Project Proposal – CS 411 Stage 1

Weather Application

Project Title: Weather Application

Project Summary

Our project is a weather app that combines real-time weather conditions with historical trends and date-specific forecasts. Anyone can check the current weather conditions for any location at any time for either a specific point in time, past or future, or over a chosen time frame. Future weather is predicted based on historical patterns and seasonal averages. Users can also create an account to build and save a personalized list of cities, by adding, removing, and even renaming locations. There is also a quarterly summary of the weather a user experiences, similar to Spotify Wrapped, but for the weather.

While other weather sites usually do 7 to 10 day forecasts, this app enhances the weather experience with historical context and customizable planning tools. Core features include viewing current and past weather, managing user profiles and saved locations, generating history-based predictions, seasonal summaries, and a customizable dashboard. The system uses real datasets like Meteostat, NOAA'S CDO (GHCN-Daily), and Open-Meteo's Historical Weather Archive to provide daily and hourly weather stats to power its insights.

Detailed Description of the Application

Do you ever need to plan a vacation that is happening a month out and need to know what the weather will be like half-way across the world?

Our website/application will provide real-time weather reports and predictive insights powered by historical data. By combining live conditions with past weather trends, the platform helps users plan for their upcoming days, weeks, or even special events.

Using a simple search bar, users can look up the current temperature and weather conditions for any location*. Here, they will also be able to explore the historical temperature and precipitation history of that location over a chosen time frame. To access predictive features, the platform will generate forecasts for specific dates based on historical patterns and seasonal averages.

To make weather tracking more convenient and adaptable for multiple users, the app includes user accounts where users can personalize their list of locations with customizable names. New users can register with a unique username and password, while returning users can log in to access their custom views. This list will be available under the "My Cities" tab, where users will be able to add, remove, or rename locations.

Another add-on feature of this platform is the quarterly summary where users will be able to see how many hot, cold, rainy, or humid days they have experienced within the past three months.

Creative Component

A history based specific day weather preview would be technically challenging but super useful. Let's say the user is planning a picnic in Chicago on June 9. Instead of guessing, the app looks back at decades of weather on and around June 9 in Chicago to show what is typical for that date, such as likely temperature range, chance of rain, humidity, and wind, adjusted for recent trends. The user would get a simple summary ("17–20°C, light breeze, 35% chance of showers") and an easy confidence meter along with plain-English tips ("bring a light jacket and a small umbrella"). The user could also compare nearby dates to find a better window ("June 7 has lower rain odds") and see how this year stacks up to the usual pattern. It won't be a perfect crystal ball, but it turns long-range planning from a guess into a smart, data-backed choice.

Usefulness

A platform to display past, current, and predicted weather is useful because it gives users a more holistic view of weather patterns in comparison to traditional weather applications. While many existing weather applications and websites focus on current and short-term forecasts – often one week – our application will allow users to see the weather today, the weather in the past, and also what the weather could be like on a day in the future based on historical patterns.

The basic functions of our application are:

- Simple:
    - Viewing current weather
    - Checking historical weather
    - Unique user accounts
- Complex:
    - Predicting weather based on historical data
    - Seasonal summary of weather experienced based on user location
    - Customizable dashboard

Currently, there are a couple of websites that are similar such as The Weather Channel and AccuWeather. While these platforms also provide real-time weather information, they typically only provide short-term forecasting up to one week or 10-days. These websites typically do not provide any information on the history of the weather.

Comparing these websites to our application, our application is different by letting users view weather history, customize their list of locations, and selecting the day in the future they would like to receive a weather forecast for. Finally, what sets our website apart from the existing websites is the seasonal, 3-month summary in which users will be able to see what kind of weather they have experienced categorized into the types of days.

Realness: Data Sources

Dataset 1: Open-Meteo Historical Weather (Archive API)
Format: JSON / CSV
Data Size: Per location, daily data has about 365 rows per year. Hourly data has about 8,760 rows per year.
What information does it capture?: Daily/hourly weather variables including temperature (min/max/avg), precipitation, wind, pressure, and humidity for specific latitude/longitude on specific dates.
Link: https://open-meteo.com/en/docs/historical-weather-api

