Software Requirements Specification

for

SolarCast: Weather Prediction Web Application to Optimize Solar Power Plants

Proposal, Technical Project

Group 11 - Uni-Coders

Client: Mr. x Karunaratne

xyz Energy (Pvt) Ltd.

Version 2.0

Prepared by,

Uni-Coders

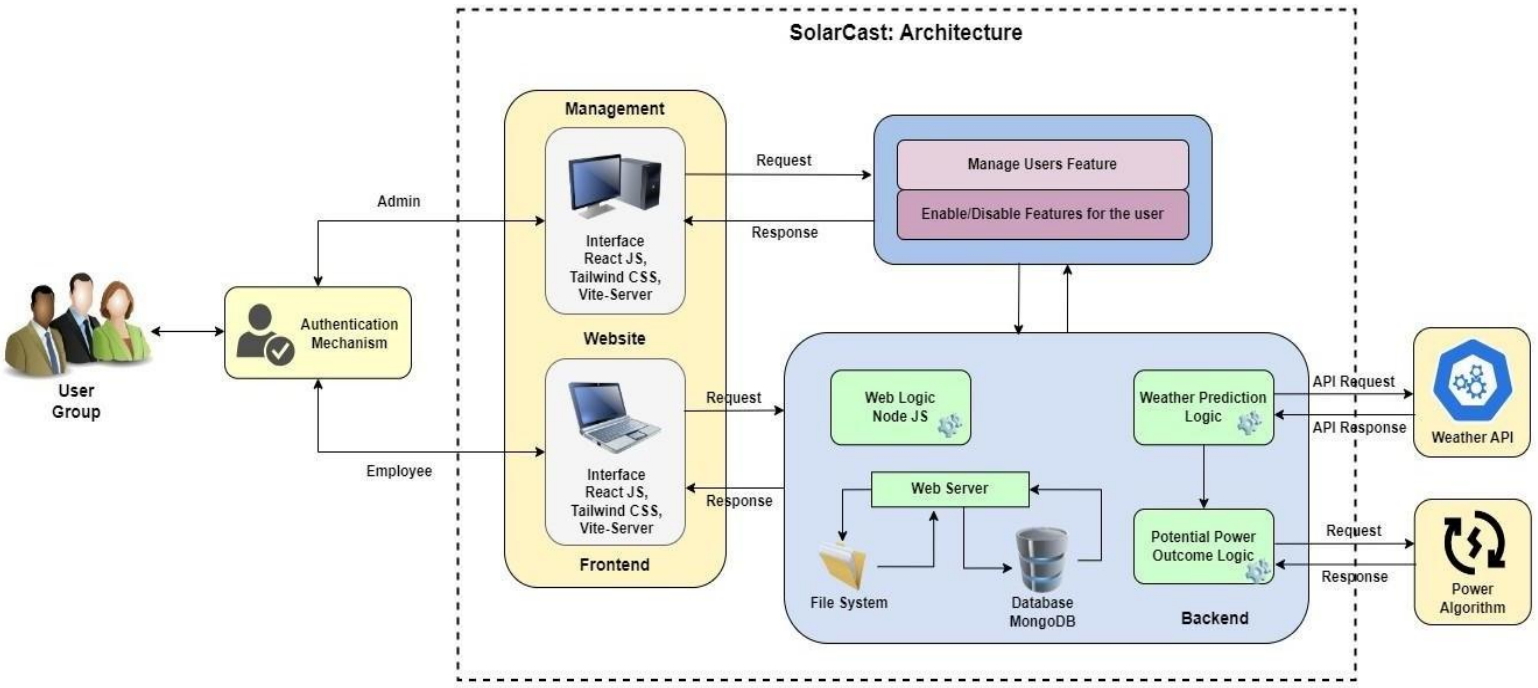
Table of Contents

1 INTRODUCTION

1.1 Purpose

The main objective of the Weather Prediction and Power Analysis web app for xzz Energy (Pvt) Ltd. is to create a user-friendly online platform that combines weather forecasting to predict power generation. The aim is to provide the company with an easy-to-use interface for accessing and analyzing relevant data, thereby improving energy management processes for demonstrations. Key goals include:

- Develop a user-friendly website for clients to access weather prediction and potential power that can be generated.
- Ensure a smooth and intuitive browsing experience.
- Allow the admin to manage users and enable and disable features for individual users



The intention of this purpose section of the Software Requirement Specification (SRS) document is to provide an elaborate description of the system. It encompasses an outline of the SRS as a whole, including the purpose, project scope, overall description, functional features, non-functional requirement references and external interface requirements. The functionalities have been suggested subsequent to a deep understanding of the client's needs. This document aims to detail how the web application will enhance the efficiency of solar plant operations.

1.2 Intended Audience and Reading Suggestions

The Web app is for xyz which is an energy solutions company dedicated to leveraging advanced supercapacitor, battery, and software technologies to combat the intermittent challenges of solar and wind power, ensuring consistent energy storage and delivery, the users of the system are xyz themselves when it comes to demonstrations when they pitch their solutions to potential users and solar power plants if they hope to see weather predictions.

The brief outline of the document;

- Overall description
- Main functions
- External interface requirements
- Non-functional requirements

The proposed web app does not require any advanced knowledge to navigate other than the basics of power units and the units the specific weather condition is measured in, for example: rainfall, windspeed, solar output, etc.. A regular. Users such as a person who works in a power plant or even xyz or the CEB (Ceylon Electricity Board) will be able to use it easily without any difficulties. The user interface is simple, direct and interactive.

1.3 Product Scope

The Weather Prediction and Power Outcome Web App project aims to develop a solution for solar power plants. This involves creating a user-friendly web application with advanced weather forecasting algorithms, allowing operators to proactively adjust solar panel power output based on predicted data conditions based on past weather conditions. Collaboration with client Mr. x Karunaratne ensures alignment with specific requirements. The overarching goal is to revolutionize solar power plant operations, introducing adaptability and efficiency for a more sustainable energy ecosystem.

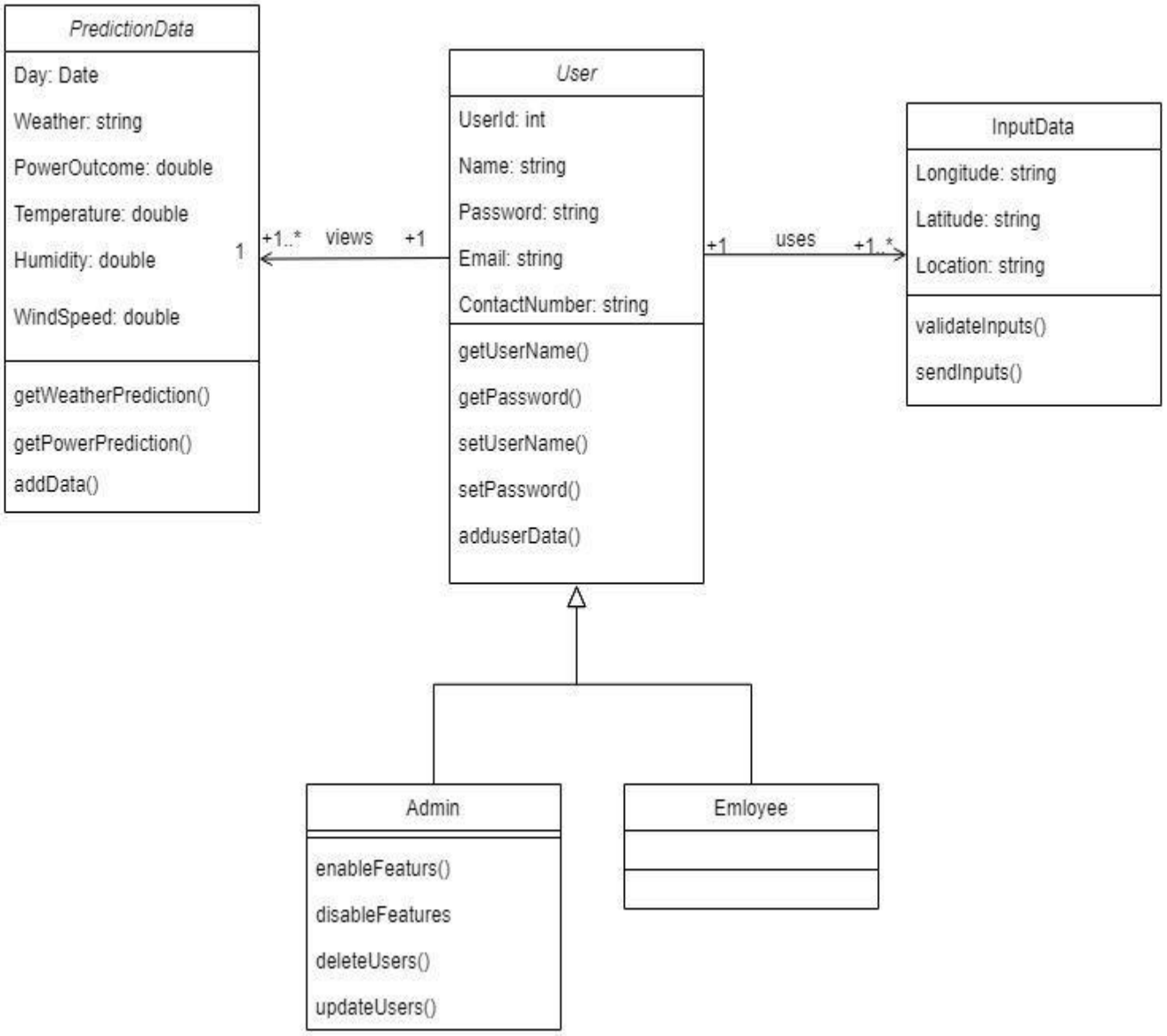
2 OVERALL DESCRIPTION

2.1 Product Perspective

The product when developed will allow users that are authorized by the admin, access to the system's features such as weather prediction and potential power output predictions based on inputs submitted by the user. Both these features generate interactive graphs. The admin can manage users as well as decide whether users get access to the web app’s features.

