Weather Adventures
Software Requirements Specification

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1. SRS Revision History

Date	Author	Description
02/14/2023	AP	Created the SRS document.
02/15/2023	PN	Altered section 2.1, 2.2.
02/15/2023	JL	Updated font size and worked on ConOps.
02/16/2023	JL	Added sections for User Classes, Modes of Operation, and Use Cases.
02/18/2023	JL	Added User Interface and API information for External Interfaces (Section 3.1).
02/21/2023	JL	Added Usability Requirements Section (3.3).
02/22/2023	JL	Updated All of Section 2 to Reflect Our Emphasis on Eugene Outdoor Activities.
02/22/2023	PN	Wrote sections 3.4, 3.5, and 4.
02/22/2023	JL	Updated citations across All of Section 2, added. Requirements for Section 3.0, added functions for Section
02/23/2023	AP	Reviewed and revised.
03/09/2023	JL	Updated most of Section 2 to reflect our current system.
03/10/2023	JL	Updated most of Section 3 to reflect our current system.
03/11/2023	PN	Added weather module to functions section.
03/11/2023	MC	Added UI module to functions section.
03/12/2023	All	Turned In Final Version for Project 2 Final Project Assignment on Canvas.

2. The Concept of Operations (ConOps)

The main objective is to create a system known as Weather Adventures designed for Oregonians who enjoy outdoor activities in Eugene, and across Lane County. This system supplies outdoor enthusiasts a helpful resource in finding nearby outdoor activities within Eugene and Lane County. Weather Adventures allows outdoor enthusiasts to navigate different areas across Eugene and Lane County in a timely manner and gather outdoor sites to include in the area of interest.

The system provides an interactive map where people can view specific areas to further inquire details of nearby outdoor activities and weather details. The map can shift between Eugene and Lane County with a click of a button and is broken down into many squares that each cover a portion of Eugene or Lane County. These individual squares form a grid to interact with the map. The map displays weather and wind direction icons for each area and these can be toggled on and off.

By clicking on an area of the map, the system will display a pop-up window that elaborates on the area's weather details and provides potential outdoor activities to consider. The pop-up window will list up to three of the nearest outdoor activity options in the specified area and factor in current weather conditions. For example, the system will not offer snowboarding even if it is the nearest option when the surrounding area is not snowing. Additionally, outdoor activities with indoor facilities like rock climbing would be listed during times of rain. The different outdoor activity options will include the name of the activity, description of it, difficulty to perform the activity, and a button to acquire further information by opening up the activity's website. From here, people can form well-informed decisions when using the system to research potential outdoor areas to visit.

2.1. Current System or Situation

The city of Eugene is a haven for outdoor activities for people to do. The city offers a variety of activities including different parks, hiking and biking trails, facilities to engage in outdoor activities, and activities along the city's rivers.

There are different services on the internet that document all the different outdoor activities available in Eugene; these include Tripadvisor, Eugene Cascade and Coasts, and AllTrails. These websites offer a description, address, and a map for different outdoor activities. A limitation to Tripadvisor and Eugene Cascades and Coasts is that their maps only reference one outdoor activity at a time; this is because a person would select an activity to view its location and learn more about it. On the other hand, AllTrails fulfills the previously mentioned limitation, but it is specifically limited to just walking and hiking trails.

The present systems displaying outdoor activities do not highlight the possibility of weather influencing a person's decision. Rain, wind, snow, and other natural events can inspire the commitment to outdoor activities or leave them stuck in the mud. The current maps provide geographical location of outdoor activities or weather preparedness, but not both. People have to get their maps from one source and their weather information from another.

2.2. Justification for a New System

The current systems available to outdoor enthusiasts in Eugene involve multiple systems in accessing different sources of information, and this results in countless back-and-forth traveling in between systems. This can include needing to check multiple websites for the same outdoor activity or needing to access both weather data and geographical location for a particular outdoor activity in separate spots. In addressing these concerns, our system seeks to minimize the amount of time and switching back-and-forth needed for researching outdoor activities by incorporating all relevant information within one system.

