📘 Technical Documentation: Gramseva – Digital Haat & Market Insight (PWA)

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1. Project Overview

Gramseva is a **PWA (Progressive Web Application)** designed to empower rural communities by providing: - Transparent access to crop market prices (past, present, future). - A secure digital marketplace for local services (tractor rental, labor, tools, transport). - AI-powered insights and natural language support via **Gemini API**. - Offline-first, voice-enabled, and multilingual access for rural inclusivity.

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2. Key Features

🔑 Must-Have

- **Market Price Dashboard**: Past, present, and AI-forecasted future crop prices.
- **Task/Service Management**: Hire or offer services in local village economy.
- **Real-Time Chat**: Text, voice notes, file upload.
- **Payment Escrow System**: Secure transactions, release on service completion.
- **Profile & Reputation**: Verified KYC, rating, and reviews.

🧱 Additional Features

- **AI Matchmaking**: Suggest best service provider/farmer using Gemini API.
- **Digital KYC**: Secure verification via Aadhaar/ID upload.
- **Voice Note Support**: Low-literacy user accessibility.
- **Dispute Resolution**: Escrow + complaint management.
- **Offline Mode**: Cache last known data when internet unavailable.

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3. Technical Architecture

3.1 Frontend (PWA with Next.js)

- **Framework**: Next.js (React-based, supports SSR + SSG for better performance)
- **Styling**: TailwindCSS / Bootstrap
- **PWA Features**:
- Service Workers for offline caching
- IndexedDB for local storage of crop price data
- Responsive mobile-first UI
- **UI Components**:
- Search crops (text + voice input)
- Price charts (Chart.js / Recharts)
- Card-based UI for prices & services
- Chat interface (WebSockets)

3.2 Backend (Node.js + Express.js)

- RESTful + WebSocket APIs for:
- Crop price data (historical, real-time, forecast)
- User management (login, profile, KYC)
- Marketplace services CRUD
- Payment escrow handling
- **Libraries/Tools**:
- Express.js for REST APIs
- Socket.IO for chat
- JWT for authentication

3.3 Database (MongoDB)

- Collections:
- `users` → profiles, KYC, roles, ratings
- `services` → listings, categories, availability
- `prices` → crop data (past, present, AI predictions)
- `transactions` → escrow payments, disputes
- `chats` → conversations, voice notes

3.4 AI/ML Layer

- **Gemini API** for:
- Market trend explanation (simple language insights)
- Service provider matchmaking
- Chatbot Q&A support
- **Time-Series Models (optional future)**:
- ARIMA/Prophet for local forecasting

3.5 Payments & Escrow

- Integration: UPI / PayTM / Razorpay APIs
- Funds flow: Buyer → Escrow Wallet → Release to Seller
- Dispute flag triggers admin moderation

3.6 Deployment & Hosting

- **Frontend (Next.js)**: Vercel / Netlify / Firebase Hosting
- **Backend (Node.js)**: Render / AWS EC2 / GCP Cloud Run
- **Database**: MongoDB Atlas (cloud-hosted)
- **Authentication**: JWT-based with role-based access

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4. User Flow (High-Level)

1. Farmer opens PWA → checks today's crop price.
2. Views past trends & Gemini's future prediction.
3. Searches for tractor rental → AI matchmaking suggests best provider.
4. Chats, negotiates, and pays via escrow.
5. After service completion → escrow released → both parties rate each other.

5. Security & Privacy

- **Data Encryption**: TLS/SSL for all API calls.
- **Escrow Security**: Payment gateway compliance (PCI-DSS).
- **User Privacy**: Minimal data collection, consent-based KYC.
- **Access Control**: Role-based auth (Farmer, Service Provider, Buyer, Admin).

6. Hackathon MVP Scope (30 Hrs)

- **Frontend**: Next.js PWA with crop price dashboard + service listing.
- **Backend**: Node.js (Express) APIs with MongoDB integration.
- **AI Integration**: Gemini API demo for simple price explanation.
- **Payments**: Mock escrow (not full integration).
- **Chat**: Basic Socket.IO chat with text.

7. Future Enhancements

- Full UPI/Razorpay integration for escrow.
- Voice-first chatbot (Gemini + Speech-to-Text).
- Offline sync with background workers.
- Multi-crop forecasting models.
- Regional language expansion.

8. Tagline

"Gramseva – Empowering Rural India with AI-powered Market Insights & Secure Services."