CONSULTANCY PROJECT REPORT

IOT BASED REMOTE MONITORING AND APP DEVELOPMENT FOR BATTERY MANAGEMENT SYSTEM

-

WEB APPLICATION DEVELOPMENT

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Sponsored by

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BONAFIDE CERTIFICATE

Certified that this project report titled **" IOT BASED REMOTE MONITORING AND APP DEVELOPMENT FOR BATTERY MANAGEMENT SYSTEM "** is submitted by **S Ashwanth (2022505011), Venkatesh TMR (2022505053), G Vijay Venkatesh (2022505026)** who carried out the work under my supervision. Certified further that to the best of my knowledge, the work reported herein all the guidelines prescribed by the University were followed during and after implementation of the project.

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ABSTRACT

A PC-Laptop Compatible User-Friendly web application enabling the client for Real Time monitoring of the developed Battery and facilitation of adding the client data to the real-time database.

Google's Firebase is the database that has been used to store and retrieve historical and real time data from the Battery monitoring system. Basically, the front end of this web application has been developed using HTML, CSS and Bootstrap.

JavaScript language has been used to make the website more responsive and also to acquire and display the required parameters from the database. JQUERY has been used for the validation of the company's and the client's login page. The web application also provides a prompt if there is any issue with a particular cell which denotes "Cell Failure status".

A separate login is created for the company and the client access. The backend page has also been developed which could be used by the company in order to allot the (Unique) UID for each customer.

The web application developed is linked with a single database only i.e., data from a single BMS. A similar web application could be developed with the same code for a different monitoring system.

ACKNOWLEDGEMENT

We would like to express our special gratitude to **Ampton Energy, Chennai** for giving us a wonderful opportunity to implement our project in real.

A special mention to our Dean **Dr. J. Prakash** for supporting us throughout the project.

Our thanks and appreciation also go to our Head of the Department **Dr. S. Srinivasan** for encouraging us and giving some brain-storming ideas to reach our end prototype.

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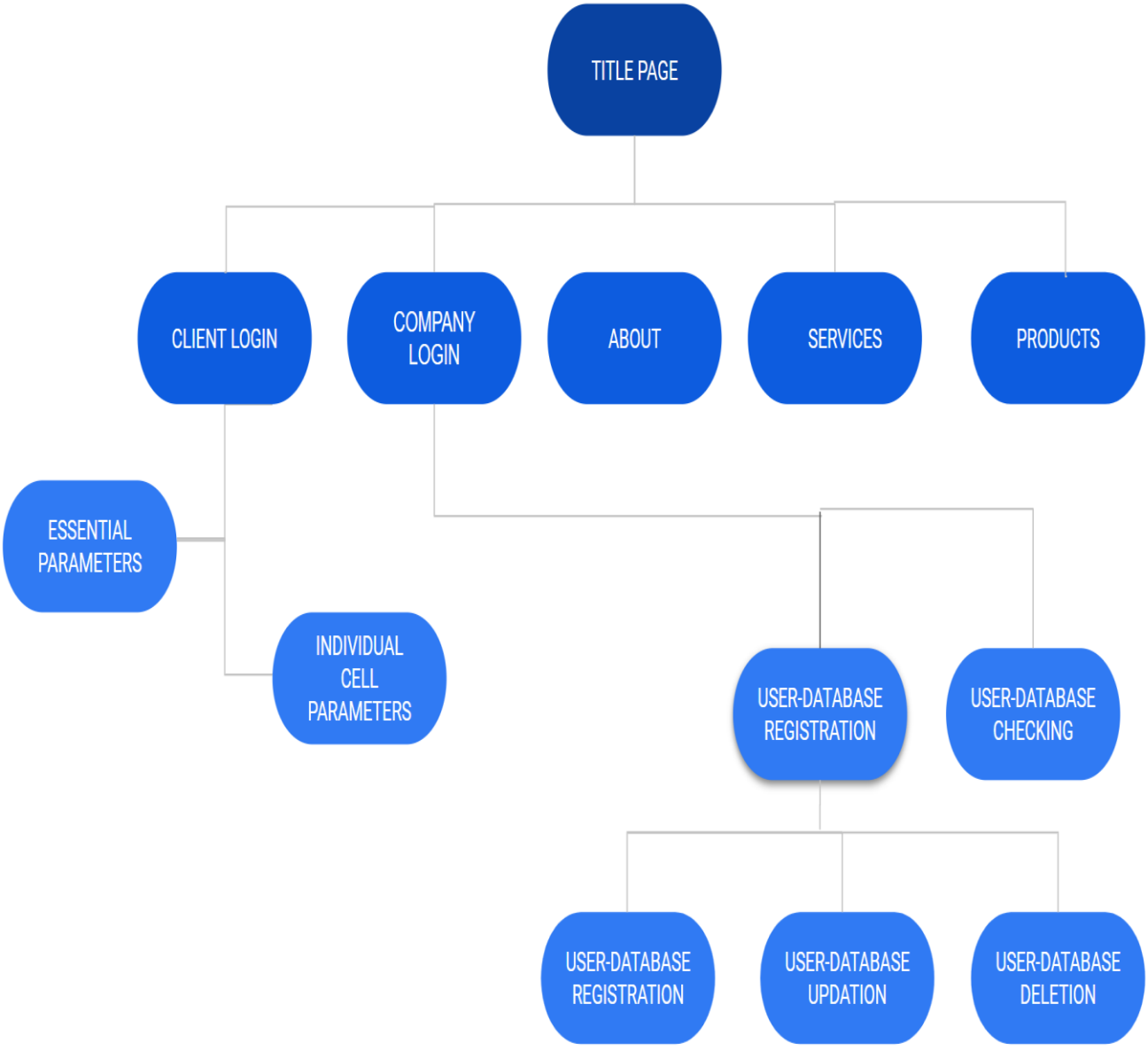
CHAPTER-1

1.1 INSTRUCTIONS:

Action	Description
Navigation Bar	Located at the top right corner, provides easy access to different sections of the application.
Client Login	Click on "Client Login" in the navigation bar to access the client login page.
	Enter your login credentials (username and password).
	Upon successful login, you will be redirected to the BMS Monitor, where battery parameters are displayed.
Company Login	Click on "Company Login" in the navigation bar to access the company login page.
	Enter your company login credentials (username and password).
	Upon successful login, you will be redirected to the BMS Database, where company-related data is stored and managed.
BMS Monitor	Accessible after successful client login.
	Displays battery parameters such as health, voltage, temperature, and other relevant information in real-time.
	Provides monitoring tools and options for efficient battery management.
Company Database	Accessible after successful company login.
	Allows adding, updating, and deleting user information within the company's database.
	Enables efficient management of user accounts and permissions for company personnel.
Additional Notes	Ensure that correct credentials are used for login to access the respective sections (client or company).
	Contact technician support if you encounter any login issues or require assistance with using the application's features.

1.2 HIERARCHICAL USAGE CLASSIFICATION:



CHAPTER-2

2.1 USER MANUAL:

2.1.1 TITLE PAGE:

Figure 1 : Title Page

PATH : Website_link / Title_page /

INSTRUCTIONS:

1) This is the title page that appears on the users device when one opens the BMS Website link.

2) This screen is equipped with a navigation bar at top right corner in order to navigate to various related screens such as Client Login, Company Login, About, Services and Products.

2.2.2 NAVIGATION BAR:

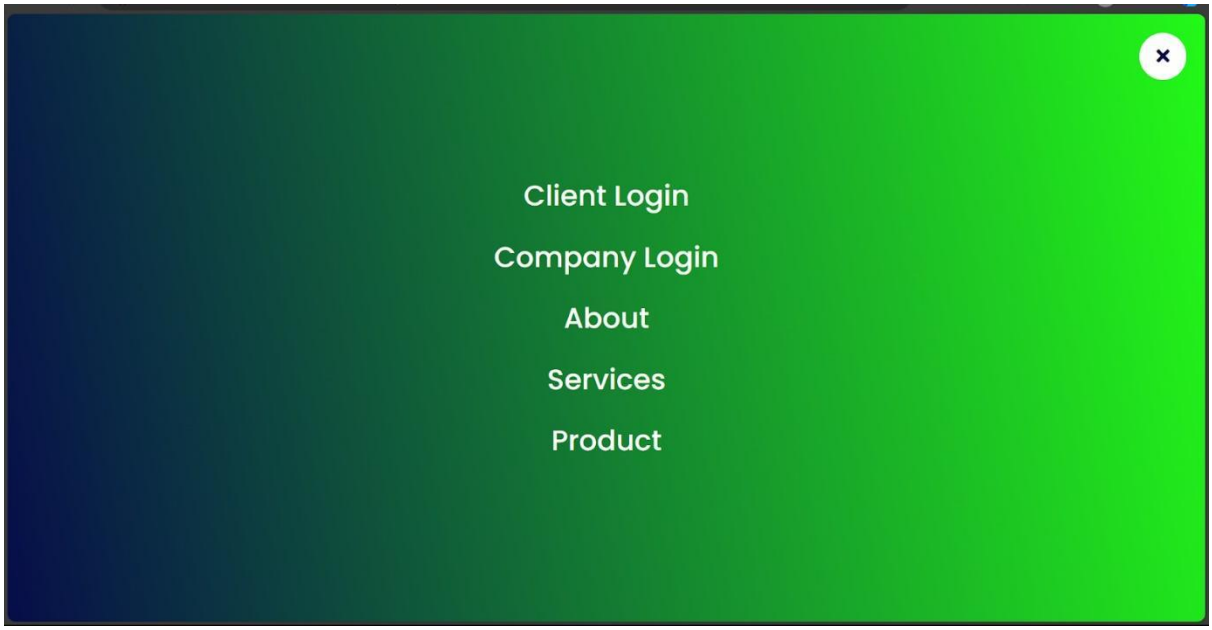


Figure 2: Navigation Page

PATH: Website_link/Title_Page/Navigation_Bar/

INSTRUCTIONS:

1) This is the screen that appears when one clicks on the navigation bar icon.

2) It has the anchor links to Client Login , Company Login , About , Service and Products.

3) The anchor links for About, Services and Products are yet to be added.

2.2.3 COMPANY LOGIN:

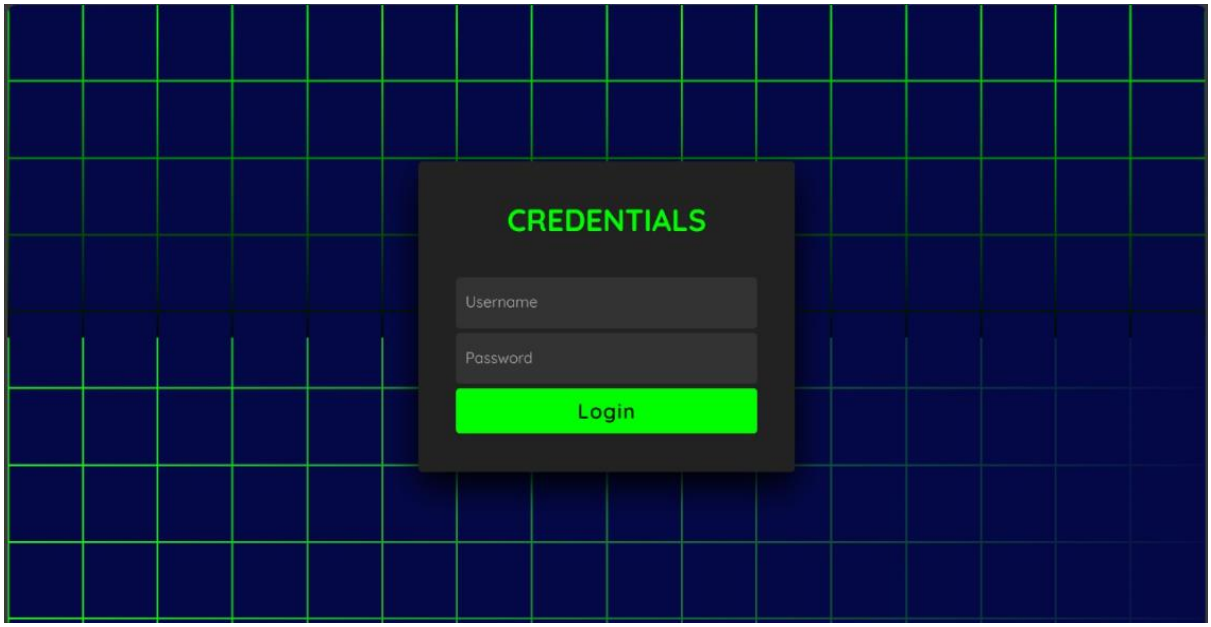


Figure 3:Company Login

PATH: Website_link/Title_Page/Navigation_Bar/Company_Login/

INSTRUCTIONS:

1) The company login screen is reached by navigating via the navigation bar present in the title screen.

