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Green Commute

A smart pollution detection system for vehicles

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CERTIFICATE

This is to certify that the report titled **Green Commute** is a bona fide record of work done by **Albin E James (2141003), Sharoan Santhosh (2141160), Maria Mathew (2141154) and Singala Richard Crispu (2141137)** of Christ (Deemed to be University), Bangalore, in partial fulfilment of the requirements of V Semester BCA during the year 2023.

Head of the Department **Project Guide**

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ABSTRACT

The Green Commute project is a sensor and Internet of Things (IoT) based car pollution detection system designed to raise public awareness about the urgent need to reduce pollution caused by personal vehicles. With the aim of combating global warming and other environmental hazards, this innovative system focuses on monitoring and alerting users about their vehicle's emissions.

Personal vehicles are a significant contributor to pollution, emitting various pollutants based on fuel quality and engine efficiency. The Green Commute project addresses these concerns by implementing a user-friendly solution that informs individuals about their contribution to pollution levels and provides service alerts when emission rates exceed standard limits.

The system utilizes sensors installed in vehicles to continuously monitor emission levels. These sensors collect real-time data on pollutants emitted by the vehicle, such as carbon monoxide, nitrogen oxides, and particulate matter. The collected data is then transmitted to a central server via IoT technology.

Through a user-friendly mobile application or web interface, individuals can access their vehicle's emission data and receive personalized insights into their pollution contributions. The system also provides alerts and notifications when emission rates surpass the standard limits, prompting users to take necessary actions, such as vehicle maintenance or adopting eco-friendly driving practices.

By raising awareness and providing actionable information, the Green Commute project aims to encourage individuals to make conscious choices that reduce pollution and contribute to a cleaner environment. This project has the potential to create a significant impact by empowering users to actively participate in the fight against pollution caused by personal vehicles.

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1. INTRODUCTION

Introduction deals with the primary objectives and describes the context of the project. This helps to understand the overview of the system, the problem we have identified, advantages of the proposed system and the scope of the project, which gives a clear idea on the need and importance of the project.

1.1 OVERVIEW OF THE SYSTEM

The Green Commute project is a sensor and Internet of Things (IoT) based car pollution detection system designed to address the environmental hazards caused by personal vehicles. The system aims to raise public awareness about the need to reduce pollution and empower individuals to make informed decisions regarding their vehicle's emissions.

The system utilizes sensors installed in vehicles to continuously monitor emission levels. These sensors collect real-time data on pollutants emitted by the vehicle, including carbon monoxide, nitrogen oxides, and particulate matter. The collected data is transmitted to a central server using IoT technology.

Users can access their vehicle's emission data and personalized insights through a user-friendly mobile application or web interface. This allows individuals to understand their contribution to pollution levels and take necessary actions to reduce their environmental impact. The system also provides service alerts when emission rates exceed standard limits, prompting users to address any issues with their vehicle's emissions.

By providing real-time information and alerts, the Green Commute system encourages users to adopt eco-friendly driving practices and prioritize vehicle maintenance. This not only helps reduce pollution but also contributes to a cleaner and healthier environment.

The project's ultimate goal is to create a significant impact by raising public awareness and promoting responsible actions to combat pollution caused by personal vehicles. By empowering individuals with knowledge and actionable insights, the Green Commute system aims to drive positive change and contribute to a sustainable future.

2.SYSTEM ANALYSIS

This system analysis helps to design the system more effectively. The requirements for the application are simple but integrating the different tools to the application needs proper planning and analysis. The feasibility of doing the same needs to be analysed and identified for effective development. The system analysis focuses on the requirement specification, which includes the functional requirements, and the non-functional requirements. The system analysis also contains the block diagram and the system requirements. The system requirements explain the hardware and software requirements as well as the external tools used in developing the website.

2.1 EXISTING SYSTEM

Currently, there are limited systems in place to address the issue of car pollution and raise public awareness about the need to reduce emissions. Some existing systems focus on vehicle emissions testing during mandatory inspections, but these are periodic and do not provide real-time data or personalized insights to users. Other systems rely on self-reporting by individuals, which can be unreliable and lack accuracy.

2.1.1 LIMITATIONS OF EXISTING SYSTEM

1. Lack of Real-time Monitoring: Existing systems often lack the capability to monitor vehicle emissions in real-time. This means that individuals are not aware of their immediate impact on pollution levels and cannot take immediate action to reduce emissions.
2. Limited User Awareness: Many individuals are unaware of the extent of their contribution to pollution levels through their personal vehicles. Existing

systems do not effectively communicate this information to users, resulting in a lack of awareness and motivation to reduce emissions.

3. Inadequate Personalization: Existing systems do not provide personalized insights to users regarding their specific vehicle's emissions. This lack of personalization makes it difficult for individuals to understand their unique impact and take targeted actions to reduce pollution.
4. Absence of Service Alerts: Current systems do not provide service alerts to users when emission rates exceed standard limits. This means that individuals may continue to drive vehicles with high emissions without being alerted to the need for maintenance or repairs.
5. Limited Accessibility: Some existing systems may not be easily accessible to all individuals, either due to technological barriers or lack of awareness about their existence. This limits the reach and effectiveness of these systems in raising public awareness and encouraging behavior change.

