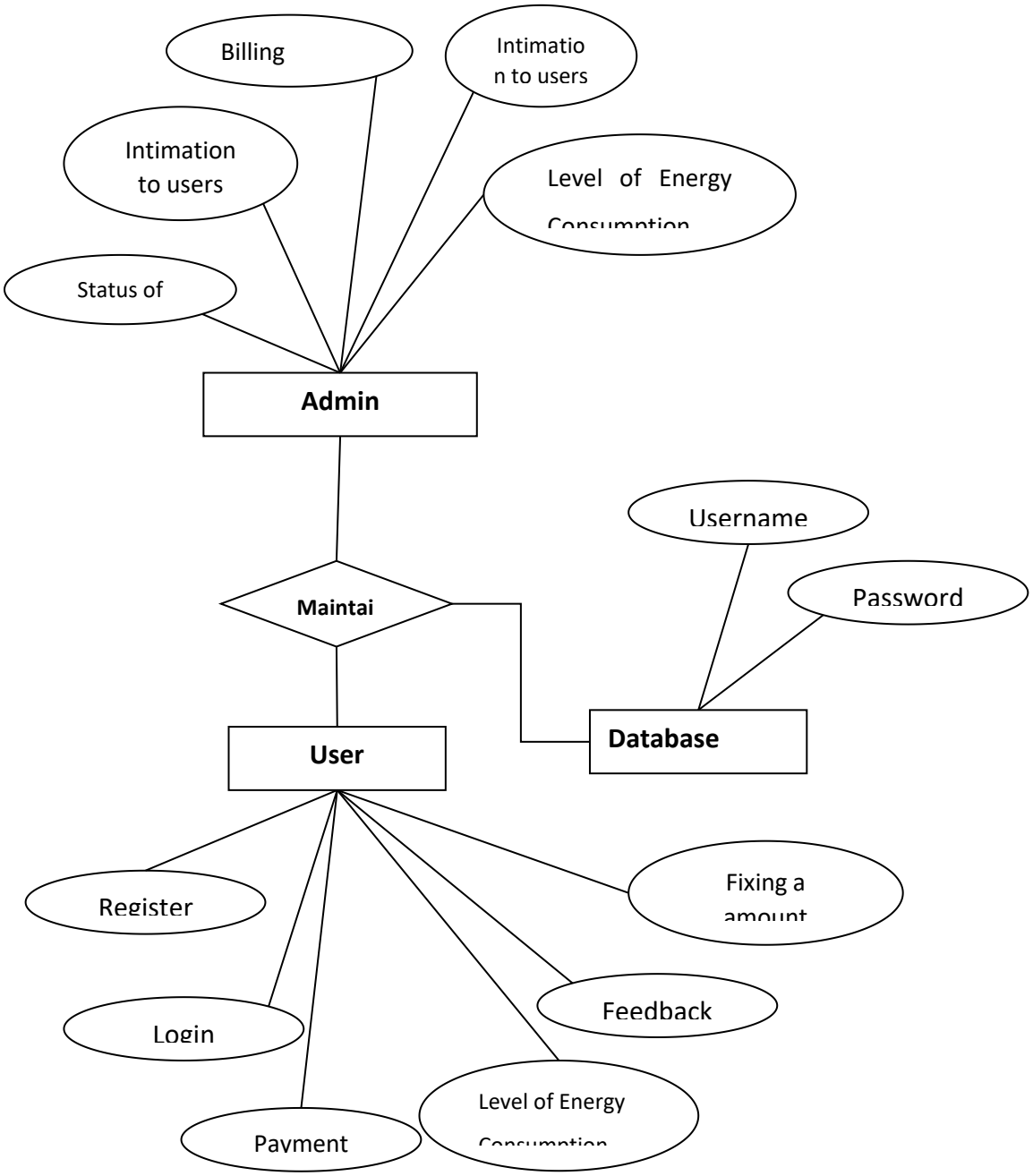
5.7. Fig 7: Activity Diagram

4.4.4. SEQUENCE DIAGRAM



5.8. Fig 8: Sequence Diagram

5.5. ER DIAGRAM

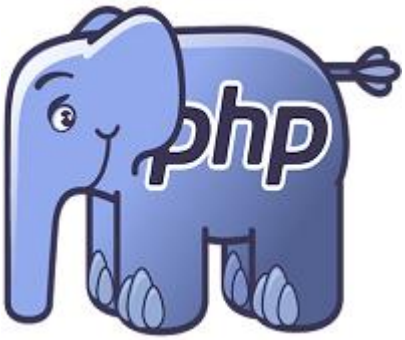


5.9. Fig 9: ER Diagram

CHAPTER 6
SODTWARE DESCRIPTION

PHP

The PHP Hypertext Preprocessor (PHP) is a programming language that allows web developers to create dynamic content that interacts with databases. PHP is basically used for developing web-based software applications. This tutorial helps you to build your base with PHP.



PHP is a flexible, dynamic language that supports a variety of programming techniques. It has evolved dramatically over the years, notably adding a solid object-oriented model in PHP 5.0 (2004), anonymous functions and namespaces in PHP 5.3 (2009), and traits in PHP 5.4 (2012).

Object-oriented Programming

PHP has a very complete set of object-oriented programming features including support for classes, abstract classes, interfaces, inheritance, constructors, cloning, exceptions, and more.

Functional Programming

PHP supports first-class functions, meaning that a function can be assigned to a variable. Both user-defined and built-in functions can be referenced by a variable and invoked dynamically. Functions can be passed as arguments to other functions (a feature called Higher-order Functions) and functions can return other functions.

Standard PHP Library

The Standard PHP Library (SPL) is packaged with PHP and provides a collection of classes and interfaces. It is made up primarily of commonly needed data structure

classes (stack, queue, heap, and so on), and iterators which can traverse over these data structures or your own classes which implement SPL interfaces.

Command Line Interface

PHP was created to write web applications, but is also useful for scripting command line interface (CLI) programs. Command line PHP programs can help automate common tasks like testing, deployment, and application administration.

MYSQL

MySQL tutorial provides basic and advanced concepts of MySQL. Our MySQL tutorial is designed for beginners and professionals. MySQL is a relational database management system based on the Structured Query Language, which is the popular language for accessing and managing the records in the database. MySQL is open-source and free software under the GNU license. It is supported by Oracle Company. MySQL database that provides for how to manage database and to manipulate data with the help of various SQL queries. These queries are: insert records, update records, delete records, select records, create tables, drop tables, etc. There are also given MySQL interview questions to help you better understand the MySQL database.

MySQL is currently the most popular database management system software used for managing the relational database. It is open-source database software, which is supported by Oracle Company. It is fast, scalable, and easy to use database management system in comparison with Microsoft SQL Server and Oracle Database. It is commonly used in conjunction with PHP scripts for creating powerful and dynamic server-side or web-based enterprise applications. It is developed, marketed, and supported by MySQL AB, a Swedish company, and written in C programming language and C++ programming language. The official pronunciation of MySQL is not the My Sequel; it is My Ess Que Ell. However, you can pronounce it in your way. Many small and big companies use MySQL. MySQL supports many Operating Systems like Windows, Linux, MacOS, etc. with C, C++, and Java languages.

WAMPSERVER

WampServer is a Windows web development environment. It allows you to create web applications with Apache2, PHP and a MySQL database. Alongside, PhpMyAdmin allows you to manage easily your database.

WAMPServer is a reliable web development software program that lets you create web apps with MYSQL database and PHP Apache2. With an intuitive interface, the application features numerous functionalities and makes it the preferred choice of developers from around the world. The software is free to use and doesn't require a payment or subscription.

BOOTSTRAP 4

Bootstrap is a free and open-source tool collection for creating responsive websites and web applications. It is the most popular HTML, CSS, and JavaScript framework for developing responsive, mobile-first websites.

It solves many problems which we had once, one of which is the cross-browser compatibility issue. Nowadays, the websites are perfect for all the browsers (IE, Firefox, and Chrome) and for all sizes of screens (Desktop, Tablets, Phablets, and Phones). All thanks to Bootstrap developers -Mark Otto and Jacob Thornton of Twitter, though it was later declared to be an open-source project.

Easy to use: Anybody with just basic knowledge of HTML and CSS can start using Bootstrap Responsive features: Bootstrap's responsive CSS adjusts to phones,

tablets, and desktops Mobile-first approach: In Bootstrap, mobile-first styles are part of the core framework

Browser compatibility: Bootstrap 4 is compatible with all modern browsers (Chrome, Firefox, Internet Explorer 10+, Edge, Safari, and Opera)

CHAPTER 7
SYSTEM IMPLEMENTATION

7.1. SYSTEM DESCRIPTION

The Smart Meter Firmware for Monitoring and Controlling Electrical Appliance Consumption project aims to revolutionize energy management in residential and commercial settings. By developing intelligent firmware for smart meters, this project seeks to empower consumers with real-time insights into their energy usage and the ability to remotely monitor and control their electrical appliances.

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Module

1. Admin.
2. User Registration and Login.
3. Level of Energy Consumption.
4. Status of User
5. Intimation of Power Consumption
6. Payment
7. Report

Use Case Description

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The entire process has been maintained by the admin, from which the details and the complete reference for the users has been provided. Admin holds the records and lists of the entire users involved in the system and their power consumption level which provides the detailed structure to the users.

