Model Program Book

Designed & Developed by

APSCHE
ANDHRA PRADESH STATE COUNCIL OF HIGHER EDUCATION
జిజ్ఞాస కార్యవాహిక

SMART INTERNSHIP PROJECT REPORT ON

WEATHER.IO: WEATHER APP

Submitted in partial fulfilments of the requirements awarded for the degree

BACHELOR OF TECHNOLOGY

In

ELECTRONICS AND COMMUNICATION ENGINEERING

Submitted by

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STUDENT PERFORMANCE ANALYSIS

A PROJECT REPORT

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CERTIFICATE

This is to certify that the Summer Internship project work entitled **WEATHER-IO: WEATHER APP** is being submitted for partial fulfillment of BACHELOR OF TECHNOLOGY in Electronics and Communication Engineering to **GIETEngineering College**, Rajahmundry, A.P. affiliated to the JNTUK, Kakinada, is Bonafide work done by NAME: **B. BEULAH MADHURI** bearing Roll. No: **20T91A0406**, NAME: **K. LOKESH DORA** bearing Roll. No: **20HK1A0402**, NAME: **A. BALAMURALI KRISHNA** bearing Roll.No:**20T91A0401**, NAME: **V. PRAMEELA** bearing Roll.No:**20T95A0409**, during the academic year 2023-2024 and it has been found suitable for acceptance according to the requirement of university. These results embodied in the community service project report have not been submitted to any other university or institute for the award of degree.

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ABSTRACT

Weather prediction is the application of science and technology to predict the state of the atmosphere for a given location. Here this system will predict weather based on parameters such as temperature, humidity and wind. This system is a web application with effective graphical user interface. To predict the future's weather condition, the variation in the conditions in past years must be utilized. The probability that it will match within the span of adjacent fortnight of previous year is very high. We have proposed the use of linear regression for weather prediction system with parameters such as temperature, humidity and wind. It will predict weather based on previous record therefore this prediction will prove reliable.

Keywords: Weather forecast, Weather conditions, Temperature, Wind speed, Humidity

