**Middleware Technologies**

**CSIWZG524**

**Assignment 1.1**

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**🌤️ Weather Forecast Application**

A sleek, responsive weather app that provides real-time weather updates using the **OpenWeatherMap API**.

* **GitHub Repository Link:-**

<https://github.com/2021wa86905/Weather-Forecast-Application.git>

* **Application Link:-**

<https://2021wa86905.github.io/Weather-Forecast-Application/>

**✨ Features**

* 🔍 **Search for Any City**: Get instant weather details by entering a city name.
* 🌈 **Dynamic Weather Icons**: Displays weather-specific icons (e.g., 🌧️ Rain, ☀️ Clear, 🌫️ Mist).
* 🚫 **Error Handling**: Informs users when an invalid city name is entered.
* 📱 **Responsive Design**: Works beautifully across devices.

**🛠️ Technologies Used**

* **Frontend**: HTML5, CSS3
* **Styling**: Modern CSS techniques, including gradients and responsiveness
* **Programming**: JavaScript (ES6+ features)
* **API**: OpenWeatherMap API

**🚀 How to Run the Project**

Follow these steps to get the app up and running on your local machine:

**1️⃣ Clone the Repository**

**2️⃣ Open the Project**

* Navigate to the project folder.
* Open the index.html file in your browser.

**3️⃣ Configure the API Key**

* Get your free API key from OpenWeatherMap.
* Replace the placeholder api key in the index.html file:

**🌟 How It Works**

1. Type a city name in the input field.
2. Click the **Search** button to fetch the weather data.
3. View the following details:
   * 🌡️ **Temperature**: Current temperature in °C
   * 💧 **Humidity**: Atmospheric humidity in %
   * 🌬️ **Wind Speed**: Wind velocity in km/h
   * ☁️ **Weather Icon**: Represents the current weather condition
4. Invalid city names display a friendly error message.

**📂 Project Structure**

📁 weather-app/

├── index.html # Main structure and JavaScript functionality

├── style.css # UI styling

└── images/ # Weather condition icons

**📖 Learning Points**

* **Asynchronous JavaScript**: Used async/await for API calls.
* **Error Handling**: Gracefully handled incorrect inputs with conditionals.
* **Dynamic DOM Updates**: Utilized JavaScript to update elements dynamically.
* **CSS Styling**: Experimented with gradients and flexible layouts.

**🔮 Future Enhancements**

* 🗓️ Add a **7-day weather forecast** feature.
* 📍 Integrate **geolocation** to fetch weather data automatically.
* 💾 Allow users to **save their favorite cities**.

**🌐 Web Services Architecture Overview**

The application uses a **client-server architecture** where:

* The **frontend** (HTML/CSS/JavaScript) runs in the browser.
* The **OpenWeatherMap API** acts as the backend service providing real-time weather data.

**📈 Scalability Considerations**

Scalability refers to the system's ability to handle increased load without performance degradation.

**🔹 Current Architecture**

* The app is **client-heavy** with minimal backend logic.
* All weather data is fetched directly from the **OpenWeatherMap API**.

**🔹 Challenges**

* **API Rate Limits**: OpenWeatherMap imposes limits on free-tier API usage.
* **No Backend Caching**: Every request hits the API, which can become costly and slow under high usage.

**🔹 Improvements**

* **Introduce a Backend Layer**:
  + Use Node.js/Express or Python Flask to act as a proxy.
  + Implement **caching** (e.g., Redis) to store frequent queries.
* **Use CDN for Static Assets**:
  + Host HTML/CSS/JS/images on a CDN to reduce load times globally.
* **Horizontal Scaling**:
  + Deploy the backend on scalable platforms like AWS Lambda, Azure Functions, or Kubernetes.

**🛡️ Fault Tolerance Considerations**

Fault tolerance ensures the app continues to function even when parts of the system fail.

**🔹 Current Architecture**

* Minimal error handling is implemented (e.g., invalid city name).
* No retry mechanism or fallback service.

**🔹 Challenges**

* **API Downtime**: If OpenWeatherMap is down, the app fails.
* **Network Failures**: No retry logic for transient network issues.