2) The Username and Password for the company login is set directly via Javascript.

3) The Username and Password details are given below:

Username: Amptonenergies
Password: Amptonenergies@BMS

2.2.4 CLIENT LOGIN:

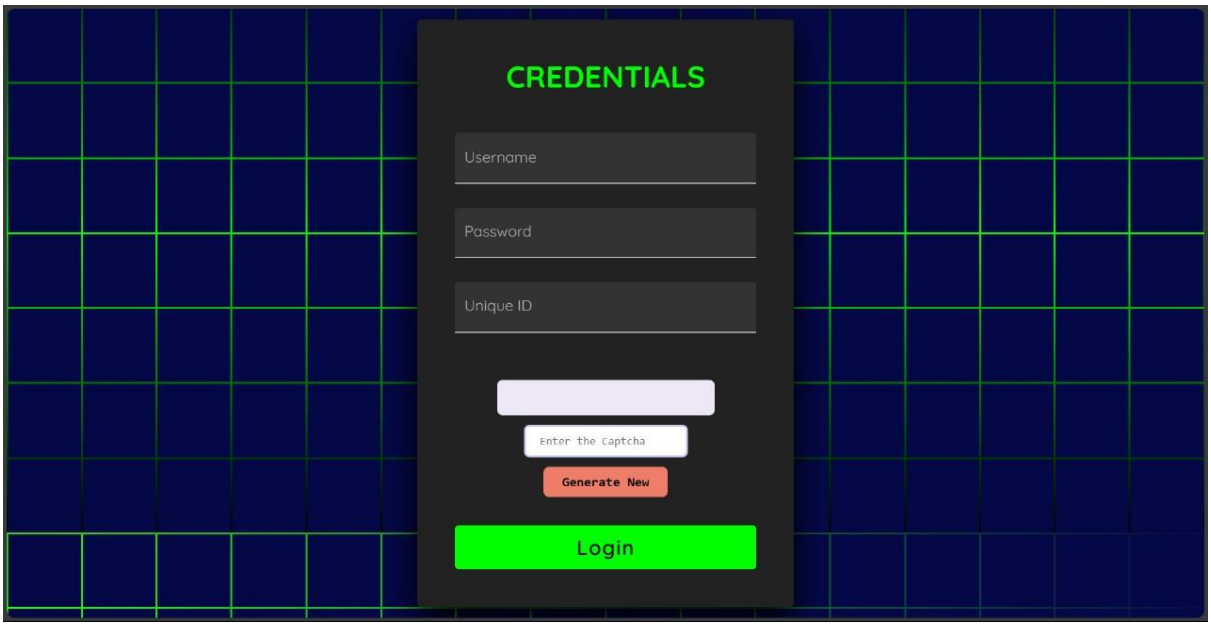


Figure 4:Customer Credentials

PATH: Website_link/Title_Page/Navigation_Bar/Client_Login/

INSTRUCTIONS:

1) The client login screen is reached by navigating via the navigation bar present in the title screen.

2) The Username , Password and the UID for the client login is set by registering via BMS database.

3) The generated Captcha has to be entered in the input Captcha Box for Logging in Successfully.

2.2.5 BMS MONITOR:

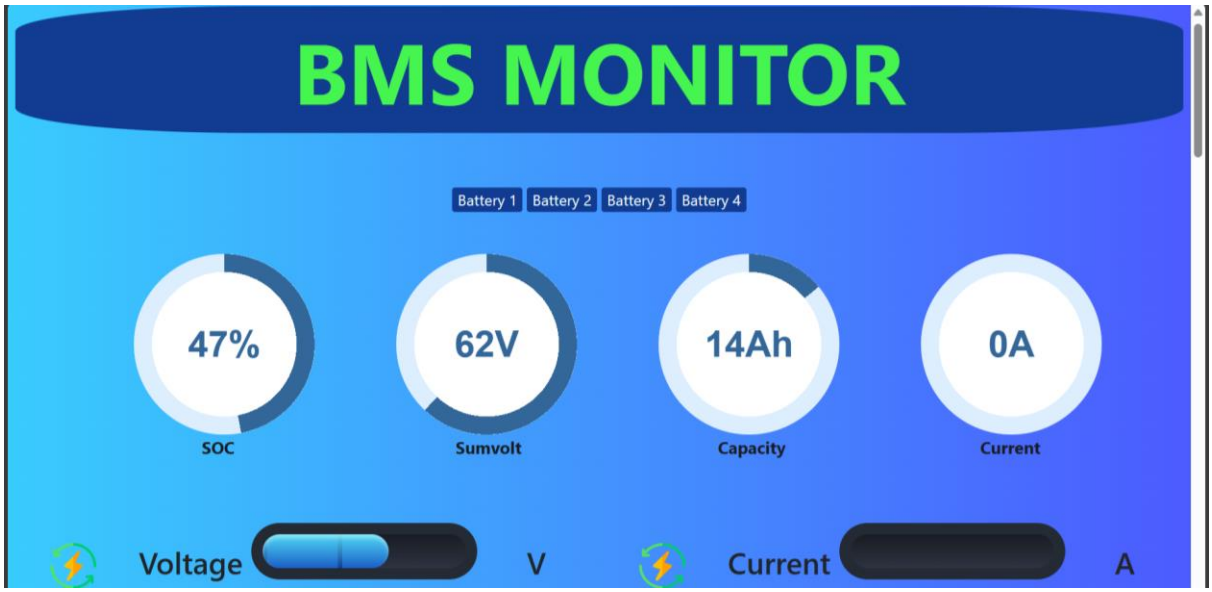


Figure 5:BMS Monitor 1

PATH:

Website_link/Title_Page/Navigation_Bar/Client_Login/BMS_Monitor/

INSTRUCTIONS:

1) The BMS Monitor screen is reached by logging in successfully into the client login page.
2) The BMS Monitor screen Displays 6 Essential Parameters and Individual Cell Parameters(19 cells).
3) The Battery button at the top of the screen helps to navigate to different battery models when the appropriate link is anchored to the code
4) 4 Essential Parameters out of the 6 Essential Parameters are displayed via Circular Progress bars.

2.2.6 ESSENTIAL PARAMETERS:

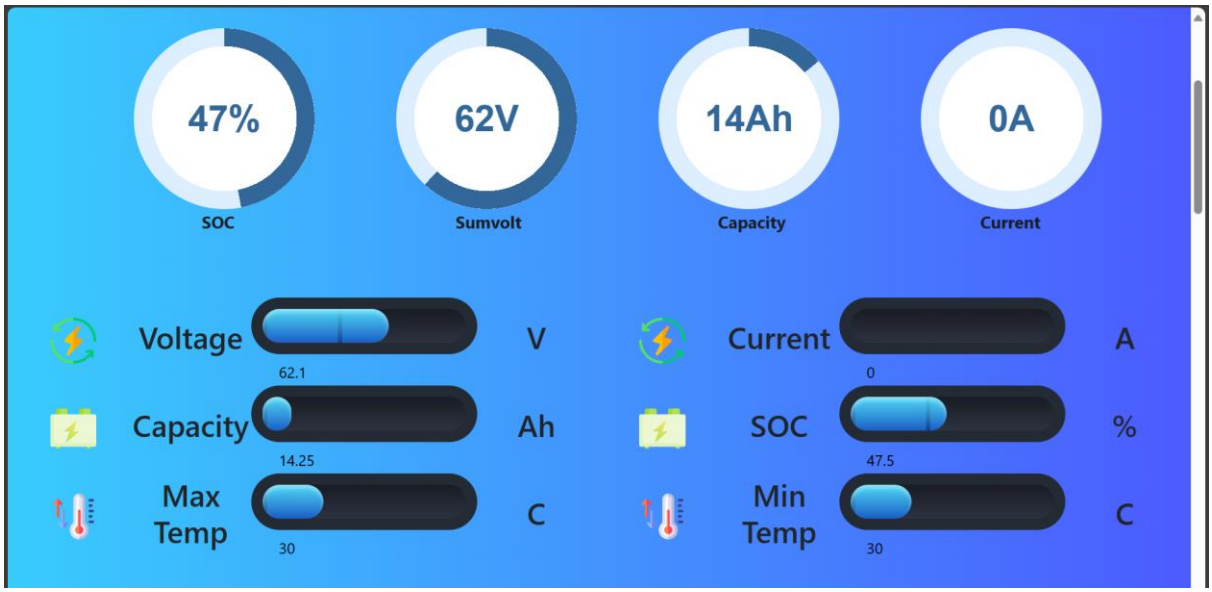


Figure 6:BMS Monitor 2

PATH:
Website_link/Title_Page/Navigation_Bar/Client_Login/BMS_Monitor/

INSTRUCTIONS:

1) After Logging in and scrolling down we will be able to view these essential parameters.
2) 4 essential parameters have been displayed using circular progress bars.
3) 6 parameters have been displayed both using progress bars and numerical values which are : Voltage, Capacity, Current, SOC, Maximum and minimum temperature of a cell in a battery.

2.2.7 INDIVIDUAL CELL PARAMETERS:

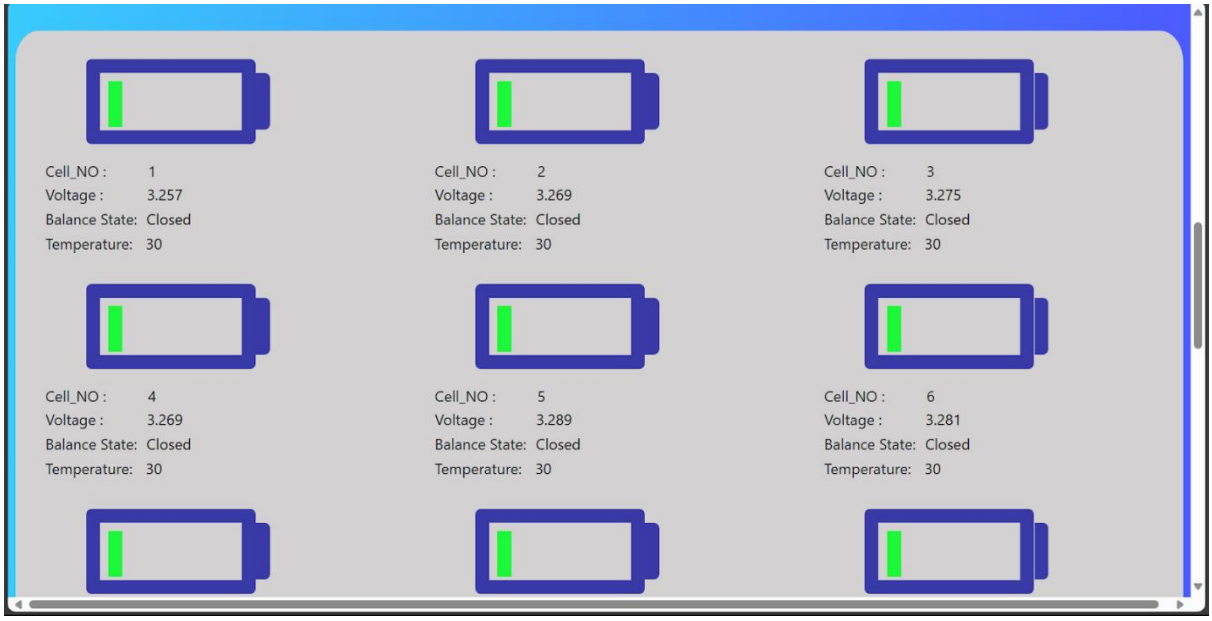


Figure 7:Individual Cell Parameters

PATH:
Website_link/Title_Page/Navigation_Bar/Client_Login/BMS_Monitor/

INSTRUCTIONS:

1) 1)On scrolling down , we reach a layout where 19 different cell images along with 4 parameters are displayed.