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This module provides the detailed statement of the energy consumption level of the customer which helps to maintain their usage level. Whereas it also increases the efficiency of the entire system by maintaining the records of customers and their consumption level involved in the system.

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The admin receives and holds the status of each and every customers involved in the process, and gain the access control to manipulate them. This module helps the administrator for further process which enhances to complete system with better efficiency.

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This module intimates the consumption level of the customers to them through their mobile, so that the customers can gather their day to day consumption level and usage. The customer receives a message if they crossed their daily usage limit, which helps them to maintain their level of usage.

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Report

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SOURCECODE

Packages

Database Connection

```
<?php
$connect=mysql_connect("localhost","root","");
mysql_select_db("eb_bill",$connect);
?>
```

User Registration

```
<?php
session_start();
include("dbconnect.php");
extract($_REQUEST);
?>
        <div class="col-lg-6">
          <div class="card">
            <div class="card-header d-flex align-items-center">
              <h2 class="h5 display display">
                <h2>User Registration</h2>
              </h2>
            </div>
            <div class="card-block">
              <p></p>
              <form name="form1" method="post" enctype="multipart/form-data">

                                        <div class="form-group">
                <label>Name</label>
                <input type="text" name="name" class="form-control">
              </div>
              <div class="form-group">
```

```
  <label>EB No.</label>
  <input type="text" name="ebno" class="form-control">
</div>
                                <div class="form-group">
  <label>Address</label>
  <input type="text" name="address" class="form-control">
</div>
                                <div class="form-group">
  <label>Area</label>
  <input type="text" name="area" class="form-control">
</div>
                                <div class="form-group">
  <label>City</label>
  <input type="text" name="city" class="form-control">
</div>

                               <div class="form-group">
  <label>Mobile No.</label>
  <input type="text" name="mobile" class="form-control">
</div>
<div class="form-group">
  <label>E-mail</label>
  <input type="text" name="email" class="form-control">
</div>
 <div class="form-group">
  <label>Username</label>
  <input type="text" name="uname" class="form-control">
</div>
                               <div class="form-group">
  <label>Password</label>
  <input type="password" name="pass" class="form-control">
</div>

 <div class="form-group">
```

```
                <label>Re-type Password</label>
                <input type="password" name="cpass" class="form-control">
               </div>


               <div class="form-group">
                <input type="submit" name="btn" value="Register" class="btn btn-primary" onClick="return validate()">
               </div>
              </form>
             </div>
            </div>
                        <a href="index.php">Home</a> |
                        <a href="login.php">Login</a>
</div>
 <?php
 $msg="";
                $rdate=date("d-m-Y");
                $yr=date("y");
          if(isset($btn))
          {


         $mq=mysql_query("select max(id) from eb_register");
   $mr=mysql_fetch_array($mq);
   $id = $mr['max(id)']+1;

         $n=mysql_query("insert into eb_register(id,name,ebno,area,address,city,mobile,email,uname,pass,rdate) values($id,'$name','$ebno','$area','$address','$city','$mobile','$email','$uname','$pass','$rdate')");

          ?>
          <script language="javascript">
```

```
            window.location.href="register.php?act=success";
            </script>
            <?php

            }
            ?>
<!--end content area-->
  <p align="center" class="msg"><?php
  if($msg!="")
  {
  echo $msg;
  }
  ?></p>
  <p> </p>
</body>
</html>
```

User Login

```
<?php
session_start();
include("dbconnect.php");
extract($_POST);
$msg="";
if(isset($btn))
{
$qry=mysql_query("select * from eb_register where uname='$uname' &&
pass='$pass'");
$num=mysql_num_rows($qry);
            if($num==1)
            {
            $_SESSION['uname']=$uname;
            header("location:home.php");
            }
```

```
        else
        {
        $msg="Invalid User!";
        }

}


?>
<!DOCTYPE html PUBLIC "-//W3C//DTD XHTML 1.0 Transitional//EN"
"http://www.w3.org/TR/xhtml1/DTD/xhtml1-transitional.dtd">
<html xmlns="http://www.w3.org/1999/xhtml">
<head>
<meta http-equiv="Content-Type" content="text/html; charset=iso-8859-1" />
<title><?php include("title.php"); ?></title>
<link rel="shortcut icon" href="img/icon.ico">

<meta charset="utf-8">
        <meta http-equiv="X-UA-Compatible" content="IE=edge">

        <link rel="shortcut icon" href="favicon.ico">

        <!-- Animate.css -->
        <link rel="stylesheet" href="css/animate.css">
        <!-- Icomoon Icon Fonts-->
        <link rel="stylesheet" href="css/icomoon.css">
        <!-- Simple Line Icons -->
        <link rel="stylesheet" href="css/simple-line-icons.css">
        <!-- Bootstrap  -->
        <link rel="stylesheet" href="css/bootstrap.css">
        <!-- Owl Carousel  -->
        <link rel="stylesheet" href="css/owl.carousel.min.css">
        <link rel="stylesheet" href="css/owl.theme.default.min.css">
        <!-- Style -->
```

```
        <link rel="stylesheet" href="css/style.css">


        <!-- Modernizr JS -->
        <script src="js/modernizr-2.6.2.min.js"></script>
        <!-- FOR IE9 below -->
        <!--[if lt IE 9]>
        <script src="js/respond.min.js"></script>
        <![endif]-->
</head>

<body>

 <div class="panel panel-default">
  <div class="t1" align="center"><span><?php include("title.php"); ?></span></div>
  <div class="panel-body">
   <h3 align="center">User</h3>
  </div>
</div>
 <!--start content area-->
<div class="row">
                        <div class="col-lg-3">

                                <!-- A grey horizontal navbar that becomes vertical on
small screens -->
                        </div>



        <div class="col-lg-6">
          <div class="card">
            <div class="card-header d-flex align-items-center">
              <h2 class="h5 display display">
                <h2>Login</h2>
```

```
            </h2>
           </div>
           <div class="card-block">
            <p></p>
            <form name="name" method="post">

                                        <div class="form-group">
              <label>Username</label>
              <input type="text" name="uname" placeholder="Username" class="form-control">
             </div>
             <div class="form-group">
              <label>Password</label>
              <input type="password" name="pass" placeholder="Password" class="form-control">
             </div>
             <div class="form-group">
              <input type="submit" name="btn" value="Login" class="btn btn-primary">
             </div>
                                        <a href="index.php">Home</a> |
                                        <a href="register.php">Register</a> |
                                        <a href="login.php">Admin</a>
            </form>
           </div>
          </div>

</div>
```

Unit Limit Setting

```
<?php
session_start();
include("dbconnect.php");
```

```
extract($_REQUEST);
$uname=$_SESSION['uname'];
$q1=mysql_query("select * from eb_register where uname='$uname'");
$r1=mysql_fetch_array($q1);

if(isset($btn))
{
mysql_query("update eb_register set setlimit='$setlimit' where uname='$uname'");
?>
        <script language="javascript">
        alert("Updated..");
        window.location.href="setlimit.php";
        </script>
        <?php
}
?>
<form name="form1" method="post">

                                        <div class="form-group">
            <label>Units Limit for Alert</label>
            <input type="text" name="setlimit" value="<?php echo $r1['setlimit']; ?>" class="form-control" />
        <input type="submit" name="btn" value="Submit" class="btn btn-primary" onClick="return validate()">
             </div>
            </form>
```

CHAPTER 8
SYSTEM TESTING

8.1 TESTING DESCRIPTION

The purpose of testing is to discover errors. Testing is the process of trying to discover every conceivable fault or weakness in a work product. It provides a way to check the functionality of components, sub assemblies, assemblies and/or a finished product It is the process of exercising software with the intent of ensuring that the Software system meets its requirements and user expectations and does not fail in an unacceptable manner. There are various types of test. Each test type addresses a specific testing requirement.

Type of Testing

Testing is the process of trying to discover every conceivable fault or weakness in a work product. The different type of testing is given below:

Unit Testing

Unit testing involves the design of test cases that validate that the internal program logic is functioning properly, and that program inputs produce valid outputs. All decision branches and internal code flow should be validated. It is the testing of individual software units of the application .it is done after the completion of an individual unit before integration.

This is a structural testing, that relies on knowledge of its construction and is invasive. Unit tests perform basic tests at component level and test a specific business process, application, and/or system configuration. Unit tests ensure that each unique path of a business process performs accurately to the documented specifications and contains clearly defined inputs and expected results.

Integration Testing:

Integration tests are designed to test integrated software components to determine if they actually run as one program. Testing is event driven and is more concerned with the basic outcome of screens or fields. Integration tests demonstrate that although the

components were individually satisfaction, as shown by successfully unit testing, the combination of components is correct and consistent. Integration testing is specifically aimed at exposing the problems that arise from the combination of components.

Functional Test:

Functional tests provide systematic demonstrations that functions tested are available as specified by the business and technical requirements, system documentation, and user manuals.

Functional testing is centered on the following items:

Valid Input : identified classes of valid input must be accepted. Invalid Input : identified classes of invalid input must be rejected. Functions : identified functions must be exercised.

Output : identified classes of application outputs must be exercised.

Systems/ Procedures: interfacing systems or procedures must be invoked.

