Real-Time Weather Monitoring and Analysis

Problem Statement:

You are tasked with designing a real-time weather monitoring and analysis system. The system should gather weather data from various locations, store it efficiently, and provide analytical insights to users.

Functional Requirements:

Data Collection:

- Utilize a weather data API (e.g., OpenWeatherMap) to obtain real-time weather information for various locations.
- Store weather data efficiently in the Weather_Data table, ensuring data integrity and consistency.

Data Analysis:

- Develop SQL queries to display real-time weather conditions for different locations.
- Calculate trends and patterns in weather data over time (e.g., hourly temperature changes, monthly precipitation trends).
- Integrate weather data with forecasting models to visualize potential future weather conditions.
- Utilizes advanced SQL features such as joins, window functions, subqueries, and common table expressions (CTEs) for complex analysis tasks.
- Implement features to calculate and display weather metrics such as average temperature, total precipitation, and highest wind speed for each location.

Data Maintenance:

- Implement mechanisms to periodically fetch new data from the weather data API and update the database accordingly.
- Ensure data consistency and accuracy by handling errors and exceptions during data retrieval and storage processes.

Databases Schema

Locations Table:

- **location_id (Primary Key)**: Unique identifier for each location.
- **location_name:** Name of the location.
- **latitude:** Latitude coordinate of the location.
- **longitude:** Longitude coordinate of the location.

Weather_Data Table:

- **data_id (Primary Key):** Unique identifier for each weather data entry.
- **location_id (Foreign Key):** Reference to the location the data belongs to.
- **timestamp:** Timestamp of the weather data entry.
- **temperature:** Temperature recorded at the location.
- **humidity:** Humidity level recorded at the location.
- **precipitation:** Precipitation amount recorded at the location.
- **wind_speed:** Wind speed recorded at the location.
- **weather_condition:** Description of the weather condition (e.g., sunny, rainy, cloudy).