2) 2)On hovering over the cells, as a part of attractive animation the cells get filled with fluorescent green bars.

3) 3)The individual cell parameters such as Cell No. , Voltage , Balance State , Temperature are displayed for the 19 cells.

2.2.8 BMS DATABASE:

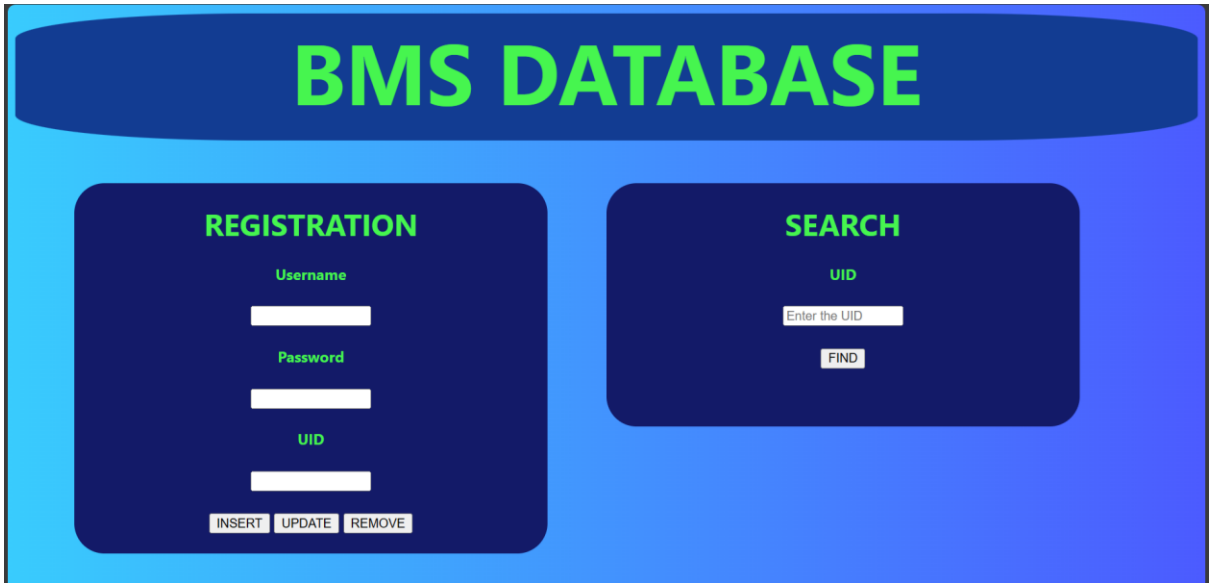


Figure 8:BMS Database

PATH:
Website_link/Title_Page/Navigation_Bar/Company_Login/Backend_Database/

INSTRUCTIONS:

1) 1)The BMS Database screen is reached by logging in successfully into the company login page.

2) 2)The BMS Database screen consists of a Registration Pallet and a Search Pallet.

3) 3)The Insertion , Updation and Removal of a Users Data can be achieved by the Registration Pallet.

4) 4)The finding of the users data by typing the UID of the particular user that is added or is present in the database.

CHAPTER 3

3.1 WEB-APP DEVELOPMENT:

3.1.1 TITLE PAGE :

```
<!DOCTYPE html>
<html>
<head>
  <title>BMS</title>
  <link rel="icon" href="full-green-3d-battery-icon-png.webp"/>
  <link rel="javascript" href="index.js"/>
  <link rel="stylesheet" href="index_bms.css"/>
  <link rel="stylesheet" href="https://cdnjs.cloudflare.com/ajax/libs/font-
awesome/5.15.3/css/all.min.css"/>
  <meta name="viewport" content="width=device-width, initial-scale=1.0">
  </head>
  <body id="wholepg">
    <input type="checkbox" id="active">
    <label for="active" class="menu-btn"><i class="fas fa-bars"></i></label>
    <div class="wrapper">
       <ul>
          <li><a href="index_bms.html">Client Login</a></li>
          <li><a href="index_company.html">Company Login</a></li>
          <li><a href="#">About</a></li>
          <li><a href="#">Services</a></li>
          <li><a href="#">Product</a></li>
       </ul>
    </div>
    <div class="content">
       <div class="title">
          AMPTON ENERGIES
       </div>
    </div>

    <div class="Indi_Cells">
      <div class="battery"></div>
    <div></div>
    <div></div>
```

```
  <div></div>
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</div>
</body>
```

3.1.2 CLIENT LOGIN PAGE :

```
<!doctype html>

<html lang="en">

<head>

  <meta charset="UTF-8">

  <title>Client Login</title>

  <link rel="stylesheet" href="./style.css">
  <link rel="stylesheet" href="index.js">
  <link rel="stylesheet" href="script.js">
  <script
src="https://ajax.googleapis.com/ajax/libs/jquery/3.3.1/jquery.min.js"></script>

</head>




<body>

  <section> <span></span> <span></span> <span></span> <span></span>
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    <div class="signin">

      <div class="content">

        <h2>CREDENTIALS</h2>

        <div class="form">

          <div class="inputBox"  id="USER">

           <input type="text" id="Username" name="Username" required>
<i>Username</i>
           <hr>
            <h4 id="one"></h4>
```

```
          </div>

          <div class="inputBox" id="PW" >

            <input type="password" id="Password" min="8" required>
<i>Password</i>
            <hr>
            <h4 id="two"></h4>


          </div>
          <div class="inputBox"id="USERNO" >

            <input type="number"  id="UID" required> <i>Unique ID</i>
            <hr>
            <h4 id="three"></h4>


          </div>
          <h3 id="findPassword"></h3>
          <div onload="generate()" class="Captcha">
            <div class="wrapper" class="Captcha1"></div>
            <h2 id="status" style="color: #46f54f" font-family="Helvetica,
Arial, sans-serif"></h2>
            <div class="Captcha1"  margin-top="10px">
                <input type="text" readonly id="generated-captcha">
            </div>
            <div>
                <input type="text" id="entered-captcha" placeholder="Enter the
Captcha">
            </div>
            <button type="button" class ="button"  onclick="generate()"
id="gen">
                Generate New
            </button>
              <script src="script.js"></script>
          </div>

          <div class="inputBox">

           <a id="submit2" > <input type="submit"  id="submit" onclick="check()"
value="Login"></a>

          </div>

</div>
       </div>
```

```
    </div>
  </section>

</body>

</html>


<script type="module">
  // Import the functions you need from the SDKs you need
  import { initializeApp } from
"https://www.gstatic.com/firebasejs/10.7.1/firebase-app.js";
  // TODO: Add SDKs for Firebase products that you want to use
  // https://firebase.google.com/docs/web/setup#available-libraries




 // Your web app's Firebase configuration
  const firebaseConfig = {
    apiKey: "AIzaSyD09KmDRNl3uujuqk-cATOLLWpjaTrtYgg",
    authDomain: "bmsuserdbms.firebaseapp.com",
    projectId: "bmsuserdbms",
    storageBucket: "bmsuserdbms.appspot.com",
    messagingSenderId: "865417729379",
    appId: "1:865417729379:web:b438c80f4da7001ce8af56"
  };

  // Initialize Firebase
  const app = initializeApp(firebaseConfig);

    import {getDatabase, ref, get, set, child, update, remove}
   from "https://www.gstatic.com/firebasejs/10.7.1/firebase-database.js";;


    const db = getDatabase();



    $(document).ready(function(){
      $('input#submit').click(function(){
              if(!$('input#Password').val()){
                  $('input#Password').addClass('empty');
                  $('h4#two').html('Field is empty');
                  $("a").removeAttr("href");

              }
              if(!$('input#Username').val()){
```

```
                $('input#Username').addClass('empty');
                $('h4#one').html('Field is empty');
                $("a").removeAttr("href");
            }
            if(!$('input#UID').val()){
                      $('input#UID').addClass('empty');
                      $('h4#three').html('Field is empty');
                      $("a").removeAttr("href");
                    }
            if(!$('input#Password').val() || !$('input#Username').val()){
              $('input#Username').addClass('empty');
                $('h4#one').html('Field is empty');
                $('h4#two').html('Field is empty');
                $("a").removeAttr("href");

            }
            if(!$('input#Password').val() || !$('input#UID').val()){
              $('input#Username').addClass('empty');
                $('h4#three').html('Field is empty');
                $('h4#two').html('Field is empty');
                $("a").removeAttr("href");

            }
            if(!$('input#UID').val() || !$('input#Username').val()){
              $('input#Username').addClass('empty');
                $('h4#one').html('Field is empty');
                $('h4#three').html('Field is empty');
                $("a").removeAttr("href");

            }
            else{
              if(!$('input#entered-captcha').val()){
                $('input#entered-captcha').addClass('empty');
                $("a").removeAttr("href");
              }
              else{
                $("a").attr("href","index_login.html")
              }
            }
        });
    });

</script>
```

3.1.3 COMPANY LOGIN:

```
<!doctype html>

<html lang="en">

 <head>

  <meta charset="UTF-8">

  <title>Company Login</title>

  <link rel="stylesheet" href="./style.css">
  <style>
@import
url('https://fonts.googleapis.com/css2?family=Quicksand:wght@300;400;500;600;700
&display=swap');

*
{
  margin: 0;
  padding: 0;
  box-sizing: border-box;
  font-family: 'Quicksand', sans-serif;
}
body
{
  display: flex;
  justify-content: center;
  align-items: center;
  min-height: 100vh;
  background: -webkit-linear-gradient(left, #23fa18, #070d4a);
}
section
{
  position: absolute;
  width: 100vw;
  height: 100vh;
  display: flex;
  justify-content: center;
  align-items: center;
  gap: 2px;
  flex-wrap: wrap;
  overflow: hidden;
}
section::before
{
```

```
  content: '';
  position: absolute;
  width: 100%;
  height: 100%;
  background: linear-gradient(#000,#0f0,#000);
  animation: animate 5s linear infinite;
}
@keyframes animate
{
  0%
  {
    transform: translateY(-100%);
  }
  100%
  {
    transform: translateY(100%);
  }
}
section span
{
  position: relative;
  display: block;
  width: calc(6.25vw - 2px);
  height: calc(6.25vw - 2px);
  background: #040847;
  z-index: 2;
  transition: 1.5s;
}
section span:hover
{
  background: #0f0;
  transition: 0s;
}

section .signin
{
  position: absolute;
  width: 400px;
  background: #222;
  z-index: 1000;
  display: flex;
  justify-content: center;
  align-items: center;
  padding: 40px;
  border-radius: 4px;
  box-shadow: 0 15px 35px rgba(0,0,0,9);
}
section .signin .content
{
```

```
  position: relative;
  width: 100%;
  display: flex;
  justify-content: center;
  align-items: center;
  flex-direction: column;
  gap: 40px;
}
section .signin .content h2
{
  font-size: 2em;
  color: #0f0;
  text-transform: uppercase;
}
section .signin .content .form
{
  width: 100%;
  display: flex;
  flex-direction: column;
  gap: 25px;
}
section .signin .content .form .inputBox
{
  position: relative;
  width: 100%;
}
section .signin .content .form .inputBox input
{
  position: relative;
  width: 100%;
  background: #333;
  border: none;
  outline: none;
  padding: 25px 10px 7.5px;
  border-radius: 4px;
  color: #fff;
  font-weight: 500;
  font-size: 1em;
}
section .signin .content .form .inputBox i
{
  position: absolute;
  left: 0;
  padding: 15px 10px;
  font-style: normal;
  color: #aaa;
  transition: 0.5s;
  pointer-events: none;
}
```

```css
.signin .content .form .inputBox input:focus ~ i,
.signin .content .form .inputBox input:valid ~ i
{
  transform: translateY(-7.5px);
  font-size: 0.8em;
  color: #fff;
}
.signin .content .form .links
{
  position: relative;
  width: 100%;
  display: flex;
  justify-content: space-between;
}
.signin .content .form .links a
{
  color: #fff;
  text-decoration: none;
}
.signin .content .form .links a:nth-child(2)
{
  color: #0f0;
  font-weight: 600;
}
.signin .content .form .inputBox input[type="submit"]
{
  padding: 10px;
  background: #0f0;
  color: #000;
  font-weight: 600;
  font-size: 1.35em;
  letter-spacing: 0.05em;
  cursor: pointer;
}
input[type="submit"]:active
{
  opacity: 0.6;
}
@media (max-width: 900px)
{
  section span
  {
    width: calc(10vw - 2px);
    height: calc(10vw - 2px);
  }
}
@media (max-width: 600px)
{
  section span
```

```
  {
    width: calc(20vw - 2px);
    height: calc(20vw - 2px);
  }
}

  </style>

 </head>

 <body> <!-- partial:index.partial.html -->

  <section> <span></span> <span></span> <span></span> <span></span>
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   <div class="signin">

    <div class="content">

     <h2>Credentials</h2>

     <div class="form">
      <form action="indexudbms.html" onsubmit="return authenticate()">
      <div class="inputBox">

       <input type="text" name="Username" id="Username" required>
<i>Username</i>

      </div>

      <div class="inputBox" style="margin-top: 5px;">

       <input type="password" name="Password"  id="Password" required>
<i>Password</i>

      </div>

      <div class="inputBox" style="margin-top: 5px;">

       <a id="submit2"><input type="submit" onclick="authenticate()"
name="submit" value="Login"></a>

      </div>
    </form>
     </div>

    </div>
```

```
   </div>

  </section>

 </body>

</html>
<script language="javascript">
 function authenticate(){
        var authorised;

        //get input values
        var Username = document.getElementById("Username").value;
        var Password = document.getElementById("Password").value;

        //check to see if the password and username match
        if(Username == "Amptonenergies" && Password == "Amptonenergies@BMS"){
          authorised = true;
          document.getElementById("submit2").setAttribute("href",
"indexudbms.html");
        }
        else{ // username or password do not match
          authorised = false;
          //alert user
          alert("Invalid Username or Password");
        }
        //return result
        return authorised;
      }
</script>
```