Overall, the existing systems fall short in providing real-time monitoring, personalized insights, service alerts, and accessibility to users. These limitations hinder the effectiveness of efforts to reduce pollution caused by personal vehicles and raise public awareness about the need for sustainable transportation practices.

2.2 PROPOSED SYSTEM

1. Real-time Monitoring: Green Commute utilizes sensors installed in vehicles to continuously monitor emission levels in real-time. This provides users with immediate feedback on their vehicle's pollution contributions, allowing them to take immediate action to reduce emissions.
2. Personalized Insights: The system provides personalized insights to users regarding their specific vehicle's emissions. Users can access their vehicle's emission data through a user-friendly mobile application or web interface, enabling them to understand their unique impact on pollution levels.
3. Service Alerts: Green Commute sends service alerts to users when emission rates exceed standard limits. This prompts users to take necessary actions, such as vehicle maintenance or adopting eco-friendly driving practices, to ensure their vehicle's emissions are within acceptable limits.

4. User-Friendly Interface: The system offers a user-friendly mobile application or web interface that allows individuals to easily access their emission data, receive alerts, and track their progress in reducing pollution. This enhances user engagement and encourages active participation in reducing emissions.
5. Accessibility: Green Commute aims to be accessible to a wide range of users. It can be integrated with various vehicle models and is designed to be compatible with different mobile devices and operating systems. This ensures that individuals from diverse backgrounds can easily access and benefit from the system.

2.2.1 BENEFITS OF PROPOSED SYSTEM

1. Increased Awareness: The Green Commute system raises public awareness about the need to reduce pollution caused by personal vehicles. By providing real-time monitoring and personalized insights, individuals gain a better understanding of their contribution to pollution levels. This increased awareness motivates users to take proactive steps to reduce emissions.
2. Behavior Change: The system encourages behavior change by providing users with actionable information and service alerts. When users receive alerts indicating that their emission rates exceed standard limits, they are prompted to take immediate action, such as vehicle maintenance or adopting eco-friendly driving practices. This leads to a positive change in behavior and a reduction in pollution.
3. Improved Environmental Impact: By empowering individuals to actively participate in reducing pollution, the Green Commute system contributes to a cleaner and healthier environment. As users become more aware of their emissions and take steps to reduce them, the overall pollution levels caused by personal vehicles decrease, leading to improved air quality and a reduced carbon footprint.
4. Cost Savings: The system helps users save money by alerting them to potential issues with their vehicle's emissions. By addressing these issues promptly, users can avoid costly repairs or penalties associated with non-compliance with emission standards. Additionally, adopting eco-friendly driving practices, such as maintaining proper tire pressure and avoiding aggressive acceleration, can lead to fuel savings.
5. Data-driven Decision Making: The Green Commute system collects and analyzes real-time data on vehicle emissions. This data can be used by policymakers, urban

planners, and researchers to make informed decisions regarding pollution control measures, infrastructure development, and transportation policies. The system contributes to evidence-based decision making for a more sustainable future.

2.3 LITERATURE REVIEW

The literature review section provides an overview of existing systems and solutions related to pollution data management and accessibility. It outlines various platforms and systems, focusing on their capabilities, limitations, and relevance to the proposed system, "Green Commute."

1. Existing Systems:
    - Shortcomings of existing pollution detection systems can be summarized as a lack of real-time data, limited user accessibility and awareness, insufficient empowerment and motivation for individuals, incomplete data collection, and a limited focus on driving behavior, all of which hinder their overall impact on reducing vehicle emissions and promoting environmental responsibility.
    - Another limitation of existing pollution detection systems is the absence of a comprehensive platform that combines real-time data, user-friendly interfaces, personalized insights, and effective alerts to drive meaningful change in individuals' behavior and contribute to a cleaner environment.

2. Yulu:
    - Limited Impact: Yulu's short-distance, weather-dependent, and seasonal nature may have a limited impact on reducing pollution compared to addressing emissions from personal vehicles with longer commutes.
    - Lack of Emission Monitoring: Yulu's bicycles and electric scooters do not have emission monitoring systems like those in personal vehicles. This absence makes it challenging to provide real-time data on emissions to users, which is a key feature of our project Green Commute.
    - Green Commute addresses Yulu's limitations by offering real-time emission monitoring for personal vehicles, comprehensive coverage, year-round

availability, user empowerment through awareness and eco-friendly driving, and accessible data interfaces, providing a holistic approach to pollution control.

