AiFi HK: System Design Documentation

1. System Overview

AiFi HK is a secure financial transaction platform with integrated AI assistance designed for the Hong Kong market. The system enables users to manage accounts, perform secure transactions with multi-factor authentication, and receive AI-powered financial insights using natural language interaction.

Banking Digitalization: The Hong Kong Monetary Authority (HKMA) actively promotes financial technology through its "Fintech 2025" strategy, encouraging banks to leverage technologies like the Internet, big data, and cloud computing. This initiative aims to automate processes previously requiring extensive manpower and in-person verification.

Elderly Market Opportunity: Government statistics (Thematic Household Survey Report No. 77, May 2023) indicate that while elderly Internet usage has risen significantly from 65% to over 80% in two years, only 21.5% of elderly users engage with online financial services. This represents a substantial gap between general technology adoption and financial technology use among seniors.

AiFi HK bridges this gap through enhanced security measures, intuitive interfaces, and AI assistance designed to make digital financial services more accessible to all age groups, including elderly users who are comfortable with basic Internet usage but hesitant to adopt digital financial tools.

2. Design Rationale

2.1 Key Design Decisions

1. **Python-based Full Stack:**
    - Python chosen for both frontend and backend to maintain consistent development approach and leverage its rich ecosystem for financial applications and AI integration.
2. **Multi-Factor Authentication:**
    - MFA implemented at both login and transaction execution stages to address the heightened security concerns in Hong Kong's financial sector following recent digital banking fraud incidents.
3. **Local AI Integration:**
    - Ollama with Llama 3.2 deployed locally to ensure data privacy compliance with Hong Kong's Personal Data (Privacy) Ordinance while providing intelligent financial assistant capabilities.
4. **Minimalist Database Design:**
    - Focused database structure optimized for transaction tracking and account management to ensure high performance with minimal complexity.

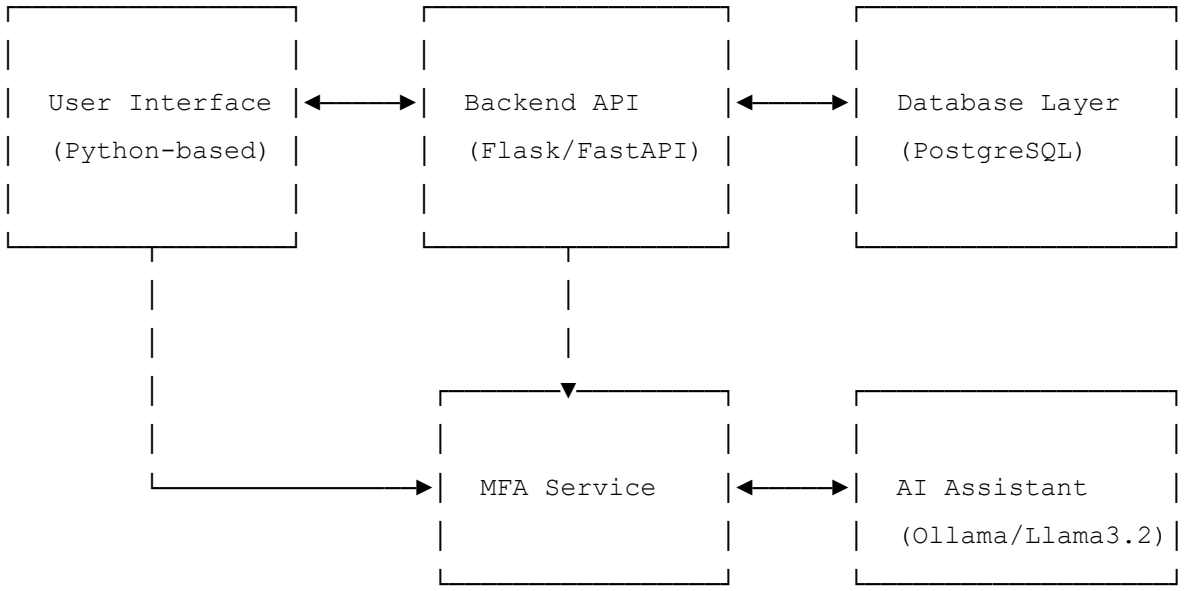
2.2 Market Gap Addressed

This solution addresses several gaps in Hong Kong's current FinTech landscape:

