Project Specification: Sona-AI (Bharat Edition)

Tagline: AI-Powered Gold & Silver Forecasting for Every Indian City.

1. Executive Summary

- **Goal:** Develop a high-accuracy price prediction engine for Gold and Silver specifically for the Indian market.
- **Target Audience:** Regular Indian consumers, jewelry buyers, and retail investors.
- **Core Value:** Delivers location-specific pricing (e.g., "Gold Rate in Patna") rather than just a generic global price.
- **Platform Strategy:** Mobile-first web application that functions like a native app on smartphones.

2. User Experience (UX) Strategy

This system is designed to be "Apple-simple" on the front end, hiding the complex AI logic from the user.

- **Mobile Responsiveness:** The interface uses a fluid column layout that stacks vertically on mobile devices, ensuring buttons and text remain large and readable.
- **Simplified Visualization:**
    - **Confidence Zones:** The forecast chart visually separates the **High Confidence Zone (1–3 Days)** from the **Trend Zone (4–7 Days)**.
    - **No Technical Clutter:** Complex trading indicators (Bollinger Bands, RSI) are hidden. Users see only the Price and the Trend.
- **Location-Based Personalization:**
    - Users select their **State** and **City** from a simple dropdown menu.
    - The dashboard instantly updates to show prices relevant to that specific location.

3. Technical Architecture

The system uses a **Dual-Layer Calculation** method to ensure both high accuracy and local relevance.

Layer A: The Global Prediction Core (Backend)

- **Strategy:** Direct Multi-Step Forecasting.
- **Logic:** Instead of one model guessing for the whole week, the system uses three separate **XGBoost** models:
    - **Model 1:** Trained specifically to predict "Tomorrow".
    - **Model 2:** Trained specifically to predict "Day After Tomorrow".
    - **Model 3:** Trained specifically to predict "Day 3".
- **Inputs:** Global market data (Gold, Silver, Oil, Dollar Index, Nifty 50).

Layer B: The Localization Engine (Frontend Logic)

- **Problem:** Live data for small cities is not available via free APIs.
- **Solution:** The "Base + Spread" Algorithm.
    - **Step 1:** AI predicts the **Mumbai/MCX Base Rate**.
    - **Step 2:** System applies a pre-defined "Spread" percentage based on the selected city (e.g., Jaipur +0.2%, Chennai -0.1%).
    - **Step 3:** Final output is displayed as the local city price.

4. Technology Stack

The stack is selected for zero cost, high performance, and ease of deployment.

Component	Technology	Function
Core Logic	Python 3.x	Primary programming language.
AI Algorithm	XGBoost	Gradient boosting engine for tabular time-series data.
User Interface	Streamlit	Framework for building the responsive web dashboard.
Charting	Plotly	Interactive graphs (pinch-to-zoom supported).
Data Feed	yfinance	Fetches live market data from Yahoo Finance.
Automation	Local Script	Simple logic to auto-trigger daily model retraining.

5. Data Ecosystem

The model achieves high accuracy by correlating gold prices with these key economic drivers:

Category	Data Source	Why it matters?
Target Asset	Gold & Silver Futures	The raw global price foundation.
Currency	USD/INR Rate	Converts global prices to Indian Rupees (critical for accuracy).
Energy	Crude Oil	High oil prices often lead to inflation and higher gold prices in India.
Market Health	Nifty 50	Represents local Indian market sentiment and liquidity.
Risk	Volatility Index (VIX)	Measures global fear; gold often spikes when fear is high.

6. User Workflow (Algorithm Flow)

1. **Initialization:** User opens the app; system defaults to "Gold" and "Mumbai".
2. **Selection:** User changes location to "Uttar Pradesh > Lucknow".
3. **Data Processing:**
   - System fetches the latest global data.
   - Calculates technical indicators (30-day trends, volatility).
4. **AI Prediction:** The XGBoost models generate the Base Price forecast for the next 3–7 days.
5. **Localization:** System adds the "Lucknow Spread" and "Import Duty" taxes to the Base Price.
6. **Presentation:**
   - Display: **"₹74,200 per 10g (Lucknow Estimate)"**.
   - Chart: Updates to show the historical and predicted trend line for Lucknow.