2.4 FUNCTIONAL REQUIREMENTS

Functional requirements for the Green Commute project typically include:

1. Emission Monitoring System: Implement a sensor-based system in vehicles to continuously monitor emission levels, including carbon monoxide, nitrogen oxides, and particulate matter.
2. Data Collection and Transmission: Develop the capability to collect real-time emission data from vehicles and transmit it to a central server using IoT technology.
3. User Interface: Create user-friendly mobile applications or web interfaces for users to access their personalized emission data and receive alerts.
4. Alert System: Implement an alert mechanism to notify users when their vehicle's emissions exceed standard limits or require maintenance.
5. Data Storage and Analysis: Store and analyze the collected emission data to provide users with insights and recommendations for reducing pollution
6. User Profiles:Allow users to create and manage profiles, including vehicle information, to personalize their experience.
7. Geo-Location Services: Incorporate geo-location services to track and map users' commutes, helping to identify pollution hotspots.
8. Integration with Vehicle Systems: Collaborate with vehicle manufacturers to integrate emission monitoring sensors into new vehicles or retrofit existing ones.
9. Scalability: Ensure the system can handle a growing user base and an increasing number of monitored vehicles.
10. Security: Implement robust security measures to protect user data and ensure the system's integrity.
11. Compliance: Ensure that the system adheres to relevant environmental regulations and standards.
12. Feedback Mechanism: Provide a channel for users to report issues, ask questions, or provide feedback for continuous improvement.

13. Data Privacy: Implement strict data privacy measures to protect user information and comply with data protection laws.
14. Service Maintenance:Establish a maintenance plan to ensure the system's ongoing functionality and reliability.

These functional requirements are essential for the Green Commute project to effectively monitor and reduce vehicle emissions while providing users with a user-friendly and informative experience.

2.5 SOFTWARE AND HARDWARE REQUIREMENTS

HARDWARE REQUIREMENTS

COMPONENT	MINIMUM REQUIREMENT
Processor	64-bit dual core processor
Memory	2 GB RAM or more
Storage	128 GB or more
Display	Super VGA [1024p onwards]

NETWORK REQUIREMENTS

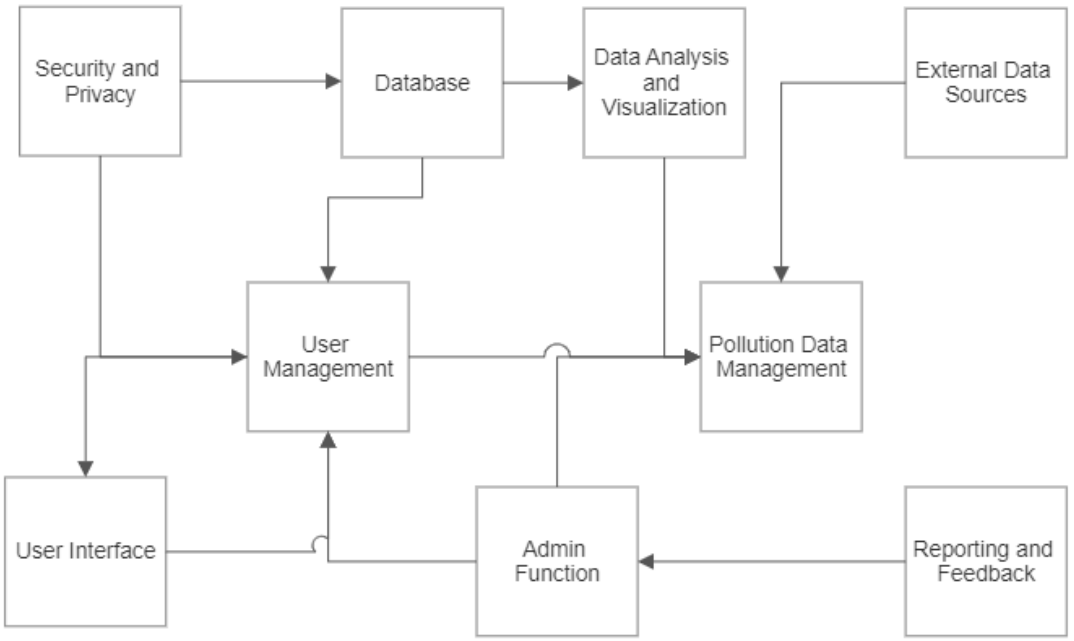
COMPONENT	MINIMUM REQUIREMENT
Bandwidth	50kbps onwards
Latency	Latency under 150ms

SOFTWARE REQUIREMENTS

COMPONENT	MINIMUM REQUIREMENT
Operating system	WINDOWS 7 / UBUNTU 14.4
Browser	Chrome 69.0 / Firefox 71.0 / IE 7.0
HTML	HTML 5
CSS	CSS 3
JAVASCRIPT	ECMA Script 2016 version
Server	XAMPP

3.SYSTEM DESIGN

3.1 BLOCK DIAGRAM



3.2 DATABASE DESIGN

DATABASE TABLES:

1. USER TABLE– 13 attributes. UserID is the primary key, Not Null condition is for all the attributes except last four attributes. Last four attributes can be edited later from the user profile.