In the development of this system, we have had the opportunity to interview two people who often engage in outdoor activities around Eugene. This allows us to better understand the system that we are trying to develop for those who would use it. We relied on Discord to find people who often engage in outdoor activities around Eugene, and this allows us to get into contact with individuals that we may not know due to Discord's ability to provide anonymity. We got into contact with our interviewees and agreed to meet in person to conduct interviews. From here, we conducted two interviews for Interviewee A and B. For Interviewee A, we learned that he is a person who enjoys rock climbing and traveling on hiking and walking trails. For Interviewee B, he is a University of Oregon college student that often has to travel to different outdoor activity sites from campus and enjoys kiting and parks around campus. After identifying their interests, we acquired detailed information on how they would plan their activities and what kind of information is valuable to that; we would go on to incorporate their input to satisfy what they agree to be important or lacking in current systems.

With accessing both geographical and weather data, there is a need to constantly shift between maps and weather data. Interviewee A describes this to be "annoying" in having to switch between different applications. Outdoor enthusiasts often consider weather in defining their means of transportation to outdoor sites as found in Interview B or whether to participate in an outdoor activity as found in Interview A. Weather Adventures melds outdoor activity locations and weather information into one cohesive

package. For outdoor enthusiasts, they will no longer need to look in two places for the vital information an outdoor trip requires.

Across different systems such as Tripadvisor and Eugene Cascades and Coasts, they offer different outdoor activities but lack any ability to organize them based on their location; each activity is displayed in its own self-contained map without other activities included. As found in Interviews A and B, the distance among outdoor activities can be an important factor. Therefore, it would be helpful to incorporate multiple nearby outdoor activity locations in one map area because it would allow outdoor individuals to better compare to gauge the location of many outdoor activities in respects to the boundaries of Eugene or Lane County when planning. Our system serves to improve current maps by presenting different types of activities within a single area in the map.

Furthermore, archives of outdoor activities offer their own descriptions in different ways and these have their own strengths and weaknesses. For example, Tripadvisor mainly relies on users' experiences through reviews while Eugene Cascades and Coasts has articles with quantitative information such as the length of an outdoor trail. Review-reliant information can be biased or lack objective information regarding outdoor activities. Additionally, AllTrails offers quantitative information but fails to provide relevant suggestions outside the scope of hiking or walking. We seek to develop a system that emphasizes objective, quantitative information of various outdoor activities that current systems may lack. It would allow users to have access to all sorts of information in one convenient place. Additionally, we will offer a way to view the activity's website if the user wants to verify the information or wishes to learn more about the activity beyond the system's scope such as the history of the outdoor activity site.

2.3. Operational Features of the Proposed System

With Weather Adventures, we have three main objectives to satisfy the different needs.

1. Incorporate all locations of outdoor activities in one map; these locations would be allocated to specific areas on the map.
2. Incorporate all the essential details in descriptions for each outdoor activity. These include the elevation, difficulty, and trail lengths (when applicable) as our interviewees value when researching.
3. Append nearby current weather data such as the temperature, precipitation, and wind direction surrounding different outdoor activity sites and areas across Eugene and Lane County.

For the first and second objective, we document all the different outdoor activities found across Eugene and Lane County. This would involve accessing various archives such as Tripadvisor and Eugene Cascades and Coasts and storing all their information within a single file for the system to read from. We recorded the address, numerical characteristics such as the lengths for applicable sites, and descriptive characteristics such as what it is. The system is able to access all this information for displaying them in pop-up windows that provide the different options for an outdoor activity.

For the third objective, we rely on the assistance of an additional system that can acquire real-time weather information from the nearest station. We are able to take its information, format it, and insert it into the pop-up window for a particular map area of interest.

2.4. User Classes

There is one primary user class: Outdoor enthusiasts, especially those around the Eugene and Lane County area, interested in doing outdoor activities in Oregon.

2.5. Modes of Operation

There is only one mode of operation and that is users. This involves outdoor enthusiasts interacting with Weather Adventures as users requesting map information through the system.