Organization and preparation of functional tests is focused on requirements, key functions, or special test cases. In addition, systematic coverage pertaining to identify Business process flows; data fields, predefined processes, and successive processes must be considered for testing. Before functional testing is complete, additional tests are identified and the effective value of current tests is determined.

Performance Testing:

System testing ensures that the entire integrated software system meets requirements. It tests a configuration to ensure known and predictable results. An example of system testing is the configuration oriented system integration test. System testing is based on process descriptions and flows, emphasizing pre-driven process links and integration points.

White Box Testing:

White Box Testing is a testing in which in which the software tester has knowledge of the inner workings, structure and language of the software, or at least its purpose. It is purpose. It is used to test areas that cannot be reached from a black box level.

Black Box Testing:

Black Box Testing is testing the software without any knowledge of the inner workings, structure or language of the module being tested. Black box tests, as most other kinds of tests, must be written from a definitive source document, such as specification or requirements document, such as specification or requirements document. It is a testing in which the software under test is treated, as a black box .you cannot "see" into it. The test provides inputs and responds to outputs without considering how the software works.

Acceptance Testing:

User Acceptance Testing is a critical phase of any project and requires significant participation by the end user. It also ensures that the system meets the functional requirements.

Test Results: All the test cases mentioned above passed successfully. No defects encountered

Validation Testing

Validation testing is the process of ensuring if the tested and developed software satisfies the client /user needs. The business requirement logic or scenarios have to be tested in detail. All the critical functionalities of an application must be tested here.

As a tester, it is always important to know how to verify the business logic or scenarios that are given to you. One such method that helps in detail evaluation of the functionalities is the Validation Process.

Whenever you are asked to perform a validation test, it takes a great responsibility as you need to test all the critical business requirements based on the user needs. There should not be even a single miss on the requirements asked by the user. Hence a keen knowledge on validation testing is much important.

As a tester, you need to evaluate if the test execution results comply with that mentioned in the requirements document. Any deviation should be reported immediately and that deviation is thus called a bug.

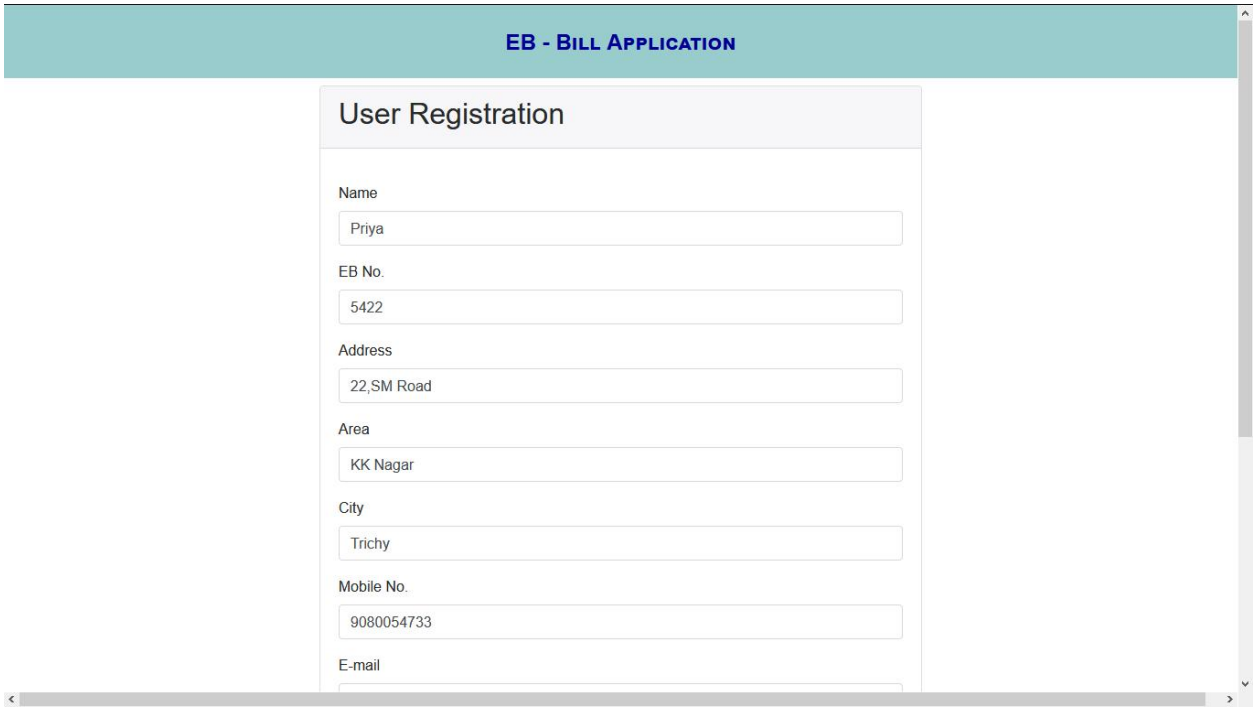
From a company perspective, the validation test in simple is carried out by the following steps:

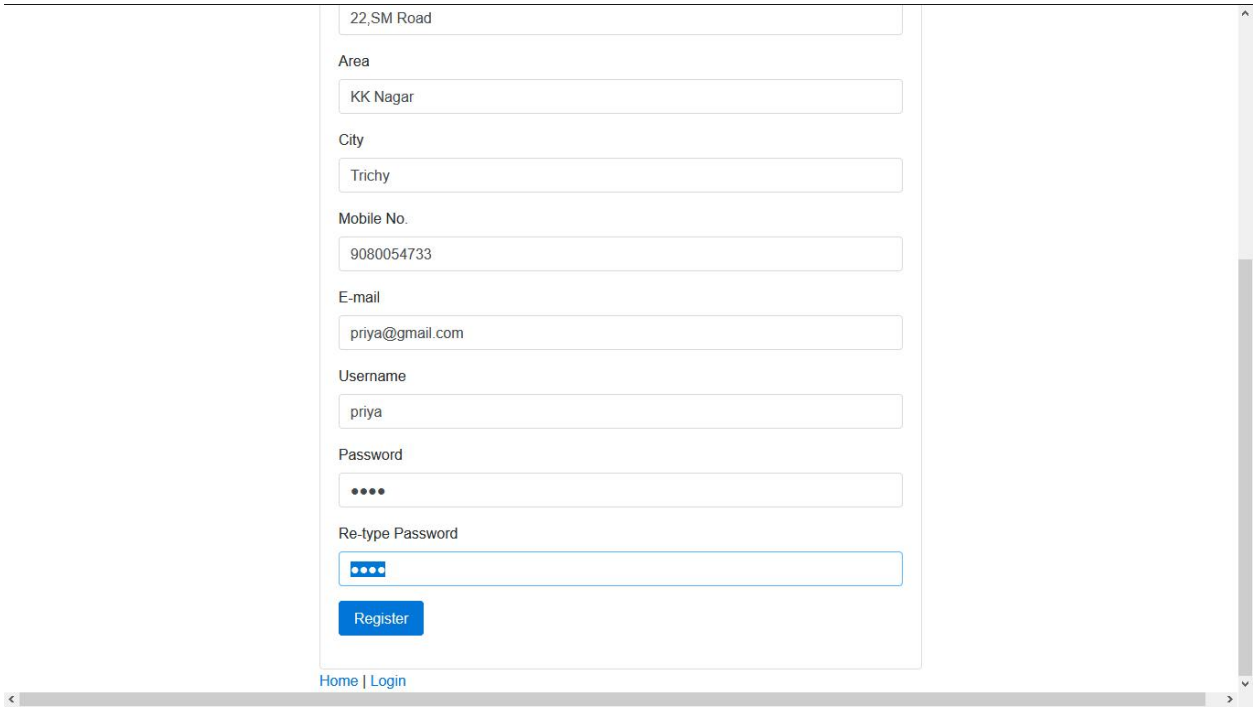
- You gather the business requirements for validation testing from the end user.
- Prepare the business plan and send it for the approval to the onsite/stakeholders involved.
- On approval of the plan, you begin to write the necessary test cases and send them for approval.
- Once approved you begin to complete testing with the required software, environment and send the deliverables as requested by the client.
- Upon approval of the deliverables, UAT testing is done by the client.
- After that, the software goes for production.