UserID	Username	Password (hashed and salted)	Email	FirstName	LastName	Role (User, Admin)	RegDate	LastLoginDate

ProfilePicture	ConNum	Address	Birthdate

2. POLICE TABLE – 11 attributes. PoliceID is the primary key. All have not null condition.

PoliceID	Badge Num	Rank	FirstName	LastName	ConNum	Email	StationAssigned	DateOfJoining

ProfilePicture	Address

3. FIR TABLE – 12 attributes. FIRNum is the primary key. ReportingOfficer is the foreign key (PoliceID from Police table). Not Null for everything except Comments and Attachments.

FIRNum	CrimeType	Description	DateAndTimeIncident	ReportingOfficer	Complainant Name

Status (Pending,In Process,Closed)	DateAndTimeFIR	ComplainantConNum	Location

Comments	Attachments (images,documents)

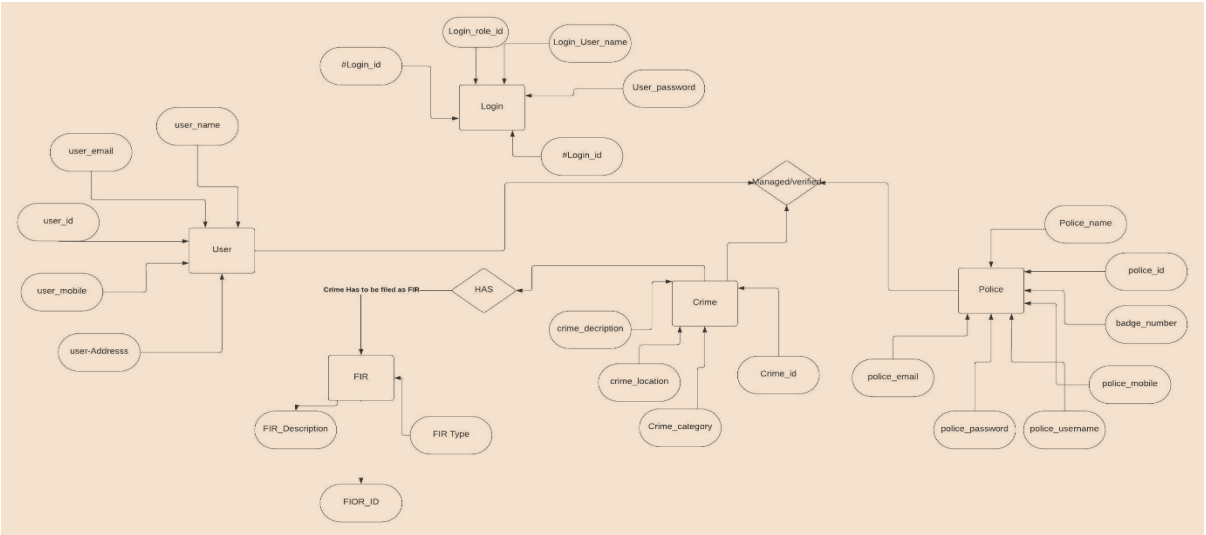
4. LOGIN TABLE – 6 attributes. LoginID is the primary key. UserID is the foreign key (UserID from User table). Not Null for everything.

LoginID	UserID	LoginTime	LogoutTime	IPAddress	DeviceInfo

5. CRIME TABLE – 10 attributes. CrimeID is the primary key. ReportingID is the foreign key (UserID form User table). Not Null for everything.

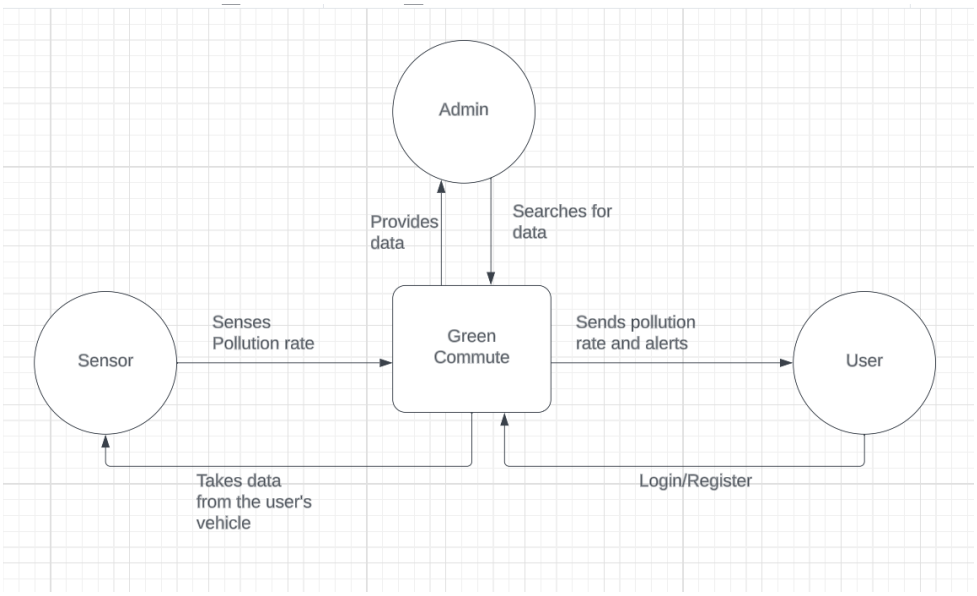
CrimeID	CrimeType	Description	DateAndTimeIncident	ReportingID	Location
Status (Reported, Under Inverstigation ,Closed)	DateAndTimeOfCrimeReport	Comments	Attachments (images,documents)		

