MINI PROJECT

SOFTWARE DESIGN DOCUMENT

SAFELAND

AI-Based Flood Level & Location Risk Prediction System

DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING

MODEL ENGINEERING COLLEGE

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CONTENTS

AI-BASED FLOOD LEVEL & LOCATION RISK PREDICTION SYSTEM

1. Introduction

1.1 Purpose

This Software Design Document (SDD) describes the detailed design and architecture of the **AI-Based Location Risk Assessment & Flood Impact Prediction System**. The primary purpose of the system is to **evaluate the suitability of land for residential construction** by analysing flood-related risks using historical flood data, geographical factors, and machine learning techniques.

This document outlines system components, data flow, interfaces, and design decisions derived from the Software Requirement Specification (SRS).

1.2 Scope

The system is designed to assist users in **assessing the construction feasibility and the safety of residential locations in Kerala**. By analysing historical flood patterns, elevation, rainfall trends, and location-specific parameters, the system predicts **flood impact likelihood** and classifies locations as **safe or risky for construction purposes**.

Flood level prediction acts as a **supporting analytical component** for broader **location risk evaluation**.

1.3 Definitions, Acronyms, and Abbreviations

- **AI** – Artificial Intelligence
- **ML** – Machine Learning
- **SDD** – Software Design Document
- **SRS** – Software Requirement Specification
- **UI** – User Interface

2. Overall Description

2.1 System Overview

The Location Risk Assessment System is a web-based application that uses machine learning models to **analyse flood vulnerability and environmental risk factors affecting construction suitability**.

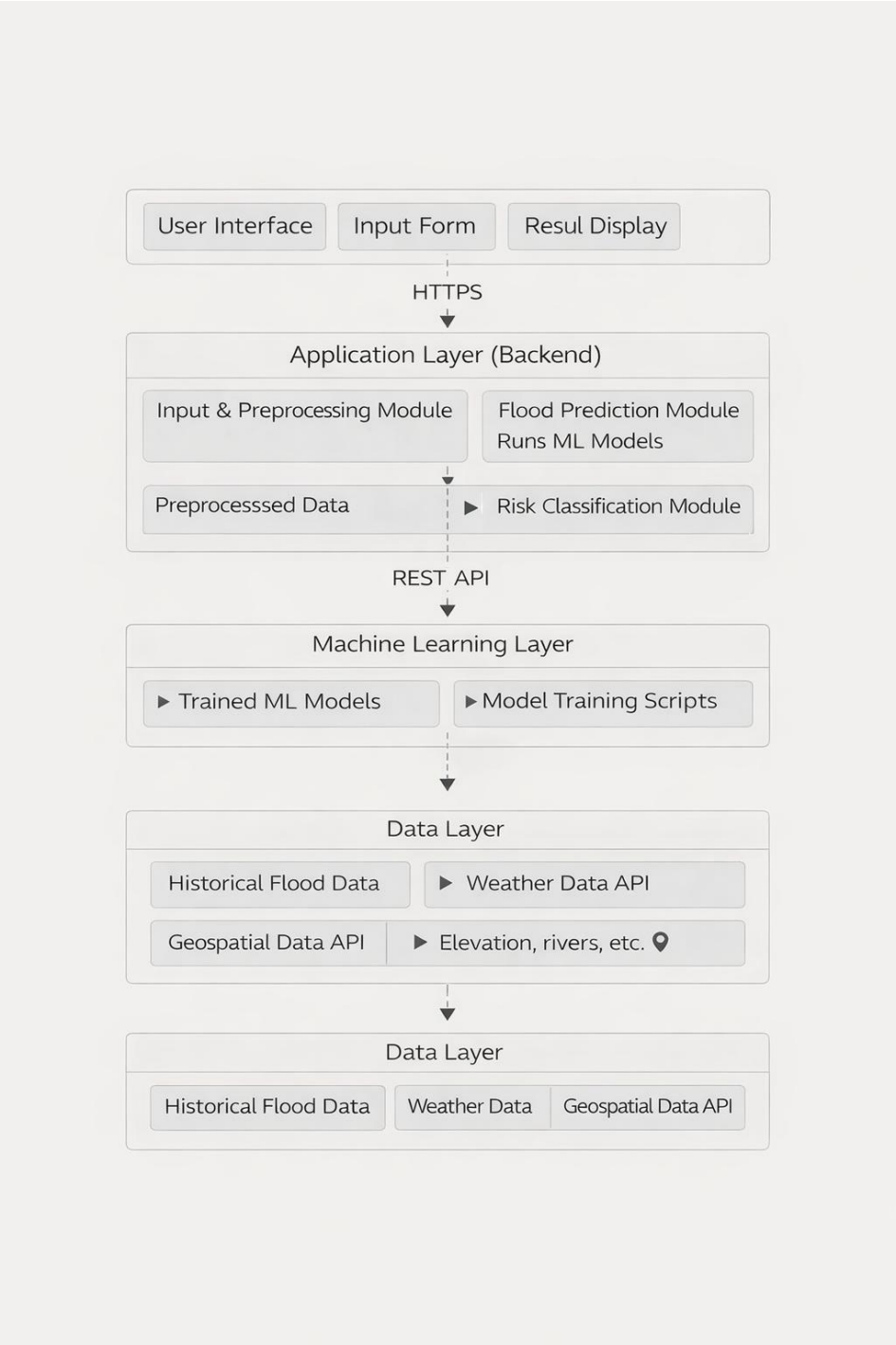
Users provide location-specific parameters, and the system evaluates the **potential flood impact on residential structures**, ultimately generating a **construction risk classification**.