2.6. Operational Scenarios/Use Cases

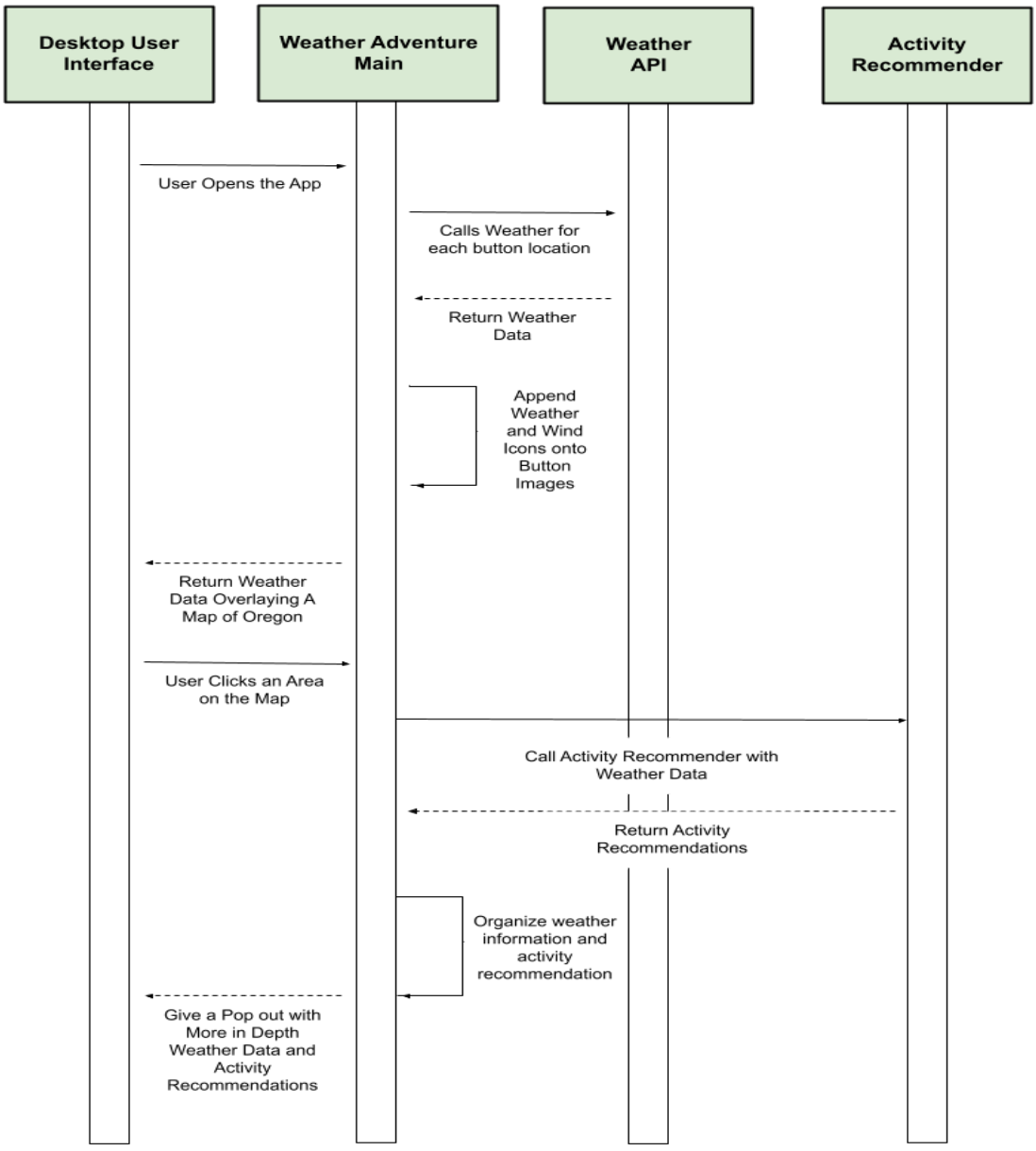

Figure 1: Sequence Diagram of Normal Use Case

Use Case: Acquire outdoor opportunities around a particular area of Eugene or Lane County (Ex. The northeast side of Eugene)

Idea: A person who enjoys doing outdoor activities can view the area's weather patterns and potential outdoor opportunities on a single interactable map.