3.3 ER DIAGRAM



3.4 DATA FLOW DIAGRAM

A data flow diagram (DFD) shows how information moves through any system or process. It displays data inputs, outputs, storage locations, and routes between each destination using predefined symbols such as rectangles, circles, and arrows as well as brief text labels**.**



3.5 USE CASE DIAGRAM

3.6 USER INTERFACE DESIGN

IMPLEMENTATION

4.1 SOURCE CODE

```
<!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>User dashboard</title>
    <link rel="stylesheet" href="style.css">
    <style>
        /* Remove the default blue color and underline for the link */
        a {
            text-decoration: none;
            color: inherit; /* Inherit the color from the parent (usually black) */
        }

        /* Style the link on hover */

    </style>
</head>
<body>
    <div class="side-bar">
        <div class="logo-name">

            <img src = "C:\Users\sharo\OneDrive\Desktop\project\dashboard\Logo.png" alt = "">

        </div>
        <h2>GREEN COMMUTE</h2>
        <ul>

            <li><img src="" alt="">   Dashboard</li>
            <li><a href = "C:\Users\sharo\OneDrive\Desktop\project\dashboard\car.html"><img src="" alt="">   Service
Details</a></li>
            <li><a href = "C:\Users\sharo\OneDrive\Desktop\project\dashboard\help.html"><img src="" alt="">   Help</a></li>

        </ul>
    </div>

    <div class="container">
        <div class="header">
            <div class="nav">
                <div class="search">
                    <input type="text" placeholder="Search..">
                    <button type="submit"> <img src="C:\Users\sharo\OneDrive\Desktop\project\dashboard\icons8-search-50.png"
alt=""></button>
                </div>
                <div class="user">


                    <div class="img-design">

                    </div>
                </div>
            </div>
        </div>
        <div class="content">
            <div class="cards">
                <div class="card">
                    <div class="box">
                        <h2>02.840 % Vol</h2>
```

```
                <h3> Emission rate of vehicle</h3>
                <h3>(CO Emission)</h3>
            </div>
            <div class="icon-design">
                <img src="C:\Users\sharo\OneDrive\Desktop\project\dashboard\icons8-car-50.png" alt="">
            </div>
        </div>
        <div class="card">
            <div class="box">
                <h2>37 AQI</h2>
                <h3> Air quality index of the city</h3>
                <h3>(Bangalore)</h3>
            </div>
            <div class="icon-design">
                <img src="C:\Users\sharo\OneDrive\Desktop\project\dashboard\small-building.png" alt="">
            </div>
        </div>
        <div class="card">
            <div class="box">
                <h2>0000</h2>
                <h3> Contribution of all vehicles to air pollution</h3>
            </div>

            <div class="icon-design">
                <img src="C:\Users\sharo\OneDrive\Desktop\project\dashboard\traffic-jam.png" alt="">
            </div>
        </div>
        <div class="card alert alert-red">
            <div class="box">

                <h3>Service Status</h3>
            </div>
            <div class="icon-design">
                <img src="C:\Users\sharo\OneDrive\Desktop\project\dashboard\dot-23833.png" alt="">
            </div>
        </div>

    </div>
    <div class="content-ii"></div>
  </div>
 </div>
</body>
</html>
```

