“ WEATHER FORECASTING”

A

Software Requirement Specification

submitted

in partial fulfillment

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Submitted To:

Mrs. Sanju Chaudhary
Associate Prof.

Submitted By :

Niharika Goyal (19ESKIT062)
Nayan Gupta (19ESKIT061)
Saurabh Nahata (19ESKIT085)
Naresh Jangid(19ESKIT060)

Project Mentor:

Dr. Sunita Gupta
Associate Prof.

Department of Information Technology
Swami Keshvanand Institute of Technology, M & G, Jaipur
Rajasthan Technical University, Kota
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Chapter 1
Introduction

1.1 Purpose

Real Time Air quality monitoring is commonly used to report the level of severity of air pollution to public. A number of methods were developed in the past by various researchers/environmental agencies for determination of AQI or API but there is no universally accepted method exists, which is appropriate for all situations.

The Weather Forecast App Using Python is essentially a scientific prediction of the weather conditions in the future.

1.2 Project Scope

The weather forecasting system has an application for farmers where they can ensure higher productivity of crops and lower the risk of weather hazards via the IoT weather. The weather station proves helpful for monitoring the weather in areas like places with volcanoes or rain forests. This is especially important with drastic changes in the weather conditions we are experiencing.The weather forecasting system using IoT supporting controllers is fully automatedand efficient. It does not require any manual labor or attention.

1.3 Technology,Tools and Language used

1.3.1 Visual Studio :

- Visual Studio Code combines the simplicity of a source code editor with powerful developer tooling, like IntelliSense code completion and debugging.
- First and foremost, it is an editor that gets out of your way. The delightfully fric- tionless edit-build-debug cycle means less time fiddling with your environment, and more time executing on your ideas.
- Visual Studio Code is a free source-code editor made by Microsoft for Windows, Linux and macOS. Features include support for debugging, syntax highlighting, intelligent code completion, snippets, code refactoring, and embedded Git.
- Users can change the theme, keyboard shortcuts, preferences, and install extensions that add additional functionality.
- Visual Studio Code's source code comes from Microsoft's free and open-source software VS-Code project released under the permissive Expat License, and the compiled binaries are freeware for any use.
- Visual Studio Code was announced on April 29, 2015, by Microsoft at the 2015 Build conference. A Preview build was released shortly thereafter.
- On November 18, 2015, Visual Studio Code was released under the Expat License and its source code posted to GitHub. Extension support was also announced.
- Visual Studio Code is a source-code editor that can be used with a variety of programming

languages, including Java, JavaScript, Go, Node.js and C++. It is based on the Electron framework, which is used to develop Node.js Web applications that run on the Blink layout engine. Visual Studio Code employs the same editor component (codenamed ”Monaco”) used in Azure DevOps (formerly called Visual Studio Online and Visual Studio Team Services).

- Instead of a project system, it allows users to open one or more directories, which can then be saved in workspaces for future reuse. This allows it to operate as a language-agnostic code editor for any language.
- It supports a number of programming languages and a set of features that differs per language. Unwanted files and folders can be excluded from the project tree via the settings..
- Visual Studio Code can be extended via extensions, available through a central repository. This includes additions to the editor and language support A notable feature is the ability to create extensions that add support for new languages, themes, and debuggers, perform static code analysis, and add code linters using the Language Server Protocol.

1.3.2 HTML :

HTML, which stands for Hypertext Markup Language, is a standardized language used for creating and structuring web pages. It provides the basic building blocks and elements necessary to define the content, layout, and formatting of a webpage. HTML uses a system of markup tags to describe the structure and presentation of the content within a document. HTML documents are typically saved with a .html file extension and can be viewed in web browsers, which interpret the HTML code and display the webpage accordingly. Along with CSS (Cascading Style Sheets) and JavaScript, HTML forms the foundation of the modern web, enabling the creation of interactive and visually appealing websites.

