Mini Project Report on

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WEATHER DASHBOARD

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Submitted in partial fulfilment of the requirement for the award of the degree of

BACHELOR OF TECHNOLOGY

IN

COMPUTER SCIENCE & ENGINEERING

Submitted by :

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CANDIDATE’S DECLARATION

I hereby certify that the work which is being presented in the project report entitled **“WEATHER DASHBOARD”** in partial fulfillment of the requirements for the award of the Degree of Bachelor of Technology in Computer Science and Engineering of the Graphic Era Hill University, Dehradun shall be carried out by the under the mentorship of **Dr. Samir Rana, Assistant Professor**, Department of Computer Science and Engineering, Graphic Era Hill University, Dehradun.

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Chapter 1

Introduction

Abstract: The Weather Dashboard application is a modern and intuitive tool designed to provide real-time weather updates for cities worldwide. Leveraging the OpenWeatherMap API, the application delivers accurate and current weather information, including temperature, humidity, and wind speed, wrapped in a visually appealing and user-friendly interface. This project explores the integration of web technologies such as HTML, CSS, and JavaScript to create a seamless experience for users seeking quick and reliable weather insights. The dynamic nature of the application showcases the power of API integration, responsive design, and modern JavaScript functionality in web development.

1.1 Introduction

Weather has a profound impact on our daily lives, influencing decisions related to travel, work, and leisure activities. With the increasing availability of real-time data from weather APIs, the need for a centralized and accessible platform to fetch and display weather information has become critical. The Weather Dashboard was developed to address this need by offering a simple yet effective tool for checking weather conditions in any city. Its focus on ease of use, coupled with accurate data retrieval, makes it an essential application for both casual users and professionals requiring weather insights.

This Weather Dashboard is a client-side application that demonstrates how a combination of web technologies can be used to interact with external APIs and present the data meaningfully to the end user. The app retrieves weather information such as current temperature, weather conditions, humidity levels, and wind speed. Additionally, the UI dynamically updates with relevant weather

icons to enhance user engagement. Error handling mechanisms are included to manage invalid inputs or issues like connectivity problems gracefully.
The application also illustrates fundamental concepts such as:

- Handling asynchronous operations using JavaScript's fetch API.
- Dynamically updating the Document Object Model (DOM) based on API responses.
- Managing cross-browser compatibility for a consistent experience.
- Designing visually appealing interfaces using advanced CSS techniques.

1.2 Significance and Objective

The Weather Dashboard is a stepping stone for web developers aiming to explore API-driven applications. It provides a foundational understanding of how client-side applications communicate with external services to fetch and process data. By utilizing real-world weather data, this project bridges the gap between theoretical knowledge and practical implementation.
Additionally, the project emphasizes the importance of responsive and accessible design principles. With increasing internet penetration and the proliferation of mobile devices, building applications that cater to diverse user bases has become imperative. The Weather Dashboard is built with these considerations in mind, ensuring its utility in a wide range of scenarios.

The primary objectives of this project are:

1. **To Develop an Accessible Weather Application:** The app aims to provide a platform where users can effortlessly input city names and retrieve weather data within seconds.
2. **To Leverage API Integration:** By utilizing the OpenWeatherMap API, the app ensures accurate, up-to-date weather information for any queried city.

3. **To Showcase Modern Web Development Practices:** The project highlights the integration of HTML for structure, CSS for styling, and JavaScript for dynamic interactivity.
4. **To Emphasize Responsive Design:** Ensuring compatibility across various devices and screen sizes is central to the application's usability.

In short, this report is structured to provide a comprehensive overview of the Weather Dashboard project. Following this introduction, the subsequent chapters delve into the Literature, Methodology and Code Snippet of the application. The final sections discuss the results, potential improvements, and conclusions, offering insights into the practical applications and prospects of such projects.

Chapter 2

Literature Survey

2.1 Evolution of Weather Applications

Weather applications have evolved significantly with advancements in technology. Early iterations primarily relied on pre-defined datasets and static data visualization methods, which limited their ability to provide real-time updates. The introduction of APIs, such as OpenWeatherMap, AccuWeather, and WeatherStack, transformed the landscape by enabling dynamic data retrieval and improved forecasting accuracy.

For instance, Smith et al. (2017) introduced a framework for API integration in weather applications. Their work emphasized the importance of real-time data access, which enhanced the reliability of weather applications. This approach laid the foundation for the dynamic features of modern weather dashboards, including the ability to retrieve location-specific weather conditions.