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1.INTRODUCTION

1.1 Overview

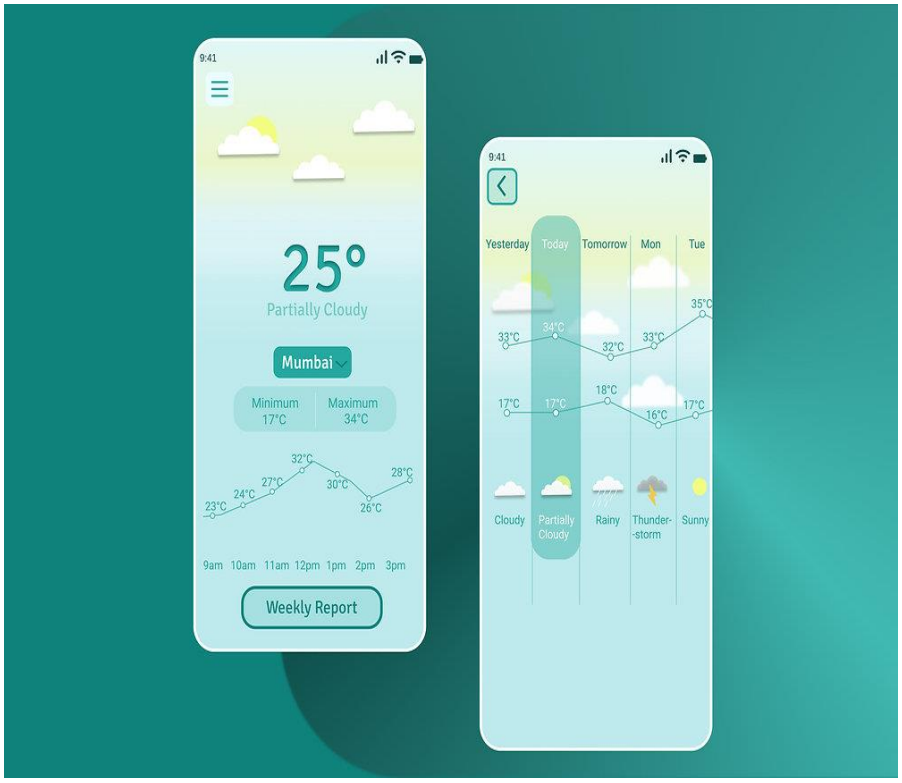

Fig:1.1 Over View Of A Weather IO App

Weather forecasting is the application of current technology and science to predict the state of the atmosphere for a future time and a given location. People can download thousands of weather apps on Apple App Store Android Play Store nowadays. Those apps show about present weather information and weather forecasts, with sleek and gorgeous interfaces. It seems it's unnecessary to design more weather applications, but I designed new one few days ago. Weather apps enable users to get instant alerts regarding weather conditions. Weather apps are the simplest method to know about the updates of the upcoming weather. Many people use weather forecasts to determine what to wear on a given day. Since outdoor activities are severely curtailed by heavy rain, snow and wind chill, forecasts can be used to plan activities around these events, and to plan ahead and survive them.

1.1 Purpose:

Weather forecasting is the application of science and technology to predict the conditions of the atmosphere for a given location and time. People have attempted to predict the weather informally for millennia and formally since the 19th century. Weather forecasts are made by collecting quantitative data about the current state of the atmosphere, land, and ocean and using meteorology to project how the atmosphere will change at a given place.

The inaccuracy of forecasting is due to the chaotic nature of the atmosphere, the massive computational power required to solve the equations that describe the atmosphere, the land, and the ocean, the error involved in measuring the initial conditions, and an incomplete understanding of atmospheric and related processes. Hence, forecasts become less accurate as the difference between current time and the time for which the forecast is being made increases.

There are a vast variety of end uses for weather forecasts. Weather warnings are important because they are used to protect life and property. Forecasts based on temperature and precipitation are important to agriculture, and therefore to traders within commodity markets. Temperature forecasts are used by utility companies to estimate demand over coming days.

1. LITERATURE SURVEY

2.1 Existing Problem

1. Prediction accuracy: Weather forecasting is a complex process, and achieving high accuracy for all weather parameters remains challenging. Factors such as chaotic atmospheric behavior, limited data, and computational limitations contribute to forecast uncertainties.

2. Short-term vs long-term forecasts: Short-term forecasts (up to 7 days) tend to be more accurate than long-term forecasts (beyond 7 days). Improving long-term forecasting accuracy is an ongoing challenge.

3. Extreme events: Predicting extreme weather events like hurricanes, tornadoes, and heatwaves with high precision is difficult due to their localized and rapidly changing nature.

4. Data assimilation: Integrating vast amounts of observational data into numerical models effectively can be problematic, leading to potential inaccuracies in the forecasts.

5. Model limitations: Numerical weather prediction models have inherent limitations, such as spatial resolution, parameterizations, and uncertainties in initial conditions.

6. Regional variations: Weather systems can vary significantly across different regions, and forecasting for specific locations may require more localized data and modeling approaches.

7. Communication and understanding: Presenting complex weather information in a clear and understandable manner to the public can be a challenge for meteorologists and weather agencies.

8. Inconsistent Data Presentation: Inconsistent or confusing data presentation across different sections of the app can make it hard for users to interpret the information correctly.

2.2 Proposed Solution

1. Enhanced data collection: Increasing the number and quality of weather observations through advanced sensor networks, satellites, and ground-based stations can provide more comprehensive data for weather models.

2. High-resolution models: Developing and utilizing higher-resolution numerical weather prediction models can improve the accuracy of forecasts, especially for localized events and extreme weather.

3. Ensemble forecasting: Implementing ensemble forecasting, which involves running multiple simulations with slightly different initial conditions, can provide a range of possible outcomes, helping meteorologists assess uncertainty.

4. Artificial Intelligence and machine learning: Integrating AI and machine learning algorithms can enhance data assimilation, model performance, and pattern recognition, leading to more accurate predictions.