2.2 Product Functions

- Admin
    - Log in and out of the system.
    - Manage users.
    - Enable or disable Features for users.
- Users
    - Log in and out of the system.
    - Submit values for predictions.
    - View the weather predictions and graphs generated from the said predictions.
    - View the potential power output based on the weather prediction Graph/Values.


PredictionData
Day: Date
Weather: string
PowerOutcome: double
Temperature: double
Humidity: double
WindSpeed: double
getWeatherPrediction()
getPowerPrediction()
addData()
1
+1..*
views
+1
User
UserId: int
Name: string
Password: string
Email: string
ContactNumber: string
getUserName()
getPassword()
setUserName()
setPassword()
adduserData()
+1
uses
+1..*
InputData
Longitude: string
Latitude: string
Location: string
validateInputs()
sendInputs()
Admin
enableFeaturs()
disableFeatures
deleteUsers()
updateUsers()
Emloyee

2.3 User Classes and Characteristics

There are two types of users in this organization that interact with this system, they mainly are Admin of the system and the users which are other authorized employees of the company. Only admins can manage the users by giving authorization to the employees and the application won’t be having any sign-up forums in order to secure the data from unauthorized parties.


SolarCast: VolfPack Energy (Pvt) Ltd.
Verify login info
<<include>>
Login
If Credentials Invalid
<<extend>>
Display login error
Retrieve data
Logout
Perform actions
Employee
Submit Values for Predictions
Weather API
View weather predictions & graphs
<<include>>
Weather prediction (API response)
<<include>>
View potential power output values
Add users
Manage Users
Update users
Delete users
Admin
Give feature permission
Enable feature
Disable feature

Only these authorized parties can get weather predictions and view all the graphs and potential power output based on the predictions. System won't be involved in any kind of financial processes since the company currently uses different systems to maintain their financial records.

2.4 Operating Environment

2.4.1. Software

- MongoDB Atlas
- Visual Studio Code
- Libraries - TailwindCSS, Vite-Server
- Project Libre
- Draw.io
- Figma
- Microsoft Word
- Microsoft PowerPoint
- Windows 7/MAC OS X or above

2.4.2. Hardware

- PC
- Wi-Fi router
- CPU i3 or above
- RAM 4GB or above
- Disk 20GB minimum

2.5 Design and Implementation Constraints

1. **Update and Error Handling** - While the project is in development, Additional features may need to be added or removed depending on the requirements.
2. **The inability to collect statistical information locally** - Due to the economic crisis in the country it is really difficult to travel into actual business locations and meet the client to gather information for research purposes since it will cost a lot of money for transportation.
3. **Limited development knowledge** - Since the project is based on a different domain (Solar Power Generation & Power Plants) and the team has no prior

experience, it took some time to get a basic understanding of the technologies and figure out a way to implement the final project.

4. **Limited development time** - Meeting all the requirements and producing the end product within the given time period since there is a limited time period to complete the whole project.
5. **Limitation of data collection** - Since the client has a wide business, and it contains sensitive and private data such as financial data, that kind of data was not collected to protect business privacy even though the project needs some of it.
6. **Data privacy** - Throughout the development cycle of the project data privacy was given a higher priority. Since the data contains sensitive details, the legality for using the said data needs to be carefully analyzed. Developers should use extreme caution when developing this application to reduce security risks because unauthorized access to the system could cost the company a significant amount of money.

2.6 User Documentation

It is considered that the user is familiar with the fundamentals of using the Internet. On the other hand, the customer will receive training sessions that will provide them a thorough understanding of how to use the website, as well as a hard copy of the user manual. It will be composed in an essay and comprehensible language that is easily understood by anyone even without any technical background. The client will receive a hard copy of the user manual along with the product delivery.

2.7 Project Documentation

All of the information regarding the documents prepared by the project team so far can be found in the Project Documentation section. This will include the project brief as well as the project proposal.

Project brief: The project brief serves as a reference guide that highlights the main features of the project. It benefits clients to have a clear grasp of the project's objectives and purpose as well as to make sure that everyone is aligned and pursuing the same goal.

Project proposal: The problems that have been identified with the client and the solutions that will be implemented using the proposed system are included in the project proposal.

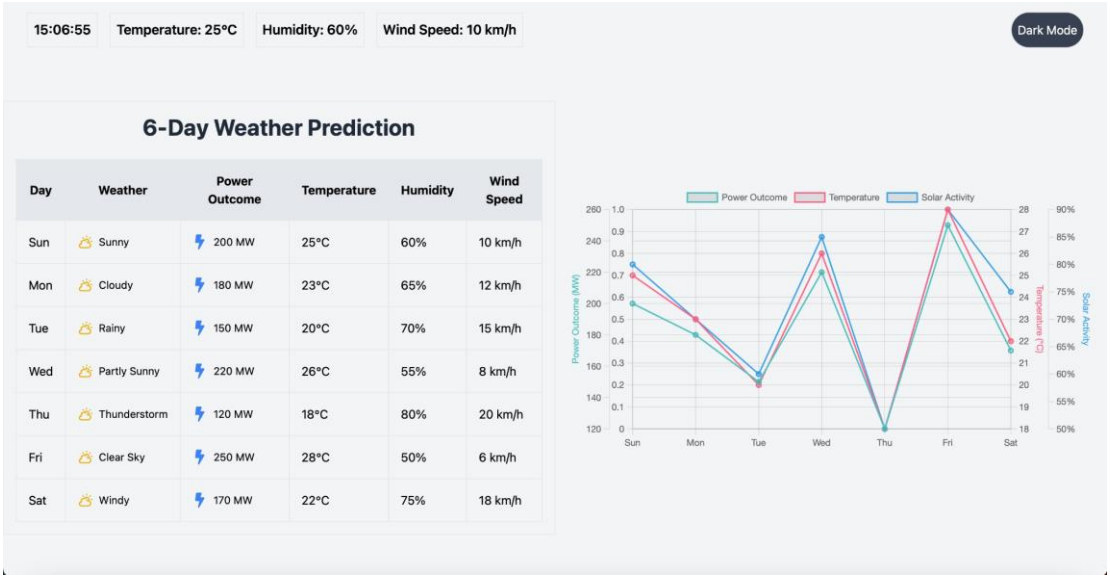
2.8 Assumptions and Dependencies

- The users are using Internet enabled devices such as desktop computers, laptops, tablets, or smartphones with web browsers which are capable of rendering the web application's content properly.
- Users can connect into a reliable and secured Internet connection.
- Users have a better understanding on using Internet accessible devices and the basic knowledge and understanding of web browsing.
- Users are aware of the best practices for online security, such as creating strong passwords and staying away from suspicious links and sites.

2.9 User Interfaces

This section consists of the sample wireframes of the modules and functions on the webSystem.

2.10 Main DashBoard



2.11 Hardware Interfaces

As a web-based application, the xyz Energy (Pvt) Ltd system doesn't directly interface with external hardware. However, there are key hardware components related to server infrastructure and client devices that play a crucial role:

Client Devices - The users will access the system through various client devices, such as desktop computers, laptops, tablets, and smartphones. The application should be optimized for different screen sizes and resolutions.

Server Infrastructure - storage capacity for archiving historical weather data and maintaining system logs.

2.12 Software Interface

The System is compatible with any windows/iOS operating system and any mobile device. Windows 7 or + version is recommended. The system requires a web browser to run the application. Chrome or Firefox is recommended.

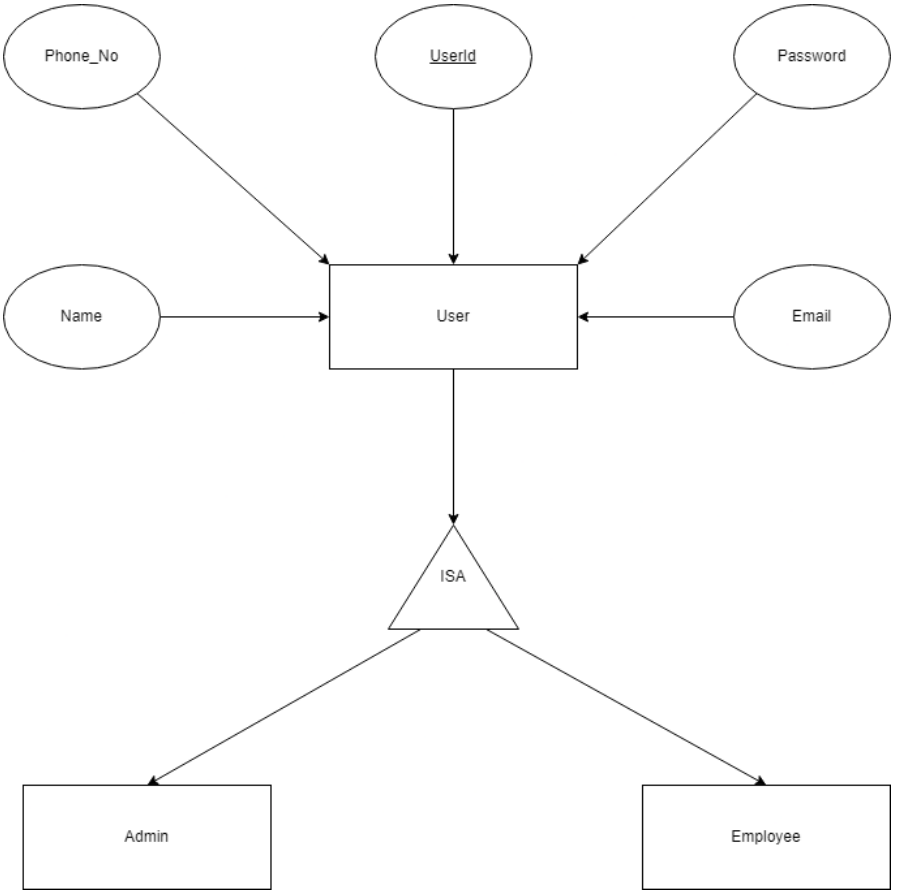
2.13 Communications Interfaces

The communication interface is a critical aspect of the xyz Energy (Pvt) Ltd system, enabling seamless interaction between users and the application. The integration with Google GraphCast enhances the visual representation of weather predictions and power output estimates.