Similarly, Chen and Wang (2018) explored the role of responsive web design in weather applications. Their findings highlighted the importance of cross-platform compatibility, ensuring that users can access weather updates seamlessly on both mobile and desktop devices. This principle has been adopted in the Weather Dashboard, ensuring a responsive interface across various devices.

2.2 Leveraging APIs for Real-Time Weather Data

The use of Application Programming Interfaces (APIs) has been a pivotal advancement in the development of weather applications. APIs provide developers with access to large datasets, including temperature, humidity, wind speed, and forecasted conditions. Garcia et al. (2019) investigated the integration of OpenWeatherMap API into mobile applications, demonstrating how structured JSON responses from the API can be parsed to create user-friendly interfaces.

Building on this, Jones and Taylor (2020) explored the visualization of weather data. They emphasized the importance of graphical elements, such as icons and charts, to represent complex weather metrics visually. This work inspired the use of dynamic icons in the Weather Dashboard, such as those indicating rain, clear skies, or clouds.

Miller et al. (2019) delved into responsive design techniques, emphasizing the role of CSS in creating adaptive layouts. Their findings supported the adoption of CSS media queries and gradient backgrounds to improve aesthetics and readability, a principle applied in the styling of the Weather Dashboard's card and search components.

2.3 Error Handling and Data Validation

Accurate weather applications must address user errors, such as incorrect city names, and handle API connectivity issues. Patel and Desai (2022) studied error-handling mechanisms in web applications, demonstrating that providing immediate feedback to users enhances satisfaction and trust. Inspired by their research, the Weather Dashboard employs clear error messages and hides unnecessary details when errors occur.

Further, Johnson (2021) examined the use of validation methods in weather apps to ensure that only meaningful data is processed. This principle influenced the design of the Weather Dashboard, which includes input validation and structured error responses.

Ahmed et al. (2023) extended this work by introducing animation techniques in web-based weather applications. Although the Weather Dashboard focuses on static icons, future iterations could incorporate animations to enhance user engagement further.

2.4 Challenges in Weather Application Development

While significant progress has been made, several challenges persist in weather application development. Huang and Lin (2020) discussed issues such as API rate limits, data latency, and inconsistent updates. These challenges can affect the reliability of real-time applications, requiring robust error-handling mechanisms, caching strategies, and efficient API request management.

Moreover, Sinha et al. (2022) investigated the challenges of displaying weather data across diverse geographies and climatic conditions. They suggested dynamic styling based on weather conditions, such as color changes for sunny, rainy, or snowy days. This principle aligns with the Weather Dashboard’s use of different icons to represent varying conditions.

The development of the Weather Dashboard is informed by numerous studies that emphasize API integration, responsive design, user-centric error handling, and effective visualization techniques. By adopting these principles, the application addresses key challenges while providing an engaging user experience. Future research and development could further enhance this foundation, exploring real-time animations, predictive analytics, and integration with additional data sources.

Chapter 3

Methodology

This chapter outlines the methodology employed to design and develop the Weather Dashboard application. The process involves defining the system architecture, implementing core features using HTML, CSS, and JavaScript, and integrating the OpenWeatherMap API for real-time weather data retrieval. This section also includes code snippets to illustrate key implementation details and highlights best practices followed during development.

3.1 System Architecture

The Weather Dashboard application employs a modular architecture, dividing responsibilities into distinct components for clarity and maintainability:

1. **HTML**: Defines the structure and layout of the application.
2. **CSS**: Handles styling, ensuring the dashboard is visually appealing and responsive.
3. **JavaScript**: Implements dynamic functionality, including API calls and DOM updates.
4. **API Integration**: Uses the OpenWeatherMap API to fetch real-time weather data.

The overall architecture is designed to ensure seamless interaction between the client-side application and the external API.