Process*:*

1. The person opens up the system through the graphic user interface (GUI).
2. The system will begin acquiring weather details through the Weather API module around Eugene and Lane County and then supply the data and map images for the GUI to use.
3. The system compiles a grid to append to the map images, weather details, and calls upon an application interface program (API) where our system makes a call to an external server outside of the system that would provide weather data for us to add to the grid.
4. The system displays a map of Eugene to interact with; it can be changed to be Lane County and display different weather-related icons.
5. The user can choose specific areas to find surrounding outdoor activity sites.
6. Users can click on specific areas of the grid to view potential outdoor activities and learn more about that area's weather.
7. Users will be able to access and learn more about the outdoor activities and weather conditions through a Pop-Up window.
8. From here, users can make their own judgment in regards to participating in outdoor activities.

3. Specific Requirements

We have a list of requirements for Weather Adventures that are prioritized based on their ability to satisfy the Eugene and Lane County outdoor enthusiast user class in what they need, should have, could have, and won't need. With the time allotted for this system's development, we are able to incorporate the requirements listed under the "must need" and "should have" categories. The requirements under "could have" can serve as additional requirements and means to enhance this system for users beyond the time and resources that were provided.

Must Need:

- A user interface that allows users to navigate between Eugene and Lane County areas.
- An interactable map with the ability to incorporate and display multiple potential outdoor activity options for the user and switch between being a map of Eugene and Lane County. Each interactive action with the map should take less than 5 seconds when a user clicks a specific area or switches the map display.
- Access to real-time weather information for each area in Eugene and Lane County. This access should take less than 10 seconds for each square area of both Eugene Lane County; this means that the complete inquiry of weather information should take less than 290 seconds.
- The ability for users to access more about an outdoor activity's applicable characteristics (difficulty, elevation, lengths, etc.).
    - This includes having numerical data for measurable characteristics such as elevation and lengths when applicable.
    - This also includes the ability to learn more about the activity outside of the system's intentions, so each activity will have its website to reference.
    - It can be as simple as clicking a specific area of the map.
- Weather information that displays the wind speed and direction and type of condition.
    - These are displayed along the map itself.
    - Additional information such as the temperature in fahrenheit, humidity, and visibility are provided in pop-up windows regarding specific square areas on the map.

- The ability to access the system with a Python version of 3.7 or higher.

Should Have:

- The presence of a grid to allow users to define which areas of Eugene or Lane County that they wish to learn more about in terms of outdoor activity options and weather conditions.
    - This involves the creation of a usable grid and having each grid space respond to users within 10 seconds or less.
- At least two recommendations of outdoor activities based on the current precipitation condition such as rain or snow.
- The system's ability to open up URLs of different outdoor activity site's websites so users can verify the current information within the system.

Could Have:

- Having warning pop-ups implemented based on various factors.
    - Safety check that identifies the activity as safe or unsafe past sunset.
    - Safety warnings regarding a history of fires or crime with the system having the ability to assess at least one case found with either fires or crime.
- The ability to display only certain outdoor activities based on the time of day, so users can know which ones are open or close.
- Additional weather information such as the history and forecast of weather patterns within seven days before and after the present information.
- The option to view information in metric units.
- The ability to view weather information and outdoor activity options in areas outside of Eugene such as across all of Oregon.

Won't Need:

- Having reviews found in review-based sources such as Tripadvisor affecting the presentation or description of Outdoor activities.
- A large expansive scope that includes the ability to learn more about outdoor activities and weather conditions outside the state of Oregon.

3.1. External Interfaces (Inputs and Outputs)

3.1.1 User Interface

Purpose: Prompt users with a map grid of Eugene and Lane County and display appropriate visual images of the weather and have the user click specific squares to view outdoor activity data and more descriptive weather information.

Inputs:

- Scope: users will select the scope of the view to be either Lane County or Eugene; the interface defaults to being Lane County. This will be presented in the form of buttons that change the view of the map by zooming in and out.
- Weather Display: users can select to view weather and wind icons on the map. Each data option will be a checkbox option to click for viewing and treated as a boolean in the system

- Further Information: users can click on specific square areas on the map's grid to gather further weather information and outdoor activities to receive further details of a particular area's weather and outdoor activity options. The system treats these areas as coordinates within the map grid.

Outputs:

- Scope: the interface will display an interactable map of the area with weather data and locations of outdoor activities appended to the map. It will be in a generated map grid within the interface window.
- Weather Display: the interface will display intuitive weather icons to indicate weather conditions such as precipitation and wind direction icons to indicate where the wind is blowing towards.
- Further Information: users will receive a pop-up window from the system that contains two sections where one describes the weather and wind conditions in more detail and another section displaying three recommended outdoor activity options based on the weather.

