

Information Requirements

The system must be able to retrieve various types of information to support both business needs and user stories effectively. Below are the key types of information that the system must retrieve:

User Information and Role Management

- **Description:** The system must store and manage detailed information about each user, including personal identification data (name, email, password hash), role (e.g., farmer, analyst, administrator), associated agricultural fields, and user preferences (such as alert preferences or notification channels). The system must also associate users with system access controls to enforce role-based permissions.
- **Business Value:** User information is critical for delivering tailored experiences, restricting access to sensitive data, and segmenting recommendations, alerts, and dashboards. It also enables monitoring of system engagement and effectiveness at the individual or organizational level.
- **Stored In:**
 - **User:** stores primary user profile and role.
 - **Agriculture_Field:** linked to users to define field ownership.
 - **Alert:** linked to users for personalized climate notifications.
 - **Recommendation:** indirectly linked to the user via their associated fields.
 - **Auth_Session** (optional): to store login session and authentication data if implemented.
- **Related User Needs:**
 - Farmers receive field-specific alerts and recommendations.
 - Analysts access aggregated data and reports.
 - Admins manage user access, roles, and system activity.

Climate Risk Prediction Data

- **Description:** The system must store and retrieve data related to climate risk predictions, including event type (e.g., flood, drought, frost), location, probability, associated severity level, and prediction timestamp. Each prediction must be traceable to the machine learning model used for generation.
- **Business Value:** This information is core to the system's analytical capacity and value proposition, enabling proactive decision-making for users by anticipating adverse weather conditions.
- **Stored In:**
 - **Prediction** (risk event, probability, timestamp, location, model)
 - **Event_type**, **Severity_level**, and **Model** (supporting metadata)
- **Related User Needs:**
 - Farmers receive alerts and reports based on prediction outcomes.
 - Managers assess the likelihood of risks across regions they oversee.

Personalized Agricultural Recommendations

- **Description:** The system must store actionable recommendations linked to specific climate predictions and tailored to the crop type, field location, and user context. Each recommendation includes a textual description and reference to its originating prediction.
- **Business Value:** These recommendations transform insights into guidance, helping farmers plan irrigation, crop rotation, pest control, and other field-level actions to optimize outcomes.
- **Stored In:**

- **Recommendation** (linked to Prediction)
- **Agriculture_Field**, **Crop**, and **User** (to contextualize each recommendation)
- **Related User Needs:**
 - Farmers access field-specific suggestions.
 - Managers oversee aggregated recommendations for strategic coordination.

Real-Time and Historical Weather Data

- **Description:** The system must collect and manage granular weather data (temperature, humidity, wind speed, timestamp) for each weather station and location. This data should be both real-time and historically queryable.
- **Business Value:** Serves as the foundational input for generating accurate predictions and trend analysis. Enables historical reporting and supports scientific credibility of the system's outputs.
- **Stored In:**
 - **Weather_Data** (linked to Weather_Station and Location)
 - **Weather_Data_Source** (to track origin and ingestion timeline)
- **Related User Needs:**
 - Farmers adjust practices based on live updates.
 - Analysts use historical trends to improve forecasting models.

Agricultural Field and Crop Information

- **Description:** The system must maintain detailed records of users' agricultural fields, including crop type, field ID, and location coordinates. Each user can be associated with one or more fields.
- **Business Value:** Essential for personalizing predictions and recommendations. Field-specific characteristics help determine risk sensitivity and agricultural practices.
- **Stored In:**
 - **Agriculture_Field**, **Crop**, and **Location** (with foreign key relations to User)
- **Related User Needs:**
 - Farmers see data related to their own plots.
 - Farm managers analyze performance by field and crop type.

Alert and Notification Records

- **Description:** The system must store alert records that include which user received what alert, for which prediction, when it was sent, and the current status (e.g., delivered, read, acknowledged).
- **Business Value:** Ensures timely risk communication, allows users to track and act upon weather-related risks, and provides administrators with traceability for compliance and auditability.
- **Stored In:**
 - **Alert** (linked to Prediction and User)
- **Related User Needs:**
 - Farmers stay informed of imminent threats.
 - Admins verify alert coverage and effectiveness.

Raw API Response Storage

- **Description:** The system must optionally store raw JSON payloads from external weather APIs (such as OpenWeather) for auditing, reprocessing, and debugging purposes. These payloads may vary in structure depending on the source, API version, or requested endpoint.
- **Business Value:** Storing raw API responses ensures transparency, traceability, and reusability. It allows the system to:
 - Compare predictions based on past input
 - Debug failures in ingestion or modeling logic
- **Stored In:**
 - **MongoDB Collection:** `api_responses`

User Interaction Logs and Feedback

- **Description:** The system must store user interaction data and optional feedback related to recommendations, alerts, and platform usage. These logs include timestamps, device type, interaction type (e.g., viewed recommendation, dismissed alert, submitted feedback), and additional metadata like geolocation, response time, or comments. This information can vary in structure depending on the event or action.
- **Business Value:** Tracking user behavior helps evaluate the effectiveness of alerts and recommendations, identify usability issues, and improve the system over time. Feedback also provides insight into user satisfaction and areas for platform improvement.
- **Stored In:**
 - **MongoDB Collection:** `interaction_logs`