3.1.4 BMS DATABASE ACCESS:

```
<!DOCTYPE html>
<html lang="en">
<head>
    <meta charset="UTF-8">
    <meta http-equiv="X-UA-Compatible" content="IE=edge">
    <meta name="viewport" content="width=device-width, initial-scale=1.0">
    <title>Ampton Database</title>
    <link rel="icon" href="full-green-3d-battery-icon-png.webp"/>
    <style>
        body {text-align: center;}
        #enterDetails {float: left; width: 40%;  background-color:#131a68;
color: #46f54f; margin-left:5%; margin-right:5%; border-radius: 2em;}
        #findDetails {float: left; width: 40%; background-color: #131a68; color:
#46f54f; margin-left:5; border-radius: 2em;}
        input {width: 120px;}
        #wholepg{
  margin-top:0em;
  margin-bottom:4em;
  margin-left: 0.5em;
  margin-right: 0.5em;
  background: -webkit-linear-gradient(left, #39ccfd, #4c5bff);
  box-sizing: border-box;
  font-family: 'Segoe UI', Tahoma, Geneva, Verdana, sans-serif;
  }
  .BMS{
background-color: #123c92;
border-radius: 20%;
font-size: bolder;
font-size: 90px;
color:#46f54f;
text-align: center;
font-weight: bolder;
height:1.5em;
margin-bottom:0.5em;
margin-top:0.1em;

}
    </style>
</head>
  <body id="wholepg">
    <header class="BMS">BMS DATABASE</header>
    <div id="enterDetails">
        <h1>REGISTRATION</h1>

        <h4>Username</h4>
```

```
        <input id="enterUsername" type="text">

        <h4>Password</h4>
        <input id="enterPassword" type="password">

        <h4>UID</h4>
        <input id="enterUID" type="number"> <br><br>

        <button id="insert">INSERT</button>
        <button id="update">UPDATE</button>
        <button id="remove">REMOVE</button> <br><br>
    </div>

    <div id="findDetails">
        <h1>SEARCH</h1>
        <h4>UID</h4>
        <input id="findUID" type="number" placeholder="Enter the UID"> <br><br>
        <button id="find">FIND</button>
        <h3 id="findUsername" type="text"></h3>
        <h3 id="findPassword" type="password"></h3> <br><br>
    </div>


    <script type="module">
        // Import the functions you need from the SDKs you need
        import { initializeApp } from
"https://www.gstatic.com/firebasejs/10.8.1/firebase-app.js";
        // TODO: Add SDKs for Firebase products that you want to use
        // https://firebase.google.com/docs/web/setup#available-libraries

        // Your web app's Firebase configuration
        const firebaseConfig = {
          apiKey: "AIzaSyCsUZcV8k1bE9DkAYjZLpU_aTUZARAnFcE",
          authDomain: "bms-uid-database.firebaseapp.com",
          databaseURL: "https://bms-uid-database-default-rtdb.firebaseio.com",
          projectId: "bms-uid-database",
          storageBucket: "bms-uid-database.appspot.com",
          messagingSenderId: "172913363514",
          appId: "1:172913363514:web:f3a32821e579558585c303"
        };

        // Initialize Firebase
        const app = initializeApp(firebaseConfig);


    import {getDatabase, ref, get, set, child, update, remove}
       from "https://www.gstatic.com/firebasejs/10.8.1/firebase-database.js";
```

```
        const db = getDatabase();

        var enterUsername = document.querySelector("#enterUsername");
        var enterPassword = document.querySelector("#enterPassword");
        var enterUID = document.querySelector("#enterUID");
        var findUsername = document.querySelector("#findUsername");
        var findPassword = document.querySelector("#findPassword");
        var findUID = document.querySelector("#findUID");


        var insertBtn = document.querySelector("#insert");
        var updateBtn = document.querySelector("#update");
        var removeBtn = document.querySelector("#remove");
        var findBtn = document.querySelector("#find");

        function InsertData() {
            set(ref(db, "Register/"+ enterUID.value),{
                Username: enterUsername.value,
                Password: enterPassword.value,
                UID: enterUID.value
            })
            .then(()=>{
                alert("Data added successfully");
            })
            .catch((error)=>{
                alert(error);
            });
        }

        function FindData() {
            const dbref = ref(db);

            get(child(dbref, "Register/" + findUID.value))
            .then((snapshot)=>{
                if(snapshot.exists()){
                    findPassword.innerHTML = "Password: " +
snapshot.val().Password;
                    findUsername.innerHTML = "Username: " +
snapshot.val().Username;
                } else {
                    alert("No data found")
                }
            })
            .catch((error)=>{
                alert(error)
            })

        }
```

```
        function UpdateData(){
            update(ref(db, "Register/"+ enterUID.value),{
                Password: enterPassword.value,
                Username: enterUsername.value
            })
            .then(()=>{
                alert("Data updated successfully");
            })
            .catch((error)=>{
                alert(error);
            });
        }

        function RemoveData(){
            remove(ref(db, "Register/"+ enterUID.value))
            .then(()=>{
                alert("Data deleted successfully");
            })
            .catch((error)=>{
                alert(error);
            });
        }

        insertBtn.addEventListener('click', InsertData);
        updateBtn.addEventListener('click', UpdateData);
        removeBtn.addEventListener('click', RemoveData);
        findBtn.addEventListener('click', FindData);

      </script>
</body>
</html>
```