4.2 CAR SERVICE DETAILS PAGE CODE

```
<!DOCTYPE html>
<html lang="en">
<head>
    <meta charset="UTF-8">
    <meta name="viewport" content="width=device-width, initial-scale=1.0">
    <title>Car Service Due Details</title>
    <style>
        body {
            font-family: Arial, sans-serif;
```

```
            margin: 0;
            padding: 0;
            background-image: url("pexels-pixabay-66869.jpg");
            background-size: cover;
            background-position: center;
        }
        header {
            background-color: #333;
            color: #fff;
            text-align: center;
            padding: 1rem 0;
        }
        h1 {
            margin: 0;
        }
        main {
            max-width: 800px;
            margin: 0 auto;
            padding: 20px;
        }
        section {
            margin-bottom: 20px;
        }
        ul {
            list-style: none;
            padding: 0;
        }
        li {
            margin-bottom: 10px;
        }
        form label {
            display: block;
            margin-bottom: 5px;
        }
        input[type="text"],
        input[type="date"] {
            width: 100%;
            padding: 10px;
            margin-bottom: 10px;
            /* Make the input fields read-only */
            readonly: true;
        }
        button {
            background-color: #333;
            color: #fff;
            padding: 10px 20px;
            border: none;
            cursor: pointer;
        }
        button:hover {
            background-color: #555;
        }
    </style>
</head>
```

```
<body>
  <header>
    <h1>Car Service Due Details</h1>
  </header>

  <main>
    <section id="add-service">
      <h2> Service Details</h2>
      <form id="service-form">
        <label for="vehicle-number">Vehicle Number:</label>
        <input type="text" id="vehicle-number" required readonly>

        <label for="owner-name">Owner Name:</label>
        <input type="text" id="owner-name" required readonly>

        <label for="car-model">Car Model:</label>
        <input type="text" id="car-model" required readonly>

        <label for="nearest-center">Nearest Service Center:</label>
        <input type="text" id="nearest-center" required readonly>

        <label for="service-name">Service Name:</label>
        <input type="text" id="service-name" required readonly>

        <label for="due-date">Due Date:</label>
        <input type="date" id="due-date" required readonly>

        <a href = "C:\Users\sharo\OneDrive\Desktop\project\dashboard\index.html">
        <button type="button">Go back to home page</button>
        </a>
      </form>
    </section>


  </main>

  <script>
    document.addEventListener("DOMContentLoaded", function () {
      const serviceForm = document.getElementById("service-form");
      const serviceList = document.getElementById("service-items");

      serviceForm.addEventListener("submit", function (e) {
        e.preventDefault();

        const vehicleNumber = document.getElementById("vehicle-number").value;
        const ownerName = document.getElementById("owner-name").value;
        const carModel = document.getElementById("car-model").value;
        const nearestCenter = document.getElementById("nearest-center").value;
        const serviceName = document.getElementById("service-name").value;
        const dueDate = document.getElementById("due-date").value;

        const serviceItem = document.createElement("li");
        serviceItem.innerHTML = `
          <strong>Vehicle Number:</strong> ${vehicleNumber}<br>
```

```
            <strong>Owner Name:</strong> ${ownerName}<br>
            <strong>Car Model:</strong> ${carModel}<br>
            <strong>Nearest Service Center:</strong> ${nearestCenter}<br>
            <strong>Service Name:</strong> ${serviceName}<br>
            <strong>Due Date:</strong> ${dueDate}
        `;

        serviceList.appendChild(serviceItem);

        // Clear the form fields
        document.getElementById("vehicle-number").value = "";
        document.getElementById("owner-name").value = "";
        document.getElementById("car-model").value = "";
        document.getElementById("nearest-center").value = "";
        document.getElementById("service-name").value = "";
        document.getElementById("due-date").value = "";
      });
    });
  </script>
</body>
</html>
```

4.3 HELPLINE PAGE CODE

```
<!DOCTYPE html>
<html lang="en">
<head>
  <meta charset="UTF-8">
  <meta name="viewport" content="width=device-width, initial-scale=1.0">
  <title>Help Numbers</title>
  <style>
    body {
      font-family: Arial, sans-serif;
      background-color: #f0f0f0;
      margin: 0;
      padding: 0;
    }

    header {
      background-color: #333;
      color: #fff;
      text-align: center;
      padding: 1rem 0;
    }

    h1 {
      margin: 0;
    }

    main {
      max-width: 800px;
      margin: 0 auto;
      padding: 20px;
    }
```

```
        section {
            background-color: #fff;
            padding: 20px;
            border-radius: 5px;
            box-shadow: 0px 0px 10px rgba(0, 0, 0, 0.2);
        }

        h2 {
            color: #333;
        }

        p {
            margin-bottom: 10px;
        }

        ul {
            list-style: none;
            padding: 0;
        }

        li {
            margin-bottom: 10px;
        }

        .emergency {
            background-color: #f00;
            color: #fff;
            padding: 5px 10px;
            border-radius: 3px;
        }
        button {
            background-color: #333;
            color: #fff;
            padding: 10px 20px;
            border: none;
            cursor: pointer;
        }
        button:hover {
            background-color: #555;
        }
    </style>
</head>
<body>
    <header>
        <h1>Help Numbers</h1>
    </header>

    <main>
        <section>
            <h2>Contact the below numbers for help and support</h2>

            <ul>
```