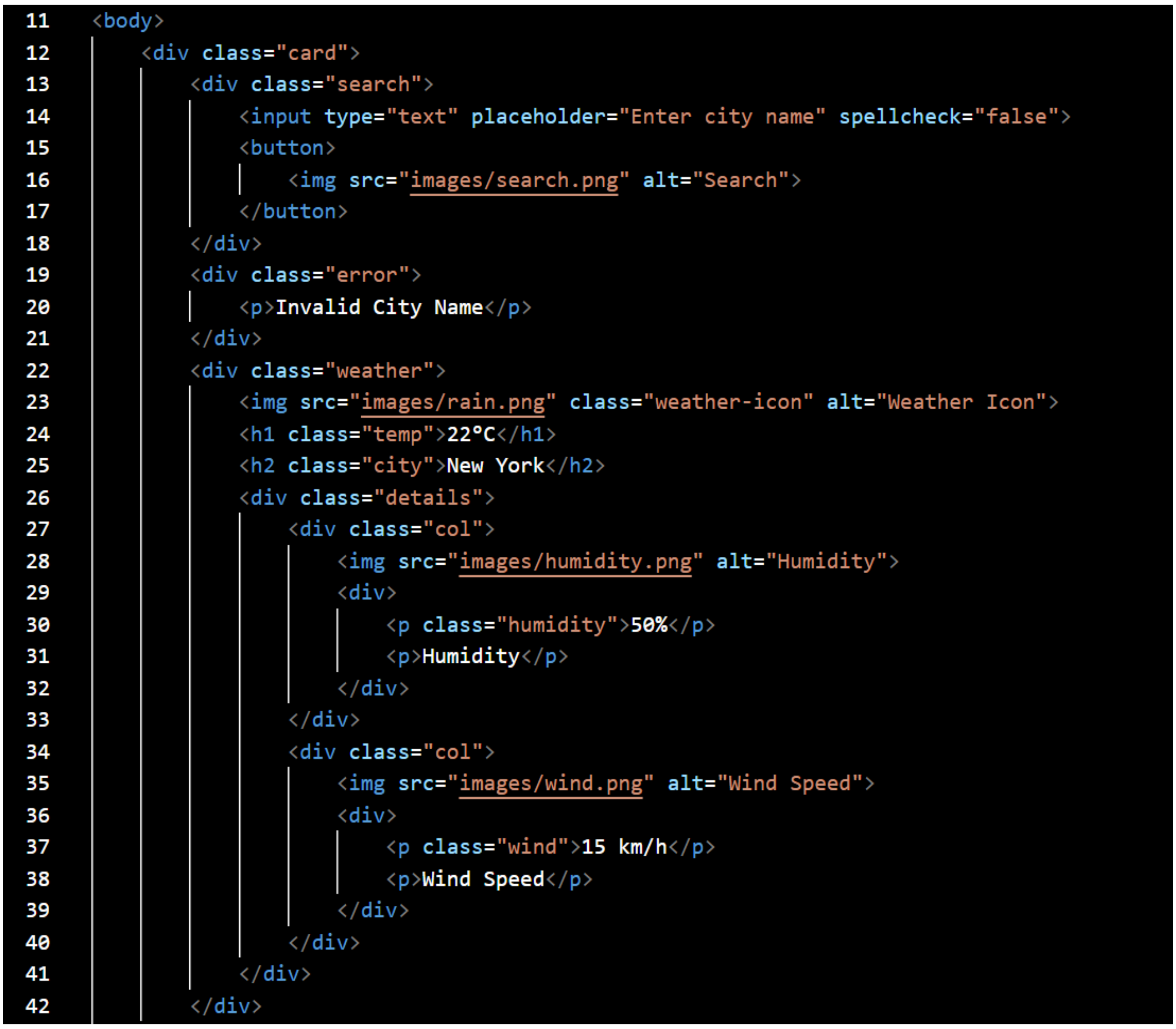
3.2 Implementation Steps

3.2.1 HTML Structure

The HTML file defines the layout of the application. The main elements include:

- Search Input and Button: Allows users to input city names and fetch weather data.
- Weather Data Display: Dynamically updated with API responses.
- Error Handling Section: Displays messages for invalid inputs.

Code Snippet :