- Enhanced security through transaction-level MFA (beyond standard login MFA)
- Natural language AI assistant for financial management (currently unavailable in local banking apps)
- Simplified yet secure architecture compared to over-engineered existing solutions

3. System Architecture

3.1 Component Architecture

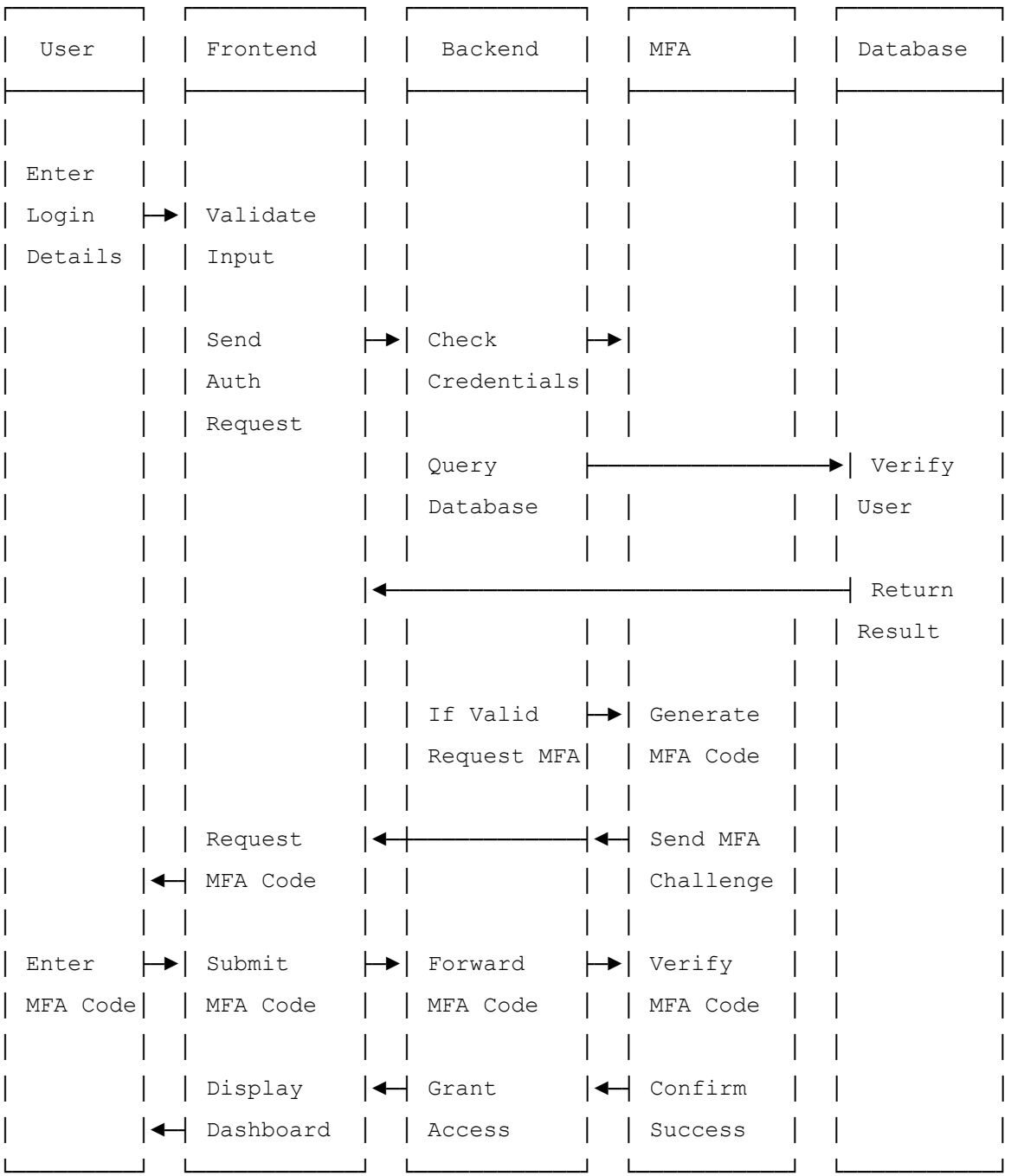