The communication between the client devices and the server will be carried out over the HTTP/HTTPS protocols.

3 SYSTEM FUNCTIONAL FEATURES

3.1 Database Requirements



3.2 Use Case Description

Use case ID	A01	
Use case Name	Admin Login	
Actors	Client (Owner & Employees)	
Pre-Conditions	A client to log-in to the system	
Post Conditions	Successful log-in	
	Action	System Response
Success path	1.Client opens the application. 3.Client enters the username and password.	2.Displays the log-in page. 4.System check and verify the information. 5.System displays the home page.
Alternate path	If the client enters the wrong username or password in step 3.	
Exception path		System shows an error message and asks to re-enter the user credentials.

Special requirements	

Use case ID	A02	
Use case Name	Manage users	
Actors	Admin	
Pre-Conditions	An admin to logged-in to the system	
Post Conditions	Successful management of users	
	Action	System Response
Success path	1. Admin opens manage users page. 3. Admin selects a user. 5. Admin make changes to the user.	2. Displays the manage users page. 4. Displays the user details. 6. System check and verify the information.

		7. System displays a message showing successful management of the user.
Alternate path		
Exception path		System shows an error message and asks to do the changes again.

Use case ID	A03	
Use case Name	Enable or disable Features for users	
Actors	Admin	
Pre-Conditions	An admin to logged-in to the system	
Post Conditions	Successful enabling or disabling of features	
	Action	System Response

Success path	1.Admin opens the features page. 3.Admin selects a feature. 5.Admin enables or disables the feature.	2.Displays features page. 4.Displays the feature. 6. System displays a message showing successful enabling or disabling of features.
Alternate path		
Exception path		System shows an error message and asks to do the changes again.
Special requirements		

Use case ID	A04	
Use case Name	Admin Log out	
Actors	Admin	
Pre-Conditions	An admin to logged-in to the system	
Post Conditions	Successful log-out	
	Action	System Response

Success path	1.Admin opens the menu. 3.Admin clicks the log-out button.	2.Displays the log-out button. 4.System log out the client. 5.System redirect client to log-in page.
Alternate path		
Exception path		System shows an error message and asks to log out again.
Special requirements		

Use case ID	A05	
Use case Name	User Login	
Actors	User	
Pre-Conditions	A user to log-in to the system	
Post Conditions	Successful log-in	
	Action	System Response

Success path	1. User opens the application. 3. User enters the username and password.	2.Displays the log-in page. 4.System check and verify the information. 5.System displays the home page.
Alternate path	If the user enters the wrong username or password in step 3.	
Exception path		System shows an error message and asks to re-enter the user credentials.
Special requirements		

Use case ID	A06	
Use case Name	Submit values for predictions	
Actors	User	
Pre-Conditions	A user that logged into the system	
Post Conditions	Successful submitting of values	
	Action	System Response

Success path	1.User opens the submit value page. 3. User enters the values.	2.Displays the submit values page. 4.System check and verify the values. 5.System displays a message showing successful submitting of values.
Alternate path	If the client enters invalid data in step 3.	
Exception path		System shows an error message and asks to re-submit the values again.
Special requirements		

Use case ID	A07	
Use case Name	View the weather predictions and graphs generated from the said predictions	
Actors	Users	
Pre-Conditions	A user that logged into the system	
Post Conditions	Successful viewing of weather predictions and graphs	
	Action	System Response

Success path	1.Client opens the view weather predictions page.	2.Displays the view weather predictions page.
Alternate path		
Exception path		System shows an error message and asks to reload the page.
Special Requirements		

Use case ID	A08	
Use case Name	View the potential power output based on the weather prediction Graph/Values	
Actors	Users	
Pre-Conditions	A user that logged into the system	
Post Conditions	Successful viewing of the potential power output	
	Action	System Response

Success path	1.Client opens the view power output page.	2.Displays the power output page.
Alternate path		
Exception path		System shows an error message and asks to reload the page.
Special Requirements		

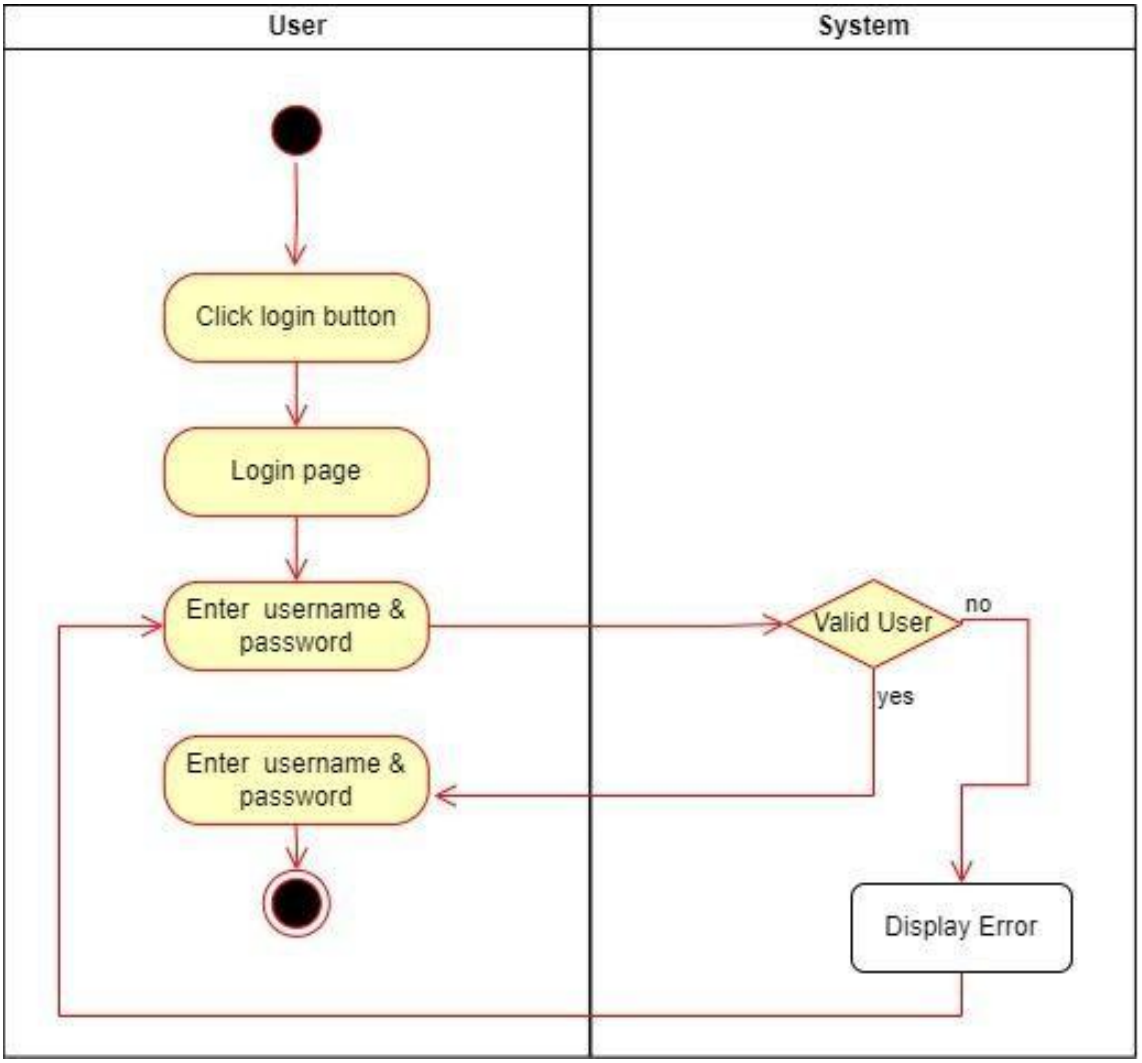
Use case ID	A09
Use case Name	User Log out
Actors	User
Pre-Conditions	A user to logged-in to the system
Post Conditions	Successful log-out

	Action	System Response
Success path	1. User opens the menu. 3. User clicks the log-out button.	2.Displays the log-out button. 4.System log out the user. 5.System redirect user to log-in page.
Alternate path		
Exception path		System shows an error message and asks to log out again.
Special requirements		