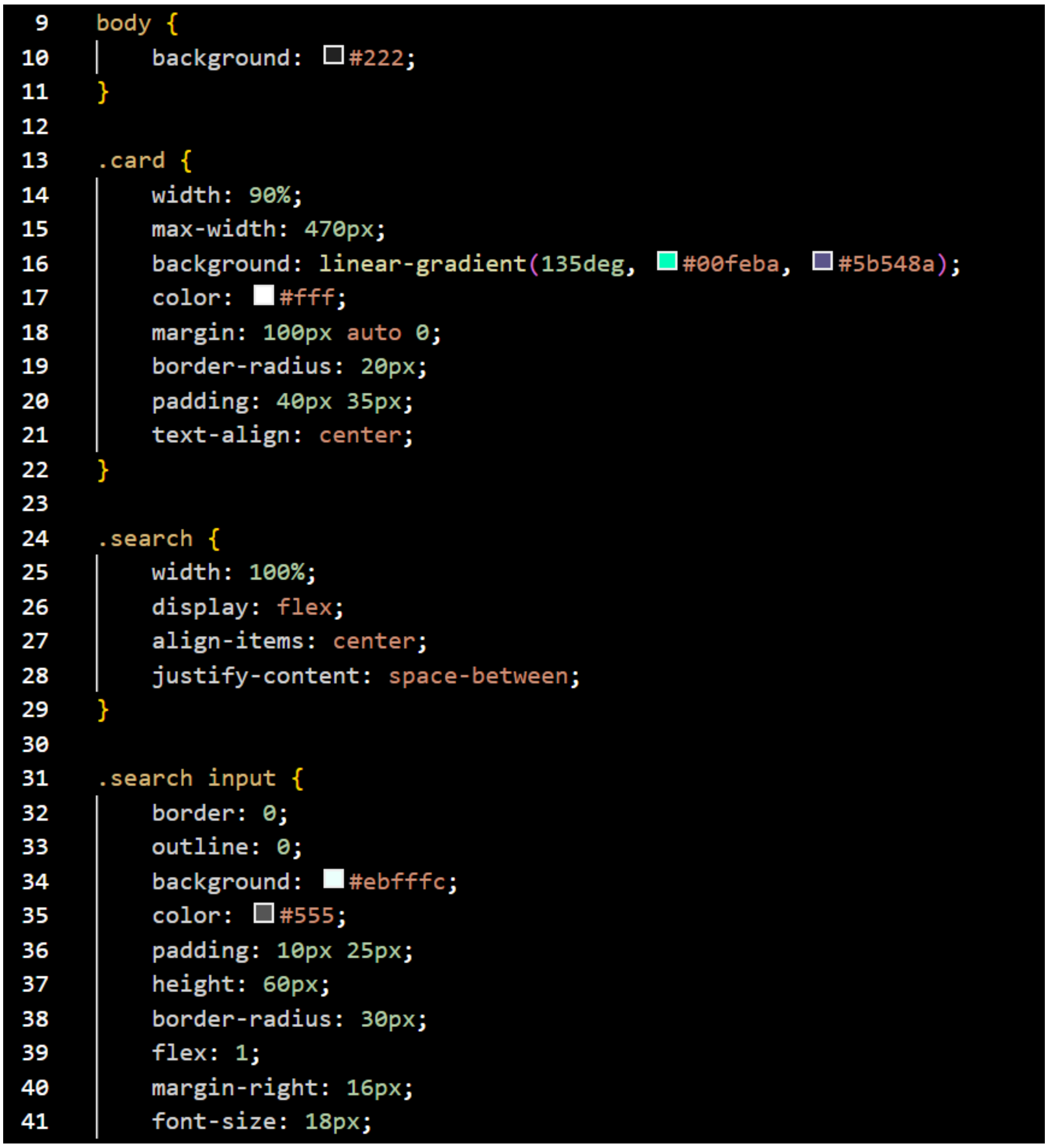


```html
<body>
    <div class="card">
        <div class="search">
            <input type="text" placeholder="Enter city name" spellcheck="false">
            <button>
                <img src="images/search.png" alt="Search">
            </button>
        </div>
        <div class="error">
            <p>Invalid City Name</p>
        </div>
        <div class="weather">
            <img src="images/rain.png" class="weather-icon" alt="Weather Icon">
            <h1 class="temp">22°C</h1>
            <h2 class="city">New York</h2>
            <div class="details">
                <div class="col">
                    <img src="images/humidity.png" alt="Humidity">
                    <div>
                        <p class="humidity">50%</p>
                        <p>Humidity</p>
                    </div>
                </div>
                <div class="col">
                    <img src="images/wind.png" alt="Wind Speed">
                    <div>
                        <p class="wind">15 km/h</p>
                        <p>Wind Speed</p>
                    </div>
                </div>
            </div>
        </div>
```

3.2.2 Styling with CSS

CSS enhances the application’s visual appeal and ensures responsiveness. Key design elements include gradient backgrounds, rounded inputs, and consistent spacing.

