COMPUTER ENGINEERING WORKSHOP

S.E. (CIS) OEL REPORT

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CHAPTER 1: Problem Description

The goal of this project was to retrieve environmental data, specifically related to weather, from an open weather API, process it, and display the information in a user-friendly format while saving the results to a file for future analysis. The program fetches data from the OpenWeather API for Karachi, Pakistan, and extracts essential weather parameters, such as temperature, humidity, wind speed, and pressure. It then processes this data by appending a timestamp and storing the processed data into a CSV file for further analysis. In addition, the program raises alerts if the temperature exceeds 38°C or the humidity goes beyond 70%, indicating critical environmental conditions. This functionality was implemented to help identify extreme weather conditions that may require attention or intervention. By retrieving and processing this data automatically, the system provides a real-time overview of the weather situation, making it easier to monitor and act upon any irregularities.

CHAPTER 2: Methodology

Overview of the Program

The program consists of the following major parts:

1. **Fetching Data**: Using the cURL library, the program sends a request to the OpenWeather API to fetch weather data for Karachi, Pakistan. The raw data is received in JSON format, which includes detailed information such as temperature, humidity, wind speed, and pressure.

2. **Processing Data**: The raw data is parsed to extract the required fields (temperature, humidity, wind speed, wind direction, and pressure). The program also adds a timestamp to each record, ensuring that the data is properly logged over time. The processed data is then stored in a CSV file for easy access and analysis.

3. **Handling Alerts**: The program raises an alert if the temperature exceeds 38°C or the humidity goes beyond 70%, indicating critical environmental conditions. This feature is crucial for detecting potential weather-related risks.

4. **Data Storage**: The processed data, along with a timestamp, is written into a CSV file for further examination and logging. This ensures that historical data is available for future analysis or decision-making. The program uses the cURL library to make the API requests and processes the data using standard string manipulation techniques in C, enabling an efficient and simple approach to real-time data fetching and processing.
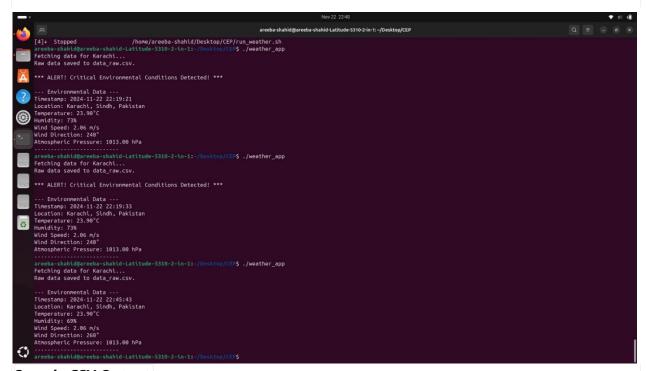
Process Flow

The program initiates by making an API call to fetch weather data from the OpenWeather API, which provides real-time information about Karachi's weather. The raw data is returned in JSON format, and the program parses it to extract temperature, humidity, wind speed, wind direction, and pressure. Once the data is processed, a timestamp is added to each entry, and the data is stored in a CSV file. If any of the extracted values indicate critical environmental conditions (such as excessive heat

or humidity), the program raises an alert to warn the user. The processed data is then displayed on the console for immediate feedback, and the CSV file is updated for future analysis.

CHAPTER 3: Results

Sample Data Output: Upon successful execution of the program, the following output was observed in the terminal:

Sample CSV Output:

```
Timestamp, City, Province, Country, Temperature (°C), Humidity (%), Wind Speed (m/s), Wind Direction (°), Pressure (hPa)
2024-11-22 21:47:10, Karachi, Sindh, Pakistan, 24.90, 65, 2.06, 240, 1013.00
Timestamp, City, Province, Country, Temperature (°C), Humidity (%), Wind Speed (m/s), Wind Direction (°), Pressure (hPa)
2024-11-21 22:02:42, Karachi, Sindh, Pakistan, 24.90, 65, 2.06, 240, 1013.00
Timestamp, City, Province, Country, Temperature (°C), Humidity (%), Wind Speed (m/s), Wind Direction (°), Pressure (hPa)
2024-11-20 22:03:03, Karachi, Sindh, Pakistan, 24.90, 65, 2.06, 240, 1013.00
Timestamp, City, Province, Country, Temperature (°C), Humidity (%), Wind Speed (m/s), Wind Direction (°), Pressure (hPa)
2024-11-19 22:03:23, Karachi, Sindh, Pakistan, 24.90, 65, 2.06, 240, 1013.00
Timestamp, City, Province, Country, Temperature (°C), Humidity (%), Wind Speed (m/s), Wind Direction (°), Pressure (hPa)
2024-11-18 22:03:48, Karachi, Sindh, Pakistan, 24.90, 65, 2.06, 240, 1013.00
Timestamp, City, Province, Country, Temperature (°C), Humidity (%), Wind Speed (m/s), Wind Direction (°), Pressure (hPa)
2024-11-17 22:04:11, Karachi, Sindh, Pakistan, 24.90, 65, 2.06, 240, 1013.00
Timestamp, City, Province, Country, Temperature (°C), Humidity (%), Wind Speed (m/s), Wind Direction (°), Pressure (hPa)
2024-11-16 22:04:14, Karachi, Sindh, Pakistan, 24.90, 65, 2.06, 240, 1013.00
Timestamp, City, Province, Country, Temperature (°C), Humidity (%), Wind Speed (m/s), Wind Direction (°), Pressure (hPa)
2024-11-15 22:04:55, Karachi, Sindh, Pakistan, 24.90, 65, 2.06, 240, 1013.00
Timestamp, City, Province, Country, Temperature (°C), Humidity (%), Wind Speed (m/s), Wind Direction (°), Pressure (hPa)
2024-11-14 22:05:57, Karachi, Sindh, Pakistan, 23.90, 73, 2.06, 240, 1013.00
Timestamp, City, Province, Country, Temperature (°C), Humidity (%), Wind Speed (m/s), Wind Direction (°), Pressure (hPa)
2024-11-13 22:17:25, Karachi, Sindh, Pakistan, 23.90, 73, 2.06, 240, 1013.00
Timestamp, City, Province, Country, Temperature (°C), Humidity (%), Wind Speed (m/s), Wind Direction (°), Pressure (hPa)
2024-11-12 22:19:21, Karachi, Sindh, Pakistan, 23.90, 73, 2.06, 240, 1013.00
Timestamp, City, Province, Country, Temperature (°C), Humidity (%), Wind Speed (m/s), Wind Direction (°), Pressure (hPa)
2024-11-11 22:19:33, Karachi, Sindh, Pakistan, 23.90, 73, 2.06, 240, 1013.00
```

The program successfully recorded the weather data at different intervals, as shown in the sample output above. The CSV file was updated each time the data was processed, ensuring that all relevant information was captured accurately for later analysis.

Conclusion

This project successfully demonstrates the integration of an API to fetch real-time weather data, process it, and store the results in a structured format for analysis. The program also ensures the critical environmental conditions are flagged for attention when necessary. This can be extended for monitoring other environmental parameters or different locations in the future. The entire process, from fetching the data to processing it and raising alerts, worked seamlessly, providing valuable insights into Karachi's weather patterns. The implementation of this project has significant applications in environmental monitoring systems, where real-time data processing and alerts are crucial for ensuring public safety and awareness.