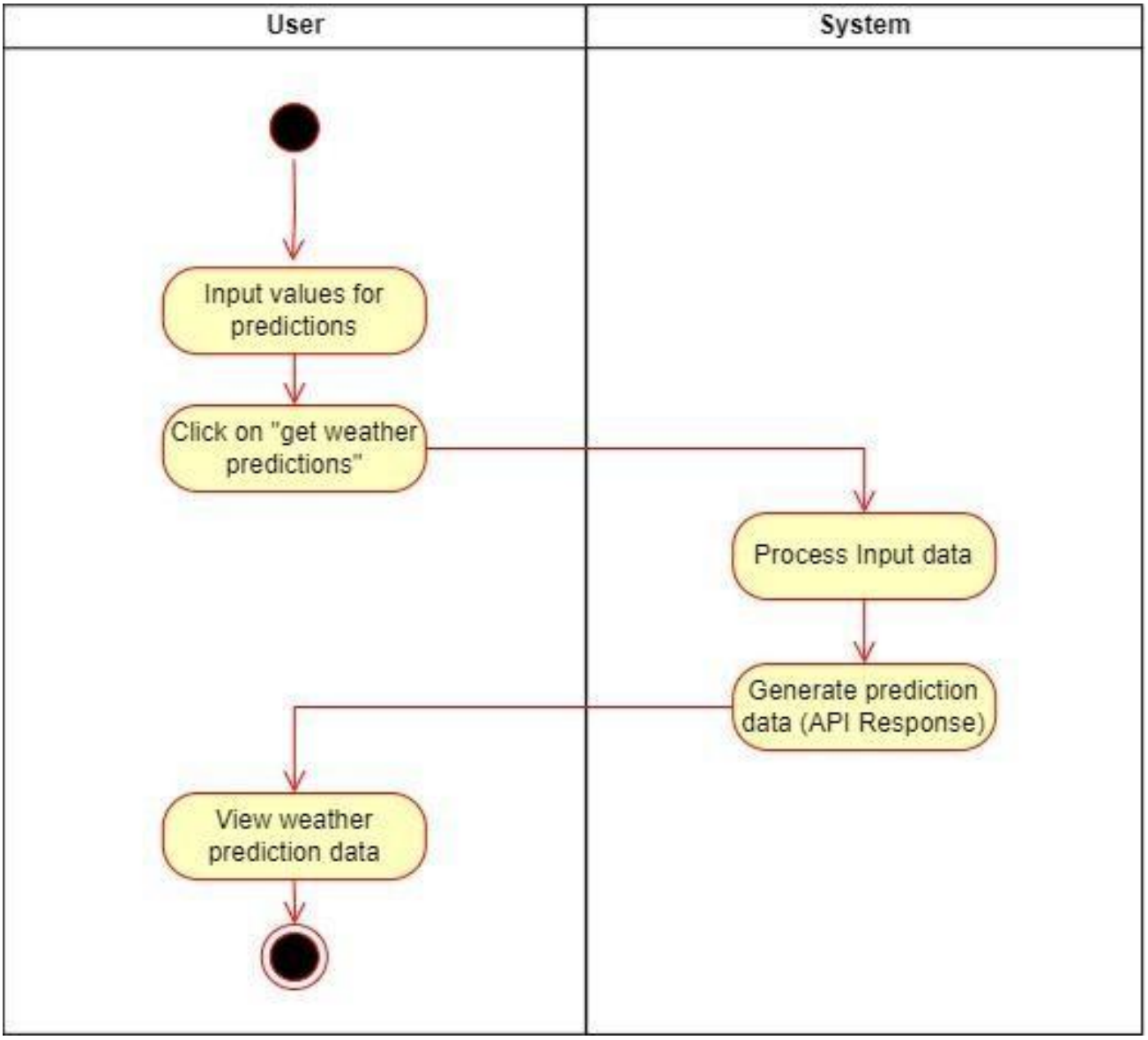
4 NON-FUNCTIONAL REQUIREMENTS

4.1 Performance Requirements

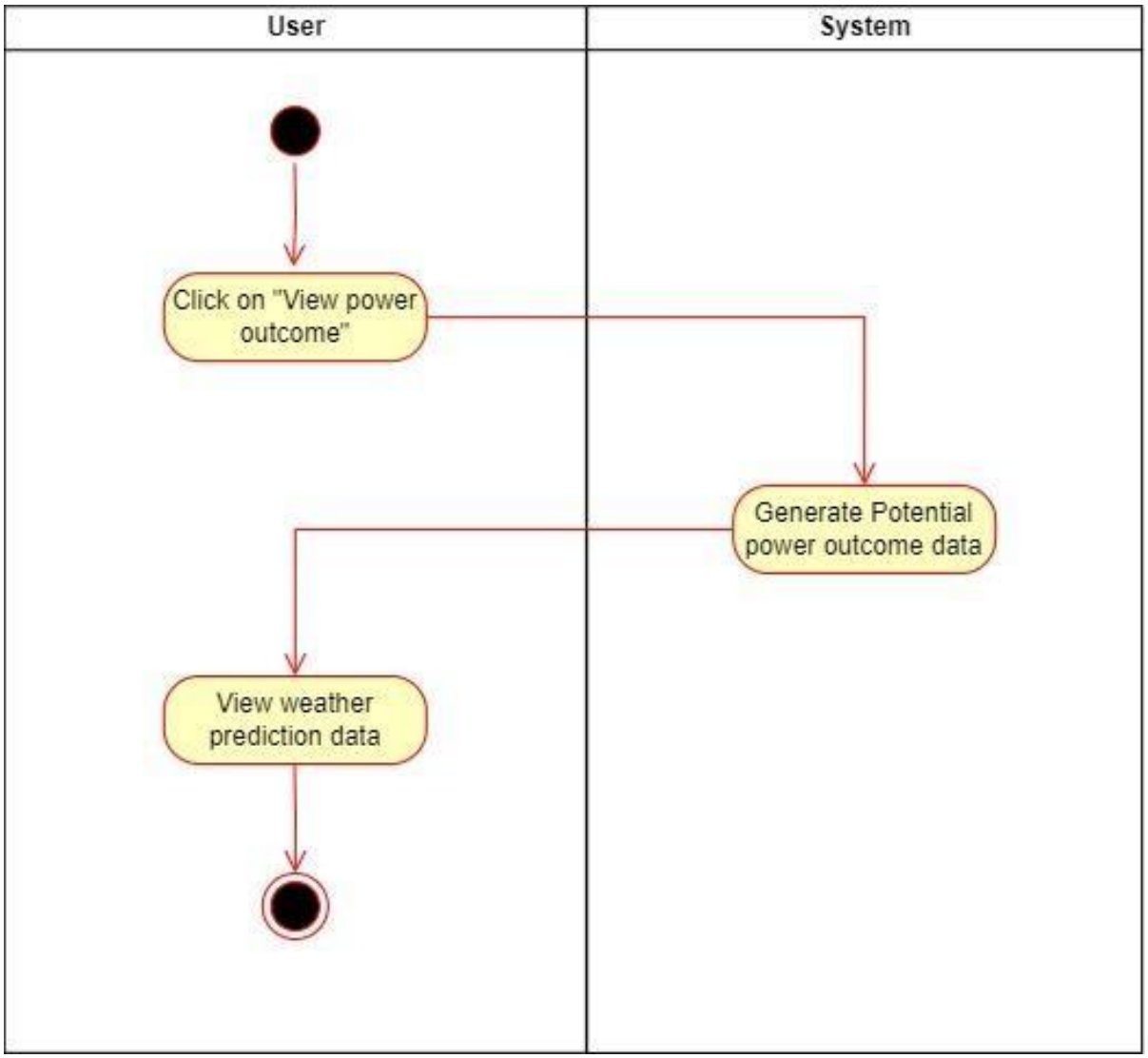
1. **User Login**



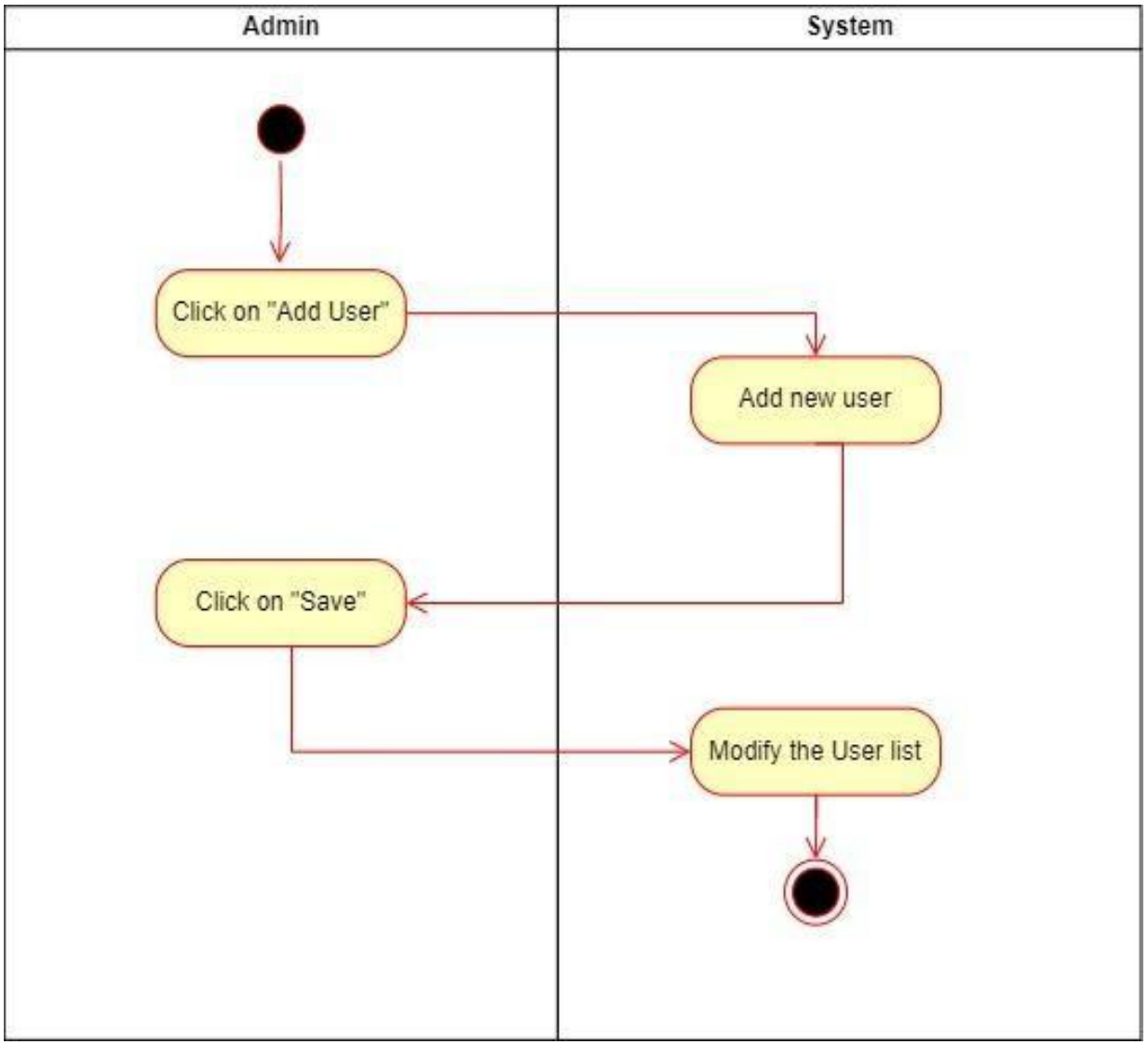
2. Weather Prediction Feature



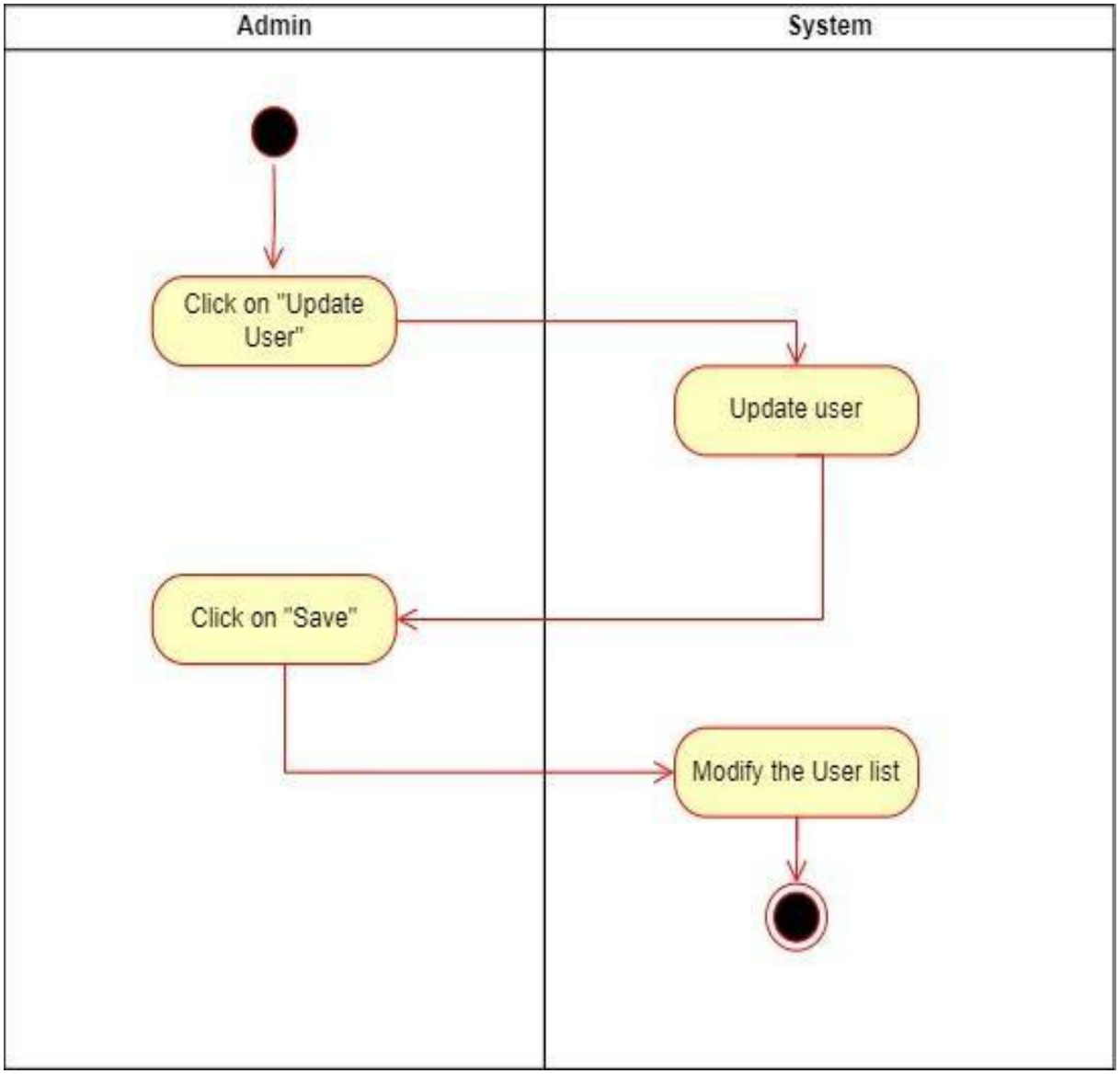
3. Potential Power Outcome



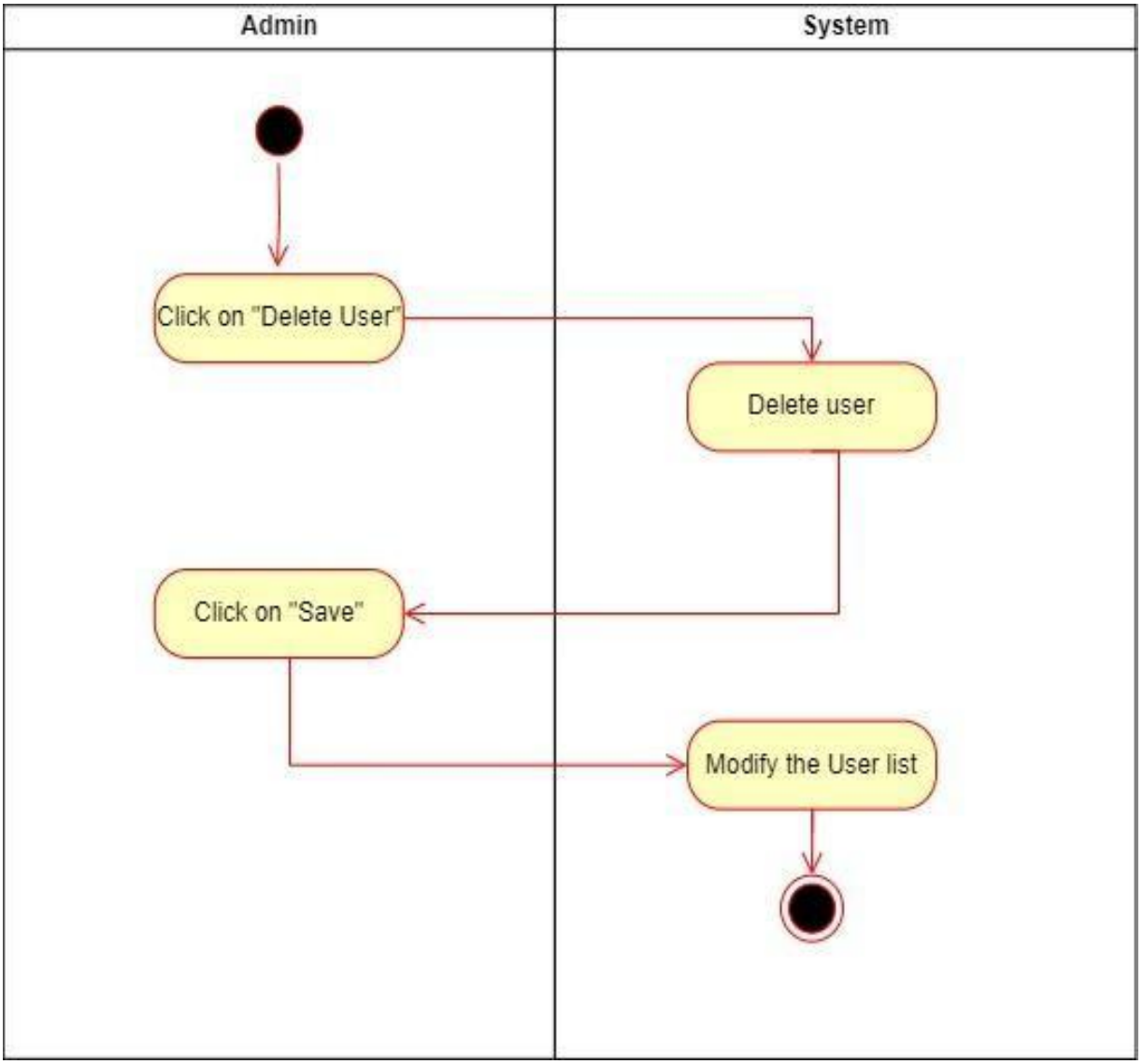
4. Add new user



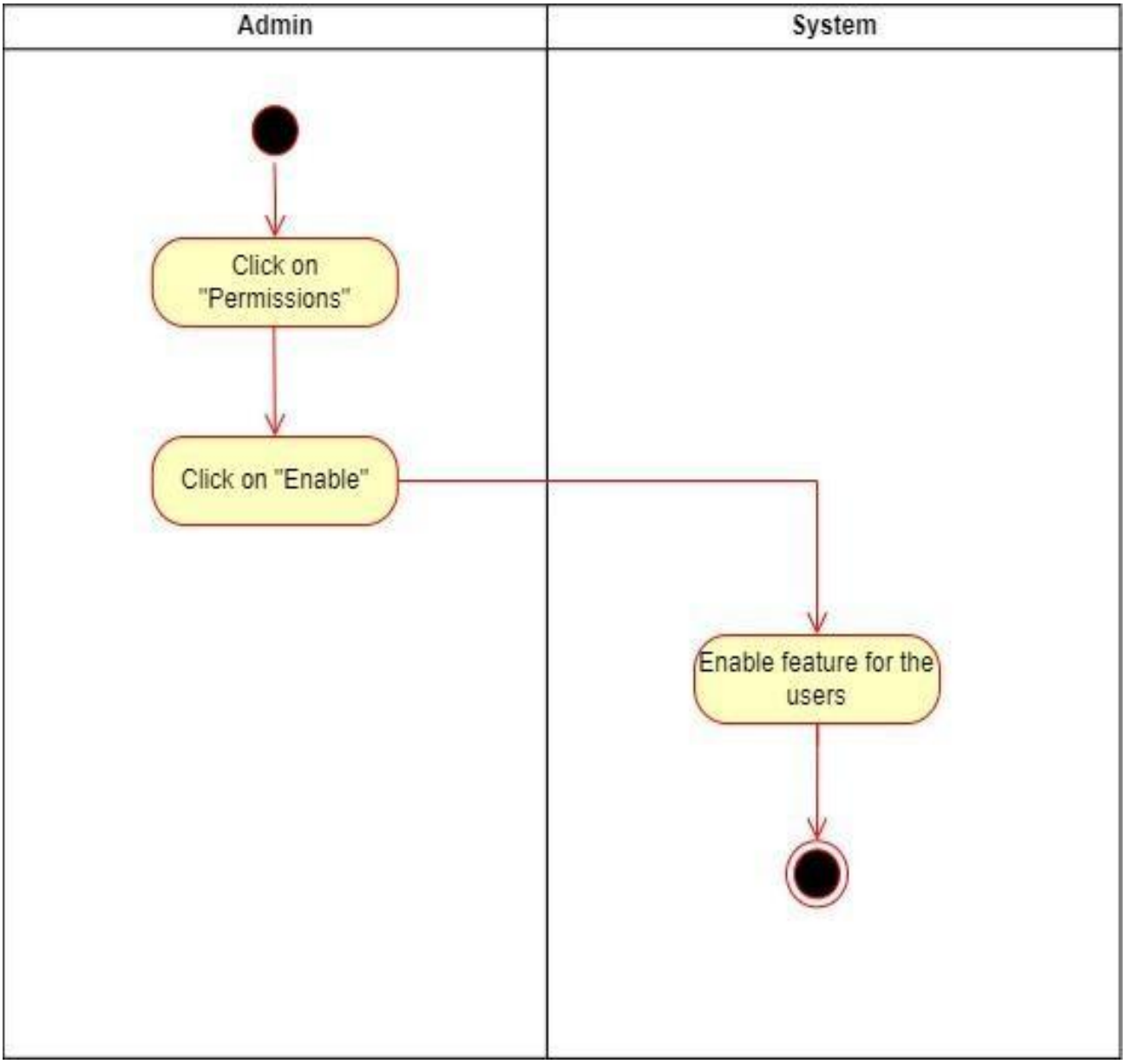
5. **Update user**



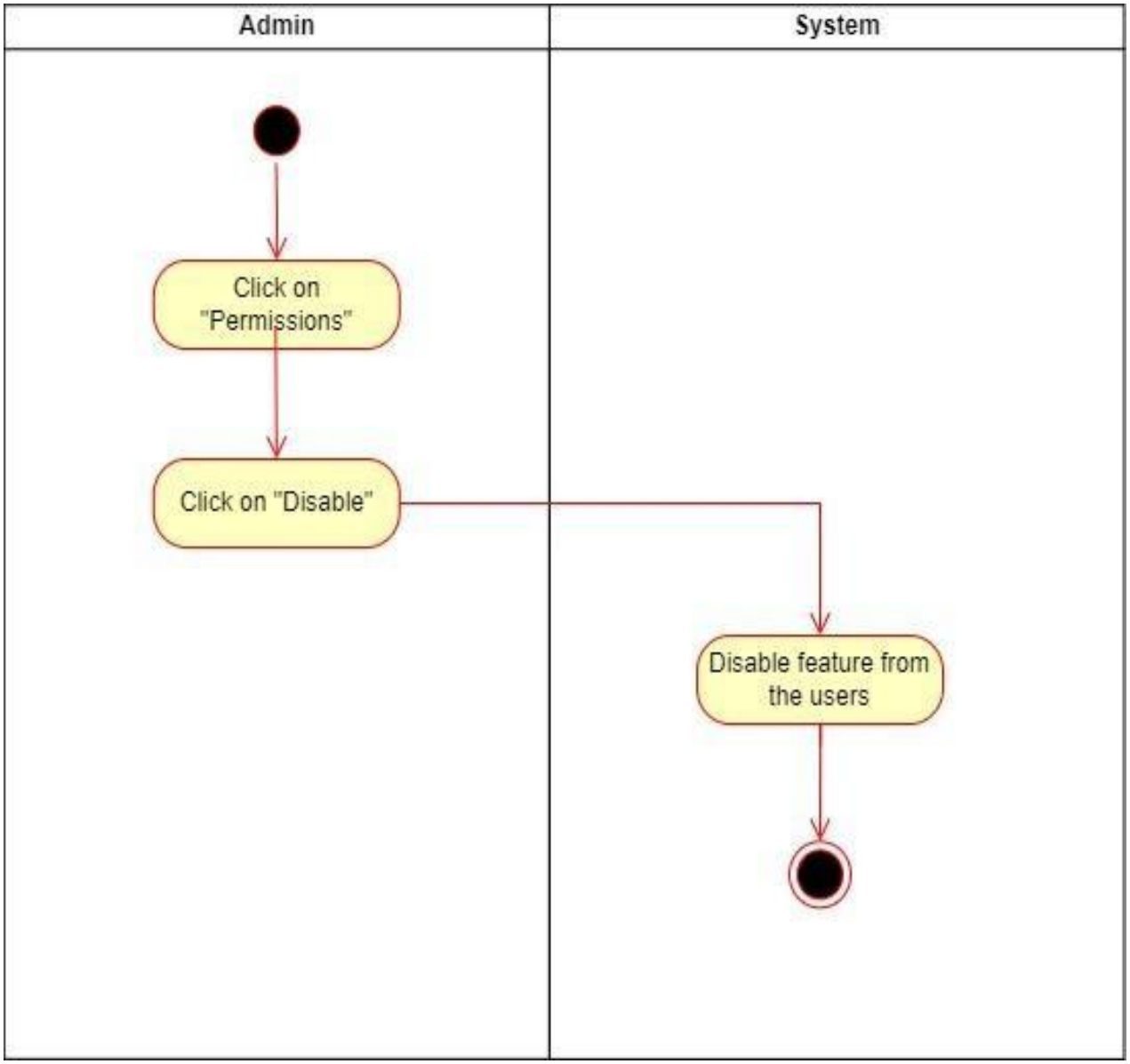
6. Delete User



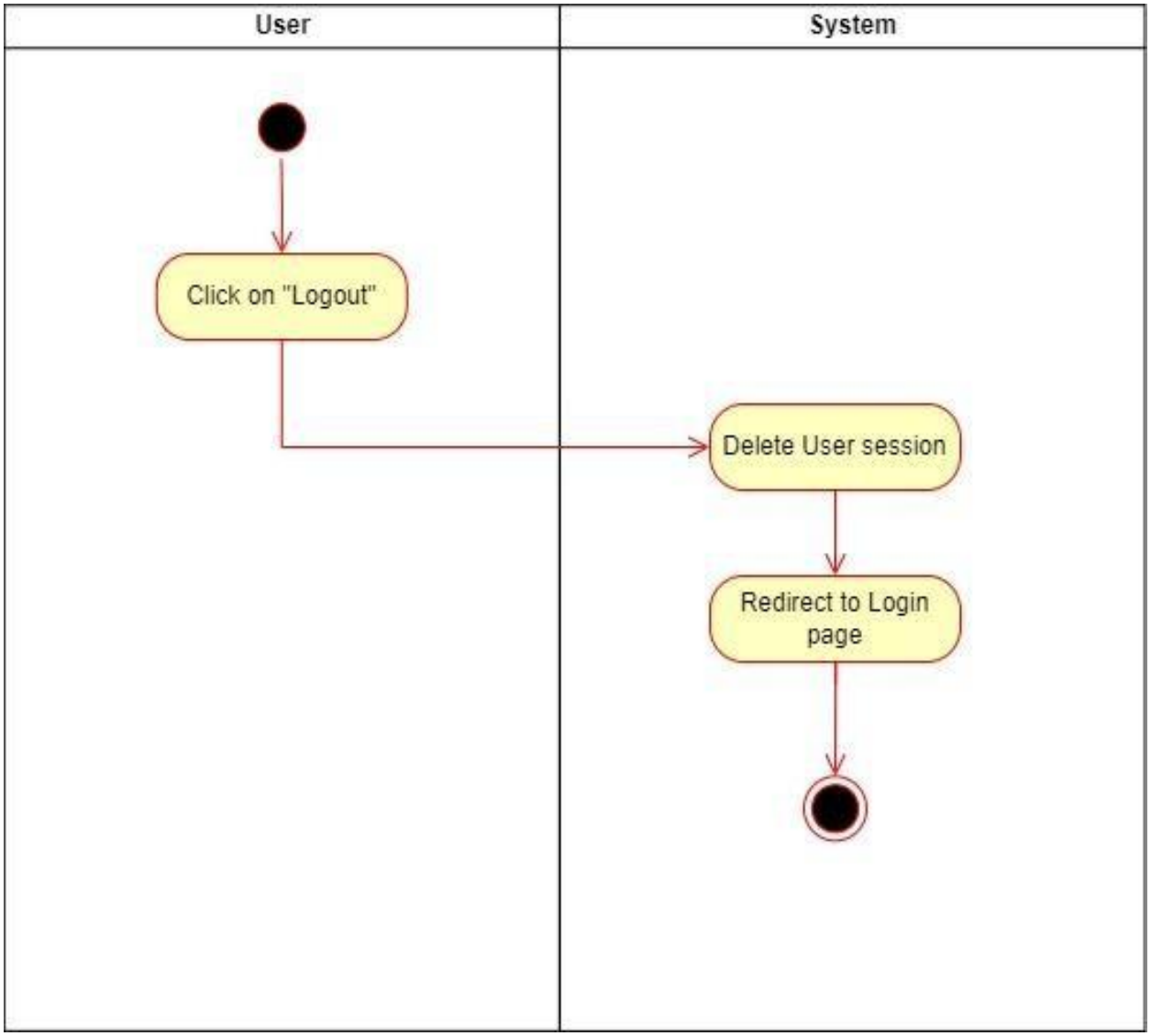
7. **Enable user feature**



8. Disable User Feature



9. **Logout from the system**



4.2 Safety Requirements

To ensure the security and reliability of the xyz Energy (Pvt) Ltd web application, several safeguards are crucial for both user satisfaction and system performance:

1. To maintain the integrity of data and facilitate swift recovery in case of data loss, it is essential to routinely schedule backups for the database.
2. The codebase will prioritize simplicity, understandability, and testability, fostering safer development practices.

4.3 Security Requirements

Ensuring the security of the xyz Energy (Pvt) Ltd web application is paramount to preserve data confidentiality, integrity, and availability. Robust encryption protocols, such as HTTPS, will be employed to secure data transmission. User authentication, including multi-factor authentication, will be enforced to mitigate unauthorized access. Regular security audits and vulnerability assessments will identify and address potential threats. Role-based access control will restrict privileges based on user roles.

4.4 Software Quality Attributes

- **Speed**: Utilizing best coding practices, the web system will exhibit efficient speed, facilitating seamless usage across various devices. Rigorous testing conducted by Quality Assurance Engineers ensures optimal performance and responsiveness.