1.3.3 CSS :

CSS, short for Cascading Style Sheets, is a style sheet language used to describe the presentation and formatting of a document written in HTML or XML. While HTML focuses on the structure and content of a webpage, CSS controls how the elements within that document are displayed and styled. With CSS, you can define various aspects of a webpage's appearance, such as colors, fonts, layout, spacing, and positioning of elements. It allows you to apply styles consistently across multiple web pages, making it easier to maintain and update the design of a website.

1.3.4 Java script:

JavaScript is a versatile programming language primarily used for creating interactive and dynamic elements on web pages. It is often referred to as the "language of the web" as it runs directly in a web browser and allows for client-side scripting. JavaScript can be embedded within HTML documents or used in separate JavaScript files that are linked to HTML pages.JavaScript enables developers to add interactivity, manipulate web page elements, handle events, create animations, validate form input, and communicate with servers for data retrieval and updates. It provides the ability to dynamically modify HTML and CSS, making it possible to create dynamic web content that can respond to user actions or update based on changing data.With JavaScript, you can define variables, write functions, and implement conditional statements and loops to control the flow of the program. The language supports object-oriented programming principles, allowing for the creation of reusable and modular code. JavaScript is supported by all modern web browsers, making it a widely accessible language for web development. In recent years, JavaScript has also gained popularity outside of the web domain and is now used for server-side scripting (Node.js), mobile app development (React Native, NativeScript), and even desktop application development (Electron).

1.3.5 Jupyter Notebook :

The Jupyter Notebook is an open source web application that you can use to create and share documents that contain live code, equations, visualizations, and text. Jupyter Notebook is maintained by the people at Project Jupyter.Jupyter Notebooks are a spin-off project from the IPython project, which used to have an IPython Notebook project itself. The name, Jupyter, comes from the core supported programming languages that it supports: Julia, Python, and R. Jupyter ships with the IPython kernel, which allows you to write your programs in Python, but there are currently over 100 other kernels that you can also use. Jupyter Notebook (formerly IPython Notebook) is a web-based interactive computational environment for creating notebook documents. Jupyter Notebook is built using several open-source libraries, including IPython, ZeroMQ, Tornado, jQuery, Bootstrap, and MathJax. A Jupyter Notebook document is a browser based REPL containing an ordered list of input/output cells which can contain code, text (using Markdown), mathematics, plots and rich media. Underneath the interface, a notebook is a JSON document, following a versioned schema, usually ending with the ".ipynb" extension.

1.4 Overview

By using React and firebase a fully featured social media application is created.Application uses signup by filling signup data,after filling all the data the application validate the data and it will redirected to the home page.In the home page we can view post of users,we can see post of different users,comments and likes. Users can also upload his image and it will be stored in firebase storage.user can also update his profile.

Chapter 2
Overall Description

2.1 Product Perspective

A Weather forecast and Air quality management system stores the following information.

- **User details :**
  There is no need of user details. Any body can access it.
- **Item details :**
  The DB consists of the location's weather forecast and Air quality. And it will show weekly report of the weather forecast and day and night also. And it will show Humidity ,Pressure ,wind speed ,Sunrise and Sunset time.

2.2 Product Functions

- Application searches any location given by the user and it will also Humidity ,Pressure ,wind speed ,Sunrise and Sunset time.
- Information gets updated according to location.
- Inform public regarding overall status of air quality through a summation parameter that is easy to understand.
- AQI has been based on maximum sub-index approach using five parameters i.e. suspended particulate matter (SPM), SO2, CO, PM10, and NO2 .

2.3 Operating Environment

The Operating Environment used in the project is Windows 11.

2.4 User Classes and Characteristics

The user can search for food nutrition's of their choice once they login to the application. Also once they have gone through a few searches then the algorithm shows them more similar kinds of food. The Users should be able to do the following functions:

- Upload the image or profile that will be stored in Firebase storage.
- User can add their food to their directory.
- User can view his total intake of nutrients to date or between any specific dates.

