Project Title:Biometric-Based Ration Distribution System with Fingerprint Authentication, Telegram OTP Verification, Load Balancing, and User Management

Aim:

To build a secure and transparent ration distribution system using fingerprint-based biometric verification, OTP verification through Telegram, automatic load measurement, and complete user management features.

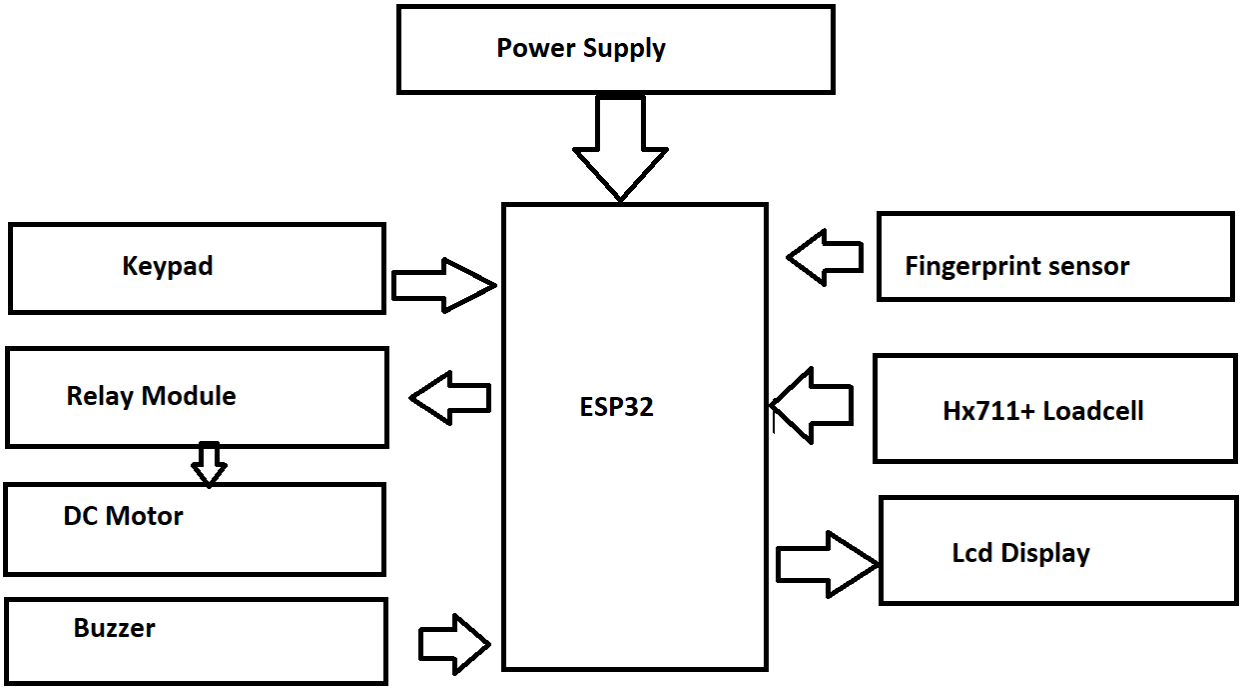
Objectives:

- To authenticate users using a fingerprint sensor.
- To send an OTP via Telegram to the registered user for double verification.
- To measure and dispense ration items using a load cell for accurate quantity.
- To allow admin-level user addition, removal, and quota modification.
- To prevent fraud, ensure fair distribution, and maintain digital records.

Working Principle:

Each user is registered in the system with their fingerprint and Telegram ID. During ration collection, the user scans their finger. If the fingerprint is verified, the system sends a unique OTP to the user's Telegram account. Upon entering the correct OTP, the system activates the dispenser and uses a load cell to dispense the exact ration quantity. After dispensing, the data is logged, and the user cannot collect again until the next cycle. Admins can add, remove, or update user profiles directly through the system.

Block Diagram



Hardware Components:

- ESP32 / Raspberry Pi
- Fingerprint Sensor (R305 / GT521F32)
- Load Cell with HX711 Amplifier
- DC Motor / Solenoid Valve (for dispensing)
- LCD / OLED Display
- Keypad or Touch Buttons (for OTP input)
- Buzzer and LEDs
- Power Supply

Software Used:

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

Advantages:

- Dual authentication (biometric + OTP) increases security
- Real-time OTP alerts via Telegram reduce impersonation
- Automatic and accurate ration dispensing
- Paperless and fully digital system
- Easily manageable by admin for user and quota control

Disadvantages:

- Telegram OTP depends on internet availability
- Fingerprint sensor may fail with dirty or injured fingers
- Requires regular maintenance and calibration
- OTP delay can slow down the process slightly

Applications:

- Government Public Distribution System (PDS)
- Military canteens and ration control
- NGO food distribution projects
- Corporate or institutional meal distribution

Future Scope:

- Link with Aadhaar or government databases for real-time sync
- Add facial recognition for additional security
- Web portal for remote monitoring and data access
- Integration with digital payment systems or prepaid wallets
- Cloud-based analytics for usage tracking and fraud detection

Conclusion:

This biometric-based ration distribution system enhances the security and efficiency of food distribution by using fingerprint authentication and Telegram-based OTP verification. With load balancing and user management features, it offers a reliable and modern solution to ensure fair and fraud-free ration access.