**🔹 Improvements**

* **Retry Logic**:
  + Implement exponential backoff for failed API calls.
* **Fallback Mechanism**:
  + Use a secondary weather API (e.g., WeatherAPI, AccuWeather) as a backup.
* **Graceful Degradation**:
  + Show cached or last-known data if the API is unreachable.
* **Monitoring & Alerts**:
  + Use tools like Sentry or LogRocket to monitor frontend errors.

**⚡ Performance Considerations**

Performance ensures the app responds quickly and efficiently.

**🔹 Current Architecture**

* Lightweight frontend with async API calls.
* No backend processing or optimization.

**🔹 Challenges**

* **Cold Start**: First-time API calls may be slow.
* **Unoptimized DOM Updates**: All DOM elements are updated even if only one value changes.

**🔹 Improvements**

* **Lazy Loading Icons**:
  + Load weather icons only when needed.
* **Minify & Bundle Assets**:
  + Use tools like Webpack or Parcel to reduce file sizes.
* **Efficient DOM Manipulation**:
  + Use frameworks like React or Vue for better state management.
* **Service Workers**:
  + Cache static assets and even API responses for offline support.

**🧠 Summary Table**

| **Aspect** | **Current State** | **Suggested Enhancements** |
| --- | --- | --- |
| **Scalability** | Direct API calls, no caching | Add backend with caching, use CDN, horizontal scaling |
| **Fault Tolerance** | Basic error handling only | Retry logic, fallback APIs, graceful degradation |
| **Performance** | Async JS, no optimization | Lazy loading, minification, service workers |

**INDEX code –[HTML]**

<!DOCTYPE html>

<html lang="en">

<head>

<meta charset="UTF-8">

<meta name="viewport" content="width=device-width, initial-scale=1.0">

<title>Weather app - Hari Shankar</title>

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

</head>

<body>

<div class="card">

<div class="search">

<input type="text" placeholder="enter city name" spellcheck="false">

<button><img src="images/search.png"></button>

</div>

<div class="error">

<p>invalid city name</p>

</div>

<div class="weather">

<img src="images/rain.png" class="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">

<div>

<p class="humidity">50%</p>

<p>humidity</p>

</div>

</div>

<div class="col">

<img src="images/wind.png">

<div>

<p class="wind">15km/h</p>

<p>wind speed</p>

</div>

</div>

</div>

</div>

</div>

<script>

const apikey = "17979f41718e81f87596320b69c4ea01";

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){

const response = await fetch(apiurl + city +`&appid=${apikey}`);

if(response.status == 404){

document.querySelector(".error").style.display = "block";

document.querySelector(".weather").style.display = "none";

}else{

var data = await response.json();

document.querySelector(".city").innerHTML= data.name;

document.querySelector(".temp").innerHTML= Math.round(data.main.temp) +"°c";

document.querySelector(".humidity").innerHTML= data.main.humidity +"%";

document.querySelector(".wind").innerHTML= 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";

}

}

searchBtn.addEventListener("click", ()=>{

checkweather(searchBox.value);

})

</script>

</body>

</html>

**CSS code [Java script]**

\*{

margin: 0;

padding: 0;

font-family: 'poppins', sans-serif;

box-sizing: border-box;

}

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;

}

.search button{

border: 0;

outline: 0;

background: #ebfffc;

border-radius: 50%;

width: 60px;

height: 60px;

cursor: pointer;

}

.search button img{

width: 16px;

}

.weather-icon{

width: 170px;

margin-top: 30px;

}

.weather h1{

font-size: 80px;

font-weight: 500;

}

.weather h2{

font-size: 45px;

font-weight: 400;

margin-top: -10px;

}

.details{

display: flex;

align-items: center;

justify-content: space-between;

padding: 0 20px;

margin-top: 50px;

}

.col{

display: flex;

align-items: center;

text-align: left;

}

.col img{

width: 40px;

margin-right: 10px;

}

.humidity, .wind{

font-size: 28px;

margin-top: -6px;

}

.weather{

display: none;

}

.error{

text-align: left;

margin-left: 10px;

font-size: 14px;

margin-top: 10px;

display: none;

}