**Client Requirement Document: AI-Based Product Recommendation Module**

**1. Project Overview**

**Client:** Macromed (Pvt) Ltd  
**Objective:** Develop an AI-based recommendation system for Macromed’s **React + Laravel + PostgreSQL eCommerce platform**, focused on **surgical and operation theatre items** (excluding medicines).  
**Goal:** Improve sales and user experience by providing **personalized product recommendations** based on user type, purchase behavior, and real-time interactions.

**2. Key Functional Requirements**

**2.1. Recommendation Types**

The system should generate product recommendations based on:

* **User Profile-Based Recommendations:** Suggest items based on user type (Hospitals, Clinics, Surgeons, Procurement Officers).
* **Purchase History-Based Recommendations:** Recommend products similar to previous purchases.
* **Real-Time Behavior-Based Recommendations:** Show items based on recent browsing, searches, and clicks.
* **Popularity-Based Recommendations:** Display trending and frequently purchased products.
* **Budget-Sensitive Recommendations:** Suggest products within the user’s budget range.
* **Collaborative Filtering (User & Item-Based):** Recommend products purchased by similar users.
* **Promotional & Discount-Based Recommendations:** Show available discounts and offers on relevant products.
* **Chat & Voice-Based Recommendations:** Allow users to get recommendations via chatbot and voice assistant.

**2.2. Exclusion Rules (What NOT to Recommend)**

* ❌ Products the user recently purchased in bulk.
* ❌ Irrelevant category matches (e.g., no dental items for an orthopedic surgeon).
* ❌ Products significantly above or below the user’s typical budget.
* ❌ Out-of-stock or discontinued items.

**2.3. User Experience & Interface Requirements**

* **Personalized Dashboards:** Different interfaces for Hospitals, Clinics, Surgeons, etc.
* **Interactive UI with Smart Filtering Options:** Allow users to refine recommendations based on price, category, and relevance.
* **Explainable AI (XAI):** Display tooltips such as "Recommended because you viewed [X]."
* **User Feedback Mechanism:** Users can 👍 or 👎 recommendations to improve suggestions.
* **Onboarding Questionnaires:** Ask initial preference questions to customize recommendations.
* **AI-Powered Bundling:** Suggest kits or product bundles to increase average order value.

**3. Technical Requirements**

**3.1. Technology Stack**

* **Frontend:** React.js
* **Backend:** Laravel (PHP)
* **Database:** PostgreSQL
* **AI/ML Frameworks:** Python (Scikit-learn, TensorFlow, PyTorch)
* **API Development:** Flask/FastAPI for AI model integration

**3.2. AI & Machine Learning Requirements**

* **Hybrid Recommendation Model:** Combines Collaborative Filtering, Content-Based Filtering, and Deep Learning.
* **Context-Aware Recommendations:** Update recommendations dynamically based on user actions.
* **Reinforcement Learning:** Allow AI to improve recommendations over time based on feedback.
* **Federated Learning:** Ensure data privacy by learning from user behavior without exposing raw data.

**3.3. Performance Benchmarks**

* **Response Time:** <500ms per recommendation query.
* **Scalability:** Handle up to 100,000 recommendation requests per day.
* **Accuracy:** Achieve at least **85% relevance** in recommendations.

**4. Data Requirements & Access**

**4.1. Data Sources**

* **Users Table:** Stores customer type, preferences, and purchase history.
* **Products Table:** Contains product details (name, category, price, availability).
* **Orders/Purchases Table:** Logs past purchases.
* **Browsing History Table:** Tracks searches and product views.
* **Promotions & Discounts Table:** Stores ongoing and future product discounts.

**4.2. Data Accessibility**

* **Client must provide** access to PostgreSQL database or sample CSV data.
* **Data refresh frequency:** Define how often new data will be updated (real-time, daily, weekly).
* **Data privacy policies:** Ensure compliance with data protection laws.

**5. Deployment & Maintenance Requirements**

**5.1. Deployment Plan**

* **Staging Environment:** Set up a test environment before going live.
* **Production Deployment:** Ensure the model runs efficiently on the client’s server.
* **API Security & Authentication:** Implement secure API endpoints with role-based access.

**5.2. Maintenance & Updates**

* **Model Retraining:** Regularly update and retrain AI models based on new user data.
* **Performance Monitoring:** Track recommendation accuracy and user engagement.
* **Error Logging & Debugging:** Implement automated error reporting.

**6. Project Timeline & Milestones**

| **Phase** | **Tasks** | **Duration** |
| --- | --- | --- |
| **Phase 1: Data Collection & Setup** | Gather and clean client data | 2-3 weeks |
| **Phase 2: Initial AI Model Development** | Build and test rule-based recommendations | 3 weeks |
| **Phase 3: Machine Learning Model Implementation** | Train Collaborative Filtering model | 4 weeks |
| **Phase 4: API Development & Backend Integration** | Deploy AI model via API (Flask/FastAPI) | 3 weeks |
| **Phase 5: Frontend Integration** | Connect AI to React & Laravel | 3 weeks |
| **Phase 6: Performance Optimization** | Improve accuracy & reduce latency | 2 weeks |
| **Phase 7: Testing & Deployment** | Test, debug, and launch the system | 4 weeks |

**7. Expected Deliverables**

✅ AI-based recommendation system integrated into Macromed’s platform. ✅ API for serving real-time product recommendations. ✅ User-friendly frontend interface with interactive filtering. ✅ Performance reports on recommendation effectiveness. ✅ Complete project documentation and training manual.

**8. Next Steps & Client Input Required**

**8.1. Client Inputs Needed**

📌 Provide access to PostgreSQL **database or sample datasets**.  
📌 Confirm **business rules and exclusion criteria** for recommendations.  
📌 Define **preferred UI/UX elements** for displaying recommendations.  
📌 Approve **timeline and milestones** for development.

**8.2. Approval & Sign-Off**

* **Client Representative Name:** \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
* **Approval Date:** \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

**Prepared By:** [Your Name]  
**Date:** [DD/MM/YYYY]  
**Contact Information:** [Your Email]