Range:

- Area: this will include only locations within Eugene and Lane County
- Weather Display: this will include the precipitation and wind direction.
- Map output: this will be a map of the specified area and its surrounding area.
- Further Information Input: this will include the specific map area that the user specified.
- Further Information Output: this includes the names, description, difficulty, and location for recommended outdoor activity and detailed weather descriptions for the selected area.

3.1.2 OpenWeatherMap API

Purpose: Allow the system to receive weather data from the nearest weather stations to different outdoor activities.

Inputs

- Coordinates**:** the interface will need the coordinates in numerical latitude and longitude.
- Units: the interface will request the option to view in imperial or metric units.
- Format: the interface will request what kind of weather data it will search for. It will need them in terms of floats. For the units, the interface requests a string that specifies what type of unit to return.

Outputs

- Weather Data: the interface will provide weather data in various forms: temperature, wind characteristics, precipitation, visibility, and humidity.
- Format: the output will be in a manipulatable JSON file.

Range:

- Coordinates: the range includes latitude and longitude values that align with outdoor activity sites located in Oregon.
- Weather Data: it will be the recorded value from the interface at the time of its successful search.

3.2. Services

3.2.1 Activity Recommender

- The activity recommender provides the service of collating multiple activities across Eugene and Lane County from a variety of resources. This allows the user to have a unique experience since they can view multiple activity options provided for them based on the weather and the location.

3.2.2 Weather API Interface and Parsing

- The weather module accepts inputs of latitude and longitude and routes queries to the OpenWeatherMap API. Different measurement units can be used such as metric or imperial. Responses are parsed and returned as a list to the caller.
- This provides users the relevant weather information they would look at in the map and pop-up windows.

3.2.3 Buttons and Maps UI

- The UI module imports the main module weather_adventures.py calling its main function with the button pressed and the current map. The UI module initially opens to display an empty map of Eugene. The user has the option to view the map empty, with wind symbols, or with weather symbols. The user can also switch between viewing a map of Eugene or a map of Lane County. When the user clicks a button on either map, a popup of activity recommendations is displayed.

3.2.4 Descriptive Pop-Up Windows

- The system will provide users with a pop-up window detailing the specific weather details and outdoor activities when requesting a specific area of Eugene or Lane county to learn more about.
- The system will include a description of the weather and conditions and information regarding the visibility and humidity of the area.
- The system will recommend outdoor activities around that area based on current weather conditions by presenting three different options on the window; users can get a thorough overview of the activity through the system's description of the activity.

3.3. Usability Requirements

3.3.1 Requirements Satisfaction

- Objectives
    - Check how the system satisfies the user class's expectations in finding outdoor activities in around Eugene and Lane County.
    - Gauge user class members' specific and overall experiences when interacting with the system.
- Measurements
    - Acquire user class input in how we should interact with the system
    - Use a rating from one to five to determine a user class experience across the other listed objectives and for their overall experience. Include an open-ended prompt for feedback as well.
        - One: user class member would be unsatisfied
        - Five: user class member would be completely satisfied

3.3.2 Accuracy

- Objectives
    - Check how accurate the map layout and weather information is compared to other systems' display of maps and/or weather.

    - Check how the displayed outdoor activities match a normal Google search of those outdoor activities.
    - Use the same location when comparing to other systems' data (Ex. checking the west side of Eugene).
- Measurements:
    - Analyze the differences between our system's map to another map system (Ex. Google Maps). Form slight adjustments based on other systems' maps of Eugene and Lane County.
    - Analyze the difference in temperature numbers and precipitation rates of our system's weather output to another weather forecast system (Ex. a built-in weather app on a smartphone).
    - Seek to find and correct any descriptive contradictions between our system's outdoor activity results' description and location to a Google search of those same places.