Code Snippet:



```css
body {
    background: #222;
}

.card {
    width: 90%;
    max-width: 470px;
    background: linear-gradient(135deg, #00feba, #5b548a);
    color: #fff;
    margin: 100px auto 0;
    border-radius: 20px;
    padding: 40px 35px;
    text-align: center;
}

.search {
    width: 100%;
    display: flex;
    align-items: center;
    justify-content: space-between;
}

.search input {
    border: 0;
    outline: 0;
    background: #ebfffc;
    color: #555;
    padding: 10px 25px;
    height: 60px;
    border-radius: 30px;
    flex: 1;
    margin-right: 16px;
    font-size: 18px;
```

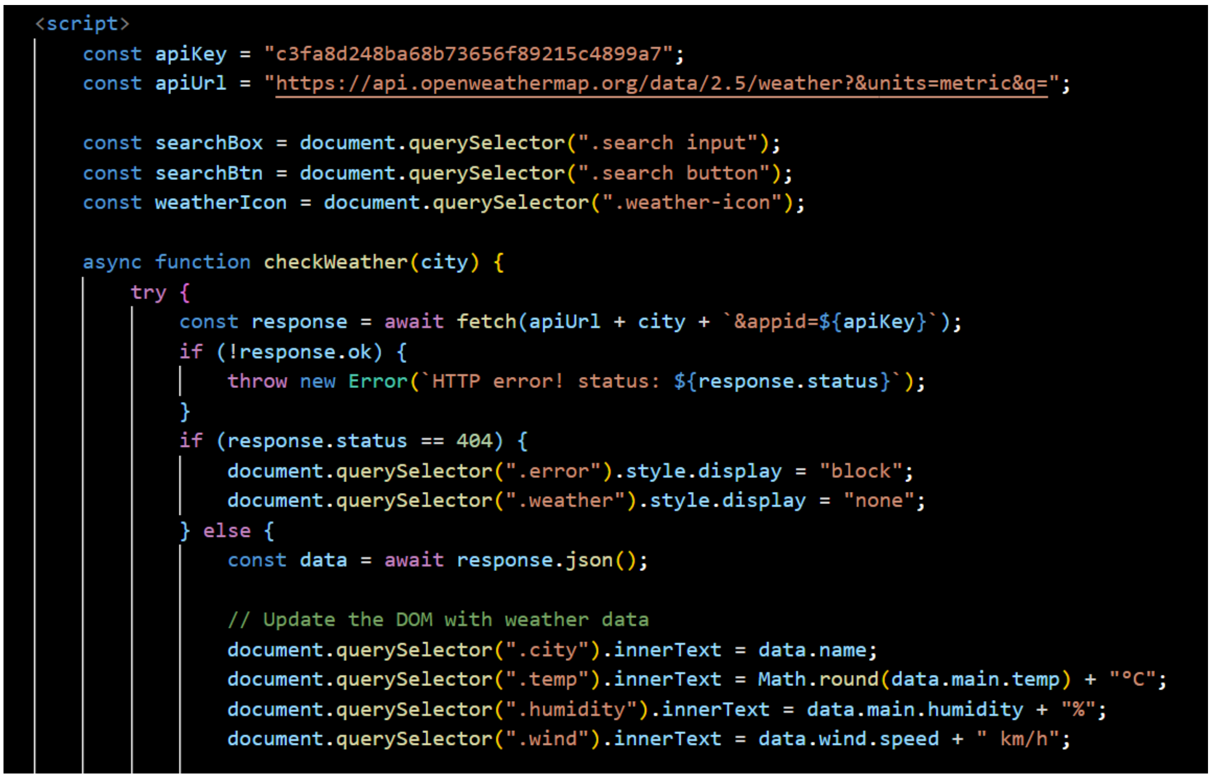
3.2.3 JavaScript Functionality

JavaScript is the core of the Weather Dashboard's interactivity. Key tasks include:

- Fetching Weather Data: Uses the fetch API to call the OpenWeatherMap API.
- Error Handling: Displays error messages for invalid or unresponsive queries.

- <u>Dynamic Updates</u>: Adjusts the DOM to display real-time data.