2.2 System Architecture

The system follows a **layered architecture**, consisting of:

- Presentation Layer
- Application Layer
- Machine Learning Layer
- Data Layer

This architecture ensures modularity, scalability, and ease of maintenance.



3. System Design

3.1 Architectural Design

The system is divided into modular components, each responsible for a distinct role in **location risk evaluation**.

Inter-module communication is handled through clearly defined interfaces to ensure reliability and extensibility.

3.2 Design Methodology

A modular and layered design methodology is adopted to allow:

- Independent development of flood analysis and risk classification logic
- Easy updates to construction suitability criteria
- Efficient testing and validation of prediction accuracy

4. Component-Level Design

4.1 User Interface Module

- Provides a web-based interface for users.
- Accepts input parameters such as pincode or latitude and longitude.
- Displays flood risk predictions and classifications.

4.2 Input & Preprocessing Module •

Validates user inputs.

- Cleans and normalises data.
- Converts raw inputs into a format suitable for machine learning models.

4.3 Flood Prediction Module

- Implements machine learning algorithms.
- Uses trained models to predict flood levels.
- Produces probability-based risk outputs.

4.4 Risk Classification Module

- Classifies predicted flood levels into risk categories such as:
- Low Risk
- Moderate Risk
- High Risk
- Helps users make informed land selection decisions.

4.5 Data Management Module

- Manages historical flood datasets.
- Stores trained models and prediction results.
- Ensures data consistency and integrity.

5. Interface Design

5.1 User Interface

- Simple and intuitive layout.
- Input form for location-related data.
- Output page displaying prediction results.

5.2 Hardware Interfaces

- The system is accessible on desktops, laptops, tablets, and mobile devices via a responsive web interface using a standard web browser.

5.3 Software Interfaces

- Web browser for accessing the application.
- Backend framework for processing requests.

6. Data Flow Design

6.1 Data Flow Description

1. The user enters input data.
2. Data is validated and preprocessed.
3. The machine learning model processes the data.
4. Flood risk is predicted.
5. Results are classified and displayed to the user.