3.1.5 BMS MONITOR:

```
<!DOCTYPE html>
<html>
<head>
  <title>BMS</title>
  <link rel="icon" href="full-green-3d-battery-icon-png.webp"/>
  <link
href="https://cdn.jsdelivr.net/npm/bootstrap@5.2.1/dist/css/bootstrap.min.css"
rel="stylesheet"></link>
  <link rel="javascript" href="index.js"></link>
  <link rel="stylesheet" href="index.css"></link>
  <link rel="python" href="index.py"></link>
  <script
src=”https://cdnjs.cloudflare.com/ajax/libs/jquery/3.3.1/jquery.min.js”></script
>
  <script src=”https://cdnjs.cloudflare.com/ajax/libs/easy-pie-
chart/2.1.6/jquery.easypiechart.min.js”></script>
  <script
src="https://cdn.jsdelivr.net/npm/bootstrap@5.2.1/dist/js/bootstrap.bundle.min.j
s" ></script>
  <meta name="viewport" content="width=device-width, initial-scale=1.0">
  </head>
  <body id="wholepg">
    <header class="BMS">BMS MONITOR</header>
    <Center><div class="buttons" style="margin-bottom: 2em; ">
     <a href="#"> <button style="border-radius:3px; border:none; background-
color: #123c92; color: azure;">Battery 1</button></a>
     <a href="#"> <button style="border-radius:3px; border:none; background-
color: #123c92; color: azure">Battery 2</button></a>
     <a href="#"> <button style="border-radius:3px; border:none; background-
color: #123c92; color: azure">Battery 3</button></a>
     <a href="#"> <button style="border-radius:3px; border:none; background-
color: #123c92; color: azure">Battery 4</button></a>
    </div></Center>

    <div class="Bars">
      <div role="progressbar1" id="p1" aria-valuemin="0" aria-valuemax="100"
aria-valuenow="" style="--value:47"></div>
      <div role="progressbar2" id="p1" aria-valuemin="0" aria-valuemax="100"
aria-valuenow="" style="--value:62"></div>
      <div role="progressbar3" id="p2" aria-valuemin="0" aria-valuemax="100"
aria-valuenow="" style="--value:14"></div>
```

```
      <div role="progressbar4" id="p3" aria-valuemin="0" aria-valuemax="100"
aria-valuenow="" style="--value:0"></div>
      <div style="margin-left:4em;">SOC</div>
      <div style="margin-left:3.5em;">Sumvolt</div>
      <div style="margin-left:3.5em;">Capacity</div>
      <div style="margin-left:3.5em;">Current</div>
    </div>
    <div class="Progress_Bars">
    <div class="row">
      <div class="column">
        <table>
          <tr>
            <th><img style="width:40%; height:40%;" src="power.png"></th>
            <th><h2><div class="text">Voltage</div><h2></th>
            <td><progress id='Sumvoltp' max='100'></progress><input readonly
id="Sumvolt" type = "text"></td>
            <th><h2><div class="text">V</div><h2></th>
          </tr>
          <tr>

            <td><img style="width:40%; height:40%;" src="charge.png"></td>
            <th><h2><div class="text">Capacity</div><h2></th>
            <td><progress id='Remcp' max='100'></progress><input id="Remc" type
= "text"></td>
            <td><h2><div class="text">Ah</div><h2></td>
          </tr>
          <tr>
            <td><img style="width:40%; height:40%;" src="Temp.png"></td>
            <th><h2><div class="text">Max Temp</div><h2></th>
            <td><progress id='Maxtp' max='100'></progress><input readonly
id="Maxt" type = "text"></td>
            <td><h2><div class="text">C</div></h2></td>
          </tr>
          <tr>
          </tr>
          <tr>
          </tr>
        </table>
      </div>
      <div class="column">
        <table>
          <tr>
            <td><img style="width:40%; height:40%;" src="Power.png"></td>
            <th><h2><div class="text">Current</div><h2></th>
              <th><progress id='Currentp' max='100'></progress><input readonly
id="Current" type = "text"></th>
            <th><h2><div class="text">A</div></h2></th>
          </tr>
          <tr>
```

```
            <td><img style="width:40%; height:40%;" src="charge.png"></td>
            <th><h2><div class="text">SOC</div><h2></th>
              <th><progress id='SOCp' max='100'></progress><input readonly
id="SOC" type = "text"></th>
            <th><h2><div class="text">%</div></h2></th>
          </tr>
          <tr>
            <td><img style="width:40%; height:40%;" src="Temp.png"></td>
            <th><h2><div class="text">Min Temp</div><h2></th>
            <th><progress id='Mintp' max='100'></progress><input readonly
id="Mint" type = "text"></th>
            <th><h2><div class="text">C</div></h2></th>
          </tr>
          <tr>
          </tr>
        </table>
      </div>
    </div>
  </div><br><br><br><br><br><br><br><br>
</div>
</div>
</div>
</div>
</div>


<body>

  <br><br><br><br>

  <div class="Cell_Info">

    <div><figure class="battery"></figure>
      <span style="margin-left:2em;">Cell_NO :
     1</span><br>
      <span style="margin-left:2em;">Voltage :
     <input readonly id="C1" type = "text"></span><br>
      <span style="margin-left:2em;">Balance State: <input readonly id="B1"
type = "text"></span><br>
      <span style="margin-left:2em;"> Temperature:  <input readonly
id="T1" type = "text"></span>
    </div>
    <div><figure class="battery"></figure>
      <span style="margin-left:2em;">Cell_NO :
     2</span><br>
      <span style="margin-left:2em;">Voltage :
     <input readonly id="C2" type = "text"></span><br>
      <span style="margin-left:2em;">Balance State: <input readonly id="B2"
type = "text"></span><br>
```

```
      <span style="margin-left:2em;"> Temperature:  <input readonly
id="T2" type = "text"></span>
    </div>
    <div><figure class="battery"></figure>
      <span style="margin-left:2em;">Cell_NO :
     3</span><br>
      <span style="margin-left:2em;">Voltage :
     <input readonly id="C3" type = "text"></span><br>
      <span style="margin-left:2em;">Balance State: <input readonly id="B3"
type = "text"></span><br>
      <span style="margin-left:2em;"> Temperature:  <input readonly
id="T3" type = "text"></span>
    </div>
    <div><figure class="battery"></figure>
      <span style="margin-left:2em;">Cell_NO :
     4</span><br>
      <span style="margin-left:2em;">Voltage :
     <input readonly id="C4" type = "text"></span><br>
      <span style="margin-left:2em;">Balance State: <input readonly id="B4"
type = "text"></span><br>
      <span style="margin-left:2em;"> Temperature:  <input readonly
id="T4" type = "text"></span>
    </div>
    <div><figure class="battery"></figure>
      <span style="margin-left:2em;">Cell_NO :
     5</span><br>
      <span style="margin-left:2em;">Voltage :
     <input readonly id="C5" type = "text"></span><br>
      <span style="margin-left:2em;">Balance State: <input readonly id="B5"
type = "text"></span><br>
      <span style="margin-left:2em;"> Temperature:  <input readonly
id="T5" type = "text"></span>
    </div>
    <div><figure class="battery"></figure>
      <span style="margin-left:2em;">Cell_NO :
     6</span><br>
      <span style="margin-left:2em;">Voltage :
     <input readonly id="C6" type = "text"></span><br>
      <span style="margin-left:2em;">Balance State: <input readonly id="B6"
type = "text"></span><br>
      <span style="margin-left:2em;"> Temperature:  <input readonly
id="T6" type = "text"></span>
    </div>
    <div><figure class="battery"></figure>
      <span style="margin-left:2em;">Cell_NO :
     7</span><br>
      <span style="margin-left:2em;">Voltage :
     <input readonly id="C7" type = "text"></span><br>
```

```
      <span style="margin-left:2em;">Balance State: <input readonly id="B7"
type = "text"></span><br>
      <span style="margin-left:2em;"> Temperature:  <input readonly
id="T7" type = "text"></span>
    </div>
    <div><figure class="battery"></figure>
      <span style="margin-left:2em;">Cell_NO :
     8</span><br>
      <span style="margin-left:2em;">Voltage :
     <input readonly id="C8" type = "text"></span><br>
      <span style="margin-left:2em;">Balance State: <input readonly id="B8"
type = "text"></span><br>
      <span style="margin-left:2em;"> Temperature:  <input readonly
id="T8" type = "text"></span>
    </div>
    <div><figure class="battery"></figure>
      <span style="margin-left:2em;">Cell_NO :
     9</span><br>
      <span style="margin-left:2em;">Voltage :
     <input readonly id="C9" type = "text"></span><br>
      <span style="margin-left:2em;">Balance State: <input readonly id="B9"
type = "text"></span><br>
      <span style="margin-left:2em;"> Temperature:  <input readonly
id="T9" type = "text"></span>
    </div>
    <div><figure class="battery"></figure>
      <span style="margin-left:2em;">Cell_NO :
     10</span><br>
      <span style="margin-left:2em;">Voltage :
     <input readonly id="C10" type = "text"></span><br>
      <span style="margin-left:2em;">Balance State: <input readonly
id="B10" type = "text"></span><br>
      <span style="margin-left:2em;"> Temperature:  <input readonly
id="T10" type = "text"></span>
    </div>
    <div><figure class="battery"></figure>
      <span style="margin-left:2em;">Cell_NO :
     11</span><br>
      <span style="margin-left:2em;">Voltage :
     <input readonly id="C11" type = "text"></span><br>
      <span style="margin-left:2em;">Balance State: <input readonly
id="B11" type = "text"></span><br>
      <span style="margin-left:2em;"> Temperature:  <input readonly
id="T11" type = "text"></span>
    </div>
    <div><figure class="battery"></figure>
      <span style="margin-left:2em;">Cell_NO :
     12</span><br>
```

```
      <span style="margin-left:2em;">Voltage :
     <input readonly id="C12" type = "text"></span><br>
      <span style="margin-left:2em;">Balance State: <input readonly
id="B12" type = "text"></span><br>
      <span style="margin-left:2em;"> Temperature:  <input readonly
id="T12" type = "text"></span>
    </div>
    <div><figure class="battery"></figure>
      <span style="margin-left:2em;">Cell_NO :
     13</span><br>
      <span style="margin-left:2em;">Voltage :
     <input readonly id="C13" type = "text"></span><br>
      <span style="margin-left:2em;">Balance State: <input readonly
id="B13" type = "text"></span><br>
      <span style="margin-left:2em;"> Temperature:  <input readonly
id="T13" type = "text"></span>
    </div>
    <div><figure class="battery"></figure>
      <span style="margin-left:2em;">Cell_NO :
     14</span><br>
      <span style="margin-left:2em;">Voltage :
     <input readonly id="C14" type = "text"></span><br>
      <span style="margin-left:2em;">Balance State: <input readonly
id="B14" type = "text"></span><br>
      <span style="margin-left:2em;"> Temperature:  <input readonly
id="T14" type = "text"></span>
    </div>
    <div><figure class="battery"></figure>
      <span style="margin-left:2em;">Cell_NO :
     15</span><br>
      <span style="margin-left:2em;">Voltage :
     <input readonly id="C15" type = "text"></span><br>
      <span style="margin-left:2em;">Balance State: <input readonly
id="B15" type = "text"></span><br>
      <span style="margin-left:2em;"> Temperature:  <input readonly
id="T15" type = "text"></span>
    </div>
    <div><figure class="battery"></figure>
      <span style="margin-left:2em;">Cell_NO :
     16</span><br>
      <span style="margin-left:2em;">Voltage :
     <input readonly id="C16" type = "text"></span><br>
      <span style="margin-left:2em;">Balance State: <input readonly
id="B16" type = "text"></span><br>
      <span style="margin-left:2em;"> Temperature:  <input readonly
id="T16" type = "text"></span>
    </div>
    <div><figure class="battery"></figure>
```

```
      <span style="margin-left:2em;">Cell_NO :
     17</span><br>
      <span style="margin-left:2em;">Voltage :
     <input readonly id="C17" type = "text"></span><br>
      <span style="margin-left:2em;">Balance State: <input readonly
id="B17" type = "text"></span><br>
      <span style="margin-left:2em;"> Temperature:  <input readonly
id="T17" type = "text"></span>
    </div>
    <div><figure class="battery"></figure>
      <span style="margin-left:2em;">Cell_NO :
     18</span><br>
      <span style="margin-left:2em;">Voltage :
     <input readonly id="C18" type = "text"></span><br>
      <span style="margin-left:2em;">Balance State: <input readonly
id="B18" type = "text"></span><br>
      <span style="margin-left:2em;"> Temperature:  <input readonly
id="T18" type = "text"></span>
    </div>
    <div><figure class="battery"></figure>
      <span style="margin-left:2em;">Cell_NO :
     19</span><br>
      <span style="margin-left:2em;">Voltage :
     <input readonly id="C19" type = "text"></span><br>
      <span style="margin-left:2em;">Balance State: <input readonly
id="B19" type = "text"></span><br>
      <span style="margin-left:2em;"> Temperature:  <input readonly
id="T19" type = "text"></span>
    </div>

    </div>


 </body>
  </html>
```