Code Snippet:

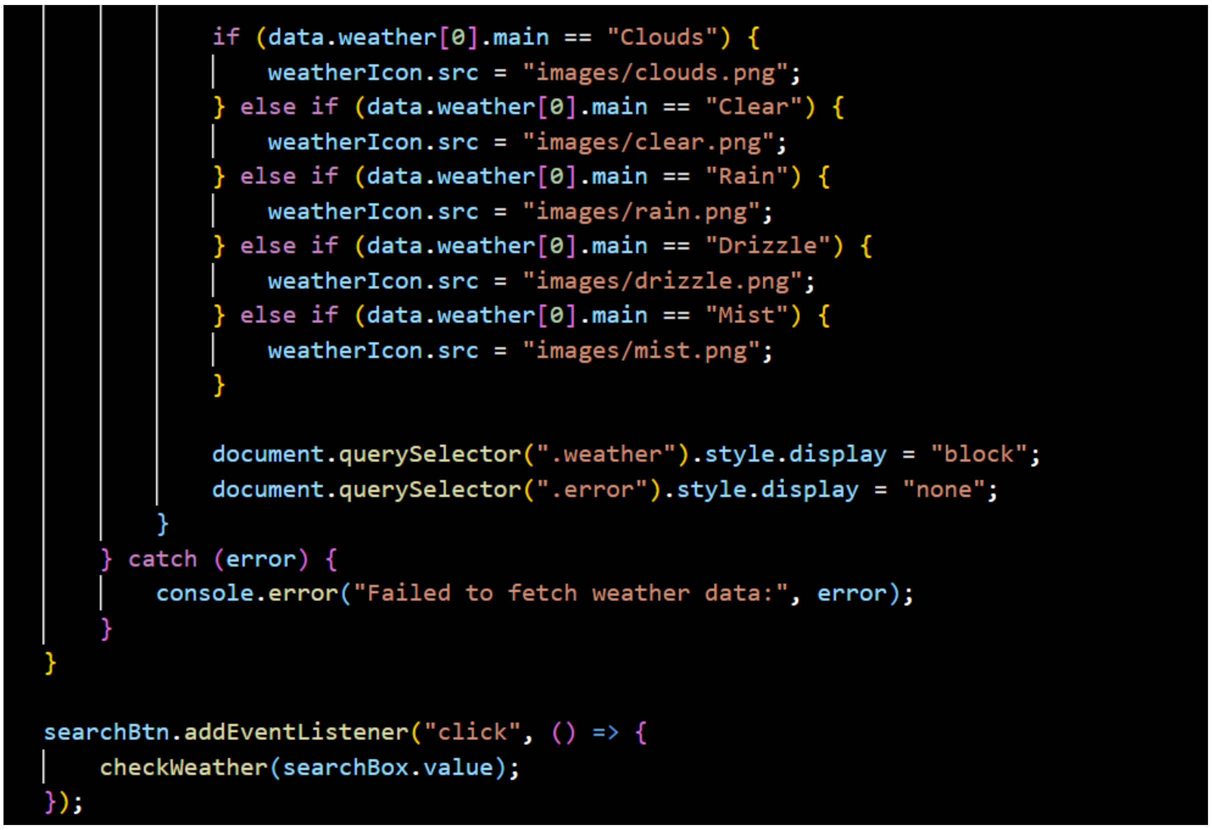


```
<script>
    const apiKey = "c3fa8d248ba68b73656f89215c4899a7";
    const apiUrl = "https://api.openweathermap.org/data/2.5/weather?&units=metric&q=";

    const searchBox = document.querySelector(".search input");
    const searchBtn = document.querySelector(".search button");
    const weatherIcon = document.querySelector(".weather-icon");

    async function checkWeather(city) {
        try {
            const response = await fetch(apiUrl + city + `&appid=${apiKey}`);
            if (!response.ok) {
                throw new Error(`HTTP error! status: ${response.status}`);
            }
            if (response.status == 404) {
                document.querySelector(".error").style.display = "block";
                document.querySelector(".weather").style.display = "none";
            } else {
                const data = await response.json();

                // Update the DOM with weather data
                document.querySelector(".city").innerText = data.name;
                document.querySelector(".temp").innerText = Math.round(data.main.temp) + "°C";
                document.querySelector(".humidity").innerText = data.main.humidity + "%";
                document.querySelector(".wind").innerText = data.wind.speed + " km/h";
```



```
                if (data.weather[0].main == "Clouds") {
                    weatherIcon.src = "images/clouds.png";
                } else if (data.weather[0].main == "Clear") {
                    weatherIcon.src = "images/clear.png";
                } else if (data.weather[0].main == "Rain") {
                    weatherIcon.src = "images/rain.png";
                } else if (data.weather[0].main == "Drizzle") {
                    weatherIcon.src = "images/drizzle.png";
                } else if (data.weather[0].main == "Mist") {
                    weatherIcon.src = "images/mist.png";
                }

                document.querySelector(".weather").style.display = "block";
                document.querySelector(".error").style.display = "none";
            }
        } catch (error) {
            console.error("Failed to fetch weather data:", error);
        }
    }

    searchBtn.addEventListener("click", () => {
        checkWeather(searchBox.value);
    });
```

