Global Agricultural Knowledge Database (GAKD)

The Global Agricultural Knowledge Database (GAKD) is a **centralized, maintained service** provided by AOFS to help farms make better decisions. It is **not a module for third parties to implement**; rather, it is a database service that AOFS controllers interact with, either online or via offline caches.

GAKD provides farms with **pre-configured, optimized defaults for crops, soils, irrigation schedules, sensor thresholds, and expected success probabilities**, allowing them to **benefit from global best practices** even in offline or disconnected environments.

Purpose & Goals

- Deliver **trusted, maintained recommendations** for crop and soil management.
- Enable farms to **start with optimal settings** and realistic expectations for crop success.
- Support **research, experimentation, and optimization** across farms.
- Aggregate anonymized data from participating farms to **refine global recommendations** (optional for contributors).
- Offer **interactive decision support**: farmers can ask “Is it a good idea to grow X here?” or request **location-based crop recommendations** with success probability estimates.
- **Global Climate Monitoring:**
    - By aggregating anonymized environmental and operational data from farms worldwide, GAKD can help **track climate change impacts** on soil, crop performance, and water availability.
    - Supports long-term **trend analysis**, allowing AOFS and farmers to adjust practices in response to climate shifts.
    - Provides valuable data for **research, policy-making, and adaptation strategies** in agriculture.
    - Maintains privacy: only aggregated or anonymized environmental measurements are used for climate analysis.

Service Model

- **Centralized & Maintained:** AOFS is responsible for database hosting, curation, updates, and integrity.
- **Offline-First Access:** Farms receive **cached defaults** and local success assessments for offline use.
- **Optional Data Contribution:**
    - Farms may share operational data (sensor logs, actuation logs, human inputs) to improve recommendations.
    - Contributors gain **full access to the latest data and recommendations**.
    - Only aggregated/anonymized data is stored; farms retain control of their own data.
- **Integration with Controllers:**
    - Field Controllers pull defaults from local cache.

    - Farm Controllers can sync data and receive updated recommendations from AOFS servers when connectivity is available.
    - HQ/Federated Controllers manage aggregation and optional refinement of contributions for global improvements.

Key Features & Usage

- Centralized Defaults: AOFS maintains and curates all crop, soil, and operational parameters in GAKD.
- Geo-aware Recommendations: Farmers can request defaults for specific crops and locations, e.g.:
    - “I want to grow rice in Zululand.”
    - GAKD returns pre-tested defaults and expected success probabilities if data exists from other farms in the region.
- Offline-First Access:
    - Defaults can be downloaded directly to Field or Farm Controllers when connectivity is available.
    - Alternatively, defaults can be exported from one controller via USB stick and imported into another controller that is offline.
- Interactive Crop Suitability Queries:
    - Farmers can ask questions like “Is it a good idea to grow crop X here?”
    - System provides expected success (%), recommendations for spacing, irrigation, fertilization, and other operational parameters.
- Optional Data Contribution:
    - Farms that have tried growing a crop in a region can share their results with GAKD.
    - Contributions improve the accuracy and reliability of defaults for other farms.
    - Only aggregated/anonymized data is stored; contributors maintain ownership of their data.
- Offline & Federated Operation:
    - Local controllers cache downloaded defaults for offline operation.
    - Manual transfer via USB or SD stick supports fully disconnected farms.
    - When connectivity is restored, controllers can optionally sync with the central GAKD to receive updates and contribute new data.

Notes

- GAKD is **provided and maintained exclusively by AOFS**; the database itself is not a specification for third-party implementation.
- Farms benefit from a **central, authoritative source of knowledge** without needing to maintain their own database.
- AOFS may provide a **well-documented API**, allowing third-party tools or controllers to query defaults, submit optional contributions, or request suitability assessments.
- Supports AOFS’s **humanitarian philosophy**: we provide guidance and optimization, and farms optionally contribute data to improve global recommendations.