5. Improved model physics: Advancing the representation of atmospheric processes in numerical models can lead to better predictions, especially in complex weather scenarios.

6. Collaborative efforts: Enhancing international cooperation and sharing weather data among meteorological agencies can lead to more comprehensive and accurate global forecasts.

7. Public engagement: Improving communication strategies to effectively disseminate weather information to the public can help people make informed decisions during weather events.

8. Forecast verification and feedback: Implementing robust verification procedures and gathering feedback from users can help identify areas for improvement and guide research efforts.

3. THEORITCAL ANALYSIS

3.1 Block Diagram

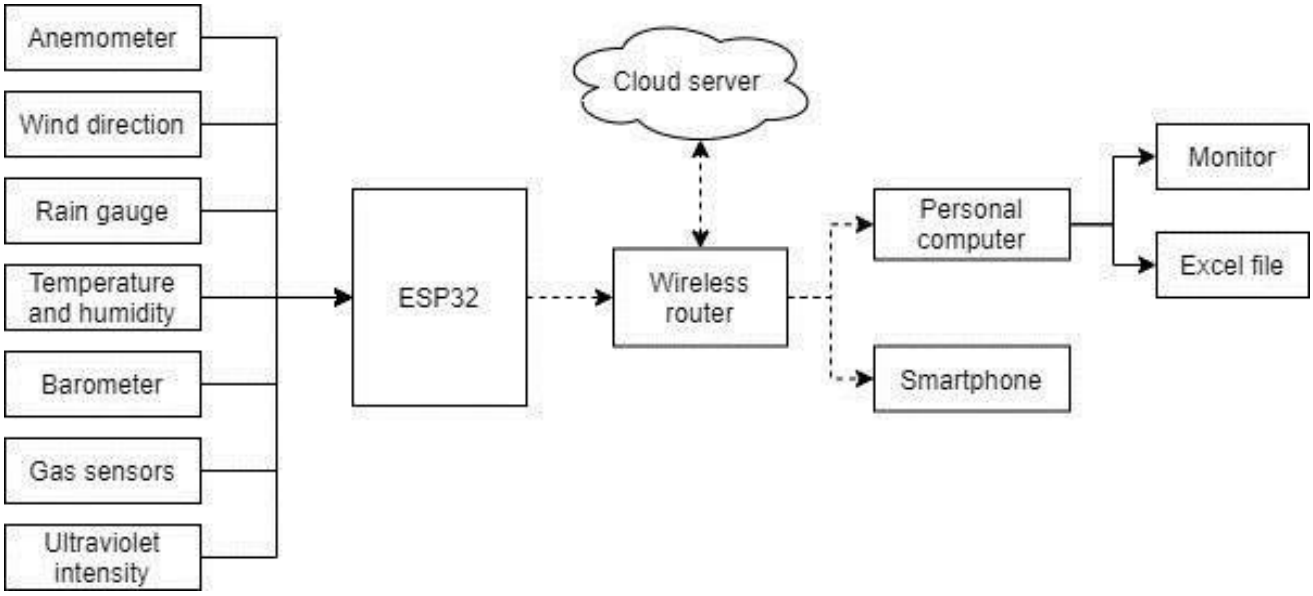

Fig 3.1 – Process of weather condition

Hardware design:

The firmware for the ESP32 was built according to the workflow. Based on the ESP32 workflow installed in the field station together with all these sensors starts with the initialization of the pins used, the library, the connection to the sensor, and the connection to Wi-fi. After that, the device is connected to a local Wi-fi network with the SSID and password that has been previously set. After a successful connection, the device will activate the server. Get into the main program, that runs in an infinite loop to read all sensor data, combine all readings into one string, then send it to the server if there any request from client device. The hardware design of the system. It uses ESP 32 development kit C as the main processor. Both processor and all sensors supplied by 2 DC/DC step down converters. The system uses 16x2 LCD to show the connected wi-fi said and its IP address on local connection.