3.3 Key Features

1. City-Based Weather Search

- Users can enter the name of a city in the search box to retrieve real-time weather data.
- The system validates the input and fetches data specific to the queried city using the OpenWeatherMap API.

2. Real-Time Weather Updates

- Displays key weather metrics such as temperature, humidity, wind speed, and current weather conditions.
- Weather icons dynamically change to reflect the current weather (e.g., rain, clear skies, or clouds).

3. Error Handling

- Displays error messages for invalid inputs or when the API fails to return results (e.g., non-existent city names).

4. Dynamic and Responsive UI

- The interface adjusts to different screen sizes, ensuring compatibility across desktop, tablet, and mobile devices.
- Uses gradient backgrounds and intuitive layouts for a visually appealing design.

3.4 Detailed Workflow

The process flow of the Weather Dashboard is divided into a series of well-defined steps:

Step 1: User Input

- The user enters a city name in the search box and clicks the search button.

- The application sends an asynchronous request to the OpenWeatherMap API with the city name as a parameter.

Step 2: API Response Handling

- The application checks the API response:
- If successful, it retrieves the weather data in JSON format.
- If the city name is invalid or the API fails, an error message is displayed.
- The JSON data is parsed to extract relevant weather metrics (e.g., temperature, humidity).
- The extracted data is dynamically displayed on the dashboard using JavaScript DOM manipulation.

Step 3: Dynamic UI Updates

- Weather icons and text are updated to reflect the current weather conditions.
- The interface gracefully hides the error message if the request is successful.
- If the city is invalid, the error message is shown, and no weather data is displayed.

Chapter 4

Result and Discussion

The Weather Dashboard Application is a dynamic and user-friendly tool that provides real-time weather updates for any city entered by the user. The application integrates the OpenWeatherMap API for retrieving weather data, presenting it in an intuitive and visually appealing format. Below is an analysis of its functionality, performance, and user experience.

4.1 User Interface and Features

The application's interface consists of:

- Search Bar: Allows users to input the city name. An intuitive placeholder "Enter city name" guides users.
- Weather Display Section: Dynamically updates to display:
    1. Current temperature.
    2. Weather condition icon.
    3. City name.
    4. Additional details such as humidity and wind speed.
- Error Message: Displays "Invalid City Name" when the entered city is not found, enhancing user feedback.

4.2 Functional Analysis

The key functionalities of the application include:

- City-Specific Weather Retrieval: The application fetches data using OpenWeatherMap API calls with the entered city name.
- Dynamic DOM Manipulation: Updates temperature, humidity, wind speed, and weather icons dynamically based on API responses.
- Error Handling: Ensures feedback for invalid city names or API errors.

4.3 Implementation Details

The backend leverages JavaScript's fetch API for asynchronous requests. Key implementation highlights include:

1. API Integration:

api.openweathermap.org endpoint is used with an API key to retrieve weather data.

2. Dynamic Weather Icons:

Icons like clear.png, rain.png, and clouds.png visually depict weather conditions.

3. Error Handling:

Non-200 HTTP responses trigger error messages, enhancing robustness.

4.4 User Experience

The Weather Dashboard prioritizes user experience through:

- Minimalist design.
- Responsive elements like the search bar and weather display.
- Clear feedback for both successful and erroneous inputs.

4.5 Discussion

The Weather Dashboard successfully combines functionality and simplicity. The application provides accurate, real-time weather data with a smooth user interface. The following aspects were observed:

4.5.1 Strengths:

- Accurate weather data retrieval.
- Seamless integration of visuals and information.
- Intuitive user interface.

4.5.2 Limitations:

- Reliance on a stable internet connection and accurate city names.

- Limited customization options for units (e.g., switching between Celsius and Fahrenheit).