2.5 Design and Implementation Constraints

The project operates under a number of design and implementation constraints. Some of these are as outlined below:

Hardware and Software constraints:

Since the project has been developed entirely using HTML CSS Script.js for frontend and Python and jupyter for Air quality index. The project can be run on any platform.The purpose of this module is the valid users and enter the inputs like Temperature (c), Visible Temperature(c), Humidity, Speed of Wind (km/h), Wind Bearing (degrees) , (km), Pressure (millibars). So that can predict to the approximate value of weather in any particular location.there is also primary memory, which is the memory that stores information that you are manipulating with immediately, when the computer is ON.

- In this system, User starts the process with the weather data. Weather module is initialized with the weather data which is acquired from the user in the processes of data collection and pre-processing as a procedure. Then the initialized data is tested using trained data module and tested data module and predicts the weather as an output and delivers to the user.
  To better understand the difference between primary and secondary, let me give you an example: Suppose you want to edit a photo.

- Your photo is stored in your Secondary Memory. When you open up your photo in a photo editor, it is loaded on your primary memory, so that you manipulate it. Then, you apply your favorite vintage filter to it, as well as colors and whatever you want. The edited photo is still on your primary memory. Then, you are happy with the result, so you click on

- Computers use CPU Memory registers, RAM (Random Access Memory), and other resources as Primary Memory. A modern laptop has around 8GB of RAM.

- Another big difference between Primary and Secondary Memory is that Primary memory is volatile. That means if your battery dies while your editing your photo, you'll lose all of your changes, because the Primary Memory can only keep information as long as there is energy. Secondary Memory, on the other hand, can keep your photo for years, even if the computer is OFF.

- An interesting thing I'd like to point up is Swap Space. Let's suppose you have 25 tabs of YouTube videos open on your browser. All of those videos are being downloaded into your RAM memory. Let's suppose you have 2GB, and then all of the videos combined occupy 3GB of memory. You don't have enough memory to hold all of that! When the computer reaches it's RAM limit, it starts using ”Swap Space”, which is basically storing the excessive data into a temporary location on your HD. HDs are too slow to hold data we are momentarily using, that's why your computer seems sluggish after your open a lot of pages and apps.

- Another place full of constraints in hardware is the CPU (Central Processing Unit). It is where everything in the computer is calculated. Every core of a CPU can only do one operation at a time. Think of operation as something like 1 - Get two numbers from memory, 2- Sum two numbers, 3- Show numbers on screen. It has a stack, which you can think of as a line of all the operations wanting to get in. It works with cycles, and with each cycle, one simple operation is done. The CPU Clock is a little device that sends electrical pulses to the CPU, and each pulse, a cycle.

- It seems quite straight forward then: Make the clock tick faster, so that we have more cycles per second, and work on all of the operations on the stack faster. There is a problem, however: You run the risk of overheating your processor, potentially melting down components and having a big headache. Many hardware hackers experiment with this, called ”Over- clocking”, and they generally use more expensive cooling systems, like liquid cooling, faster fans, bigger heat dissipators, etc.

- An approach that has been widely used on the industry is to increase the number of ”Cores” on a processor. You probably heard the terms dual-core, quad-core somewhere, since now even smartphones can be quad-core (four cores). So, that way, you multiply your processing power. That doesn't come without obstacles, of course. You need to carefully craft your software to work well with Parallel computing (AKA The art of using multiple processing units).

- One of the biggest challenges for computing today is the size of the transistor, a fundamental component of a processor. Transistors are getting so small, that Quantum Effects are starting to be relevant, as they will play out bigger interference with the functioning of the component. That's a very important constraint for today's industry.

- I’d like to briefly talk about I/O (Input/Output). I/O is basically communication across devices (AKA the thing behind USB stuff). Suppose you have just bought a super cool webcam, with 20 megapixels, 60 frames per second. Of course, the amount of data it generates is large. In that same scenario, your computer is old, and the USB port can only transport 10 frames per second of your beautiful camera. You have a problem there. You won’t be able to enjoy 60fps Skype Calls (and remember there are internet constraints as well, to slow it even further). Your computer’s I/O is slow, that’s a constraint, and even a 4GHZ, Octa-Core Processor, or a 50GB of RAM (I’m exaggerating values here) wouldn’t solve that issue.
- As you can see, there can be many constraints coming from many places in a computer. Many of the design decisions that have to be taken will have to take into account many tradeoffs of speed, capacity, price, compatibility, etc. You can think of it as a huge equation with thousands, millions of variables, and your job is to find the optimal value for each of those variables.