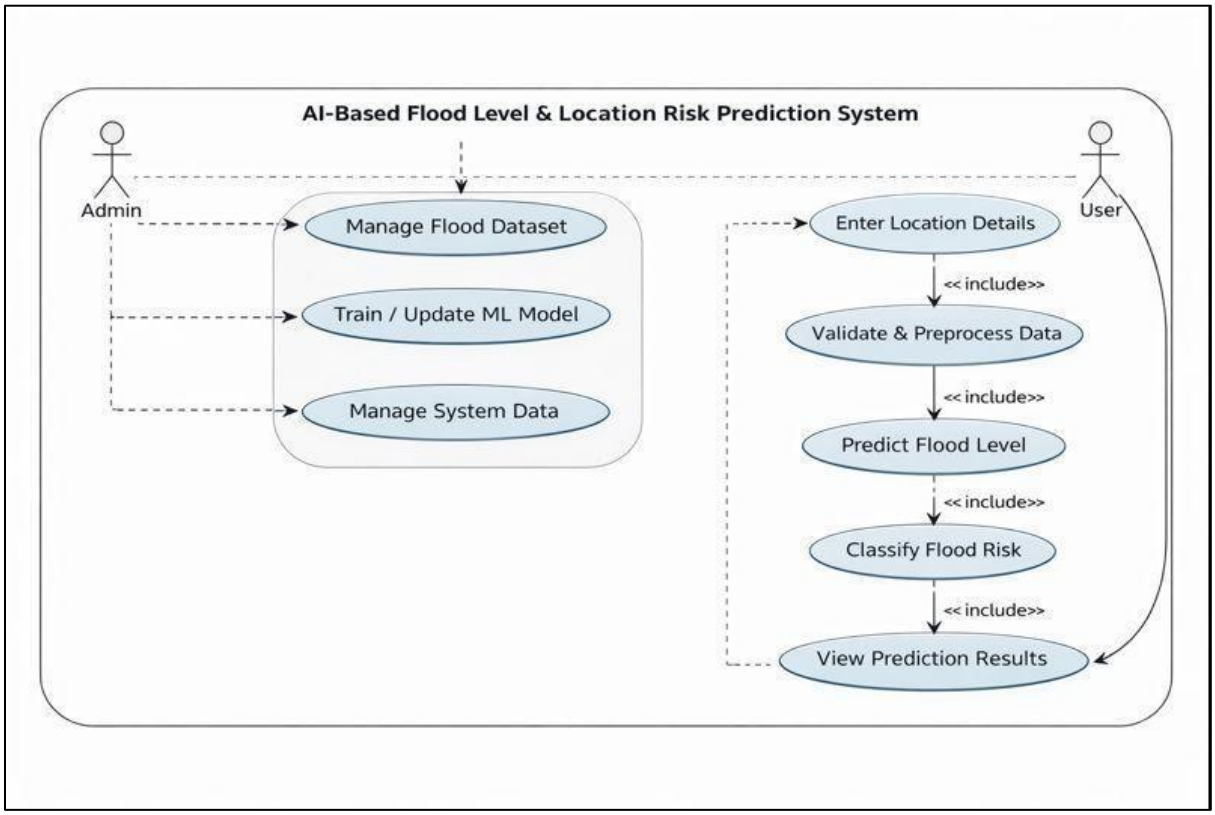
7. UML Diagrams

7.1 Use Case Diagram

Actors: • User

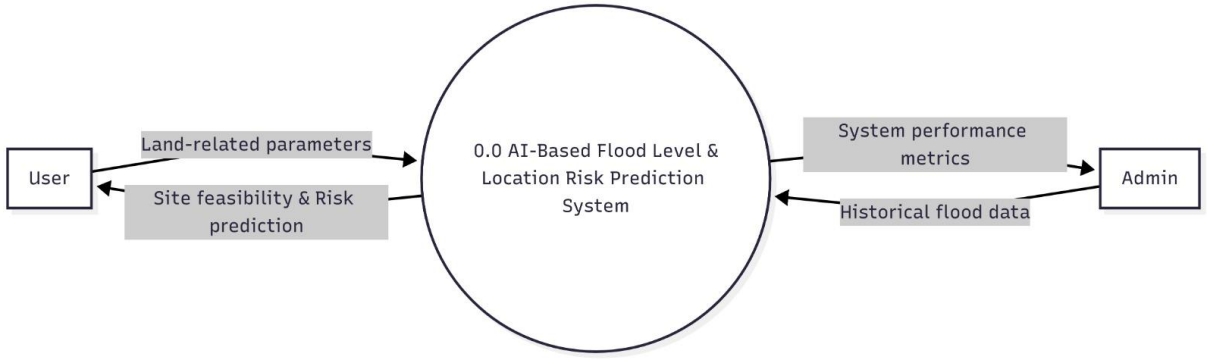
Use Cases:

- Enter location details
  - Predict flood risk
  - View results

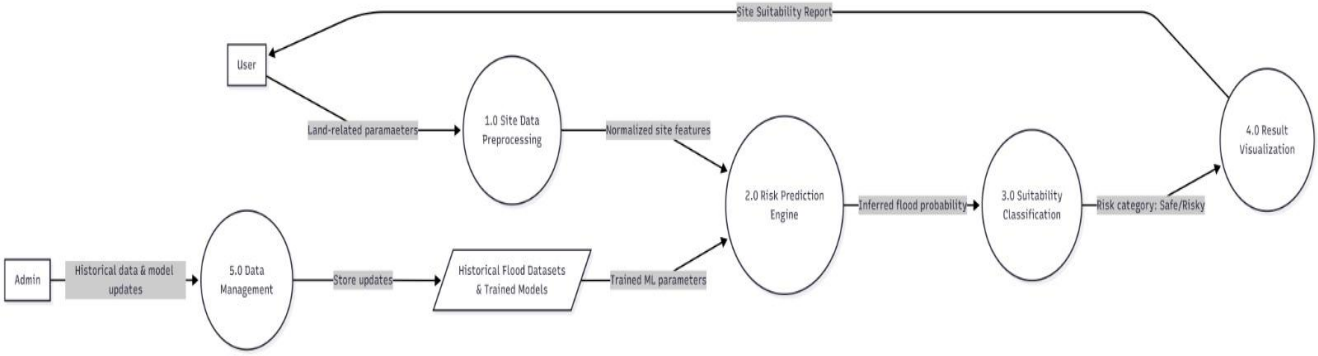


7.2 Data Flow Diagram (DFD)

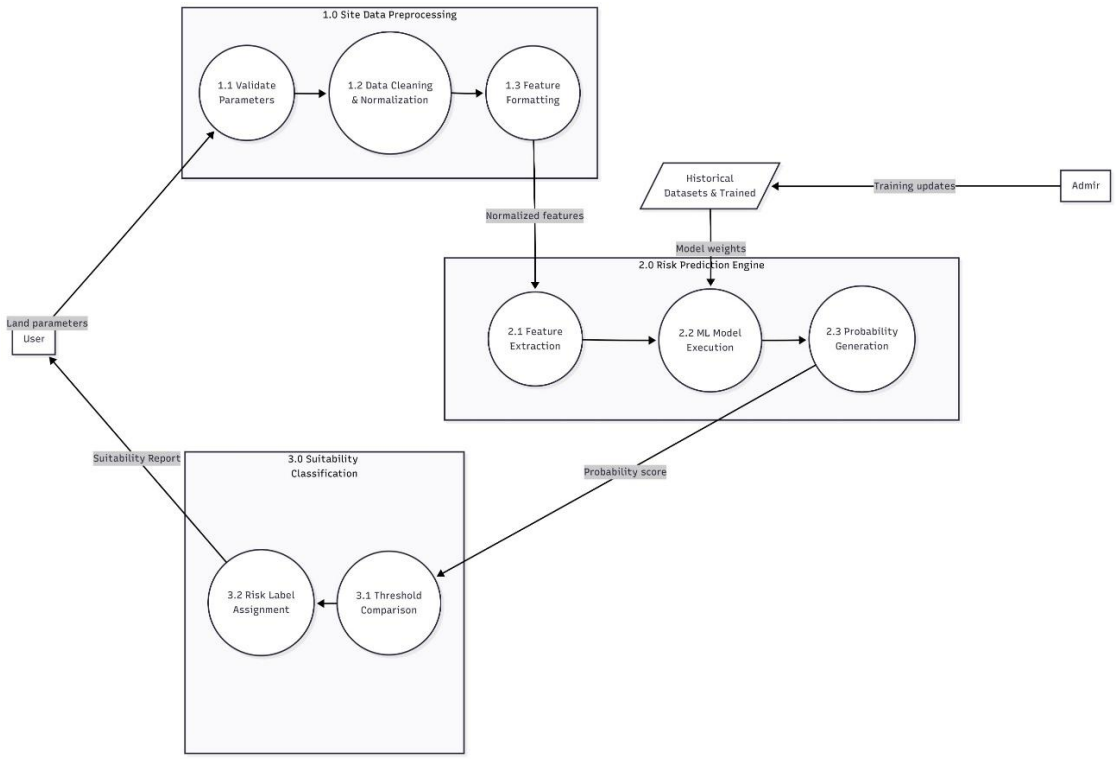
- **Level 0:** The user interacts with the Flood Prediction System.