3.2 Data Flow

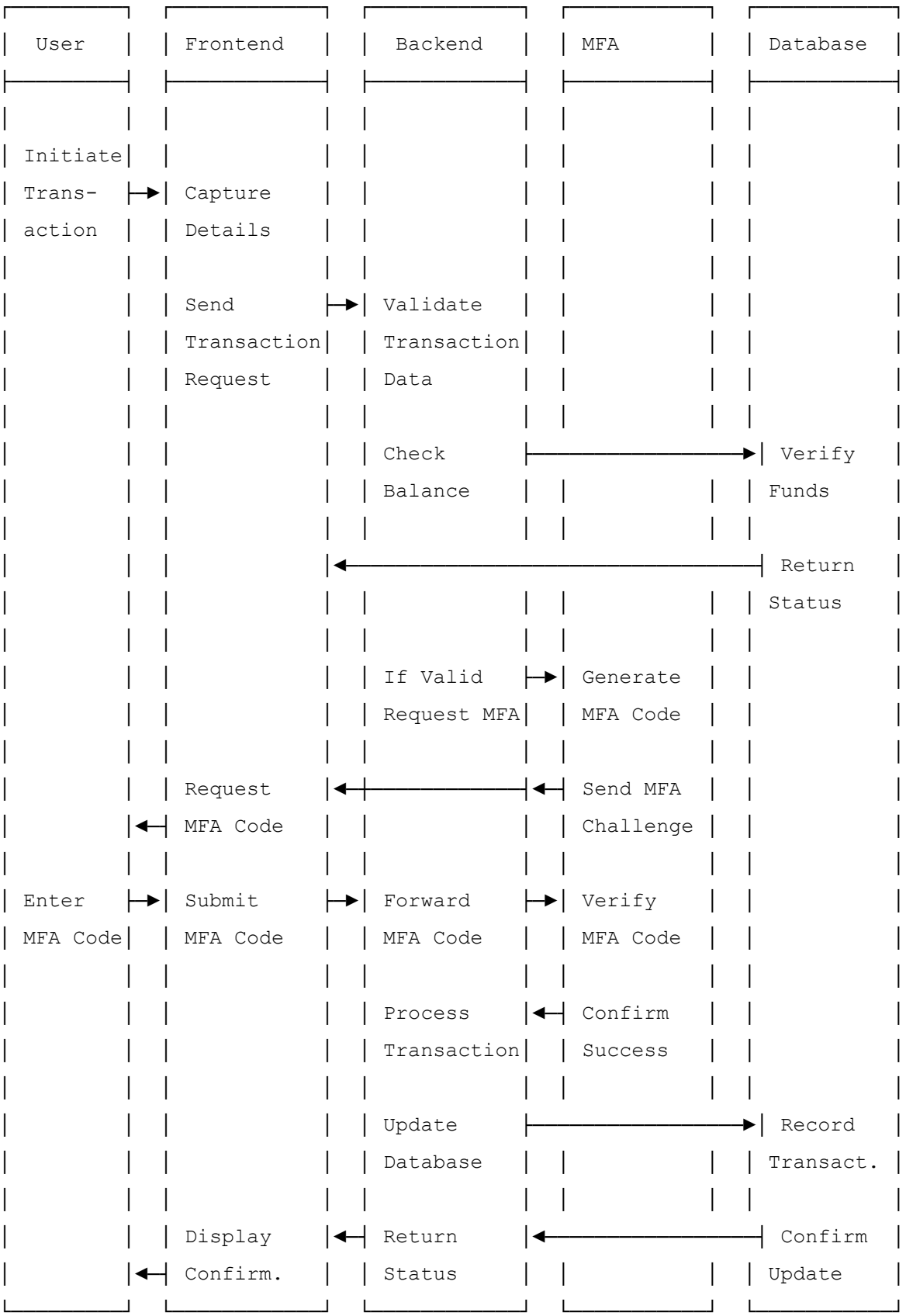
- User requests flow through the UI to the Backend API
- The Backend API interfaces with the Database Layer for data persistence
- Authentication requests are routed through the MFA Service
- Natural language processing requests are directed to the AI Assistant
- Responses follow the reverse path back to the user