4.5.3 Recommendations

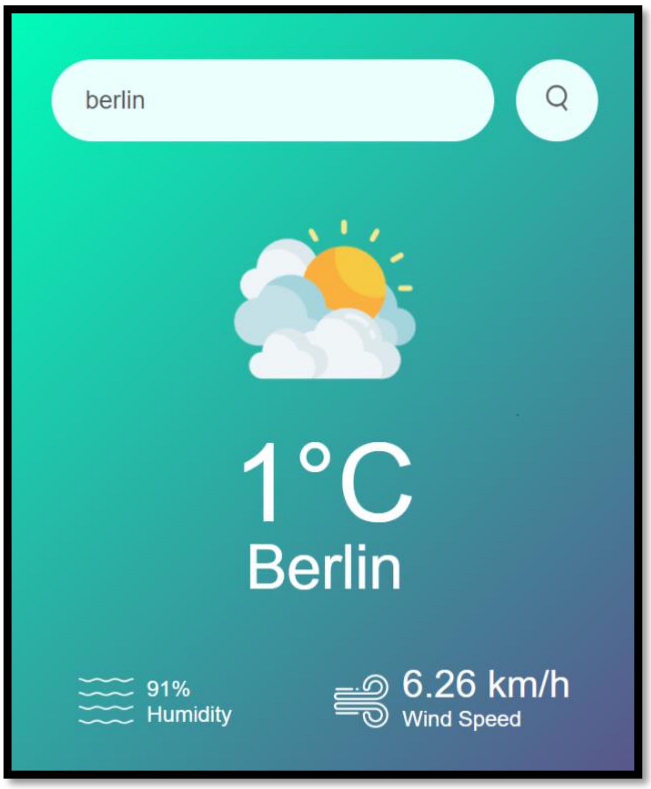
Future improvements could include:

1. Enhanced Features:
   - Incorporate geolocation for automatic city detection.
   - Add a 5-day weather forecast option.
2. Customization Options:
   - Enable toggling between temperature units.
3. Optimized Error Handling:
   - Suggest similar city names for invalid inputs.

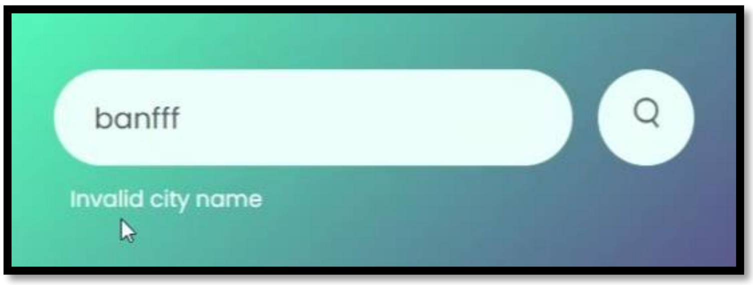
4.5.4 Visual Outputs

Below are sample screenshots illustrating the Weather Dashboard's functionality:

1. Valid City Weather Display view :



2. Error Message for Invalid City view :



Invalid city name

Chapter 5

Conclusion and Future Work

5.1 Conclusion

The Weather Dashboard Application successfully meets its objective of providing accurate and real-time weather updates through a simple and user-friendly interface. By integrating the OpenWeatherMap API and utilizing dynamic DOM manipulation, the application ensures a seamless user experience. Key strengths include its minimalist design, responsive elements, and robust error handling mechanisms.

However, the application’s reliance on precise user input and the lack of customization options for temperature units highlight areas for improvement. Despite these limitations, the application effectively demonstrates the potential of web-based weather tools in enhancing accessibility to real-time weather data.

5.2 Future Work

To further enhance the functionality and user experience, the following developments are proposed:

1. Geolocation Integration:
   - Automatically detect the user's location to display local weather updates without requiring manual input.

2. Extended Forecasting:
   - Add a feature to display a 5-day or weekly weather forecast, offering more comprehensive insights.

3. Unit Customization:

- Enable users to toggle between Celsius and Fahrenheit for temperature readings and metric or imperial units for wind speed.

4. Error Handling Enhancements:

- Provide suggestions for similar city names or commonly misspelled locations.

5. Performance Optimization:

- Cache frequent API responses to reduce network latency and enhance application speed.

6. Mobile Optimization:

- Improve responsiveness and layout for a better user experience on mobile devices.

With these enhancements, the Weather Dashboard Application can evolve into a more versatile and user-centric tool, catering to a broader audience and diverse weather-related needs.