UPI Payment Gateway System

A secure and distributed UPI (Unified Payments Interface) payment gateway system implementing lightweight cryptography, blockchain ledger, and quantum cryptography simulation.

1 Features

- Secure transaction processing between users, merchants, and banks
- Lightweight Cryptography (LWC) implementation using SPECK algorithm
- QR code generation for payment information
- Blockchain ledger for transaction recording and verification
- Quantum cryptography simulation demonstrating PIN vulnerabilities
- Network communication using socket programming

2 Architecture

The system consists of three main components:

1. **Bank Server**: Manages user accounts, merchant accounts, transaction processing, and blockchain ledger
2. **UPI Machine**: Merchant-side terminal for generating payment requests and QR codes
3. **User Device**: Customer-side application for scanning/processing payments and authorizing transactions

3 Setup Instructions

3.1 Prerequisites

- Python 3.8 or higher
- Required packages (install using `pip install -r requirements.txt`)

3.2 Installation

1. Clone the repository
2. Install dependencies when prompted

4 Running the Application

The system requires three separate terminals, one for each component:

4.1 Terminal 1: Bank Server

```
# Navigate to the project directory
cd UPI_Payment_Gateway

# Run the bank server
python -m bank_server.main
```

4.2 Terminal 2: UPI Machine

```
# Navigate to the project directory
cd UPI_Payment_Gateway

# Run the UPI machine
python -m upi_machine.main
```

4.3 Terminal 3: User Device

```
# Navigate to the project directory
cd UPI_Payment_Gateway

# Run the user device
python -m user_device.main
```

5 Usage Flow

1. Register users and merchants through the Bank Server
2. Generate payment QR codes using the UPI Machine
3. Process payments by scanning QR codes with the User Device
4. Verify transactions in the blockchain ledger

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