Rising Waters: A Machine Learning Approach To Flood Prediction

Solution Requirement Document

1. Functional Requirements

1.1 Data Collection
• Collect real-time and historical weather data (rainfall, temperature, humidity).
• Monitor river water levels using IoT sensors.
• Track soil moisture levels.
• Integrate satellite and GIS data.
• Support API-based automated data ingestion.

1.2 Data Processing
• Clean and preprocess raw environmental data.
• Handle missing or inconsistent values.
• Normalize and transform datasets.
• Store processed data in structured databases.

1.3 Machine Learning Model
• Train predictive models using historical flood records.
• Implement algorithms such as Random Forest, Gradient Boosting, and LSTM.
• Generate flood probability scores.
• Continuously retrain models with new incoming data.

2. Risk Analysis and Alert System

2.1 Risk Analysis Engine
• Classify flood risk levels (Low, Medium, High, Critical).
• Identify high-risk zones using geospatial analytics.
• Estimate potential flood impact areas.

2.2 Alert & Notification System
• Send early warning alerts via Mobile App, SMS, and Email.
• Provide real-time flood maps and dashboards.
• Issue evacuation recommendations and safety guidelines.

2.3 User Interface
• Dashboard for disaster management authorities.
• Mobile application for public users.
• Real-time visualization charts and graphs.
• Location-based risk tracking features.

3. Non-Functional and Technical Requirements

3.1 Performance
• Real-time prediction capability.
• Alert response time under 5 seconds.
• Scalable for large geographic regions.

3.2 Reliability & Security
• 99% system uptime.
• Automatic backup and disaster recovery mechanisms.
• Secure API communication (HTTPS).
• Role-based access control and data encryption.

3.3 Hardware & Software Requirements
• Weather, river level, and soil moisture sensors.
• Cloud servers for scalable infrastructure.
• Programming Language: Python.
• ML Libraries: TensorFlow, Scikit-learn, Keras.
• Database: PostgreSQL / MongoDB.
• GIS Tools: QGIS.

3.4 Data Requirements
• 10–20 years of historical flood data.
• Real-time meteorological datasets.
• Geographic elevation data.
• Satellite imagery datasets.