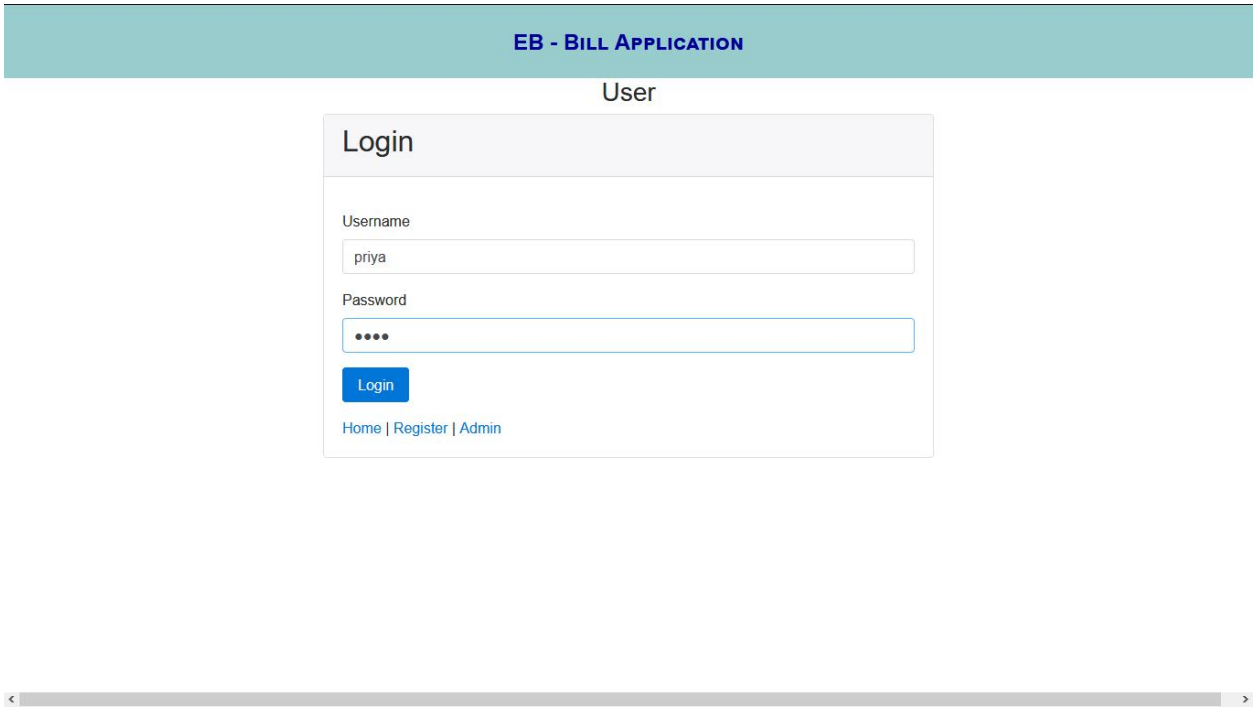
Fields Testing

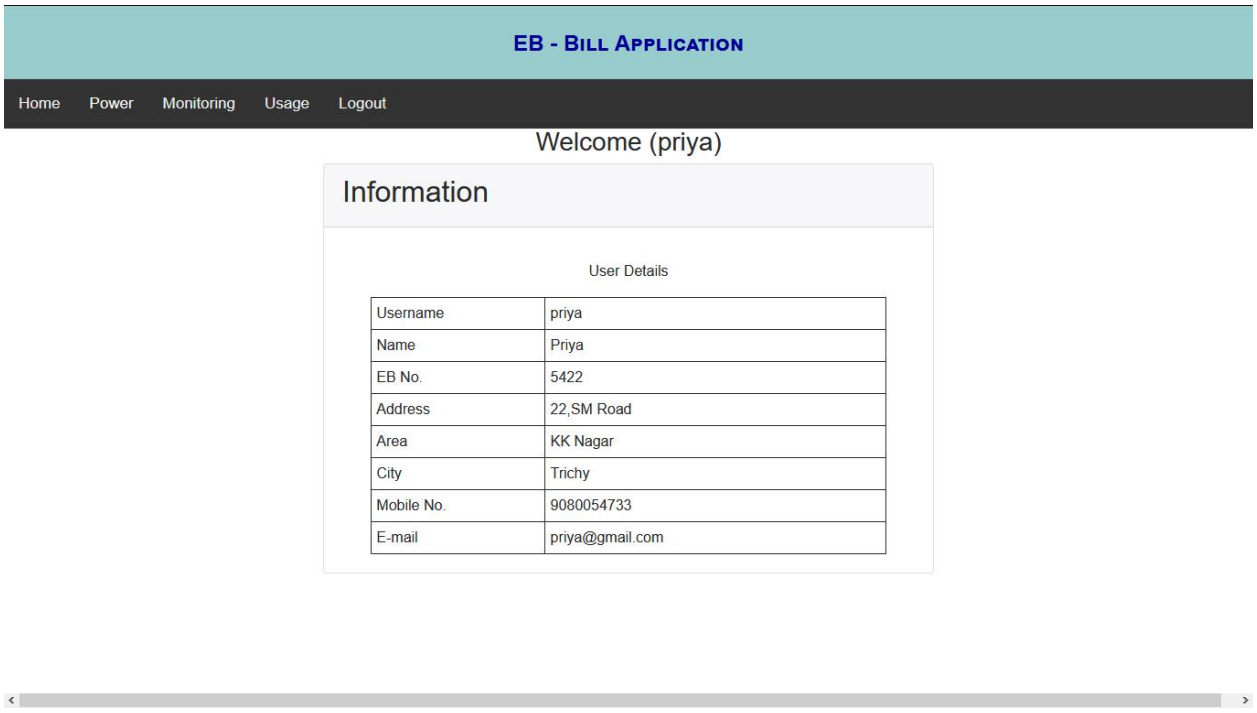
This testing is done in the last phase when the regression is done for the application and the application is called stable by the ‘Team’ before the release. There may or may not be a requirement given for this from the customer. The type of testing mainly include the functional and usability of the application. This is strictly done on Mobile Networks. QA's need to step out and test while walking around or at home or driving. Testing is done only on real devices.