End user constraints:

The major constraints for the end user is having a proper internet connection on his computer or mobile. Also he should be familiar with the operation of the application to a certain extent.

2.6 User Documentation

User manual and GitHub link will be available for troubleshooting and help. The user manual will contain detailed information about the usage of the application from a layman’s perspective to an expert network/system administrator. The manual shall also be made available online.

2.7 Assumptions and Dependencies

The proposed solution will be designed to work in an enterprise environment . The target environment may consist of some technical error by the network . The solution has to be self sufficient and free from any unfamiliar dependencies

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Chapter 3
External Interface Requirements

3.1 User Interfaces

We have tried to keep the User interface as simple as possible so that users can use the application without putting much of their efforts. Like any other Weather forecasting and Air quality website. In this application user can just hop on to the site and check weather and air quality.

3.2 Software Interfaces

Following are the software used for the Weather forecasting and Air quality website.

Software used	**Description**
Operating system	We have chosen a windows operating system for its best support and user friendliness.
Tools/IDE	To implement the project we have chosen Visual studio for its more interactive support.
Platform	Website
Technologies and Tools Used	HTML,CSS,Script.js,python.jupyter.

3.1 Communications Interfaces

As the Weather Forecsting Website ,it requires high speed internet modem for the use of this . For the suitable use there must be a correct internet connection among the users.The users can directly interact with the website and use its functionalities.

Chapter 4
System Features

4.1 User Registration

4.1.1 Description And Priority :

When the web page run for the very first time the user is presented with a screen to directly check the weather of their desired city. This screen prompts the user to directly check the weather, temperature, humidity, wind of their desired city . The priority of this feature is highest because it will not waste time to create account and all that things it will directly show the result.

4.1.2 Stimulus/Response Sequence :

Step 1 : When the web page run for the very first time the user is presented with a screen to directly check the weather of their desired city .

Step 2 : This information is directly visible to the user via API .

Step 3 : After this process the user can directly see all the information.

4.1.3 Functional Requirements :

The application will not ask for any email address or anything for registration purpose .User can directly access the website in the globe.

4.1.4 Description And Priority :

The next thing that has to be done after registration and login is post the new profile or may like existing profiles.

4.1.5 Stimulus/Response Sequence :

Step 1 : When the web page run for the very first time the user is presented with a screen to directly check the weather of their desired city .

Step 2 : This information is directly visible to the user via API .

Step 3 : After this process the user can directly see all the information.

4.1.6 Functional Requirements :

When you create an weather website , it’s not all about the weather as it may seem. Your weather forecast website should satisfy the user with even humidity, how’s the wind quality and some other basic things along with weather.

Chapter 5
Other Nonfunctional Requirements

5.1 Performance Requirements

- **Normalized data-** data redundancy should be minimal which in turn reduces the chances of insert, delete and update anomalies.

- **Response time-** the overall time beginning with the user action (click on sign up button after filling up the details), the request going to the server, the response received from the server, and finally the response processing by the application will not take more than 10 seconds.

- **Scalability-** according to intended number of users and the projected load scenarios, the system should be able to serve 50 queries / day (in large part during the peak hours).

5.2 Safety Requirements

Some security measures are provided to the application account holders such as account holder must give his/her account id and password to login. Other than that security to user's personnel details and photos galleries. If there is extensive damage to a wide portion of database due to catastrophic failure, like disk crash, recovery method restores a past copy of the database that was backed up to archival storage (typically tape) and reconstructs a more current state by reapplying or redoing the operations of committed transactions from the backed up log, up to the time of failure.