- **Level 1:** Input processing, prediction, classification, and result generation.

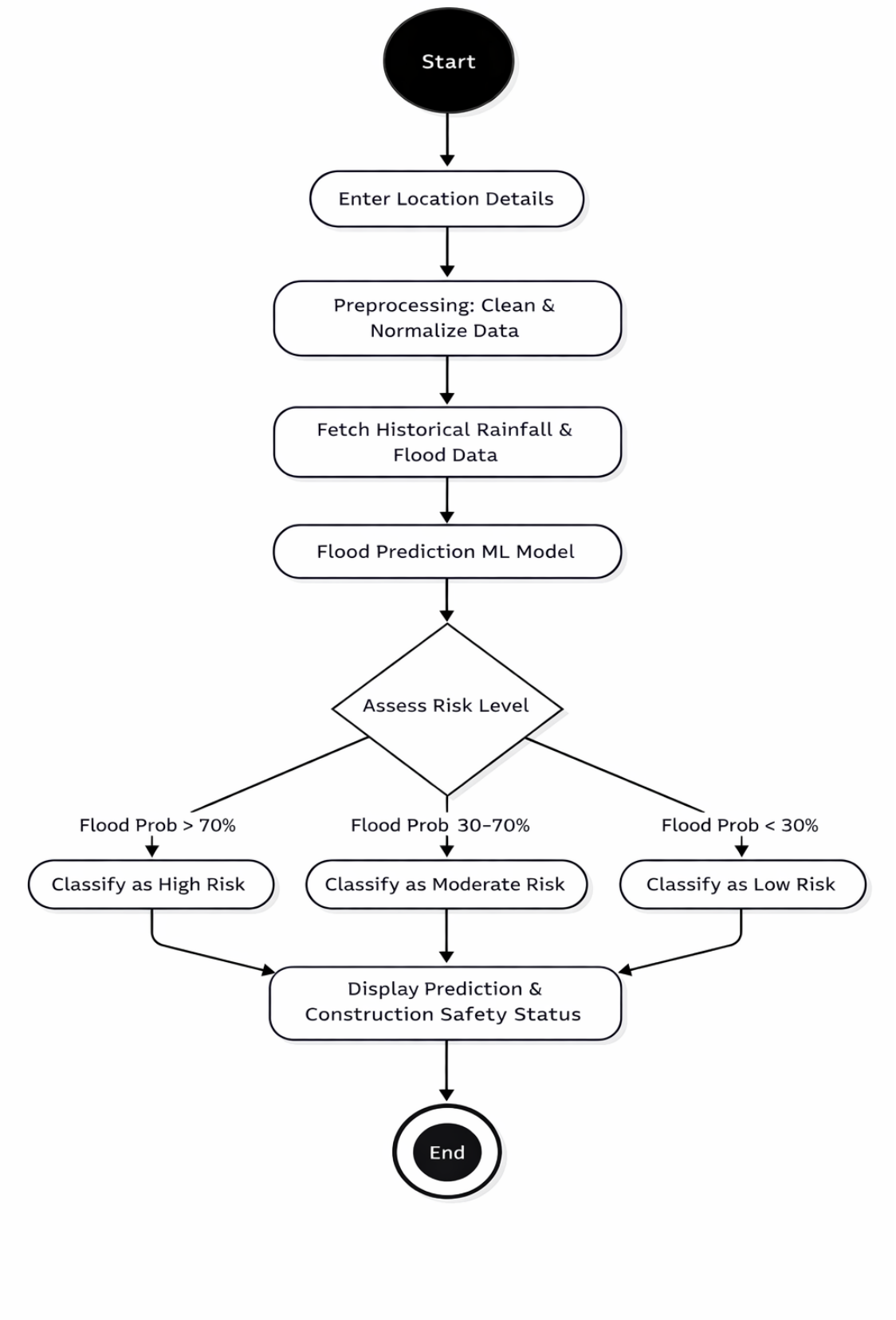


- **Level 2**

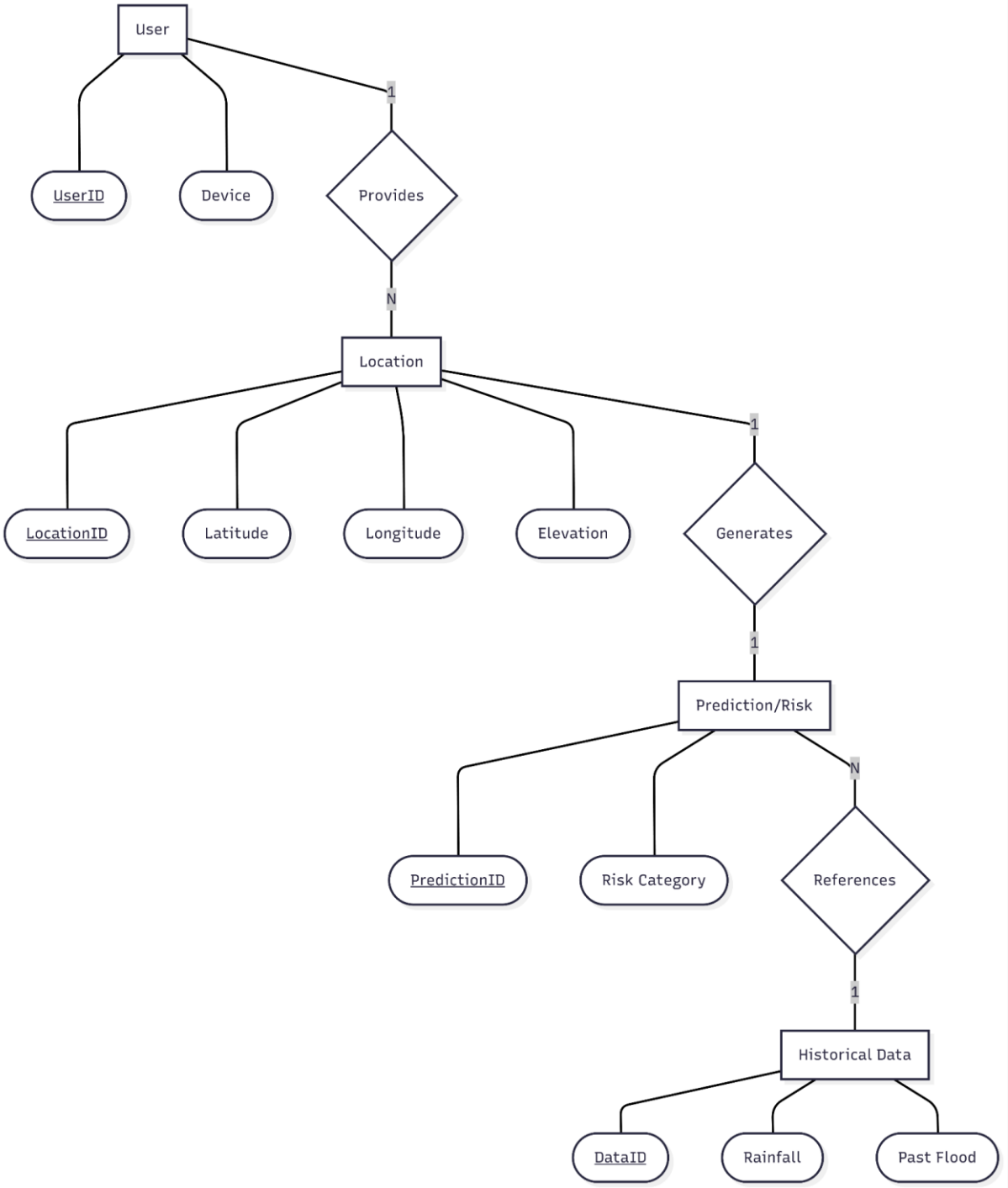


7.3 Activity Diagram

Represents the sequence from data input to prediction output.



7.4 ER Diagram



8. Design Constraints

- Availability of accurate historical flood data.
- Model accuracy depends on data quality.
- Internet connectivity is required for web access.

9. Future Enhancements

- Integration of real-time weather data.
- Visualisation using flood risk heat maps.
- Mobile application support.
- Enhanced prediction accuracy using deep learning models.

10. Conclusion

This Software Design Document presents a structured and modular design for the AI-Based Flood Risk Prediction System. The design fulfils the requirements specified in the SRS and provides a scalable framework for future enhancements.