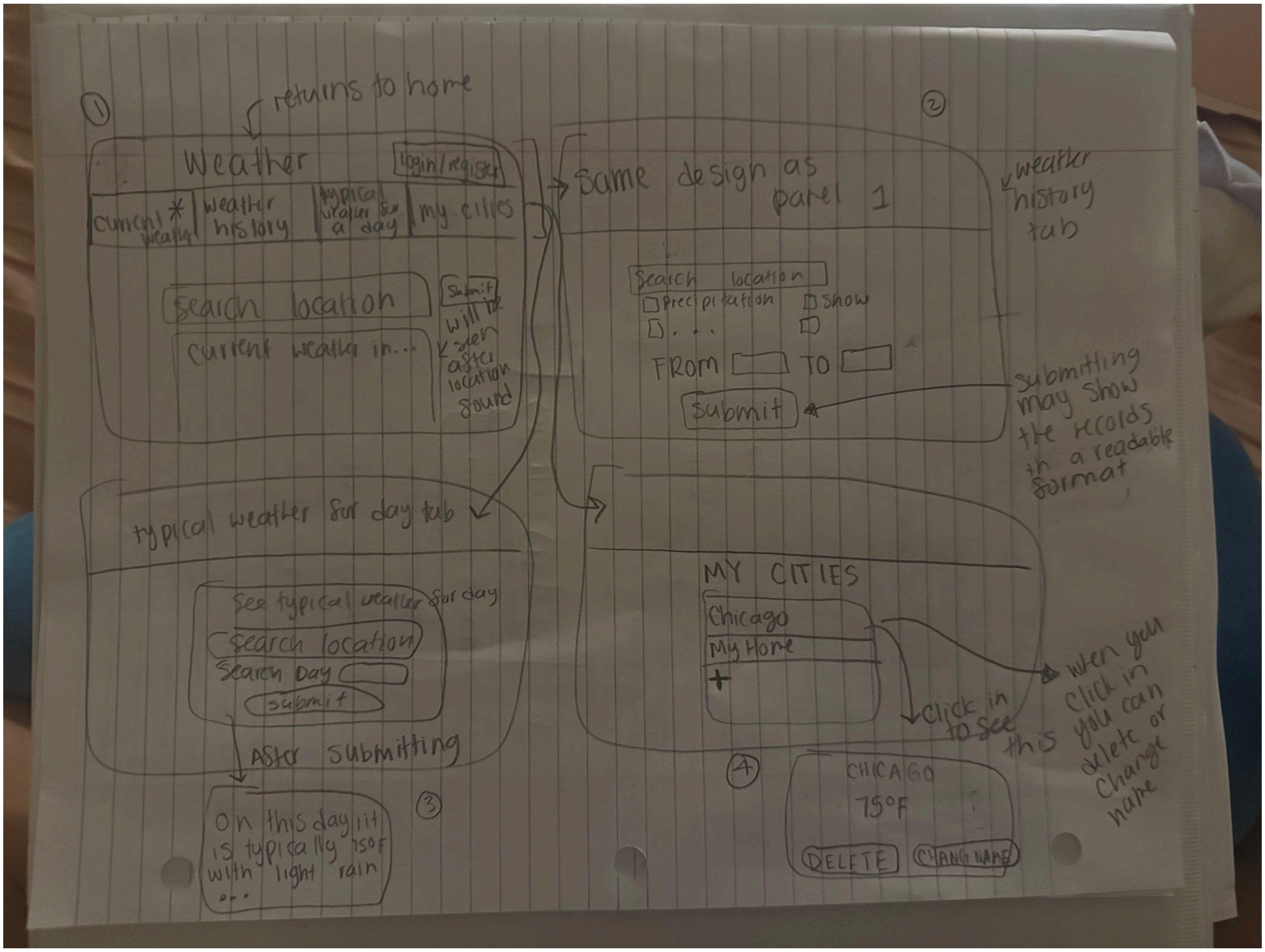
Dataset 2: NOAA Climate Data Online (CDO) – GHCN-Daily
Format: CSV
Data Size: Daily records per U.S. weather station. Stations have 10,000+ rows in the dataset; the full dataset spans millions of records.
What information does it capture?: Daily summaries of temperature, precipitation, snowfall, snow depth, and other climate variables.
Link: https://www.ncdc.noaa.gov/cdo-web/webservices/v2

(Extra) Dataset 3: Meteostat Historical Weather API
Format: JSON / CSV
Data Size: Hourly/daily time series from thousands of global stations over multiple decades. A single station provides tens of thousands of rows.
What information does it capture?: Temperature, precipitation, wind speed, pressure, sunshine duration, and other meteorological observations at different weather stations.
Link: https://dev.meteostat.net/api/

Functionality of the Website
List of Functionalities

1. Users should be able to view the temperatures/current weather of the requested location. The user would submit a form with the requested location (using a keyword search box) when they want to view the temperatures/current weather of the requested location.
2. Users should be able to view the temperature/precipitation history of the requested location with the requested time frame. The user would submit a form with the requested location along with the requested time frame when they want to view the previous temperature history of the location.
3. Users should be able to see what the likely weather would be on a certain day. The user would submit a form with the requested location along with the requested day when they want to view what the likely weather would be on a certain day. Then, they would see what the typical weather would look like on that day in that place.
4. Users should be able to sign up for an account. The user would submit a form with their username and password when they want to create an account. Then, an account would be created for them.
5. Users should be able to login to an existing account. The user would submit a form with their username and password when they want to login.
6. Users that are logged in should be able to add and delete a city on their “My Cities” tab where they can view the weather for particular cities. When the user adds or deletes the city, the “My Cities” tab should be updated with the city added/deleted.
7. When someone logs in, their “My Cities” list will be read and pulled into the “My Cities” section of the website. The user would login and this action would automatically occur.
8. A user can change the title on “My Cities”, for example instead of “Chicago” a user can update the name shown on the “My Cities” list to be “Home” instead.
9. Every 3 months, users will see a summary of what kind of weather they experienced. This data will be divided into hot/cold, rainy, and humid days.

Low-Fidelity UI Mockup



Project Work Distribution

Project Work Distribution will go as follows

- Ayman: database design for weather_observations, implement “current weather” and “weather history” features (#1–2).
- William: database design for cities, implement “typical weather for a day” (#3) and any procedures or triggers related.
- Shannon: database design for users, implement signup/login (#4–5) and co-implement “typical weather for a day” with William
- Connie: database design for “My Cities”, implement related CRUD operations (#6-8)
- While everyone has their own tasks, it will be expected that everyone will be available and willing to help any teammates that are struggling.