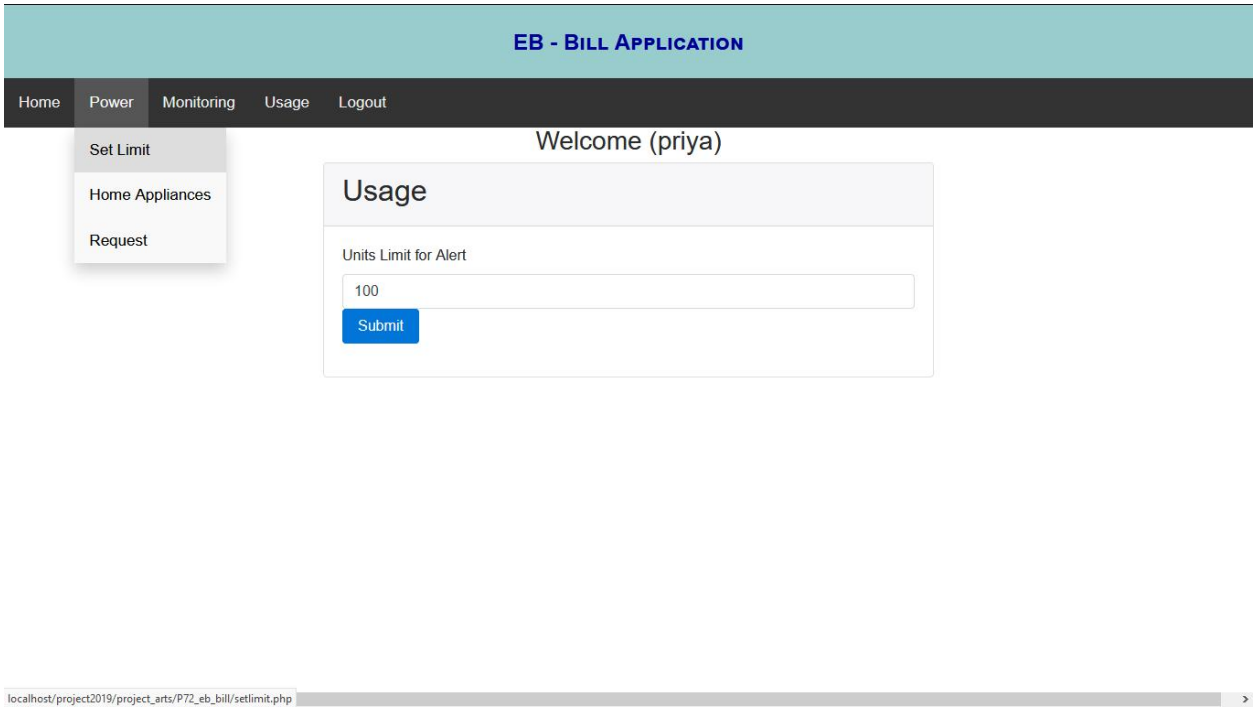
CHAPTER 9
SCREENSHOTS

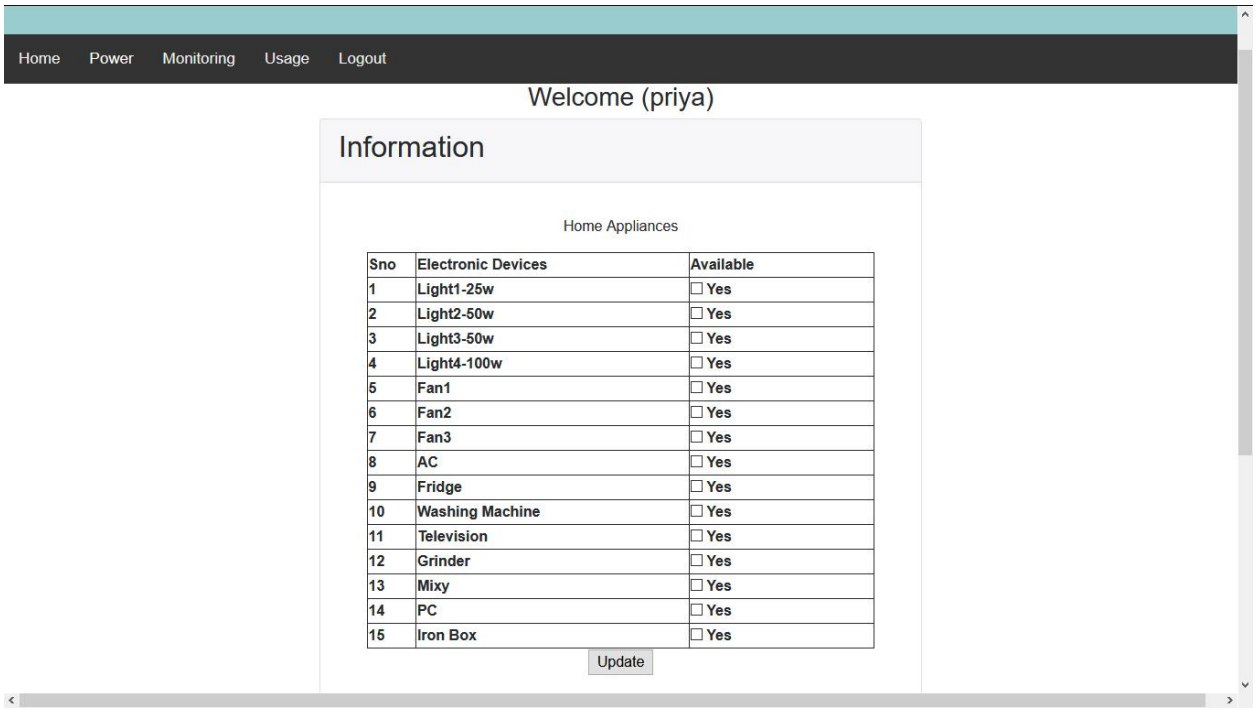





EB - Bill Application
User
Login
Username
priya
Password
Login
Home | Register | Admin


EB - Bill Application
Home
Power
Monitoring
Usage
Logout
Welcome (priya)
Information
User Details
Username priya
Name Priya
EB No. 5422
Address 22,SM Road
Area KK Nagar
City Trichy
Mobile No. 9080054733
E-mail priya@gmail.com





Sno	Electronic Devices	Available
1	Light1-25w	☐ Yes
2	Light2-50w	☐ Yes
3	Light3-50w	☐ Yes
4	Light4-100w	☐ Yes
5	Fan1	☐ Yes
6	Fan2	☐ Yes
7	Fan3	☐ Yes
8	AC	☐ Yes
9	Fridge	☐ Yes
10	Washing Machine	☐ Yes
11	Television	☐ Yes
12	Grinder	☐ Yes
13	Mixy	☐ Yes
14	PC	☐ Yes
15	Iron Box	☐ Yes

4	Light4-100w	☐ Yes
5	Fan1	☐ Yes
6	Fan2	☐ Yes
7	Fan3	☐ Yes
8	AC	☐ Yes
9	Fridge	☐ Yes
10	Washing Machine	☐ Yes
11	Television	☐ Yes
12	Grinder	☐ Yes
13	Mixy	☐ Yes
14	PC	☐ Yes
15	Iron Box	☐ Yes

Update

Availabe Devices

Sno	Electronic Devices
1	Light1-25w
2	Light2-50w
3	Fan1
4	Fan2
5	Fridge
6	Washing Machine
7	Television
8	Grinder

EB - BILL APPLICATION

Home Power Monitoring Usage Logout

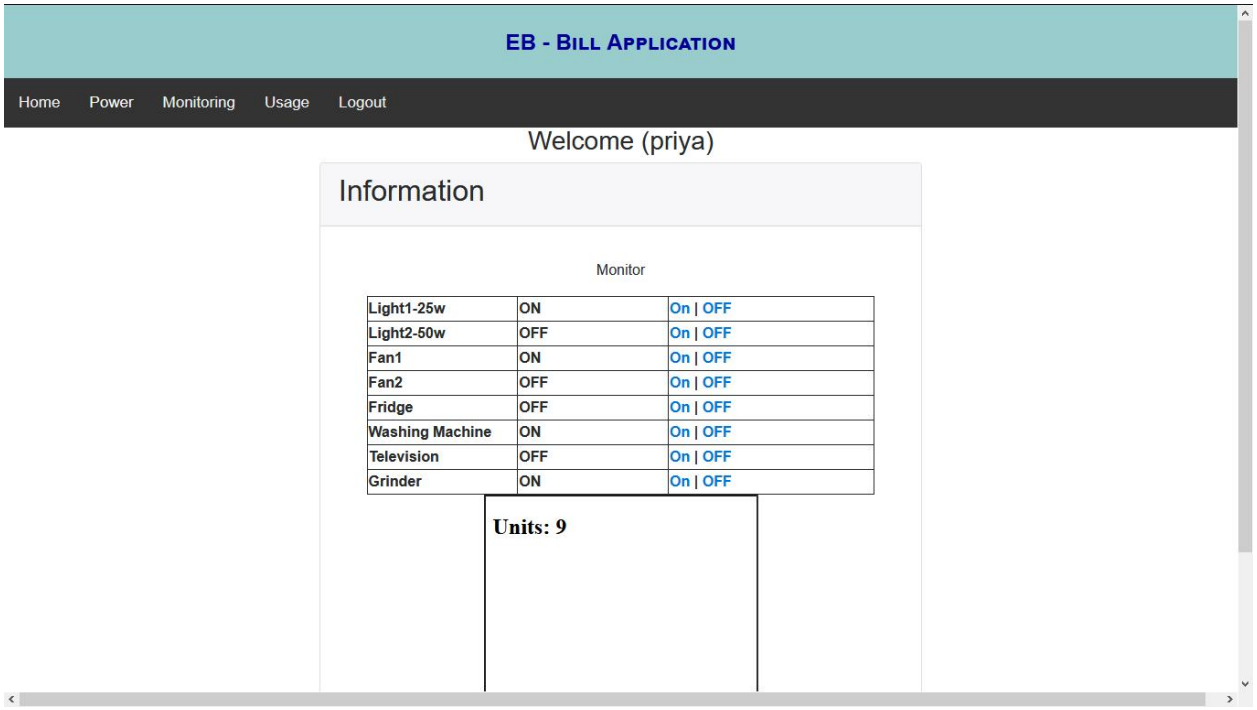
Welcome (priya)