Software used:

Code Editor I used for this project is VS Code. It is used to code complex piece of programs and to develop complex projects. Further technologies I used for this project are HTMLS, CSS and JS.

Milestone 1: Set up the project structure

Create a new project folder for the Weather App.

Inside the project folder, create the following files/folders:

index.html

style.css

script.js

Next, put CSS and JS files in **static** folder while index.html file in **templates** folder as you have to render it through flask.

Create app.py and write the python code for running your application

Milestone 2: Design and implement the user interface

Open index.html in your code editor.

Set up the basic HTML structure.

Design the layout and structure of the user interface using HTML elements and CSS classes.

Apply styles to the UI elements using CSS in style.css.

Link style.css to index.html.

Milestone 3: Connect to the Open Weather Map API

In script.js, define a constant variable to store your Open Weather Map API key.

Create a function to handle API calls and fetch weather data from the Open Weather Map API.

Use the fetch () function or an AJAX library to make a GET request to the Open Weather Map API, passing the necessary parameters (e.g., city name).

Handle the API response and extract the relevant weather data.

```
async function fetchWeatherData(city) {
  try {
    const response = await fetch(
      `${baseUrl}?q=${city}&appid=${apiKey}&units=${units}`
    );
    if (!response.ok) {
      throw new Error("Weather data not available.");
    }
    const data = await response.json();
    updateWeatherInfo(data);
  } catch (error) {
    console.log(error);
  }
}
```

Fig 3.2 - Weather Map API key

```
function updateWeatherInfo(data) {
  cityElement.textContent = data.name;
  datetimeElement.textContent = getCurrentTime();
  forecastElement.textContent = data.weather[0].description;
  iconElement.innerHTML = `<img src="http://openweathermap.org/img/wn/${data.weather[0].icon}.png" alt="Weather Icon">`;
  temperatureElement.innerHTML = `${Math.round(data.main.temp)}&#176;${
    units === "metric" ? "C" : "F"
  }`;
  minMaxElement.innerHTML = `<p>Min: ${Math.round(data.main.temp_min)}&#176;${
    units === "metric" ? "C" : "F"
  }</p><p>Max: ${Math.round(data.main.temp_max)}&#176;${
    units === "metric" ? "C" : "F"
  }</p>`;
  realFeelElement.innerHTML = `<p>${Math.round(data.main.feels_like)}&#176;${
    units === "metric" ? "C" : "F"
  }</p>`;
  humidityElement.textContent = `${data.main.humidity}%`;
  windElement.textContent = `${data.wind.speed} ${
    units === "imperial" ? "mph" : "m/s"
  }`;
  pressureElement.textContent = `${data.main.pressure} hPa`;
}
```

Fig 3.3 – Open Weather Map key

Milestone 4: Fetch weather data based on user input

Add an input field and a button to the UI to allow users to enter a city name or zip code.

Add an event listener to the button to trigger the weather data fetch function when clicked.

Retrieve the user input from the input field.

Call the API function, passing the user input as a parameter.

```
searchForm.addEventListener("submit", (e) => {
  e.preventDefault();
  const city = searchInput.value.trim();
  if (city !== "") {
    fetchWeatherData(city);
  }
  searchInput.value = "";
});
```

Fig 3.4 – Fetching weather data

Milestone 5: Update the UI with the fetched weather data

Create functions to update the UI with the fetched weather data.

Select the necessary UI elements using JavaScript DOM manipulation methods. Modify the UI elements' content or styles to display the weather information dynamically.