- **User-friendly Interface:** The system will feature a user-friendly interface, enabling easy navigation and comprehension for all users.

- **Security:** Robust security measures will safeguard the web system against potential cyber threats, ensuring the confidentiality and integrity of user data.

- **Flexibility:** The system's architecture allows for the addition of new features without introducing defects, ensuring adaptability to evolving requirements.

- **Maintainability:** The web system will be designed for ease of maintenance and updates, enabling modifications based on client preferences and needs.

- **Testability:** The system will be equipped with comprehensive testing capabilities, allowing for seamless testing of functions at any time as required.

4.5 Business Rules

The objective of the Weather Prediction System project is twofold: firstly, to enhance solar power plant operations by leveraging advanced forecasting technology, and secondly, to expand the client base and increase sales by creating an intuitive and secure web platform. It is imperative that customer data remains confidential, adhering to strict privacy protocols. The website will be designed with role-based privileges, particularly for the admin role, which aims to streamline system management tasks. Admin privileges include deleting and updating information, managing products, viewing payments, products, and customer reviews. By prioritizing both operational efficiency and customer privacy, the project aims to deliver a comprehensive solution that meets all quality assurance criteria.

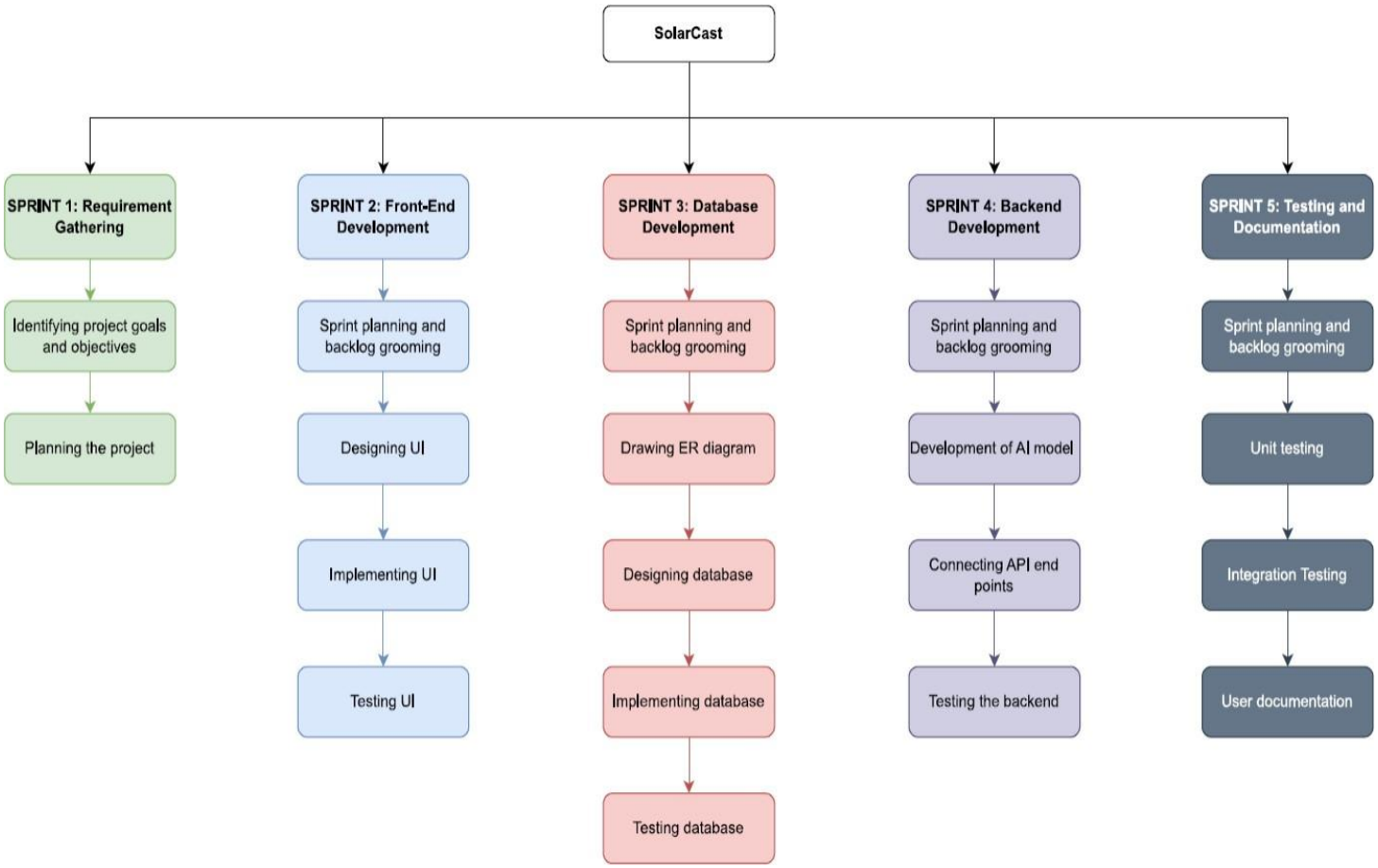
5 REFERENCES

[1] What are the software quality attributes? (2023) *Testsigma Blog*. Available at: https://testsigma.com/blog/software-quality-attributes/ (Accessed: 15 February 2024).

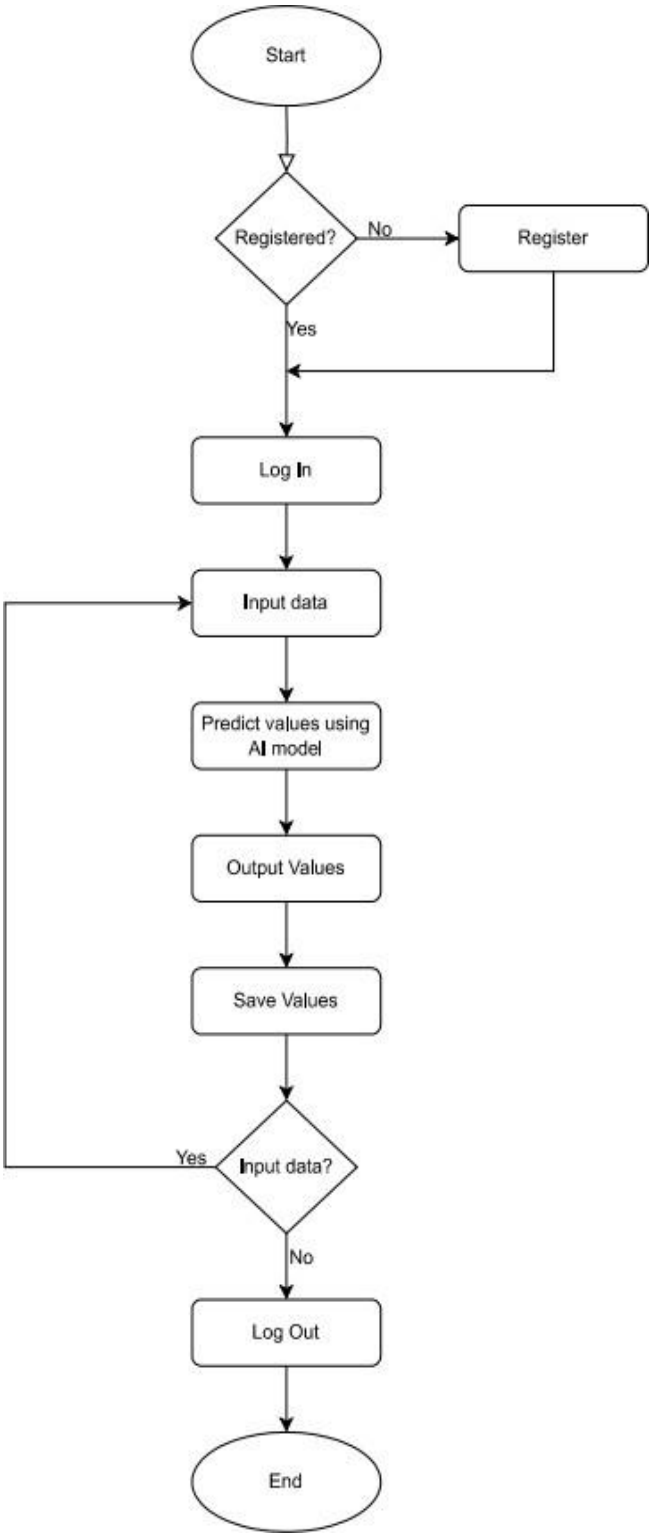
[2] What are business rules? (no date) *IBM*. Available at: https://www.ibm.com/topics/business-rules (Accessed: 15 February 2024).