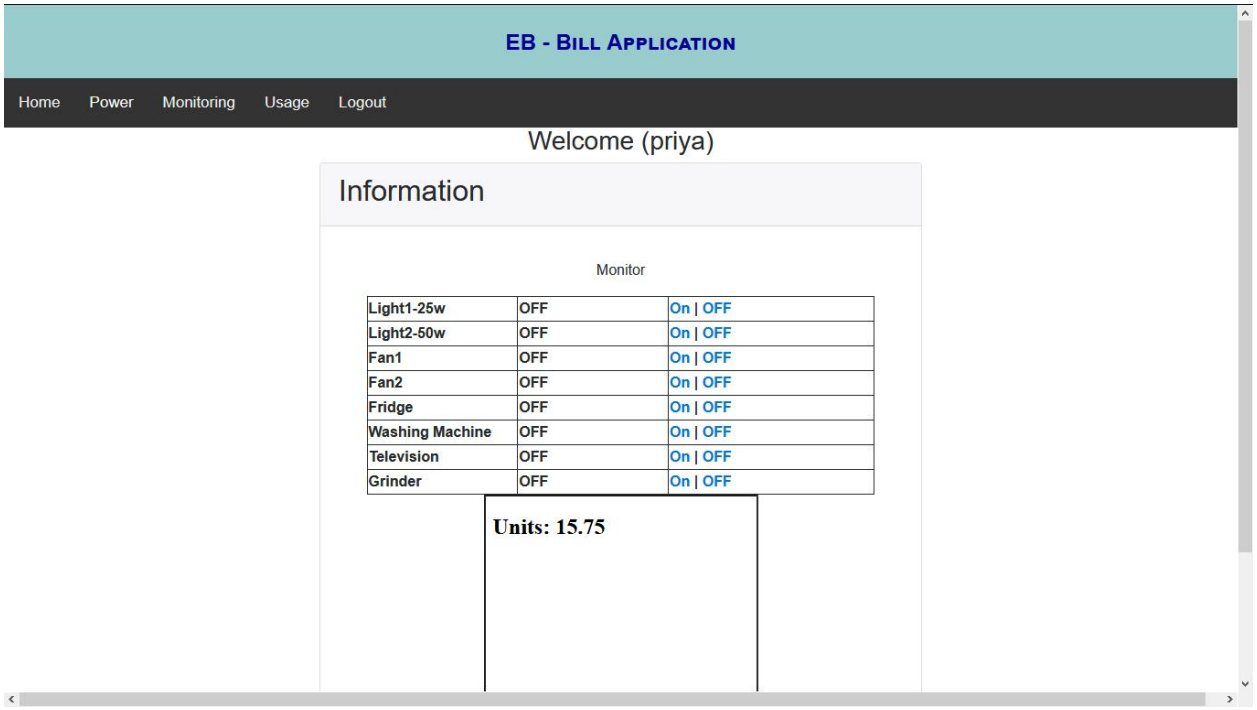
Information

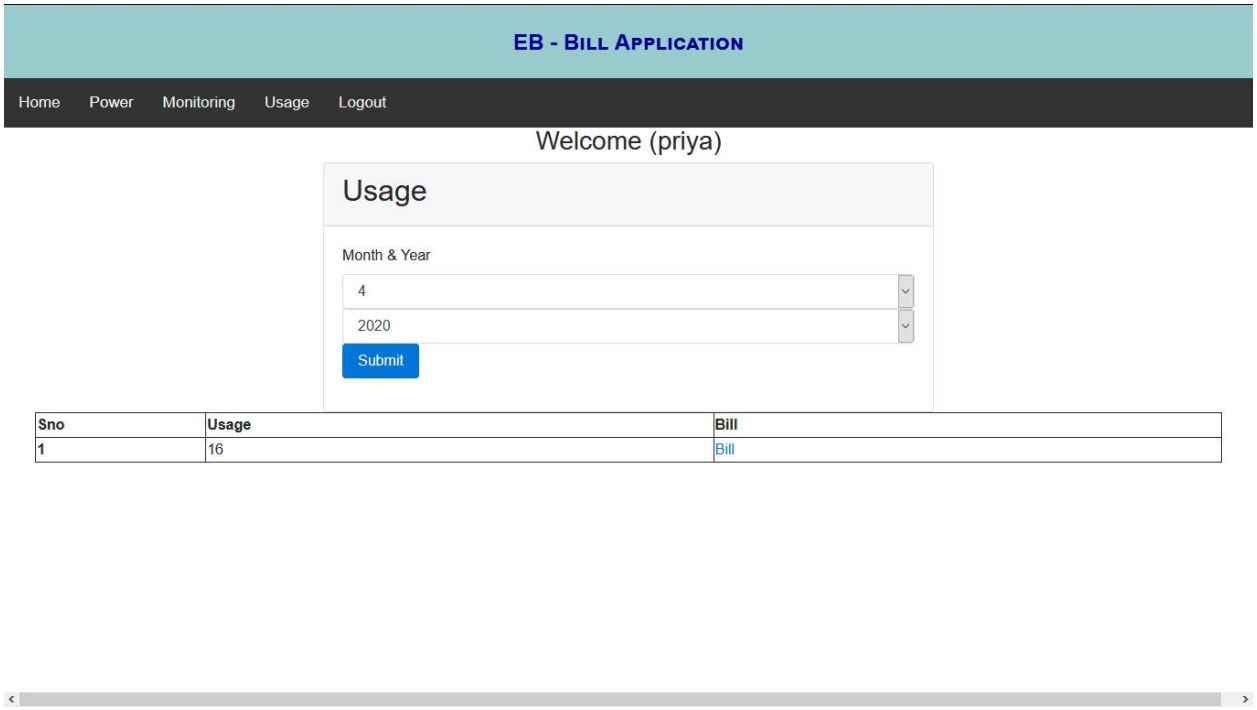
Monitor

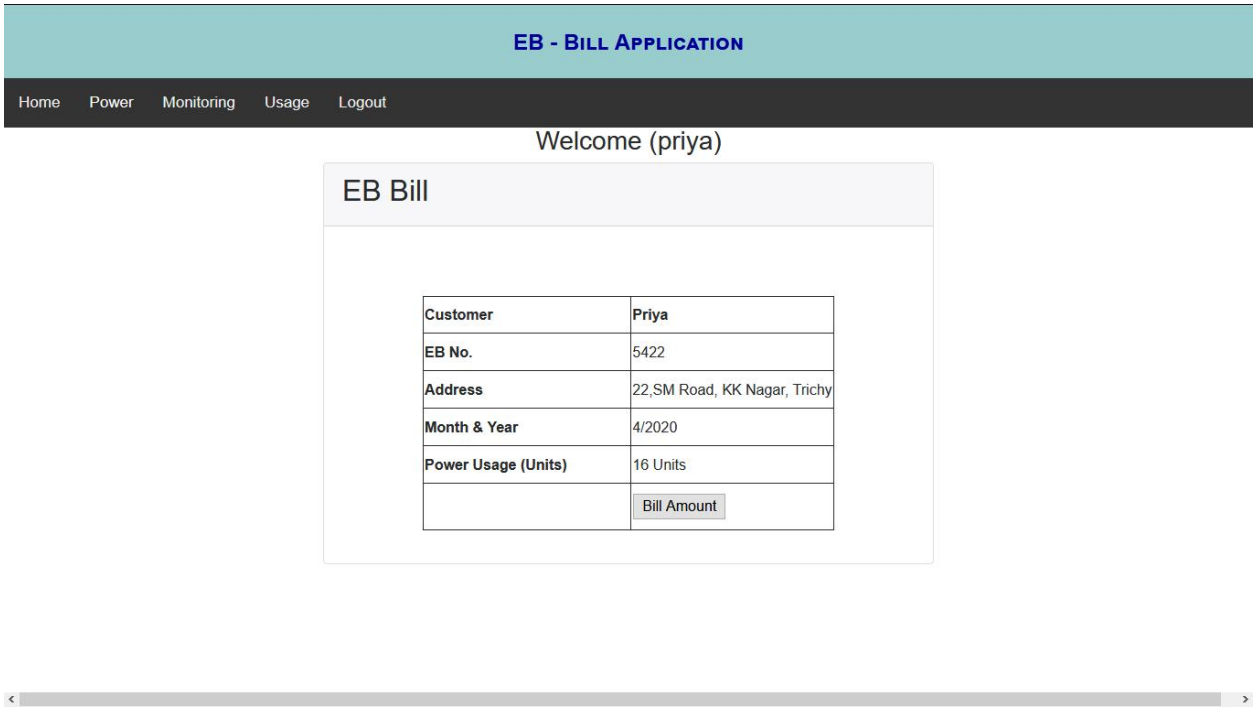
Light1-25w	ON	On | OFF
Light2-50w	OFF	On | OFF
Fan1	ON	On | OFF
Fan2	OFF	On | OFF
Fridge	OFF	On | OFF
Washing Machine	ON	On | OFF
Television	OFF	On | OFF
Grinder	OFF	On | OFF