3.3.3 Effectiveness

- Objectives
    - Check how detailed our system is in terms of its display
    - This requirement goes along with Requirements Satisfaction
- Measurements involve verifying the existence of three categories and their associated information
    - Map of Eugene and Lane County with descriptive pop-up windows
        - Interactable with the user
        - Can display weather details and outdoor activities
        - Zoom in and out between the city and county
    - Outdoor activities based on weather displays
        - Description of the activity
        - Difficulty of the activity
        - Location of the activity
    - Weather patterns incorporated
        - Temperature
        - Precipitation
        - Wind direction and speed
        - Visibility
        - Humidity

3.3.4 Efficiency

- Objectives
    - Check how fast results can be acquired in our system.
    - Check for optimization in resource use.
        - Ensure files are properly opened and closed.
- Measurement involve recording the time it takes for an interaction with the user between an initial user input and system output
    1. Having the system be ready for user inputs in less than 3 minutes when turning it on.
    2. Generating a pop-up with weather information and nearby outdoor activities of a requested area in less than 10 seconds after receiving input from the user.
        a. Acquire all the relevant information for this pop-up window.
            i. Incorporate Weather API data in less than 5 seconds
            ii. Acquire and append outdoor activities to the map in less than 5 seconds
    3. Access to more information of a particular outdoor activity in less than 3 seconds when a user clicks on a specific outdoor activity's website.

3.4. Performance Requirements

The OpenWeatherMap API returns each request in around half a second with no published reports of server down-time. Openweathermap.org reports 90 - 100% overall nowcasting accuracy compared to on-site testing.

Our map of Eugene will have a grid resolution of 2x2, which means that the weather information retrieval delay should not exceed 5 seconds. Our map of Lane County has a grid resolution of 5x3, and a maximum delay of 15 seconds. Our map data will be inputted manually during the development of this system. Two map images will be used. So our overall data for both settings should take less than 20 seconds.

3.5. Software System Attributes

3.5.1 Reliability

The main consideration in the development of Weather Adventures is reliability. Our system will be reliant on variable data sources in the form of maps and weather information. Maps are often redrawn, and weather changes constantly. For our software system to be reliable, these data streams must be available and up-to-date. In order to achieve this measure of reliability, we selected APIs and data sources that are reliable in turn. For example, if an API often experiences server down-time, then an alternative API should be selected by our team to maintain reliability.

3.5.2 Maintainability

Another consideration of Weather Adventures development is maintainability. Our plan for system architecture prioritizes ease of repair and expansion by separating data collection, data processing, and interface modules. This will allow our team to follow a path of service expansion to include data from other regions and a wider range of outdoor activities.

3.5.3 Precision

Another worthwhile consideration is efficiency. Our plan involves ensuring that our system can precisely and quickly return the appropriate weather information and outdoor activity options. This means that our system will display appropriate outdoor activities based on the proper weather conditions and having weather information consistent with the actual weather conditions of the particular area of interest.

4. References

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5. Acknowledgements

This template builds slightly on a similar document produced by Stuart Faulk in 2017, and heavily on the publications cited within the document, such as IEEE Std 1362-1998 and ISO/IEC/IEEE Intl Std 29148:2018. The template was provided by Professor Anthony Hornof and permitted for use for describing the requirements for Weather Adventures.

Much of the map configurations and displays take inspiration from user class members. At the time of this writing, we had interviewed two user class members where we would ask questions about their outdoor activities experiences and interests in planning outdoor activities. Here, we were able to gain a better understanding of the system that we are developing for them. Their input is valuable in configuring how we can merge various details that one would research when planning outdoor activities.

Information regarding different outdoor activities in Eugene will be drawn from different website sources Tripadvisor, Eugene Cascades and Coasts, and AllTrails. The website for each source is listed below:

- Tripadvisor: https://www.tripadvisor.com/Tourism-g51862-Eugene_Oregon-Vacations.html
- Eugene Cascades and Coasts: https://www.eugenecascadescoast.org/outdoors/adventures/
- AllTrails: https://www.alltrails.com/

Our weather data stems from the OpenWeatherMap API and more information about it can be found here: https://openweathermap.org/. To access the API, we needed the addition of the Requests module for Python to access the OpenWeatherMap API. The OpenWeatherMap API and Requests module were approved in an email from Anthony Hornof to Joey Le on February 26th, 2023.

In addition, we needed an additional module outside the Python Standard Library to interact with images in order to display a map in our system. We used the Pillow Module to interact with map, weather, and wind icon images in order to properly display visual information in our system. The Pillow module was approved in an email from Anthony Hornof to Joey Le on March 8th, 2023.