Software Requirements Specification (SRS)

Project Name: SmartAgro

Version: 1.1 (Revised)

Date: December 18, 2025

Team: Soft Touch

1. Introduction

1.1 Purpose

The purpose of SmartAgro is to provide a digital marketplace connecting Ghanaian farmers directly with buyers and logistics aggregators to reduce post-harvest losses. The system utilizes a Progressive Web App (PWA) architecture to ensure functionality in remote areas with unstable internet connectivity.

1.2 Scope

The application includes an offline-first PWA frontend for users and a backend API managing inventory, orders, escrow payments, and AI-driven advisory services.

2. User Personas

Proxy representations of our target users to guide design decisions.

Persona 1: Opanyin Kwame (Smallholder Farmer)

- **Age:** 55 years old
- **Location:** Tomato farmer in Techiman
- **Literacy:** Limited formal education, basic smartphone literacy
- **Primary Concerns:** Securing buyers and receiving fair prices for his harvest.
- **Goals:** Needs to sell his harvest immediately before it spoils. Wants fair market prices without traveling to urban centers.
- **Tech Literacy:** Low-Moderate. Uses a smartphone but data is expensive and network is spotty on the farm.
- **Pain Points:**
    - **Weather Uncertainty:** Lacks access to reliable weather data, often applying fertilizer right before unexpected rain (wasting money).
    - **Market Access:** Struggles to find buyers for large bulk harvests before the produce rots.
    - **Connectivity Issues:** Cannot use apps that require constant high-speed internet because his farm has poor signal.

Auntie Esi (Wholesale Buyer)

- **Age:** 32 years old
- **Role:** Restaurant owner
- **Location:** Accra
- **Primary Concerns:** Reliable access to fresh produce at predictable prices
- **Goals:** Needs a consistent supply of fresh vegetables for her restaurant. Wants to automate sourcing.
- **Tech Literacy:** High. Uses digital banking and social media for business.
- **Pain Points:**
    - **Sourcing Inefficiency:** Wastes hours calling different farmers or visiting markets to find specific quality produce.
    - **Trust Deficit:** fears sending money via Mobile Money before seeing the goods, having been scammed in the past.
    - **Inconsistent Quality:** Often receives produce that is different from what was described or promised.

Persona 3: Kweku the Aggregator (The Middleman)

- **Age:** 28 years old
- **Role:** Logistics Provider with a medium-sized truck.
- **Location:** Accra
- **Goals:** Buys in bulk from multiple small farms to sell to factories or supermarkets. Wants to maximize his truck's capacity per trip.
- **Tech Literacy:** Moderate. Uses GPS and WhatsApp for coordination.
- **Pain Points:**
    - **Logistics Coordination:** Finds it difficult to coordinate pickups from multiple small farms to fill his truck efficiently.
    - **Inventory Visibility:** Unable to see which farmers have harvest ready for pickup, resulting in wasted fuel driving to empty farms.
    - **Cash Risks:** Dislikes carrying large amounts of cash to pay farmers in remote areas due to robbery risks.

3. Functional Requirements

3.1 PWA & Offline Capabilities

- **FR-01:** The system shall be a Progressive Web App (PWA) capable of being installed on mobile devices without an app store.
- **FR-02:** The system must cache core application assets (shell, UI) and recent data to function in "Offline Mode."
- **FR-03:** Users shall be able to draft product listings or messages while offline; the system must auto-sync these when connectivity is restored (Background Sync).

3.2 Marketplace & Inventory

- **FR-04:** Farmers shall be able to create product listings with photos. Photos must be compressed client-side to save data bandwidth.
- **FR-05:** Buyers and Aggregators shall be able to search for products by location.
- **FR-06:** System must track inventory states (Available, Reserved, Sold).

3.3 Financial Transactions (Escrow)

- **FR-07:** System shall integrate with Paystack to process Mobile Money.
- **FR-08:** Funds must be held in Escrow and released only after the Buyer or Aggregator confirms successful pickup/delivery.

3.4 Intelligent Agent (AI)

- **FR-09:** System shall provide an AI Chat interface (via OpenRouter) that answers farming questions.
- **FR-10:** The agent must provide a "Lite Mode" for text-only advice when internet speed is detected as 2G/Edge.

4. User Stories

ID	As a...	I want to...	So that...
US-1	**Farmer**	list my harvested produce on the SmartAgro platform with quantity, location, and expected price,	I can find buyers before my crops spoil and avoid distress sales at unfair prices.
US-2	**Farmer with limited access to extension officers**	ask questions using voice, images, or text and receive localized farming advice	I can improve crop quality, reduce post-harvest losses, and make informed selling decisions.
US-3	**Aggregator**	I want to aggregate produce from multiple farmers transparently through the platform,	I can provide transport or bulk coordination services without exploiting price asymmetries.

US-4	**Buyer**	discover nearby farmers offering fresh produce and pay through a secure escrow system	I can access fresh goods at fair prices without relying on informal intermediaries
US-5	**Farmer**	use the same account to both sell my produce and buy produce or inputs from other farmers	I can participate flexibly in the agricultural market without switching roles or platforms.

Acceptance Criteria

US1

- Farmer can create a produce listing using a low-bandwidth PWA interface
- Listings are available offline and sync when connectivity is restored
- Price guidance is shown to reduce exploitation by middlemen

US2

- AI assistant supports multimodal input (audio/image/text)
- Advice is contextualized for Ghanaian crops and seasons
- Works under low connectivity conditions

US3

- Aggregator can view multiple farmer listings
- Pricing margins are visible and constrained by platform rules
- Aggregator adds logistical value rather than price manipulation

US4

- Buyer can browse/filter listings by crop, location, and availability
- Payment is held in escrow via Paystack until delivery is confirmed
- Buyer sees transparent pricing rather than inflated middleman rates

US5

- Single user account supports both buyer and seller actions
- Role switching does not require re-registration
- Reflects real informal market behavior in Ghana

5. Non-Functional Requirements (NFRs)

System attributes and constraints.

5.1 Connectivity & Performance

- **NFR-01:** The application bundle size (Initial Load) must not exceed 300KB to ensure fast loading on 3G networks.
- **NFR-02:** The PWA must achieve a Lighthouse Performance score of at least 90 on mobile devices.

5.2 Reliability

- **NFR-03:** The system shall aim for 99.9% server availability during business hours.
- **NFR-04:** Local storage (IndexedDB) must be used to persist user data if the network request fails.

5.3 Security

- **NFR-05:** All sensitive user data must be encrypted.
- **NFR-06:** Offline data stored on the device must be cleared if the user explicitly logs out.