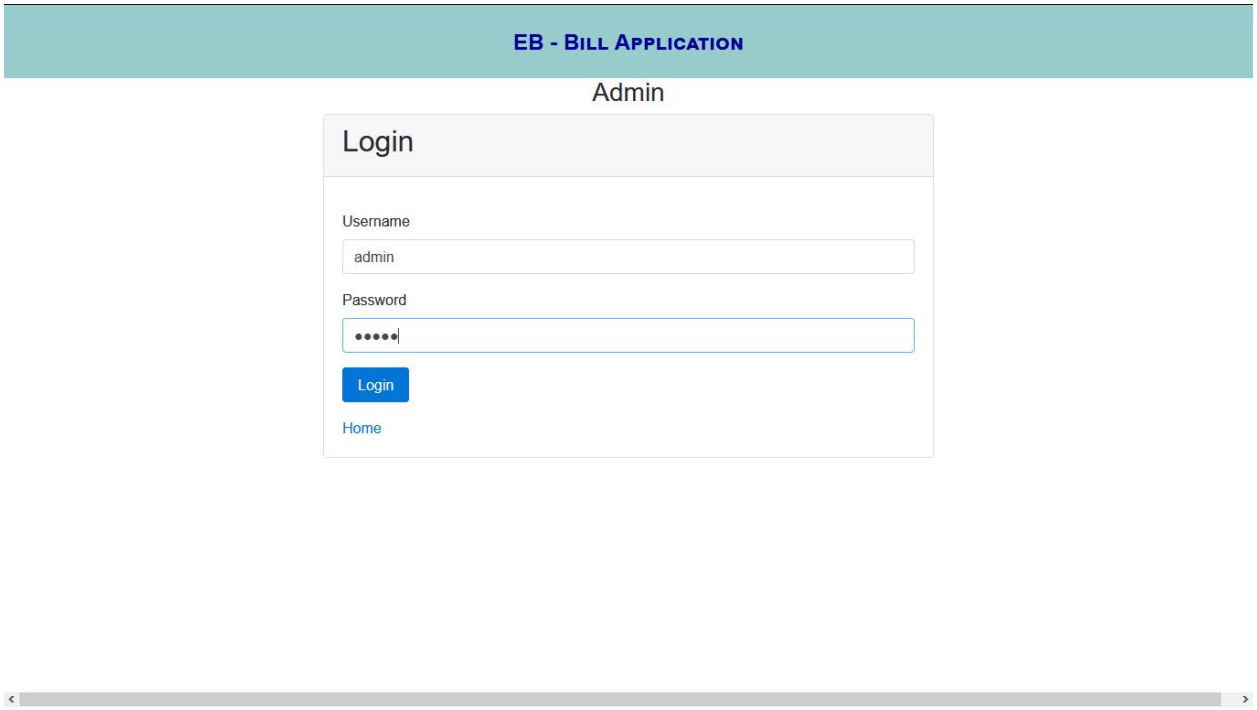
Units: 4.25

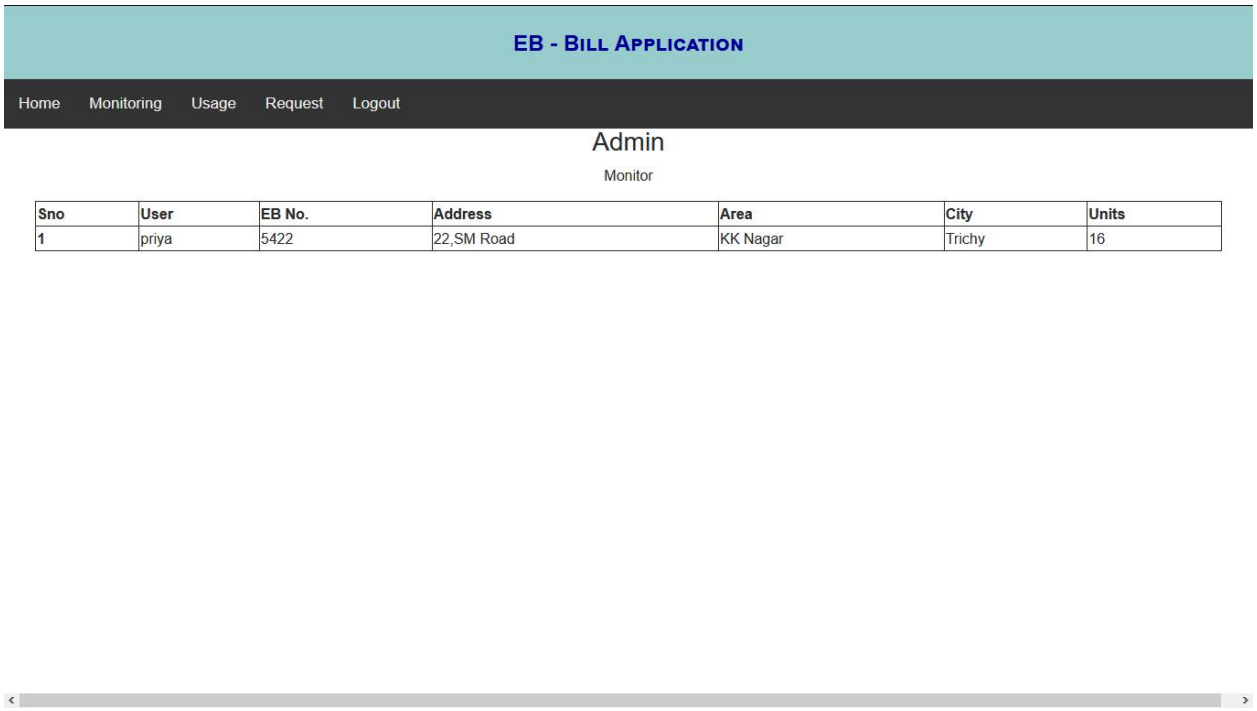

EB - Bill Application
Home
Power
Monitoring
Usage
Logout
Welcome (priya)
Information
Monitor
Light1-25w ON On | OFF
Light2-50w OFF On | OFF
Fan1 ON On | OFF
Fan2 OFF On | OFF
Fridge OFF On | OFF
Washing Machine ON On | OFF
Television OFF On | OFF
Grinder ON On | OFF
Units: 9

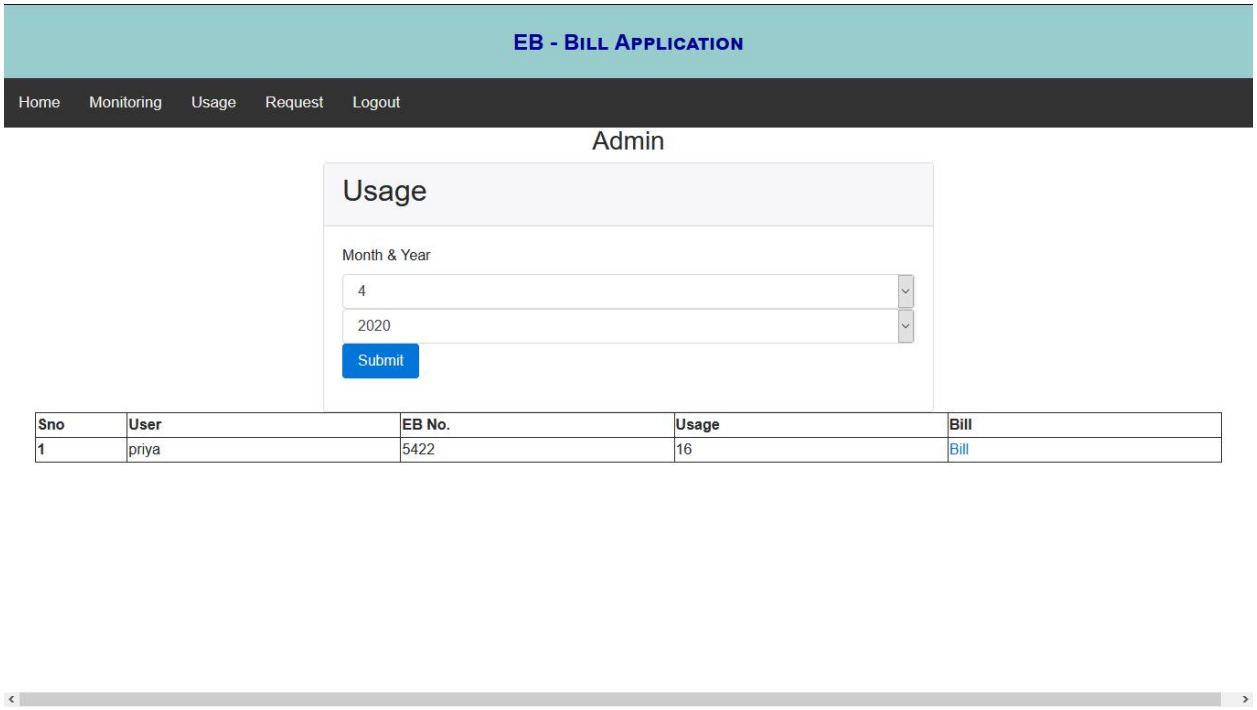

EB - Bill Application
Home
Power
Monitoring
Usage
Logout
Welcome (priya)
Information
Monitor
Light1-25w OFF On | OFF
Light2-50w OFF On | OFF
Fan1 OFF On | OFF
Fan2 OFF On | OFF
Fridge OFF On | OFF
Washing Machine OFF On | OFF
Television OFF On | OFF
Grinder OFF On | OFF
Units: 15.75

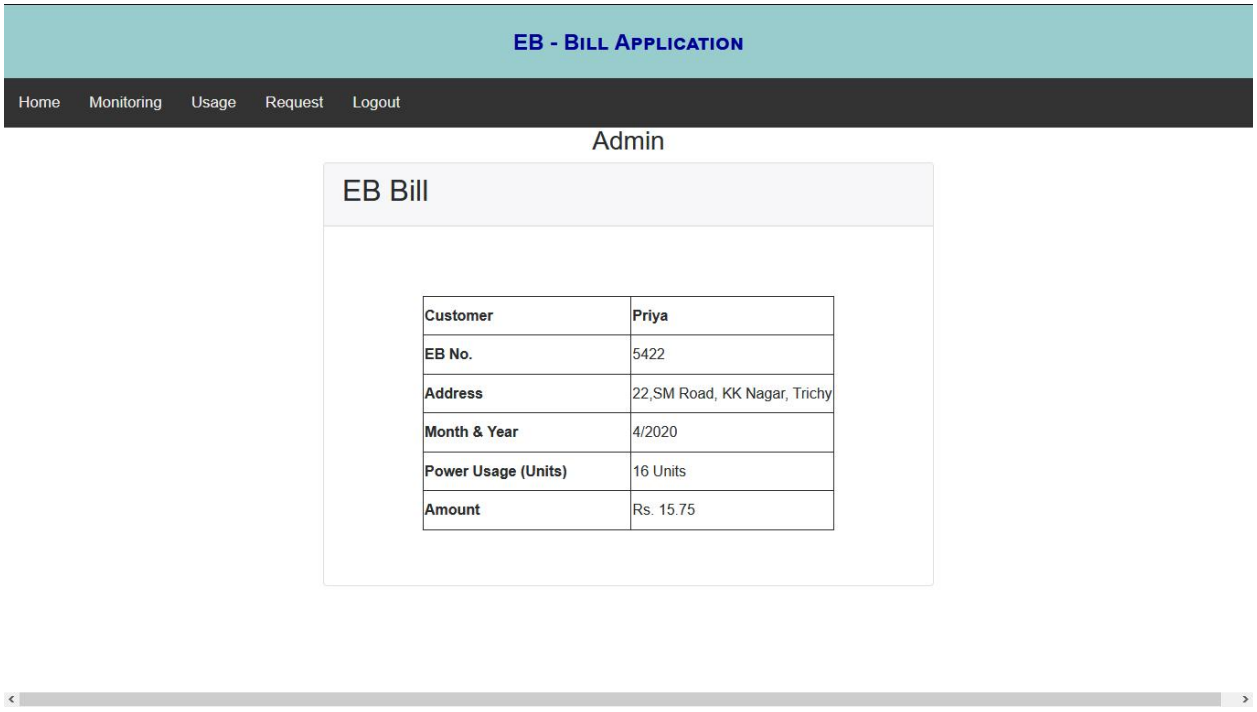

EB - Bill Application
Home
Power
Monitoring
Usage
Logout
Welcome (priya)
Usage
Month & Year
4
2020
Submit
Sno
Usage
Bill
1
16
Bill