5.3 Security Requirements

- Secure API Authentication: Implement secure authentication mechanisms to access the weather API. This can include API keys, access tokens, or OAuth authentication, depending on the API provider's requirements.
- Rate Limiting: Enforce rate limiting on API requests to prevent abuse and protect against Denial of Service (DoS) attacks. Set limits on the number of requests per user or IP address to ensure fair usage and avoid excessive load on the API server.
- Input Validation and Sanitization: Validate and sanitize all user inputs before sending requests to the API to prevent injection attacks and data manipulation. Follow best practices for input validation to ensure only expected and safe data is sent to the API.

5.4 Software Quality

Attributes :

- **Availability-** all the services should be available to the user. Correctness-the list of the products related to an user should be stored correctly.

- **Usability-** the details of products should be self-explanatory.

- **Maintainability-** User should maintain the database and store in updated form.

- **Portability-** the application should be portable to mobile.
- **Reliability-** the system should give 98
- **Extendibility-** the application should be easy to extend, code should be written in such a way that it favors implementation of new functions.

Chapter 6

References

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- https://www.freecodecamp.org/news/how-i-built-my-own-forecasting-tool-using-a-weather-api/

- https://github.com/topics/weather-website

Chapter 7
Appendix:

A: Overview Appendix

B: Analysis Models

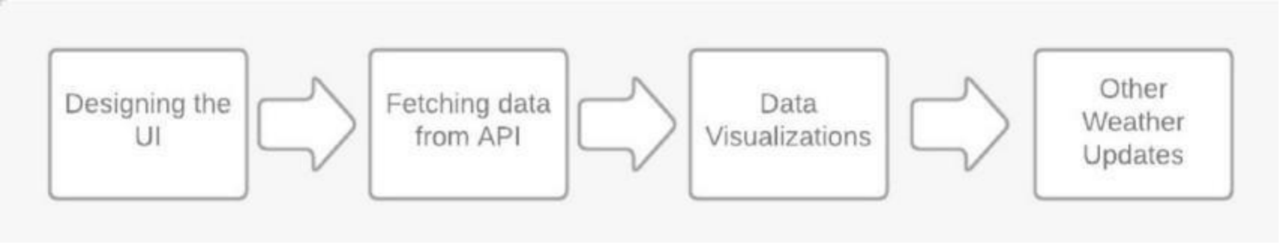

Figure 7.1: Analysis Models

E-R Diagram

ER diagram abbreviated as Entity-relationship model outlines the struc-tures of the database. An ER model is usually a blueprint or design which is later applied to database. The main entities of the social me- dia application are users,friends,posts,photos.

- This diagram illustrates how “entities” such as people, objects orconcepts relate to each other within a system.
- Entities in Internet applications can be user, posts with user activ-ity as separate behavior on their login.
- User attributes: city name which is input data etc.
- After successful login users can perform user activity and use thefunctionalities of the application.
- Database manages all the products.

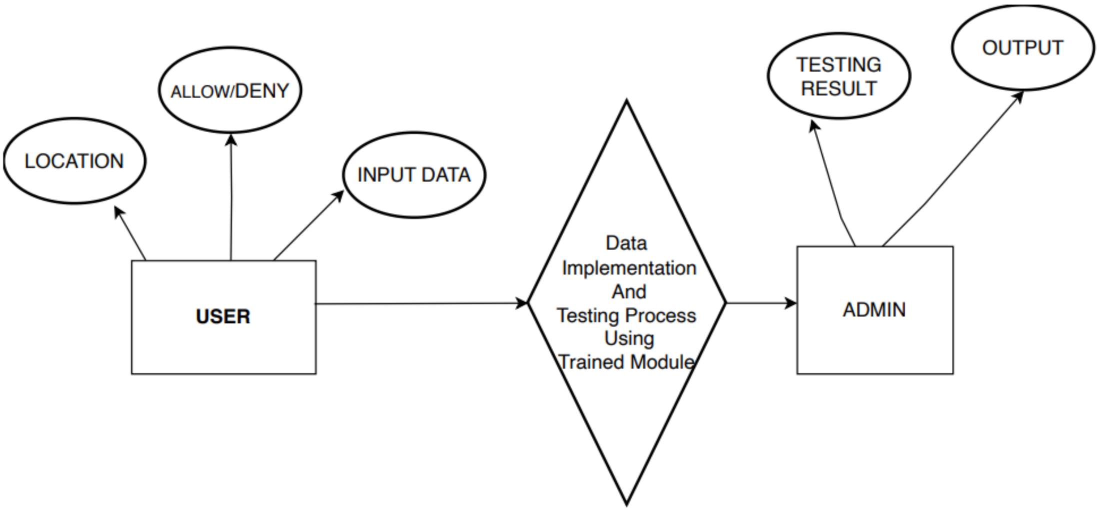
LOCATION
ALLOW/DENY
INPUT DATA
USER
Data Implementation And Testing Process Using Trained Module
TESTING RESULT
OUTPUT
ADMIN