6 APPENDICES

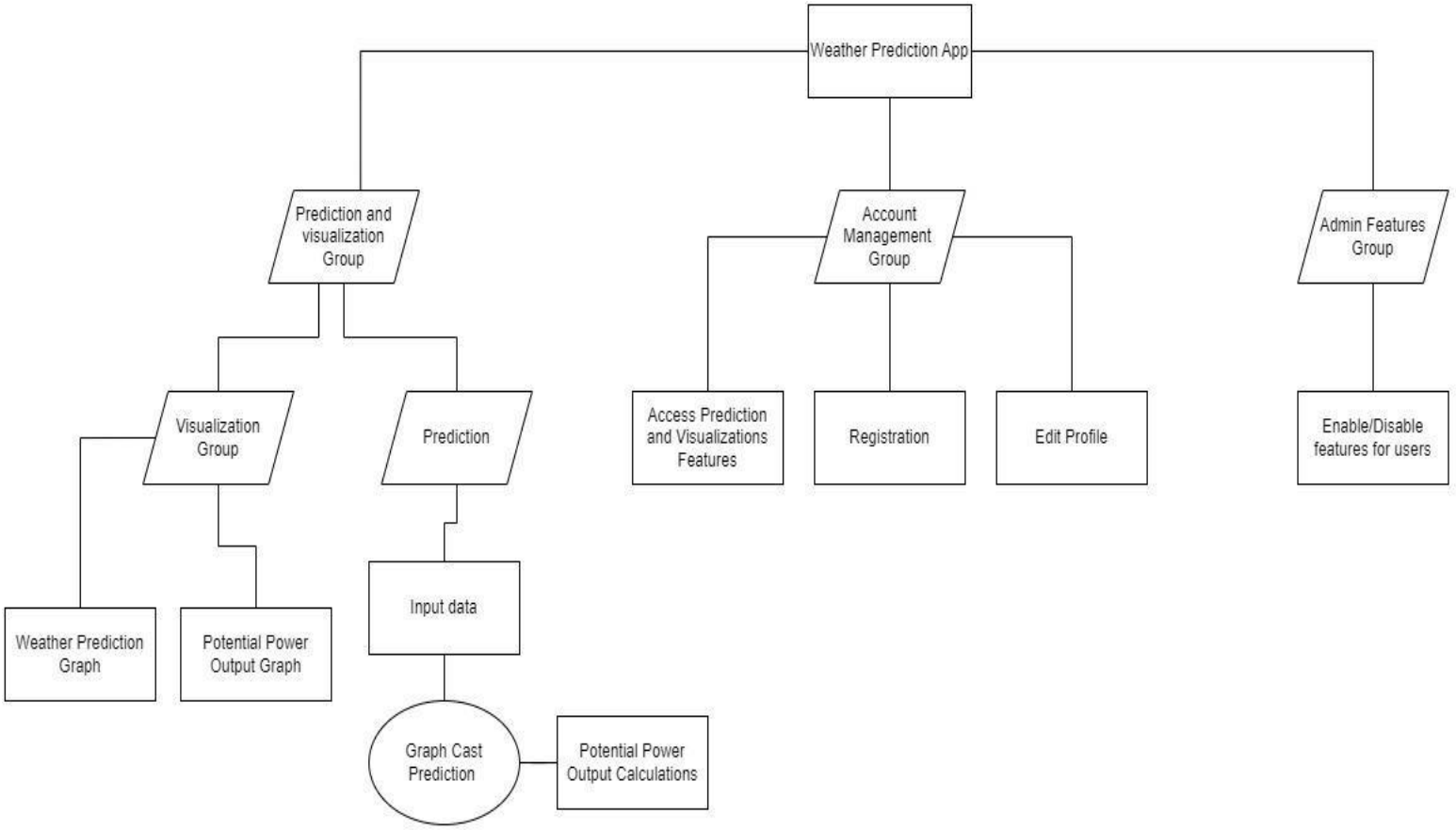
6.1. Work Breakdown Structure



6.2. Flow Diagram



6.3. PBS Diagram



6.4. PDM Diagram

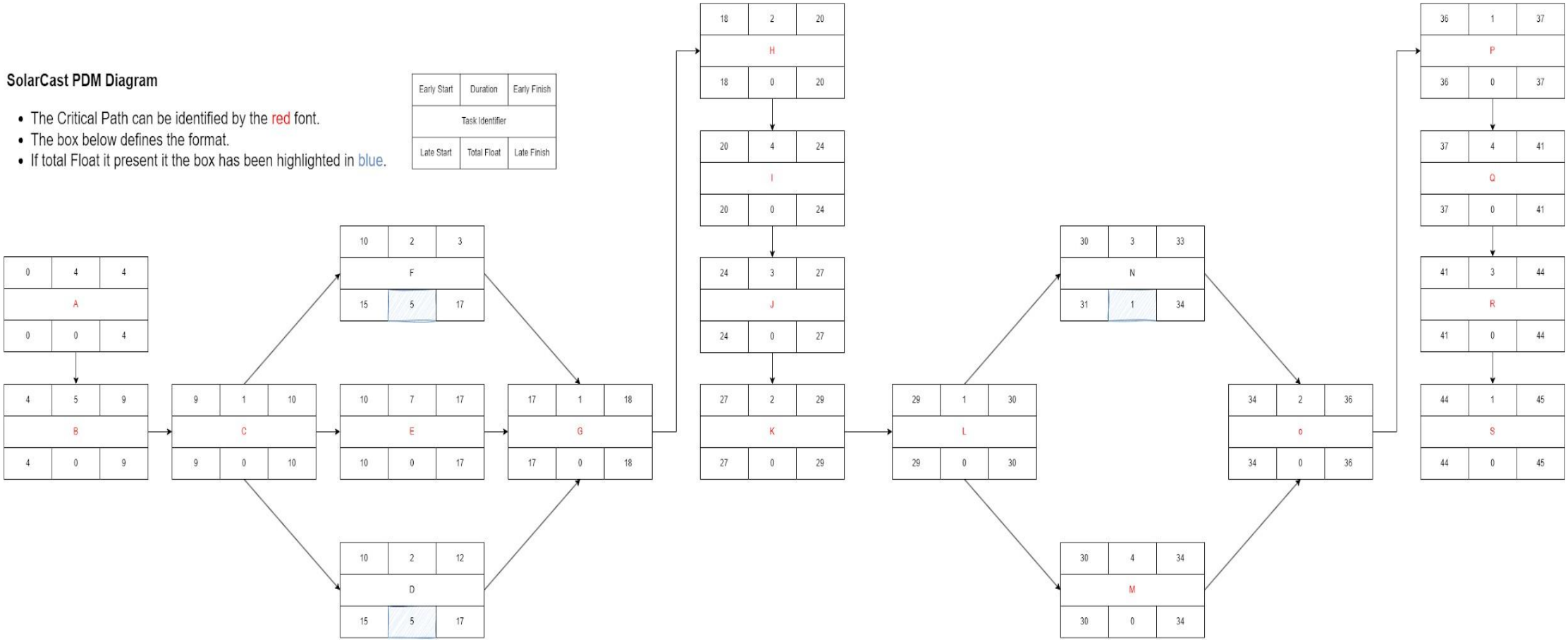
Refer to This Table for Context for the next few Diagrams

SPRINT Number	Description	Name	Duration	Dependency
SPRINT 1: Requirement Gathering	Identifying project goals and objectives	A	4	-
	Planning the project	B	5	A
SPRINT 2: Front-End Development	Sprint planning and backlog grooming	C	1	B
	Designing UI	D	2	C
	Implementing UI	E	7	C
	Testing UI	F	2	C
SPRINT 3: Database Development	Sprint planning and backlog grooming	G	1	D,E,F
	Drawing ER diagram	H	2	G
	Designing database	I	4	H
	Implementing database	J	3	I
	Testing database	K	2	J
SPRINT 4: Backend Development	Sprint planning and backlog grooming	L	1	K
	Development of AI model	M	4	L
	Connecting API endpoints	N	3	L
	Testing the backend	O	2	M,N
SPRINT 5: Testing and Documentation	Sprint planning and backlog grooming	P	1	O
	Unit testing	Q	4	P
	Integration Testing	R	3	Q
	User documentation	S	1	R

SolarCast PDM Diagram

- The Critical Path can be identified by the red font.
- The box below defines the format.
- If total Float it present it the box has been highlighted in blue.

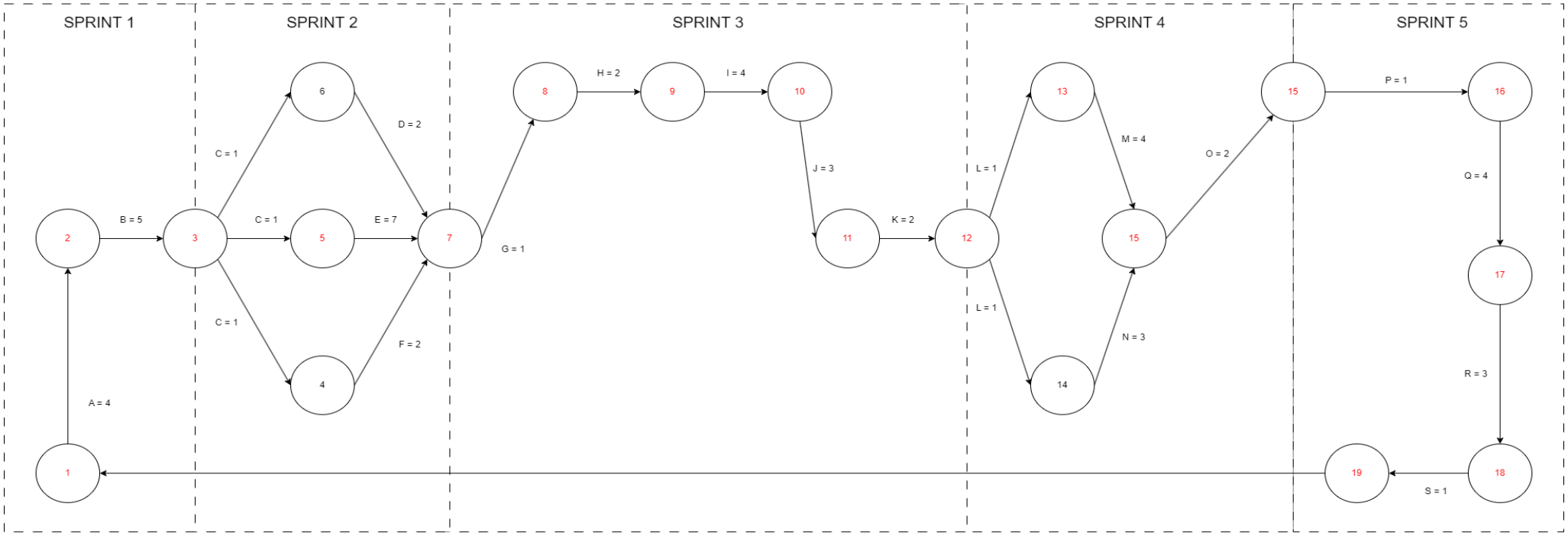
Early Start	Duration	Early Finish
Task Identifier		
Late Start	Total Float	Late Finish



6.5. AOA Diagram

SolarCast AOA Diagram

- The Critical Path can be identified by the red font.
- Refer to Docs for Task List



The Critical Path is 45 Days
The path:
A B C E G H I J K L M O P Q R S