3.1.6 STYLE SHEETS:

3.1.6.1 BMS MONITOR :

```
@import
url('https://fonts.googleapis.com/css?family=Poppins:400,500,600,700&display=swa
p');
*{
  margin: 0;
  padding: 0;
  box-sizing: border-box;
  font-family: 'Poppins', sans-serif;
}
.wrapper{
  position: fixed;
  top: 0;
  left: 0;
  height: 100%;
  width: 100%;
  background: linear-gradient(-100deg,#23fa18,#070d4a);
  clip-path: circle(25px at calc(100% - 45px) 45px);
  transition: all 0.3s ease-in-out;
}
#active:checked ~ .wrapper{
  clip-path: circle(75%);
}
.menu-btn{
  position: absolute;
  z-index: 2;
  right: 20px;
  top: 20px;
  height: 50px;
  width: 50px;
  text-align: center;
  line-height: 50px;
  border-radius: 50%;
  font-size: 20px;
  color: #fff;
  cursor: pointer;
  background: linear-gradient(-135deg, #23fa18,#070d4a);

  transition: all 0.3s ease-in-out;
}
#active:checked ~ .menu-btn{
```

```
  background: #fff;
  color: #070d4a
}
#active:checked ~ .menu-btn i:before{
  content: "\f00d";
}
.wrapper ul{
  position: absolute;
  top: 50%;
  left: 50%;
  transform: translate(-50%, -50%);
  list-style: none;
  text-align: center;
}
.wrapper ul li{
  margin: 15px 0;
}
.wrapper ul li a{
  color: none;
  text-decoration: none;
  font-size: 30px;
  font-weight: 500;
  padding: 5px 30px;
  color: #fff;
  position: relative;
  line-height: 50px;
  transition: all 0.3s ease;
}
.wrapper ul li a:after{
  position: absolute;
  content: "";
  background: #fff;
  width: 100%;
  height: 50px;
  left: 0;
  border-radius: 50px;
  transform: scaleY(0);
  z-index: -1;
  transition: transform 0.3s ease;
}
.wrapper ul li a:hover:after{
  transform: scaleY(1);
}
.wrapper ul li a:hover{
  color: #070d4a;
}
input[type="checkbox"]{
  display: none;
}
```

```
.content{
  position: absolute;
  top: 50%;
  left: 50%;
  transform: translate(-50%, -50%);
  z-index: -1;
  text-align: center;
  width: 100%;
  color:#23fa18;
}
.content .title{
  font-size: 70px;
  font-weight: 700;
}
.content p{
  font-size: 35px;
  font-weight: 600;
}
#wholepg{
  margin-top:0em;
  margin-bottom:4em;
  margin-left: 0.5em;
  margin-right: 0.5em;
  background: -webkit-linear-gradient(left, #39ccfd, #4c5bff);
  box-sizing: border-box;
  z-index: 10;
  }
  .Bars{
  display:grid;
  grid-template-columns: 1fr 1fr 1fr 1fr;
  justify-content: space-between;
  justify-content: space-around;
  color:#191c23;
  font-size: large;
  font-weight: bolder;
  margin-left:7em;
  }

  #ml{
    height:40%;
    width:60%;
    margin-top:3%;
  }
  #ml,#leftsec{
    display: inline-flex;
    vertical-align: center;
    justify-content: center;
  }
  #midsec{
```

```
  display: inline-flex;

}

:root {
  --progress-bar-width: 200px;
  --progress-bar-height: 200px;
  --font-size: 2rem;
}

.circular-progress {
  width: var(--progress-bar-width);
  height: var(--progress-bar-height);
  border-radius: 50%;
  display: flex;
  justify-content: center;
  align-items: center;
  background-color: aquamarine;
}
.inner-circle {
  position: absolute;
  width: calc(var(--progress-bar-width) - 30px);
  height: calc(var(--progress-bar-height) - 30px);
  border-radius: 50%;
  background-color: rgb(0, 0, 0);
}

.percentage {
  position: relative;
  font-size: var(--font-size);
  color: rgba(186, 186, 186, 0.8);
}
@media (min-width: 420px) and (max-width: 659px) {
  .container {
    grid-template-columns: repeat(2, 160px);
  }
}
@media (min-width: 660px) {
  .container {
    grid-template-columns: repeat(3, 160px);
  }
}
.Voltage_Table,th,td{
  border:none;
  width:90%;
  align-items: center;
  text-align: center;
}
.Sno{
```

```
    width:20%;
}
.id{
  width:30%;
}
.voltage{
  width:40%;
}
.Parameters1{
  width:100%;
  color:white;
  text-align: center;
}
.Parameters2{
  width:100%;
  color:white;
  text-align: center;

}

.BMS{
background-color: #123c92;
border-radius: 20%;
font-size: bolder;
font-size: 90px;
color:#46f54f;
text-align: center;
font-weight: bolder;
height:1.5em;
margin-bottom:0.5em;
margin-top:0.1em;

}
.icon{
  width:20%;
  height:20%;
  color:white;
}
.values{
  width:20%;
}
.column {
  flex: 50%;
}
.row {
  display: flex;
  margin-left:-5px;
  margin-right:-5px;
}
```

```
* {
  box-sizing: border-box;
}

.row {
  margin-left:-5px;
  margin-right:-5px;
}

.column {
  float: left;
  width: 30%;
  padding: 5px;
}

.row::after {
  content: "";
  clear: both;
  display: table;
}

table {
  border-collapse: collapse;
  border-spacing: 0;
  width: 100%;
  text-align:center;
  border:none;
  margin-top:3em;
}

th{
  text-align: center;
  width:20%;
  border:none;


}
td{
  text-align: center;
  width:20%;

  border:none;

}
.img{
     width: 100%;
     height: auto;
 }
```

```css
 body {
  display: grid;
  grid-gap: 2vmin;
  place-content: center;
  margin: 0;
  min-height: 100vh;
  background: #262f3e;
}

progress {
  box-sizing: border-box;
  border: solid 0.15em #242b35;
  width: 3em;
  height: 0.75em;
  border-radius: 0.5em;
  background: linear-gradient(#191c23, #2d3341);
  font: clamp(.625em, 7.5vw, 5em) monospace;
}
progress::-webkit-progress-bar {
  background: transparent;
}
progress::-webkit-progress-value {
  border-radius: 0.35em;
  box-shadow: inset 0 0.05em 0.05em rgba(255, 255, 255, 0.35);
  background: var(--fill);
}
progress::-moz-progress-bar {
  border-radius: 0.35em;
  box-shadow: inset 0 0.05em 0.05em rgba(255, 255, 255, 0.35);
  background: var(--fill);
}
progress:nth-child(1) {
  --fill:
  linear-gradient(rgba(90, 240, 255, 0.85), transparent),
  repeating-linear-gradient(90deg,
    #123c92 0 0.0625em, #1b5ec6 0 1em) ;
}
progress:nth-child(2) {
  --fill:
  linear-gradient(rgba(90, 240, 255, 0.85), transparent),
  repeating-linear-gradient(90deg,
    #123c92 0 0.0625em, #1b5ec6 0 1em) ;
}
progress:nth-child(3) {
  --fill:
    linear-gradient(rgba(90, 240, 255, 0.85), transparent),
    repeating-linear-gradient(90deg,
      #123c92 0 0.0625em, #1b5ec6 0 1em) ;
}
```

```
progress:nth-child(4) {
  --fill:
    linear-gradient(rgba(90, 240, 255, 0.85), transparent),
    repeating-linear-gradient(90deg,
      #123c92 0 0.0625em, #1b5ec6 0 1em) ;
}
progress:nth-child(5) {
  --fill:
    linear-gradient(rgba(90, 240, 255, 0.85), transparent),
    repeating-linear-gradient(90deg,
      #123c92 0 0.0625em, #1b5ec6 0 1em) ;
}
progress:nth-child(6) {
  --fill:
    linear-gradient(rgba(90, 240, 255, 0.85), transparent),
    repeating-linear-gradient(90deg,
      #123c92 0 0.0625em, #1b5ec6 0 1em) ;
}
@keyframes growProgressBar {
  0%, 33% { --pgPercentage: 0; }
  100% { --pgPercentage: var(--value); }
}

@property --pgPercentage {
  syntax: '<number>';
  inherits: false;
  initial-value: 0;
}

div[role="progressbar1"] {
  --size: 12rem;
  --fg: #369;
  --bg: #def;
  --pgPercentage: var(--value);
  animation: growProgressBar 3s 1 forwards;
  width: var(--size);
  height: var(--size);
  border-radius: 50%;
  display: grid;
  place-items: center;
  background:
    radial-gradient(closest-side, white 80%, transparent 0 99.9%, white 0),
    conic-gradient(var(--fg) calc(var(--pgPercentage) * 1%), var(--bg) 0)
    ;
  font-family: Helvetica, Arial, sans-serif;
  font-size: calc(var(--size) / 5);
  color: var(--fg);
}
div[role="progressbar2"] {
```

```
  --size: 12rem;
  --fg: #369;
  --bg: #def;
  --pgPercentage: var(--value);
  animation: growProgressBar 3s 1 forwards;
  width: var(--size);
  height: var(--size);
  border-radius: 50%;
  display: grid;
  place-items: center;
  background:
    radial-gradient(closest-side, white 80%, transparent 0 99.9%, white 0),
    conic-gradient(var(--fg) calc(var(--pgPercentage) * 1%), var(--bg) 0)
    ;
  font-family: Helvetica, Arial, sans-serif;
  font-size: calc(var(--size) / 5);
  color: var(--fg);
}
div[role="progressbar3"] {
  --size: 12rem;
  --fg: #369;
  --bg: #def;
  --pgPercentage: var(--value);
  animation: growProgressBar 3s 1 forwards;
  width: var(--size);
  height: var(--size);
  border-radius: 50%;
  display: grid;
  place-items: center;
  background:
    radial-gradient(closest-side, white 80%, transparent 0 99.9%, white 0),
    conic-gradient(var(--fg) calc(var(--pgPercentage) * 1%), var(--bg) 0)
    ;
  font-family: Helvetica, Arial, sans-serif;
  font-size: calc(var(--size) / 5);
  color: var(--fg);
}
div[role="progressbar4"] {
  --size: 12rem;
  --fg: #369;
  --bg: #def;
  --pgPercentage: var(--value);
  animation: growProgressBar 3s 1 forwards;
  width: var(--size);
  height: var(--size);
  border-radius: 50%;
  display: grid;
  place-items: center;
  background:
```

```
    radial-gradient(closest-side, white 80%, transparent 0 99.9%, white 0),
    conic-gradient(var(--fg) calc(var(--pgPercentage) * 1%), var(--bg) 0)
    ;
  font-family: Helvetica, Arial, sans-serif;
  font-size: calc(var(--size) / 5);
  color: var(--fg);
}

div[role="progressbar1"]::before {
  counter-reset: percentage var(--value);
  content: counter(percentage) '%';
}
div[role="progressbar2"]::before {
  counter-reset: percentage var(--value);
  content: counter(percentage) 'V';
}
div[role="progressbar3"]::before {
  counter-reset: percentage var(--value);
  content: counter(percentage) 'Ah';
}
div[role="progressbar4"]::before {
  counter-reset: percentage var(--value);
  content: counter(percentage) 'A';
}



.battery{
  font-size:30px;
  width:6em;
  height:3em;
  color:rgb(57, 57, 167);
  border:0.5em solid;
  border-radius: 0.2em;
  position:relative;
  background-image: linear-gradient(to right,rgb(29, 248, 58),rgb(29, 248, 58));
  background-repeat: no-repeat;
  background-size:10% 80%;
  background-position:0.3em 0.3em;
  margin-left:2.5em;
 }
 .battery::after{
  content:'';
  position:absolute;
  width:0.5em;
  height:2em;
  background-color: currentColor;
  right:-1em;
  border-radius: 0 0.2em 0.2em 0;
```

```
 }
 .battery{
  transition: background-size 0.1s steps(2);
 }
 .battery:hover{
  background-size:90% 80%;
 }
 .Cell_Info{
  background-color: #d3d2d2;
  display:grid;
  grid-template-columns:1fr 1fr 1fr;
  border-radius:2%;
  margin-top:-10em;
 }
 figure{
  margin-left:1em;
  margin-top:1em;
}
input{
border:none;
background-color: transparent;

}
.Charge_State{
  position: relative;
  width: 100%;
  height: 100%;
  margin-top:-6em;
}
/* ON/OFF Switch */
.onoffswitch {
  position: relative;
  width: 55px;
  display: inline-block;
  font-size: 80%;
}
.onoffswitch .onoffswitch-label {
  display: block;
  overflow: hidden;
  cursor: pointer;
  border: 1px solid hsl(0, 0%, 90%);
  -moz-border-radius: 20px;
  -webkit-border-radius: 20px;
  border-radius: 20px;
  margin: 0;
}
.onoffswitch .onoffswitch-inner {
  width: 200%;
  margin-left: -100%;
```

```
  -webkit-transition: margin 0.15s ease-in-out;
  -o-transition: margin 0.15s ease-in-out;
  -moz-transition: margin 0.15s ease-in-out;
  transition: margin 0.15s ease-in-out;
}
.onoffswitch .onoffswitch-inner:before,
.onoffswitch .onoffswitch-inner:after {
  float: left;
  width: 50%;
  height: 24px;
  padding: 0;
  line-height: 24px;
  font-size: 80%;
  color: hsl(0, 0%, 100%);
  font-weight: normal;
  -moz-box-sizing: border-box;
  -webkit-box-sizing: border-box;
  box-sizing: border-box;
}
.onoffswitch .onoffswitch-inner:before {
  content: "ON";
  padding-left: 10px;
  background-color: hsl(203, 100%, 39.1569%);
  color: hsl(0, 0%, 100%);
}
.onoffswitch .onoffswitch-inner:after {
  content: "OFF";
  padding-right: 10px;
  background-color: hsl(0, 0%, 98%);
  color: hsl(0, 0%, 24%);
  text-align: right;
}
.onoffswitch .onoffswitch-switch {
  width: 22px;
  height: 22px;
  margin: 0;
  background: hsl(0, 0%, 100%);
  box-shadow: 0 0 3px rgba(0, 0, 0, 0.3);
  -moz-border-radius: 50%;
  -webkit-border-radius: 50%;
  border-radius: 50%;
  position: absolute;
  top: 2px;
  bottom: 0;
  right: 35px;
  -webkit-transition: right 0.15s ease-in-out;
  -o-transition: right 0.15s ease-in-out;
  -moz-transition: right 0.15s ease-in-out;
  transition: right 0.15s ease-in-out;
```

```
}
.toggle-group {
  position: relative;
  height: 27px;
  font-family: "Helvetica Neue", Helvetica, Arial, sans-serif;
  top: 50%;
  left: 20px;
  margin-top: -13.5px;
}
.toggle-group input[type=checkbox] {
  position: absolute;
  left: 10px;
}
.toggle-group input[type=checkbox]:checked ~ .onoffswitch .onoffswitch-label
.onoffswitch-inner {
  margin-left: 0;
}
.toggle-group input[type=checkbox]:checked ~ .onoffswitch .onoffswitch-label
.onoffswitch-switch {
  right: 1px;
  box-shadow: 0 0 3px rgba(0, 0, 0, 0.5);
}
.toggle-group input[type=checkbox]:focus ~ .onoffswitch {
  outline: thin dotted #333;
  outline: 0;
}
.toggle-group label {
  position: absolute;
  cursor: pointer;
  padding-left: 65px;
  display: inline-block;
  text-align: left;
  line-height: 24px;
  width: 100%;
  z-index: 1;
  height: 24px;
  font-weight: 200;
}
/* ==== Accessibility ===== */
.aural {
  clip: rect(1px, 1px, 1px, 1px);
  height: 1px;
  overflow: hidden;
  position: absolute;
  width: 1px;
}
.aural:focus {
  clip: rect(0, 0, 0, 0);
  font-size: 1em;
```

```
  height: auto;
  outline: thin dotted;
  position: static !important;
  width: auto;
  overflow: visible;
}
.wrapper_charge{
  background-color: #848484;
  border-radius:2%;
  display:grid;
  grid-template-columns: 1fr 1fr;
}

.fleft {
  float: left;
 }
.fright {
  float: right;
}
.clear {
  clear: both;
  }

.bold {
  font-weight: bold;
  }

  .progressbar {
    position: relative;
    max-width: 500px;
    width: 100%;
    margin: 30px auto 0;
    height: 30px;
    background: #274545;
    overflow: hidden;
  }

  span.progress {
    position: absolute;
    left: 0;
    top: 0;
    bottom: 0;
    width: 0;
    background: #326666;
    transition: all .3s;
  }
```