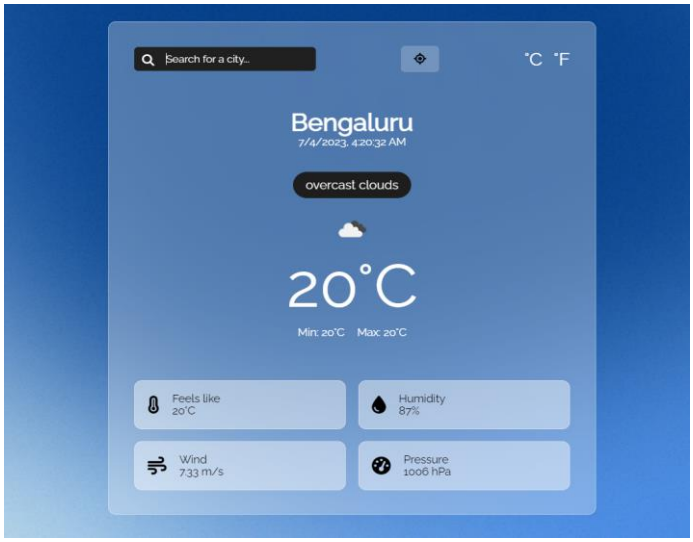

Fig 3.5 – Weather Information of Bengaluru

As you can see there is button In between search and degrees, which is a button when clicked tells you the weather of your current location this uses geolocation property in JS.

Milestone 6: Run it using Flask

Using the following code, you can run your application using flask

```python
from flask import Flask, render_template

app = Flask(__name__)

@app.route("/")
def weather():
    return render_template("index.html")

if __name__ == "__main__":
    app.run()
```

Fig 3.6 – Flask Application

4. RESULT

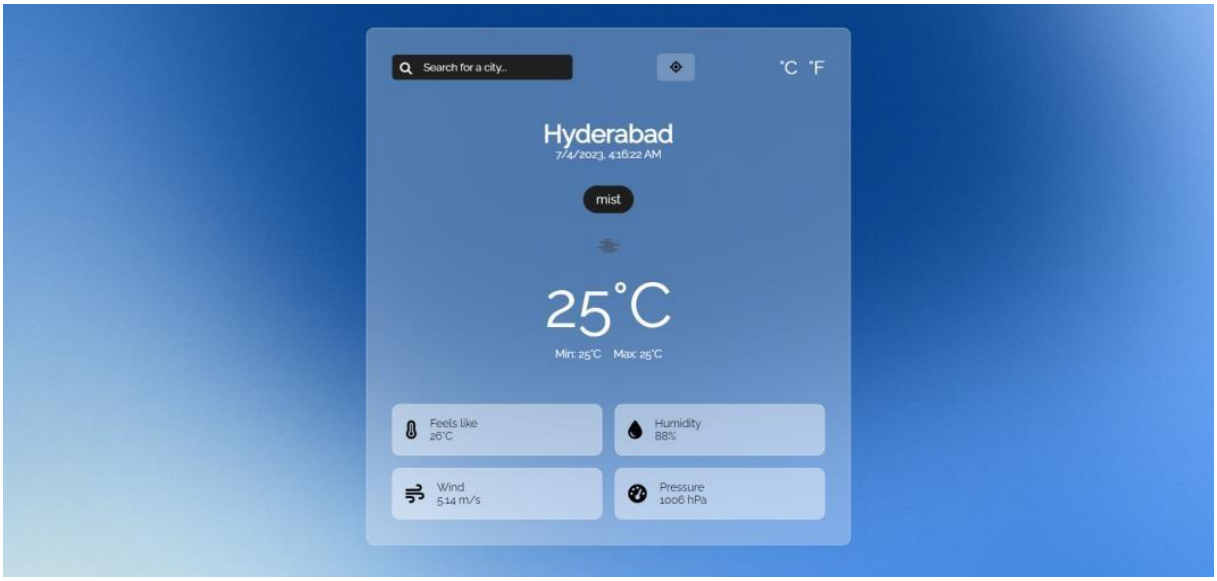

Fig 4.1 – Website page of Weather app

Using HTML, CSS, Java Script we built a blog app. The results of blog app are shown above.

HTML: It is the code for creating web pages, using tags and other commands that a browser reads and converts into the normal web pages that people see.

CSS: CSS is the language for describing the presentation of Web pages, including colors, layout, and fonts.

JS: JavaScript is a text-based programming language used both on the client-side and server side that allows you to make web pages interactive. It gives web pages interactive elements that engage a user.