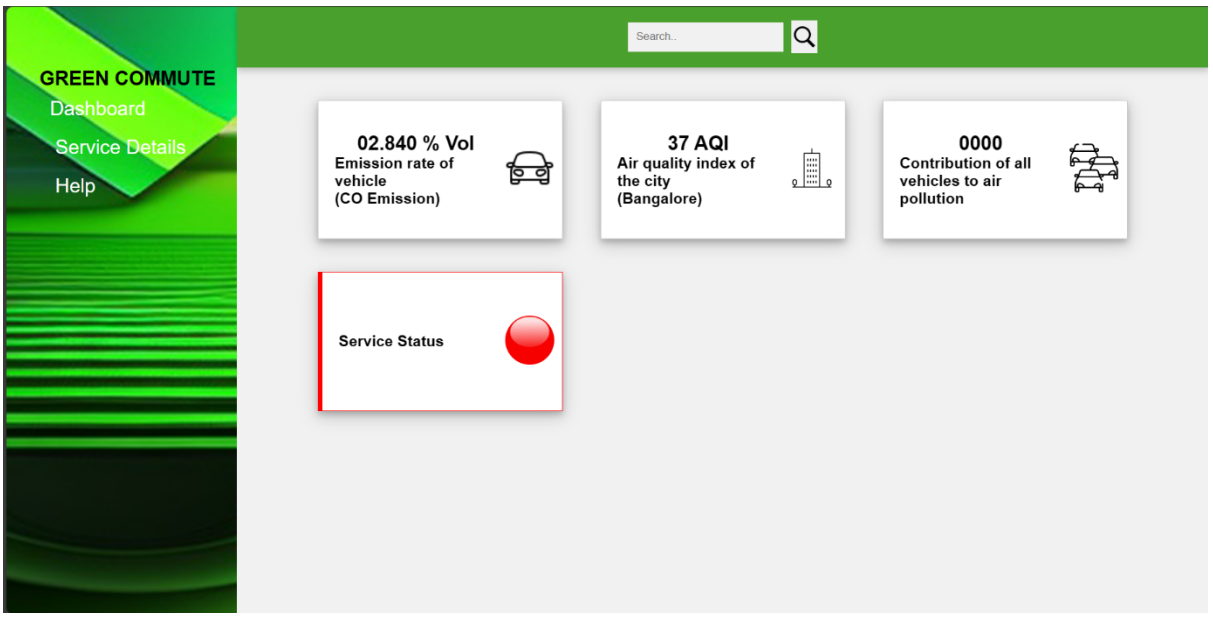
```
            <li> 123-456-7890</li>
            <li> 123-455-6785</li>
          </ul>
        </section>
        <a href = "C:\Users\sharo\OneDrive\Desktop\project\dashboard\index.html">
          <button type="button">Go back to home page</button>
          </a>

      </main>
    </body>
    </html>
```