3.1.6.2 SIGN-IN PAGE:

```
@import
url('https://fonts.googleapis.com/css2?family=Quicksand:wght@300;400;500;600;700
&display=swap');
*
{
  margin: 0;
  padding: 0;
  box-sizing: border-box;
  font-family: 'Quicksand', sans-serif;
}
body
{
  display: flex;
  justify-content: center;
  align-items: center;
  min-height: 100vh;
  background: -webkit-linear-gradient(left, #23fa18, #070d4a);
}
section
{
  position: absolute;
  width: 100vw;
  height: 100vh;
  display: flex;
  justify-content: center;
  align-items: center;
  gap: 2px;
  flex-wrap: wrap;
  overflow: hidden;
}
section::before
{
  content: '';
  position: absolute;
  width: 100%;
  height: 100%;
  background: linear-gradient(#000,#0f0,#000);
  animation: animate 5s linear infinite;
}
@keyframes animate
```

```
{
  0%
  {
    transform: translateY(-100%);
  }
  100%
  {
    transform: translateY(100%);
  }
}
section span
{
  position: relative;
  display: block;
  width: calc(6.25vw - 2px);
  height: calc(6.25vw - 2px);
  background: #040847;
  z-index: 2;
  transition: 1.5s;
}
section span:hover
{
  background: #0f0;
  transition: 0s;
}
section .signin
{
  position: absolute;
  width: 400px;
  background: #222;
  z-index: 1000;
  display: flex;
  justify-content: center;
  align-items: center;
  padding: 40px;
  border-radius: 4px;
  box-shadow: 0 15px 35px rgba(0,0,0,9);
}
section .signin .content
{
  position: relative;
  width: 100%;
  display: flex;
  justify-content: center;
  align-items: center;
```

```
  flex-direction: column;
  gap: 40px;
}
section .signin .content h2
{
  font-size: 2em;
  color: #0f0;
  text-transform: uppercase;
}
section .signin .content .form
{
  width: 100%;
  display: flex;
  flex-direction: column;
  gap: 25px;
}
section .signin .content .form .inputBox
{
  position: relative;
  width: 100%;
}
section .signin .content .form .inputBox input
{
  position: relative;
  width: 100%;
  background: #333;
  border: none;
  outline: none;
  padding: 25px 10px 7.5px;
  border-radius: 4px;
  color: #fff;
  font-weight: 500;
  font-size: 1em;
}
section .signin .content .form .inputBox i
{
  position: absolute;
  left: 0;
  padding: 15px 10px;
  font-style: normal;
  color: #aaa;
  transition: 0.5s;
  pointer-events: none;
}
.signin .content .form .inputBox input:focus ~ i,
.signin .content .form .inputBox input:valid ~ i
```

```
{
  transform: translateY(-7.5px);
  font-size: 0.8em;
  color: #fff;
}
.signin .content .form .links
{
  position: relative;
  width: 100%;
  display: flex;
  justify-content: space-between;
}
.signin .content .form .links a
{
  color: #fff;
  text-decoration: none;
}
.signin .content .form .links a:nth-child(2)
{
  color: #0f0;
  font-weight: 600;
}
.signin .content .form .inputBox input[type="submit"]
{
  padding: 10px;
  background: #0f0;
  color: #000;
  font-weight: 600;
  font-size: 1.35em;
  letter-spacing: 0.05em;
  cursor: pointer;
}
input[type="submit"]:active
{
  opacity: 0.6;
}
@media (max-width: 900px)
{
  section span
  {
    width: calc(10vw - 2px);
    height: calc(10vw - 2px);
  }
}
@media (max-width: 600px)
```

```
{
  section span
  {
    width: calc(20vw - 2px);
    height: calc(20vw - 2px);
  }
}


.Captcha{
  display: flex;
  justify-content: center;
  align-items: center;
  padding: 0;
  margin: 0;
  flex-direction: column;
  background-size: cover;
}
.Captcha1{
  margin-bottom: 10px;
}
.button {
  margin-bottom: 5px;
  margin-top: 5px;
  cursor: pointer;
}
input {
  text-decoration: none;
}
#generated-captcha {
  text-decoration: line-through;
  font-weight: bold;
  text-align: center;
  font-size: 20px;
  background-color: #ede7f6;
  border-radius: 6px;
  border: none;
  padding: 6px;
  outline: none;
  color: #1d1d1d;
}
#entered-captcha {
  border: 2px solid #c5c7f7;
  font-family: monospace;
  outline: none;
```

```
  border-radius: 6px;
  padding: 8px 15px;
  font-size: 12px;
  margin-bottom:5px;
}
.button {
  border: none;
  padding: 8px 20px;
  border-radius: 6px;
  font-size: 14px;
  font-family: monospace;
  font-weight: bold;
  outline: none;
  background-color: #64f394;
}

#gen {
  background-color: #ee7e6a;
}
.wrappr {
  /* border: 1px solid red; */
  display: flex;
  flex-direction: column;
  /* align-items: center; */
  justify-content: center;
}
```

3.1.6.2 SIGN-IN PAGE:

```
@import
url('https://fonts.googleapis.com/css2?family=Quicksand:wght@300;400;500;600;700
&display=swap');

*
{
  margin: 0;
  padding: 0;
  box-sizing: border-box;
  font-family: 'Quicksand', sans-serif;
}
body
{
  display: flex;
  justify-content: center;
  align-items: center;
  min-height: 100vh;
  background: -webkit-linear-gradient(left, #23fa18, #070d4a);
}
section
{
  position: absolute;
  width: 100vw;
  height: 100vh;
  display: flex;
  justify-content: center;
  align-items: center;
  gap: 2px;
  flex-wrap: wrap;
  overflow: hidden;
}
section::before
{
  content: '';
  position: absolute;
  width: 100%;
  height: 100%;
  background: linear-gradient(#000,#0f0,#000);
  animation: animate 5s linear infinite;
}
@keyframes animate
{
  0%
```

```
  {
    transform: translateY(-100%);
  }
  100%
  {
    transform: translateY(100%);
  }
}
section span
{
  position: relative;
  display: block;
  width: calc(6.25vw - 2px);
  height: calc(6.25vw - 2px);
  background: #040847;
  z-index: 2;
  transition: 1.5s;
}
section span:hover
{
  background: #0f0;
  transition: 0s;
}

section .signin
{
  position: absolute;
  width: 400px;
  background: #222;
  z-index: 1000;
  display: flex;
  justify-content: center;
  align-items: center;
  padding: 40px;
  border-radius: 4px;
  box-shadow: 0 15px 35px rgba(0,0,0,9);
}
section .signin .content
{
  position: relative;
  width: 100%;
  display: flex;
  justify-content: center;
  align-items: center;
  flex-direction: column;
  gap: 40px;
}
section .signin .content h2
{
```

```
  font-size: 2em;
  color: #0f0;
  text-transform: uppercase;
}
section .signin .content .form
{
  width: 100%;
  display: flex;
  flex-direction: column;
  gap: 25px;
}
section .signin .content .form .inputBox
{
  position: relative;
  width: 100%;
}
section .signin .content .form .inputBox input
{
  position: relative;
  width: 100%;
  background: #333;
  border: none;
  outline: none;
  padding: 25px 10px 7.5px;
  border-radius: 4px;
  color: #fff;
  font-weight: 500;
  font-size: 1em;
}
section .signin .content .form .inputBox i
{
  position: absolute;
  left: 0;
  padding: 15px 10px;
  font-style: normal;
  color: #aaa;
  transition: 0.5s;
  pointer-events: none;
}
.signin .content .form .inputBox input:focus ~ i,
.signin .content .form .inputBox input:valid ~ i
{
  transform: translateY(-7.5px);
  font-size: 0.8em;
  color: #fff;
}
.signin .content .form .links
{
  position: relative;
```

```
  width: 100%;
  display: flex;
  justify-content: space-between;
}
.signin .content .form .links a
{
  color: #fff;
  text-decoration: none;
}
.signin .content .form .links a:nth-child(2)
{
  color: #0f0;
  font-weight: 600;
}
.signin .content .form .inputBox input[type="submit"]
{
  padding: 10px;
  background: #0f0;
  color: #000;
  font-weight: 600;
  font-size: 1.35em;
  letter-spacing: 0.05em;
  cursor: pointer;
}
input[type="submit"]:active
{
  opacity: 0.6;
}
@media (max-width: 900px)
{
  section span
  {
    width: calc(10vw - 2px);
    height: calc(10vw - 2px);
  }
}
@media (max-width: 600px)
{
  section span
  {
    width: calc(20vw - 2px);
    height: calc(20vw - 2px);
  }
}


.Captcha{
  display: flex;
  justify-content: center;
```

```
  align-items: center;
  padding: 0;
  margin: 0;
  flex-direction: column;
  background-size: cover;
}
.Captcha1{
  margin-bottom: 10px;
}
.button {
  margin-bottom: 5px;
  margin-top: 5px;
  cursor: pointer;
}
input {
  text-decoration: none;
}
#generated-captcha {
  text-decoration: line-through;
  font-weight: bold;
  text-align: center;
  font-size: 20px;
  background-color: #ede7f6;
  border-radius: 6px;
  border: none;
  padding: 6px;
  outline: none;
  color: #1d1d1d;
}
#entered-captcha {
  border: 2px solid #c5c7f7;
  font-family: monospace;
  outline: none;
  border-radius: 6px;
  padding: 8px 15px;
  font-size: 12px;
  margin-bottom:5px;
}
.button {
  border: none;
  padding: 8px 20px;
  border-radius: 6px;
  font-size: 14px;
  font-family: monospace;
  font-weight: bold;
  outline: none;
  background-color: #64f394;
}
```

```
#gen {
  background-color: #ee7e6a;
}
.wrappr {
  /* border: 1px solid red; */
  display: flex;
  flex-direction: column;
  /* align-items: center; */
  justify-content: center;
}

$(document).ready(function() {

  var progress = $('.progressbar .progress')

  function counterInit( fValue, lValue ) {

    var counter_value = parseInt( $('.counter').text() );
    counter_value++;

    if( counter_value >= fValue && counter_value <= lValue ) {

      $('.counter').text( counter_value + '%' );
      progress.css({ 'width': counter_value + '%' });

      setTimeout( function() {
        counterInit( fValue, lValue );
      }, 50 );


    }

  }

  counterInit( 0, 50 );

});
```

3.1.7 CLIENT LOGIN PAGE AUTHENTICATION:

```
let captcha;
let alphabets = "AaBbCcDdEeFfGgHhIiJjKkLlMmNnOoPpQqRrSsTtUuVvWwXxYyZz";
let status = document.getElementById('status');
status.innerText = "";
generate = () => {
let first = alphabets[Math.floor(Math.random() * alphabets.length)];
let second = Math.floor(Math.random() * 10);
let third = Math.floor(Math.random() * 10);
let fourth = alphabets[Math.floor(Math.random() * alphabets.length)];
let fifth = alphabets[Math.floor(Math.random() * alphabets.length)];
let sixth = Math.floor(Math.random() * 10);
captcha =
first.toString()+second.toString()+third.toString()+fourth.toString()+fifth.toSt
ring()+sixth.toString();
document.getElementById('generated-captcha').value = captcha;
document.getElementById("entered-captcha").value = '';
}
 check = () => {
    const dbref = ref(db);
    get(child(dbref, "Register/")).then((snapshot)=>{
        if(snapshot.exists()){
            var findPassword = snapshot.val().Password;
            var findUsername = snapshot.val().Username;
            let check1=document.getElementById(Password).value;
            let check2=document.getElementById(Username).value;
        } else {
            alert("No data found");
        }
    })
    .catch((error)=>{
        alert(error)
    })
let userValue = document.getElementById("entered-captcha").value;
if(userValue == captcha){
        if(check3){
    document.getElementById("submit2").setAttribute("href", "index_login.html");
    }
else{
    alert("Invalid Username or Password or UID")
}
}
else{
    document.getElementsByTagName('a')[0].removeAttribute('href');
    status.innerText = "Try Again!"
    document.getElementById("entered-captcha").value = '';
}
}
```