5.ADVANTAGES AND DISADVANTAGES

Advantages:

1. Farmers can know when to plant or harvest their crops
2. People can choose where and when to take their holidays to take advantages of good weather
3. Surfers known when large waves are expected
4. Regions can be evacuated if hurricanes or floods are expected
5. Aircraft and shipping rely heavily on accurate weather forecasting
6. Preparedness for temperature and precipitation changes
7. Outdoor activity planning
8. Early warnings for severe weather
9. Agricultural planning
10. Transportation and aviation support
11. Farmers can know when to plant or harvest their crops
12. People can choose where and when to take their holidays to take advantages of good weather
13. Surfers known when large waves are expected
14. Regions can be evacuated if hurricanes or floods are expected
15. Aircraft and shipping rely heavily on accurate weather forecasting

Disadvantages:

1. Weather is extremely difficult to forecast correctly.
2. It is expensive to monitor so many variables from many sources
3. The computers needed to perform the millions of calculations necessary are expensive
4. The weather forecasters get blamed if the weather is different from the forecast
5. The terminology used in weather forecasting can be confusing, making it difficult for some people to understand the predictions.
6. Weather forecasting relies heavily on technology, and if the technology fails or is unavailable, accurate predictions cannot be made.
7. Weather forecasts are not available for many remote or sparsely populated areas, making it difficult for people in these areas to prepare for severe weather.
8. Forecasting models can only make predictions based on existing data and are limited by the quality and quantity of that data.
9. Forecasts are usually only accurate for a short time frame, making it difficult to plan ahead.
10. Weather is extremely difficult to forecast correctly
11. It is expensive to monitor-so many variables from so many sources
12. The computers needed to perform the millions of calculations necessary are expensive
13. The weather forecasters get blamed if the weather is different from the forecast

6. APPLICATIONS

1. Agriculture: Farmers use weather forecasts to plan irrigation, planting, and harvesting, optimizing crop yields.

2. Transportation: Airlines, shipping companies, and road maintenance crews rely on forecasts to plan routes and schedules, minimizing disruptions due to adverse weather.

3. Energy Management: Utilities use forecasts to anticipate demand for heating or cooling, helping them manage energy resources more efficiently.

4. Disaster Preparedness: Early warnings of severe weather events like hurricanes, tornadoes, and floods allow communities to evacuate and take protective measures.

5. Construction: Builders use forecasts to schedule outdoor work, reduce downtime due to weather-related delays, and ensure worker safety.

6. Tourism: Travel companies and tourist destinations use weather forecasts to attract visitors and offer suitable activities.

7. Retail and Marketing: Businesses use weather data to tailor marketing strategies, such as promoting weather-appropriate products.

8. Emergency Services: First responders rely on forecasts during emergencies to plan and allocate resources effectively.

7. FUTURE SCOPE

The demand for weather and climate forecast information in support of critical decision-making has grown rapidly during the last decade, and will grow even faster in the coming years. Weather app could involve incorporating more advanced forecasting techniques, integrating real-time data from various sources, enhancing user customization options, and possibly utilizing AI to provide personalized weather recommendations and alerts. Additionally, features like augmented reality weather visualization or climate change tracking might become more prevalent in the future. The app could also expand its reach to provide weather-related services for industries like agriculture, transportation, and renewable energy. Great advances have been made in the utilization of predictions in many areas of human activities.

8. CONCLUSION

In the era of the global warming, research in weather measurement, monitoring and forecasting are become more and more relevant. This research demonstrates the design and implementation of an affordable mini weather monitoring system that ensures flexibility, portability, scalability and user-friendly operations which can provide data of some weather variables including temperature, humidity and pressure. With the advancement of technology weather forecasting has developed to its level best, but there is yet to develop, as far as a nature is so unpredictable. Weather forecasts are increasingly accurate and useful, and their benefits extend widely across the economy. While much has been accomplished in improving weather forecasts, there remains much room for improvement. Simultaneously, they are developing new technologies and observational networks that can enhance forecaster skill and the value of their services to their users.

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