4. Vertical Swimlane Diagrams

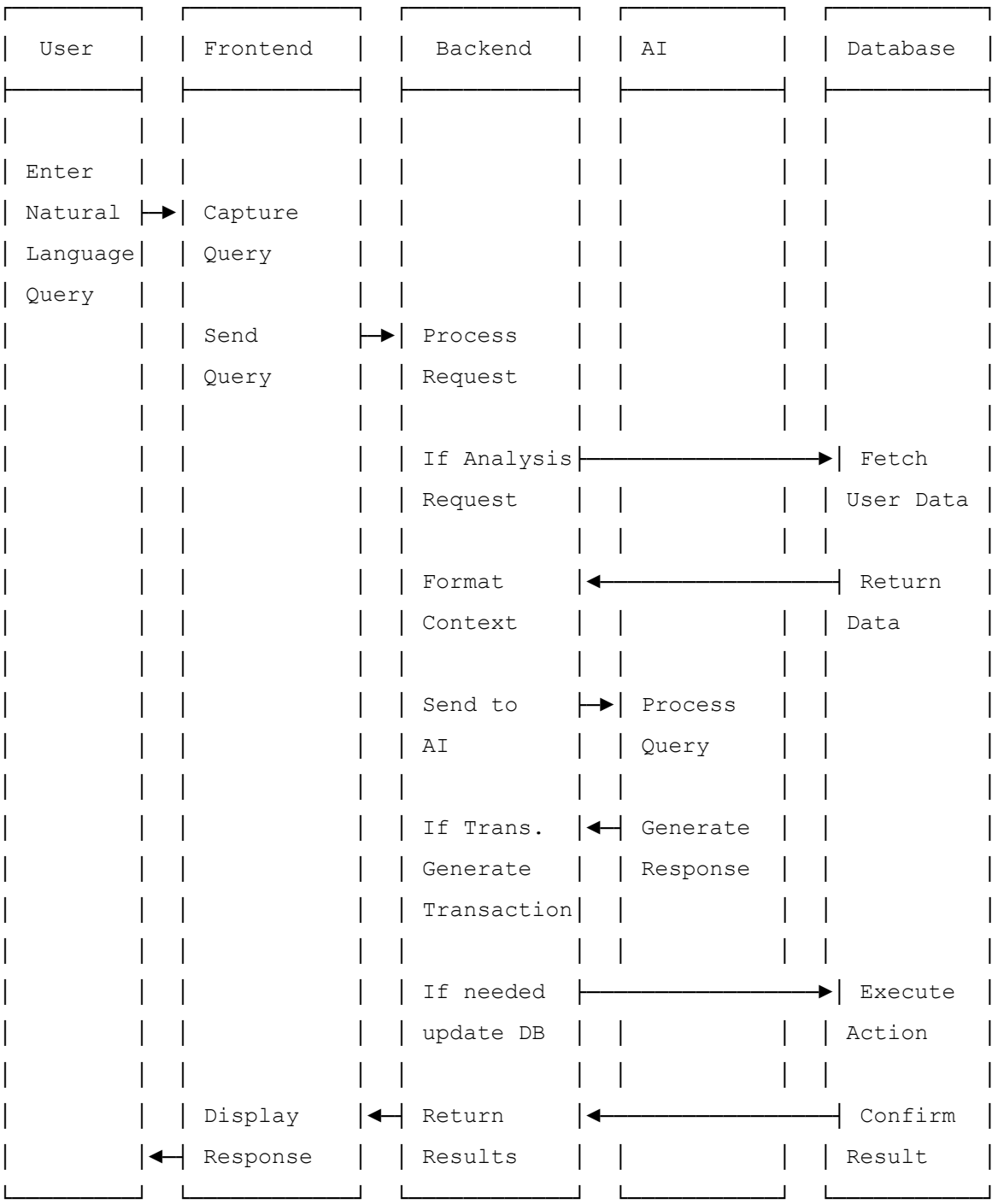
4.1 User Authentication Workflow



4.2 Transaction Processing Workflow

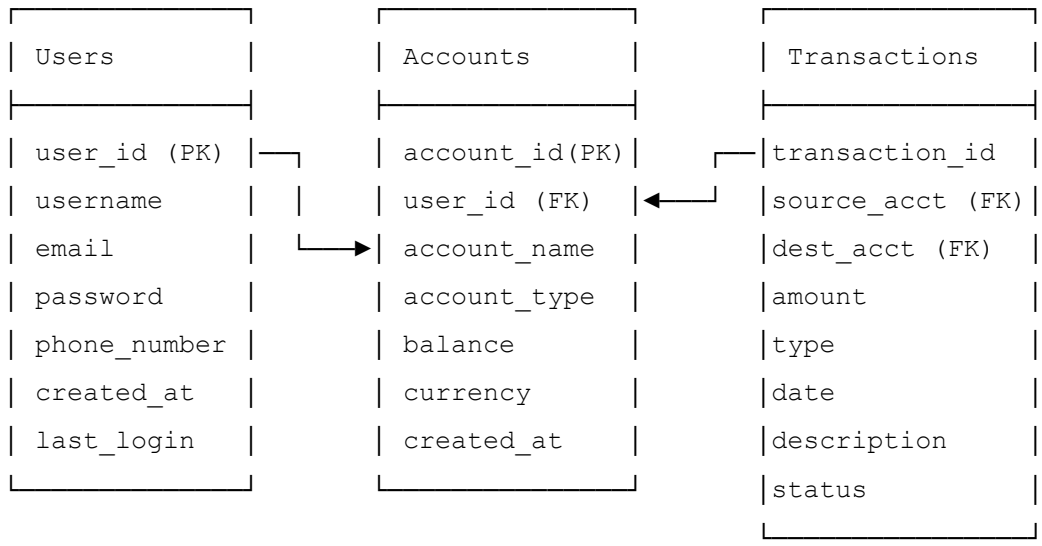


4.3 AI Assistant Interaction Workflow



5. Database Design

5.1 Entity Relationship Diagram



5.2 Database Schema

Users Table

```
CREATE TABLE users (
    user_id SERIAL PRIMARY KEY,
    username VARCHAR(50) UNIQUE NOT NULL,
    email VARCHAR(100) UNIQUE NOT NULL,
    password_hash VARCHAR(255) NOT NULL,
    phone_number VARCHAR(20) NOT NULL,
    created_at TIMESTAMP DEFAULT CURRENT_TIMESTAMP,
    last_login TIMESTAMP,
    mfa_enabled BOOLEAN DEFAULT TRUE,
    mfa_secret VARCHAR(100)
);
```

Accounts Table

```
CREATE TABLE accounts (
    account_id SERIAL PRIMARY KEY,
    user_id INTEGER REFERENCES users(user_id) ON DELETE CASCADE,
    account_name VARCHAR(100) NOT NULL,
    account_type VARCHAR(50) NOT NULL,
    balance DECIMAL(15,2) DEFAULT 0.00,
    currency VARCHAR(3) DEFAULT 'HKD',
    created_at TIMESTAMP DEFAULT CURRENT_TIMESTAMP,
    last_updated TIMESTAMP DEFAULT CURRENT_TIMESTAMP
);
```

Transactions Table

```
CREATE TABLE transactions (
    transaction_id SERIAL PRIMARY KEY,
    source_account_id INTEGER REFERENCES accounts(account_id),
    destination_account_id INTEGER REFERENCES accounts(account_id),
    amount DECIMAL(15,2) NOT NULL,
    transaction_type VARCHAR(50) NOT NULL,
    transaction_date TIMESTAMP DEFAULT CURRENT_TIMESTAMP,
    description TEXT,
    status VARCHAR(20) DEFAULT 'pending',
    mfa_verified BOOLEAN DEFAULT FALSE
);
```

6. Security Considerations

6.1 Authentication Security