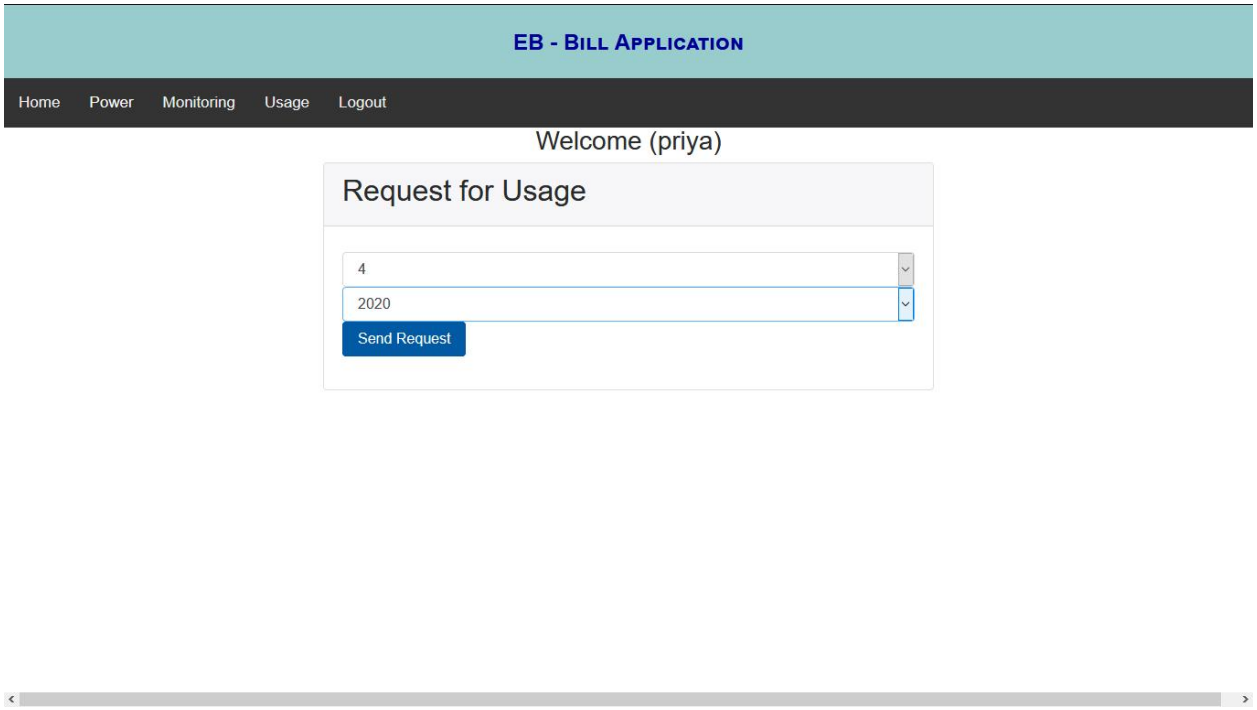

EB - Bill Application
Home
Power
Monitoring
Usage
Logout
Welcome (priya)
EB Bill
Customer
Priya
EB No.
5422
Address
22,SM Road, KK Nagar, Trichy
Month & Year
4/2020
Power Usage (Units)
16 Units
Bill Amount

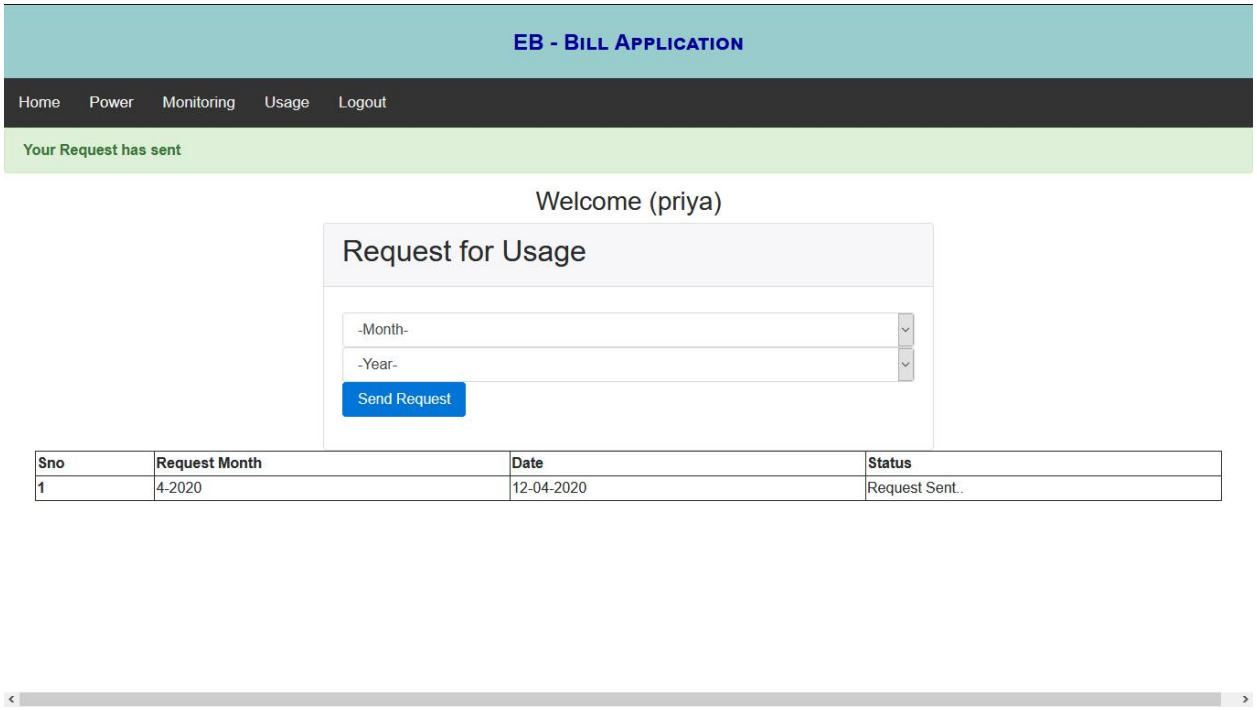

EB - Bill Application
Admin
Login
Username
admin
Password
Login
Home


EB - Bill Application
Home
Monitoring
Usage
Request
Logout
Admin
Monitor
Sno
User
EB No.
Address
Area
City
Units
1
priya
5422
22,SM Road
KK Nagar
Trichy
16


EB - Bill Application
Home
Monitoring
Usage
Request
Logout
Admin
Usage
Month & Year
4
2020
Submit
Sno
User
EB No.
Usage
Bill
1
priya
5422
16
Bill


EB - Bill Application
Home
Monitoring
Usage
Request
Logout
Admin
EB Bill
Customer
Priya
EB No.
5422
Address
22,SM Road, KK Nagar, Trichy
Month & Year
4/2020
Power Usage (Units)
16 Units
Amount
Rs. 15.75


EB - Bill Application
Home
Power
Monitoring
Usage
Logout
Welcome (priya)
Request for Usage
4
2020
Send Request


EB - Bill Application
Home
Power
Monitoring
Usage
Logout
Your Request has sent
Welcome (priya)
Request for Usage
-Month-
-Year-
Send Request
Sno
Request Month
Date
Status
1
4-2020
12-04-2020
Request Sent..

EB - BILL APPLICATION

Home Monitoring Usage Request Logout

Welcome (admin)

Sno	User	Request Month	Date	Action
1	cherry	2-2020	27-02-2020	Accept
2	priya	4-2020	12-04-2020	Accept

EB - BILL APPLICATION

Home Power Monitoring Usage Logout

Welcome (priya)

Sno	Home Appliance	Unit
1	Light1-25w	1.25
2	Fan1	5
3	Washing Machine	7.5
4	Grinder	2

CHAPTER 10
CONCLUSION

This Lower Electricity Bills at Home is window based applications which can be reducing the work in the particular Electricity Board for maintain the details as well as report generation. This software package can be operational in menu driven way which will be helpful to the end user. This project aims to move away from the traditional method of manual process of storing the details about electricity bill in which an individual has to physically record the reading. Administrative can view all the details in the Electricity board like employee details, consumer details, etc, and it has an efficient tool for search any result. Different types of reports can be obtained from the report menu. This system improves the performance of the EB which has facility to store the reading details, billing details of the particular service. The main advantage of this system is to reduce the work of the staff and reduce the time of the customer while waiting for paying bill. This process has the efficient mechanism to display customer details while enter the service number and also reduce the paper work while billing process. The success of the process is to maintain the details all related details in one application and has the efficient search operation. There is possible to generate the report in all the dimensions of the details. Further the extension of the process is obtain a web based application which will help to the user can view their bill details and also allow the customer for online payment of their EB Bill amount.

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CHAPTER 11
FUTURE ENHANCEMENT

This application is used to continuously record the readings and the live meter reading can be send to the Electricity department on request. This system also can be used to disconnect the power supply to the house in case of non-payment of electricity bills. Then this system is used to pay the electricity charge through the online payment. Then this system is also used to find calculation of how much of units and amount are used at a particular home appliance at the month usage

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