3.2 DECODING & DATABASE ACCESS-BMS MONITOR:

```
<script type="module">
    // Import the functions you need from the SDKs you need
    import { initializeApp } from
"https://www.gstatic.com/firebasejs/10.5.0/firebase-app.js";
    import { getAnalytics } from
"https://www.gstatic.com/firebasejs/10.5.0/firebase-analytics.js";
    // TODO: Add SDKs for Firebase products that you want to use
    // https://firebase.google.com/docs/web/setup#available-libraries

    // Your web app's Firebase configuration
    // For Firebase JS SDK v7.20.0 and later, measurementId is optional
    const firebaseConfig = {
      apiKey: "AIzaSyBX1IurW-DEPL5lv6ulOJvS_Wzw3Yg_8gc",
      authDomain: "smartbms-b6354.firebaseapp.com",
      databaseURL: "https://smartbms-b6354-default-rtdb.firebaseio.com",
      projectId: "smartbms-b6354",
      storageBucket: "smartbms-b6354.appspot.com",
      messagingSenderId: "418880758978",
      appId: "1:418880758978:web:0ae0409718579c87c8c75b",
      measurementId: "G-PQYGG1K6FR"
    };

    // Initialize Firebase
    const app = initializeApp(firebaseConfig);
    const analytics = getAnalytics(app);

    import {getDatabase, get, child, ref} from
"https://www.gstatic.com/firebasejs/10.5.0/firebase-database.js"

    const db = getDatabase();
    const dbref = ref(db);

    var sums = document.getElementById("Sumvolt");
    var remcap = document.getElementById("Remc");
    var maxte = document.getElementById("Maxt");
    var curr = document.getElementById("Current");
    var Soc1 = document.getElementById("SOC");
    var minte = document.getElementById("Mint");

    var sumsp= document.getElementById("Sumvoltp");
    var remcapp = document.getElementById("Remcp");
    var maxtep = document.getElementById("Maxtp");
    var currp = document.getElementById("Currentp");
    var Soc1p = document.getElementById("SOCp");
    var mintep = document.getElementById("Mintp");
```

```
var cv1 = document.getElementById("C1");
var cv2 = document.getElementById("C2");
var cv3 = document.getElementById("C3");
var cv4 = document.getElementById("C4");
var cv5 = document.getElementById("C5");
var cv6 = document.getElementById("C6");
var cv7 = document.getElementById("C7");
var cv8 = document.getElementById("C8");
var cv9 = document.getElementById("C9");
var cv10 = document.getElementById("C10");
var cv11 = document.getElementById("C11");
var cv12 = document.getElementById("C12");
var cv13 = document.getElementById("C13");
var cv14 = document.getElementById("C14");
var cv15 = document.getElementById("C15");
var cv16 = document.getElementById("C16");
var cv17 = document.getElementById("C17");
var cv18 = document.getElementById("C18");
var cv19 = document.getElementById("C19");

var bv1 = document.getElementById("B1");
var bv2 = document.getElementById("B2");
var bv3 = document.getElementById("B3");
var bv4 = document.getElementById("B4");
var bv5 = document.getElementById("B5");
var bv6 = document.getElementById("B6");
var bv7 = document.getElementById("B7");
var bv8 = document.getElementById("B8");
var bv9 = document.getElementById("B9");
var bv10 = document.getElementById("B10");
var bv11 = document.getElementById("B11");
var bv12 = document.getElementById("B12");
var bv13 = document.getElementById("B13");
var bv14 = document.getElementById("B14");
var bv15 = document.getElementById("B15");
var bv16 = document.getElementById("B16");
var bv17 = document.getElementById("B17");
var bv18 = document.getElementById("B18");
var bv19 = document.getElementById("B19");

var tv1 = document.getElementById("T1");
var tv2 = document.getElementById("T2");
var tv3 = document.getElementById("T3");
var tv4 = document.getElementById("T4");
var tv5 = document.getElementById("T5");
var tv6 = document.getElementById("T6");
var tv7 = document.getElementById("T7");
var tv8 = document.getElementById("T8");
```

```
    var tv9 = document.getElementById("T9");
    var tv10 = document.getElementById("T10");
    var tv11 = document.getElementById("T11");
    var tv12 = document.getElementById("T12");
    var tv13 = document.getElementById("T13");
    var tv14 = document.getElementById("T14");
    var tv15 = document.getElementById("T15");
    var tv16 = document.getElementById("T16");
    var tv17 = document.getElementById("T17");
    var tv18 = document.getElementById("T18");
    var tv19 = document.getElementById("T19");

    function bal_state(x){
      if (x == "0"){
        return "Closed";
      }
      else{
        return "Open";
      }
    }

    let line1,line2,line3,line4,line5,line6,line7;

    get(child(dbref,"90")).then((snapshot)=>{
      line1 = snapshot.val().slice(8);
      sums.value = Number.parseInt(line1.slice(0, 4), 16) * 0.1;
      sumsp.value = Number.parseInt(line1.slice(0, 4), 16) * 0.1;
      curr.value = Number.parseInt(line1.slice(8, 12), 16) * 0.1 - 3000;
      currp.value = Number.parseInt(line1.slice(8, 12), 16) * 0.1 - 3000;
      Soc1.value = Number.parseInt(line1.slice(12, 16), 16) * 0.1;
      Soc1p.value = Number.parseInt(line1.slice(12, 16), 16) * 0.1;
    });

    get(child(dbref,"92")).then((snapshot)=>{
      line2 = snapshot.val().slice(8);
      maxte.value = Number.parseInt(line2.slice(0, 2), 16) - 40;
      maxtep.value = Number.parseInt(line2.slice(0, 2), 16) - 40;
      minte.value = Number.parseInt(line2.slice(4, 6), 16) - 40;
      mintep.value = Number.parseInt(line2.slice(4, 6), 16) - 40;
      tv1.value = tv2.value = tv3.value = tv4.value = tv5.value = tv6.value =
tv7.value = tv8.value = tv9.value = tv10.value = tv11.value = tv12.value =
tv13.value = tv14.value = tv15.value = tv16.value = tv17.value = tv18.value =
tv19.value = maxte.value;
    });
    get(child(dbref,"93")).then((snapshot)=>{
      line3 = snapshot.val().slice(8);
      remcap.value = Number.parseInt(line3.slice(8, 16), 16) * 0.001;
      remcapp.value = Number.parseInt(line3.slice(8, 16), 16) * 0.001;
    });
```

```
  get(child(dbref,"95")).then((snapshot)=>{
    line4 = snapshot.val();
    cv1.value = Number.parseInt(line4.slice(10, 14), 16) * 0.001
    cv2.value = Number.parseInt(line4.slice(14, 18), 16) * 0.001
    cv3.value = Number.parseInt(line4.slice(18, 22), 16) * 0.001
    cv4.value = Number.parseInt(line4.slice(36, 40), 16) * 0.001
    cv5.value = Number.parseInt(line4.slice(40, 44), 16) * 0.001
    cv6.value = Number.parseInt(line4.slice(44, 48), 16) * 0.001
    cv7.value = Number.parseInt(line4.slice(62, 66), 16) * 0.001
    cv8.value = Number.parseInt(line4.slice(66, 70), 16) * 0.001
    cv9.value = Number.parseInt(line4.slice(70 ,74), 16) * 0.001
    cv10.value = Number.parseInt(line4.slice(88, 92), 16) * 0.001
    cv11.value = Number.parseInt(line4.slice(92, 96), 16) * 0.001
    cv12.value = Number.parseInt(line4.slice(96, 100), 16) * 0.001
    cv13.value = Number.parseInt(line4.slice(114, 118), 16) * 0.001
    cv14.value = Number.parseInt(line4.slice(118, 122), 16) * 0.001
    cv15.value = Number.parseInt(line4.slice(122, 126), 16) * 0.001
    cv16.value = Number.parseInt(line4.slice(140, 144), 16) * 0.001
    cv17.value = Number.parseInt(line4.slice(144, 148), 16) * 0.001
    cv18.value = Number.parseInt(line4.slice(148, 152), 16) * 0.001
    cv19.value = Number.parseInt(line4.slice(166, 170), 16) * 0.001
  });

  get(child(dbref,"97")).then((snapshot)=>{
    line5 = snapshot.val().slice(7);
    line7 = parseInt(line5, 16).toString(2);
    bv1.value = bal_state(line7.slice(4,5));
    bv2.value = bal_state(line7.slice(5,6));
    bv3.value = bal_state(line7.slice(6,7));
    bv4.value = bal_state(line7.slice(7,8));
    bv5.value = bal_state(line7.slice(8,9));
    bv6.value = bal_state(line7.slice(9,10));
    bv7.value = bal_state(line7.slice(10,11));
    bv8.value = bal_state(line7.slice(11,12));
    bv9.value = bal_state(line7.slice(12,13));
    bv10.value = bal_state(line7.slice(13,14));
    bv11.value = bal_state(line7.slice(14,15));
    bv12.value = bal_state(line7.slice(15,16));
    bv13.value = bal_state(line7.slice(16,17));
    bv14.value = bal_state(line7.slice(17,18));
    bv15.value = bal_state(line7.slice(18,19));
    bv16.value = bal_state(line7.slice(19,20));
    bv17.value = bal_state(line7.slice(20,21));
    bv18.value = bal_state(line7.slice(21,22));
    bv19.value = bal_state(line7.slice(22,23));
  });
</script>
```

CHAPTER 4

4.1 ERRORS AND DEBUGGING:

Debugging in HTML and JavaScript involves identifying and fixing errors in your code.

- **Use the Browser Developer Tools:**

  Open the browser's developer tools by right-clicking on your webpage and selecting "Inspect" or pressing Ctrl+Shift+I (Windows/Linux) or Cmd+Opt+I (Mac).
  Go to the "Console" tab to check for JavaScript errors.
  Errors will be displayed with detailed information, helping you identify the issue.

- **Check the Console for Errors:**

  Use console.log() statements in your JavaScript code to print information and debug messages to the console.
  Look for error messages in the console that can help pinpoint the issue.
  javascript
  Code:
  console.log("Debug message");

- **Validate HTML and CSS:**

  Use online validators to check your HTML and CSS code for syntax errors.
  Fix any reported errors, as they may cause unexpected behavior in your webpage.

- **Review Code Logic:**

  Carefully review your JavaScript code for logical errors.
  Use comments to explain complex sections of code, making it easier to understand javascripts.

- **Use debugger Statement:**

  Insert the debugger statement in your JavaScript code where you suspect the issue.

This will pause the execution of the code and allow you to inspect variables and step through the code javascript.

- **Check Network Requests:**

  Use the "Network" tab in the developer tools to monitor network requests.
  Ensure that all resources are loading correctly, and there are no failed requests.

- **Cross-browser Compatibility:**

  Test your webpage on different browsers to ensure compatibility.
  Some browsers may have specific quirks or issues that need to be addressed.

- **Update Libraries:**

  Ensure that you are using the latest versions of external libraries and frameworks.
  Check for updates and bug fixes that may address known issues.

- **Break the Code into Smaller Parts:**

  If you have a large codebase, break it into smaller, manageable sections.
  Debug each section independently to identify and fix issues more easily.

4.2 LINKS FOR DOWNLOADING SOFTWARES:

VISUAL STUDIO CODE:

https://code.visualstudio.com/Download

PYTHON:

https://www.python.org/downloads/

FIREBASE:

To setup firebase Realtime database ,
Follow the instruction given in the link to start a Realtime database in google firebase:
https://firebase.flutter.dev/docs/database/start/

To get the database url and other important information of the Realtime Firebase database, follow the instruction given in the link below:

https://www.appypie.com/faqs/how-can-i-get-api-key-auth-domain-database-url-and-storage-bucket-from-my-firebase-account

Once the firebase config is obtained paste it in the program and run it.

Thus, the station has been set and started to run.

4.3 INDEX:

- **Absolute Path:** An absolute path refers to the complete details needed to locate a file or folder, starting from the root element and ending with the other subdirectories. Absolute paths are used in websites and operating systems for locating files and folders.

- **Relative Path:** A relative path is a link that points to a file location on the page where the link is located. Unlike an absolute path, a relative path does not include the domain name of the website. Instead, it contains just the directory and slug.

- **Essential Parameters:** The parameters like SOC, Capacity, Voltage, Current, Maximum and Minimum Temperature which are monitored for the Overall Battery are called Essential Parameters.

- **Individual Cell Parameters:** The parameters like Cell Voltage, Balance State, and Cell Temperature that are monitored for individual cells are called Individual Cell parameters.