- Password hashing using bcrypt
- Time-based one-time passwords (TOTP) for MFA
- Session management with JWT tokens
- Account lockout after failed attempts

6.2 Transaction Security

- Mandatory MFA for all transactions
- Transaction signing
- Amount-based verification levels
- Real-time fraud detection

6.3 Data Security

- Encrypted data storage
- TLS for all communications
- Local AI processing to minimize data transmission
- Compliance with Hong Kong data protection regulations

7. AI Integration Design

7.1 AI Capabilities

- Natural language transaction initiation
- Spending pattern analysis
- Personalized financial advice
- Anomaly detection in transaction history

7.2 AI Model Implementation

- Ollama server running locally
- Llama 3.2 model deployment
- Context window optimization for financial data
- Fine-tuning for Hong Kong financial terminology

7.3 AI Interaction Flow

1. User inputs natural language query
2. Backend preprocesses query
3. Relevant financial context is retrieved
4. Query and context sent to Llama 3.2
5. Model generates response/action
6. Backend validates and executes any requested actions
7. Result returned to user

8. Implementation Roadmap

1. Core database and authentication setup
2. Backend API development
3. Frontend interface implementation
4. MFA integration
5. Basic transaction processing
6. AI assistant integration
7. Advanced features and optimization
8. Testing and security auditing

This system design document provides a comprehensive blueprint for implementing your FinTech solution, addressing the key requirements while focusing on the core functionality you specified.