Figure 7.2: ER-Diagram

Use-case :-

The data from the user are taken as inputs.Then the data is processed. Data isimplemented in the trained module and are tested.

- This use-case diagram is a graphic depiction of the interaction among the ele- ments of the Shopping application.It represents the methodology used in sys- tem analysis to identify,clarify and organise system requirements of Shopping application.
- The main actors in the weather forecasting website are the API who give the data.
- In weather forecast users are the actors who can interact with the frontend of the application and API handles the data (back-end) and Express Js is used for the communication between frontend and backend.
- Both user and firebase play their roles on their respective ends.
- Users can also update their profile by adding details such as Bio,location,personal or professional information,once these are submitted they are validated and af- ter validation these details are publicly visible to other users of the application.

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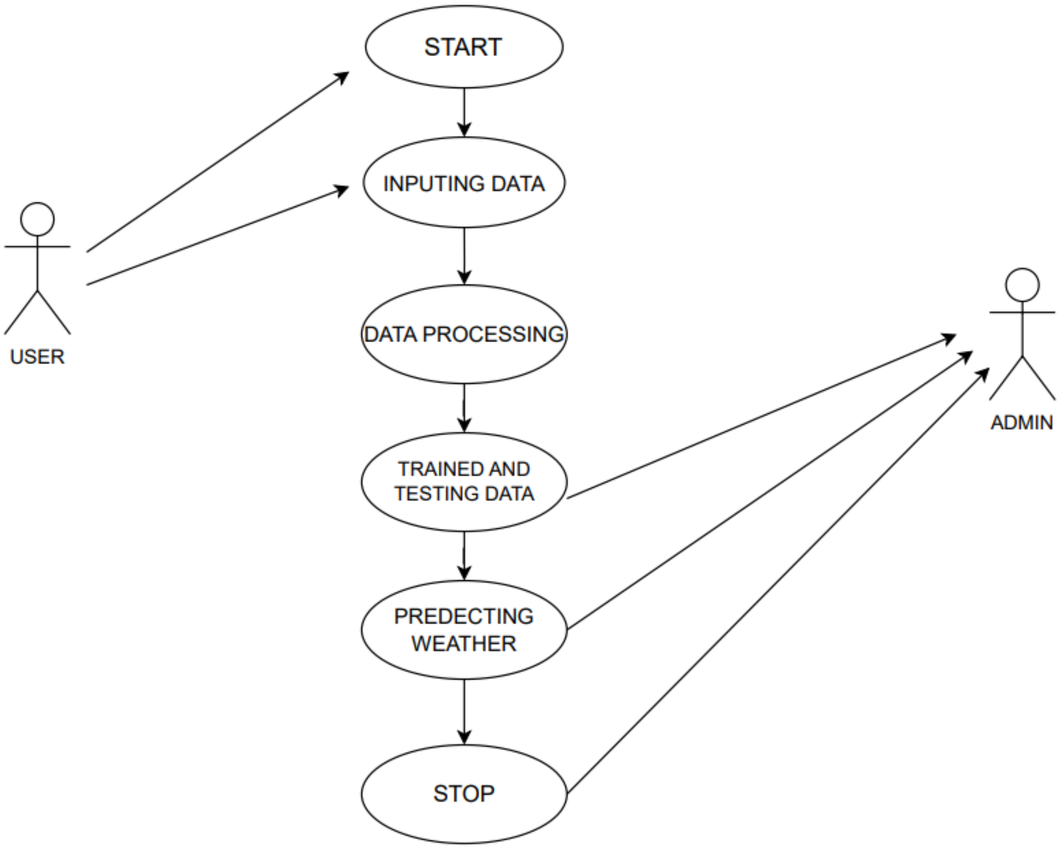

