Project Title : Fingerprint-Based Multi-Locker Bank System with Dual Authentication Using OTP and Biometric Verification

Aim:

To develop a secure multi-locker bank system where each user can access their assigned locker only through dual authentication: fingerprint verification and a one-time password (OTP) sent to their registered number via Telegram or SMS.

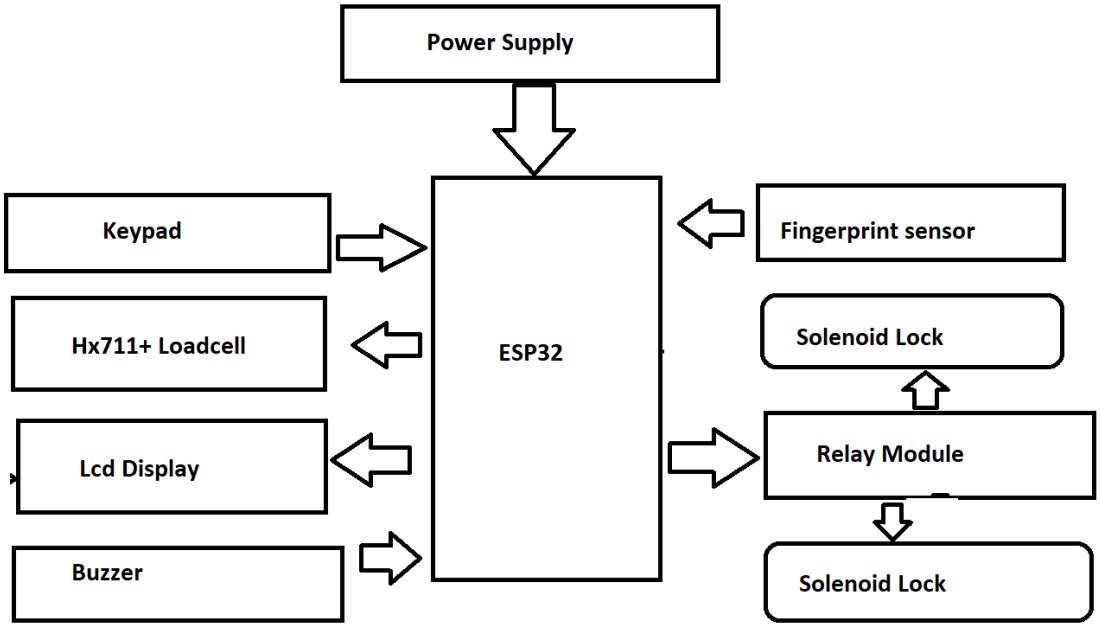
Objectives:

- To provide secure access to personal lockers using biometric verification.
- To enhance security by implementing an additional OTP-based authentication system.
- To allow multiple users to access only their assigned lockers.
- To prevent unauthorized access and theft in shared or public locker systems.
- To provide logging or alert options for attempted or failed access.

Working Principle:

Each user is registered with their fingerprint and Telegram ID or phone number. When a user wishes to open their locker, they first scan their fingerprint. If it matches a stored record, the system sends a unique OTP to the user's Telegram or mobile. Upon entering the correct OTP using a keypad or touchscreen, the corresponding locker is unlocked using a servo or solenoid lock. If either step fails, access is denied.

Block Diagram



Hardware Components:

- ESP32
- Fingerprint Sensor (R305 / GT511C3)
- Keypad / Touchs
- Solenoid Locks (1 per locker)
- Relay Module
- LCD / OLED Display
- Buzzer / LED Indicators
- Power Supply

Software Used:

- Arduino IDE
- Telegram Bot API
- Embedded C/C++

Advantages:

- Dual authentication ensures high security
- Each user can access only their assigned locker
- Telegram/SMS OTP adds real-time verification
- Easily scalable for more lockers
- Ideal for smart banks, schools, gyms, or hostels

Disadvantages:

- OTP system requires stable internet or GSM connectivity
- Biometric mismatch can occur with dirty fingers
- Telegram setup requires bot configuration and user linking
- Slight delay due to OTP verification step

Applications:

- Bank locker systems
- Hostel or dormitory personal lockers
- Gym or club smart lockers
- School bag safety locker systems
- Smart storage in co-working or rental spaces

Future Scope:

- Add RFID card or facial recognition as a third layer of security
- Include mobile app for locker status and logs
- Generate access reports for admin through the cloud
- Use AI-based user behavior alerts (e.g., failed attempts tracking)
- Auto-lock after idle timeout with tamper detection alarms

Conclusion:

This project introduces a smart and secure locker access system that combines the accuracy of biometric fingerprint verification with the flexibility of OTP-based authentication. It ensures that only authorized users gain access, making it ideal for secure, shared, or public environments.