4.2 SCREEN SHOTS

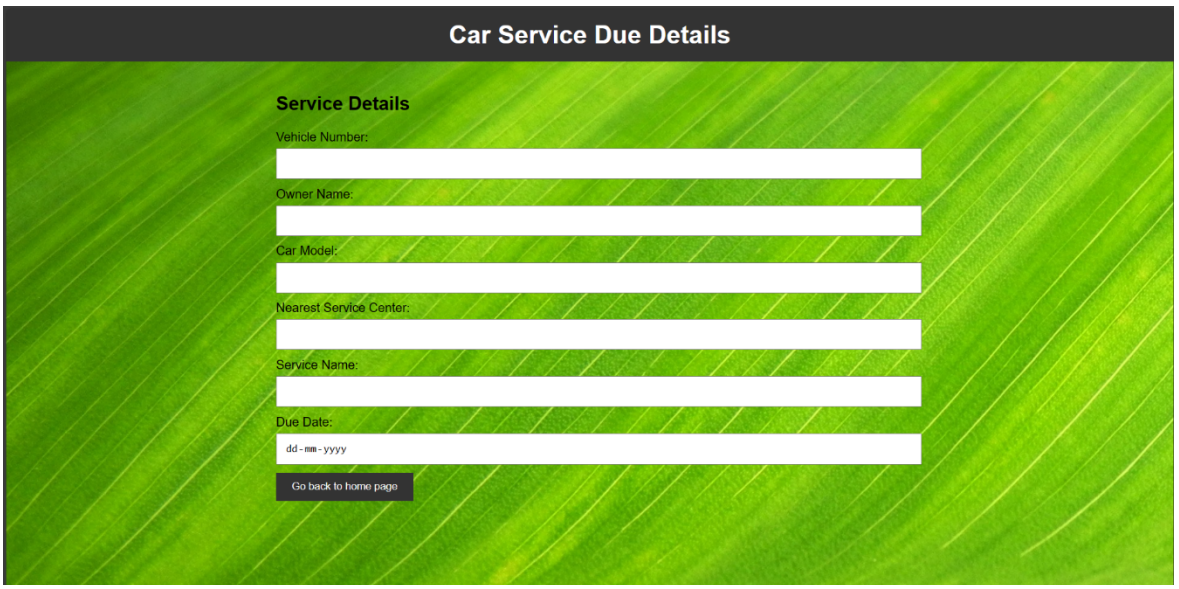
LOGO

SIGN IN & SIGN UP

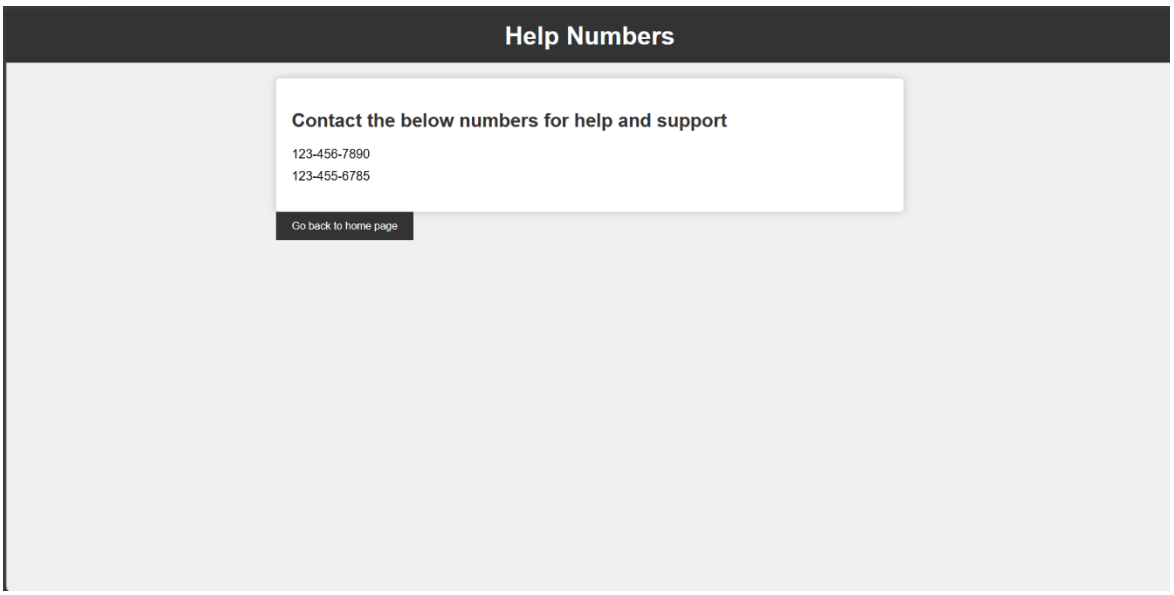
HOME PAGE



SERVICE DETAILS PAGE



HELPLINE PAGE



5. TESTING

5.1 TEST STRATEGIES

A strategy for software testing integrates software test cases into a series of well-planned steps that result in a successful construction of software. Software testing is a broader topic for what is referred to as verification and validation. Verification refers to the set of activities that ensure that the software that has been built is traceable to customer's requirements.

Testing Steps:

- Unit testing

  Unit testing means testing each unit of design separately. Here in this project, we tested each unit of design separately and verified that there were no errors. For this testing each design is run individually After executing each page if there any error occurs the correction mechanism is done instantly.

- Integration testing

In our project we combine many units of modules to form a sub system. These subsystems are then tested. This is done to see whether the modules can be integrated properly. Based on integration testing some necessary changes were made to the design.

- System testing

  System testing is done to ensure the entire software performs its function as intended. In our project all the tested subsystems were integrated and tested for all the possible ranges of coupling variables, based on the testing errors that were rectified for pleasant working experience.

- Acceptance testing

  The goal of acceptance testing is to see if the software meets all the requirements as needed. The testing was performed by data of all the users of the system. It was found that the software meets all the requirements as needed.

5.2 TEST CASES AND REPORTS

Table 1. Login Module Test Case

Sr no	**Login module (1)**		
1.1	**Input:** valid details completely	**Output:** successfully logged in	The user is logged into their account and redirected to the dashboard
1.2	**Input:** incorrect or invalid details	**Output:** Enter valid username/password	The user is prompted to check their username and password.

Table 2. User Registration Module Test Case

Sr no	**User Registration module (2)**		
2.1	**Input:** valid details completely	**Output:** successfully registered	The user is registered into the database, redirected to search page
2.2	**Input:** input with certain fields empty	**Output:** Fill all the fields of form	The user is prompted to fill all the required fields.

2.3	**Input:** Enters invalid data in certain fields.	**Output:** Enter valid details in the particular field	The user is prompted to enter valid details in the particular field that is incorrect.

6. CONCLUSION

In summary, the Green Commute project is a transformative initiative focused on empowering individuals to combat pollution stemming from personal vehicles. By addressing the shortcomings of existing pollution detection systems through real-time monitoring, accessible interfaces, personalized insights, and service alerts, Green Commute offers a holistic solution to pollution control.

It not only encourages eco-friendly driving habits but also elevates public awareness, driving positive environmental change. Green Commute is poised to make a significant contribution to environmental consciousness and sustainability.

The project's dedication and innovation hold the promise of fostering a cleaner and healthier environment, paving the way for a greener future. By providing individuals with actionable data and insights, Green Commute aligns with the broader goals of promoting responsible actions and reducing emissions. With its potential to create a significant impact, the project exemplifies the potential of technology to address environmental challenges, and strives to enhance community safety through data-driven transparency and accessibility. Together, these initiatives contribute to building safer, more informed, and sustainable communities.

7. REFERENCES

8. APPENDIX A