Figure 7.3: Use case for weather forecasting system

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Sequence Diagram-

- A sequence diagram shows object interactions arranged in time sequence. It depicts the objects and classes involved in the sce- nario and the sequence of messages exchanged between the objects needed to carry out the functionality of the scenario. Se- quence diagrams are typically associated with use case realiza- tions in the Logical View of the system under development. Sequence diagrams are sometimes called event diagrams or event scenarios.

- A sequence diagram shows, as parallel vertical lines (lifelines), different processes or objects that live simultaneously, and, as hor-izontal arrows, the messages exchanged between them, in the order in which they occur. This allows the specification of simple runtime scenarios in a graphical manner.

- Here, the classes are referred to by the term lifeline and as shown in the diagram there is a sequence maintained between the life- lines according to the actions performed by the user and admin respectively on the system.

- Messages from one lifeline to another are synchronous and asyn- chronous also as required in the activity performed.

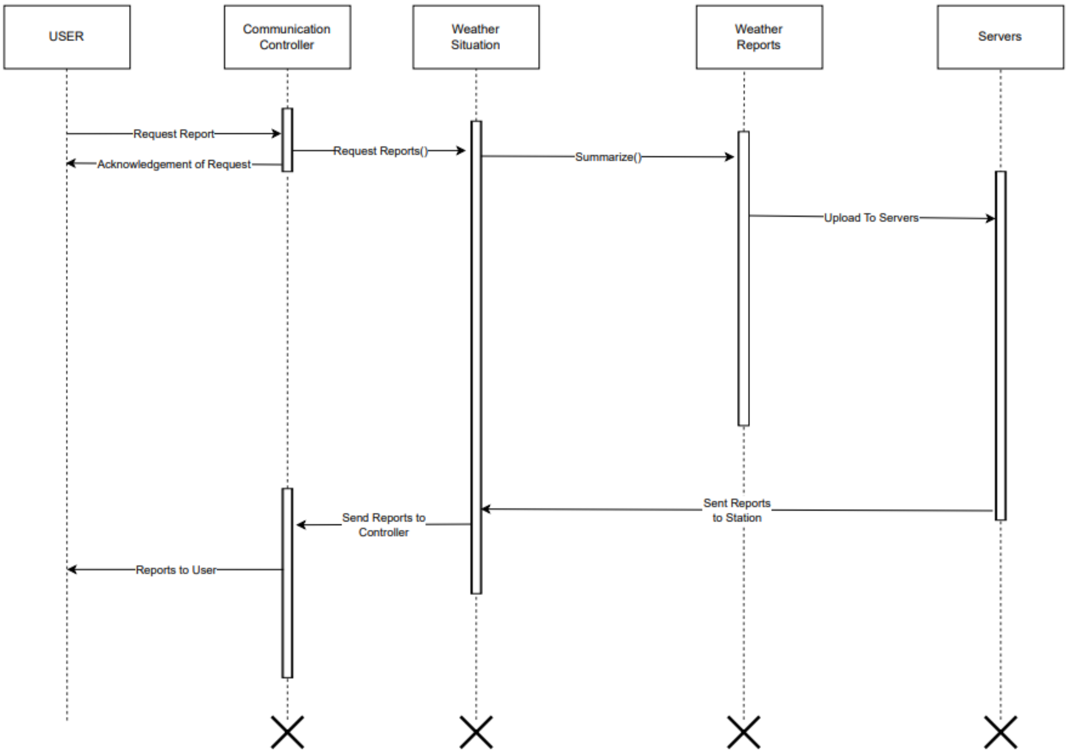

Figure 7.4: Sequence Diagram

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