Smart Breach Prevention System

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***Abstract*— The problem with the facility of lockers provided by banks to the account holders is the lack of adequate security due to the conventional "lock and key" mechanism used. The system proposed will attempt to overcome these trade-offs by providing a smart, breach-proof system which will provide multiple levels of security and ensure maximum protection of the articles placed inside the locker.**

Index Terms—Electric strike lock, Face recognition, Fingerprint, Geofencing, Keypad, Wi-Fi

I. Introduction

The number of incidents of theft of articles from lockers in various banks across India has been increasing considerably since the past few years. Cases of breaches into lockers from the ground level as well as through underground paths (for e.g. thieves dug a 125 feet long hole and looted 77 lockers in Haryana) have been rising in popular government and private sector banks across the country. Right from the theft of articles worth lakhs of rupees in HDFC bank in Kashmir to the stealing of gold worth Rs.60 lakhs from the locker of Central bank of India, Bengaluru, there have been multiple successful attempts to breach and steal the articles from lockers which has increased he security concerns. The Smart Breach prevention system will be using the most unique, irreplaceable identity-the user's fingerprint to secure the contents of the locker. The user will be allowed to access the next level, the password only if their fingerprint matches the one stored in the database of the locker system. Then the authorized bank staff member will enter the primary password after which the user will receive an OTP (one-time password) on their cell phone number linked to the bank account number. After these stages have been successfully passed, the PIR sensors inside the locker will be deactivated until the locker is locked again. The biggest merit of this system is its minimum complexity which will make fault finding, rectification and maintenance an easy task. Provision for securing the database of the system which maintains the record of users' fingerprints and other important information to the maximum will also be given which was an issue with the earlier systems.

II. Literature Review

The design titled "Fingerprint based door locking system" [1] provides for a design which uses fingerprint and RFID tag as the two means for providing security to lockers. The drawback of this system is that only one level of security is used compared to the high cost of the final product, thus making it undesirable. The "Locker Opening and Closing System Using Fingerprint and RFID" [2] introduces a RFID reader, password and GSM module. Though reliable and cost effective, the main demerit of this system is that the user needs to maintain a RFID tag with them each time they need to access the locker. If the RFID tag is lost, it further worsens the problem. Also, multiple modules lead to a bulky design which will create an obstacle in repairs and maintenance. The design "Implementation of bank locker security system based on fingerprint sensing and RFID reader" [3] utilizes a fingerprint sensor and RFID reader. This system appears to be most feasible for use barring the fact that constant monitoring through a laptop or desktop forces one to compromise on the parameter of portability of the system.

As of now, ICICI bank in India is working on a smart locker system which will provide security to lockers using fingerprints of users. The research and development related to the system is underway and it is highly uncertain as to when it will be implemented.

TABLE I
Literature Review

S. No.	Title	Authors	Year	Drawbacks
1.	Fingerprint based door locking system	A. Aditya Shankar, P.R.K. Sastry, A. L. Vishnu Ram, A. Vamsi Dhar	2015	Unreliable, RFID tag needed.
2.	Locker opening closing using RFID, fingerprint, password and GSM	Raghu Ram Gangi Subhramanya Sarma Gollapudi	2013	High complexity, no database security
3.	Design & implementation of bank locker security system based on fingerprint sensing circuit and RFID reader	Khaing Mar Htwe, Zaw Min Min Htun, Hla Myo Tun	2015	Laptop/desktop needed, fault-finding difficult

III. Block Diagram and Description

Microcontroller LPC 2148 was initially found to be ideal for the system based on reference from the book by Joseph Yiu [4] but the cost of the microcontroller itself was high which would further increase the overall cost of the entire system. The book by Jeremy Blum [5] led to the finalizing of Arduino Mega microcontroller. Two choices were available at approximately the same cost-Arduino UNO or Arduino mega. Since higher number of digital pins is provided by Arduino Mega, it was chosen. ESP 8266 Wi-Fi-module is a self-contained SoC with integrated TCP/IP protocol stack which will give any microcontroller access to a wi-fi network. It is compliant with the 802.11 b//g/n standards. The keypad will serve the purpose of entering the OTP received by the user on their registered mobile number. It is a 4x4 numeric keypad with keys from 0 to 9. Since the conventional LCD display unit will consume more digital pins, 2.4-inch Thin Film Transistor(TFT) LCD screen will be used to display the progress to the user. TFT is an active matrix LCD in comparison to traditional passive matrix LCD. An electric strike lock which operates on DC voltage will switch between locking and unlocking only when it receives a specific signal from the controller and a specific voltage and current.

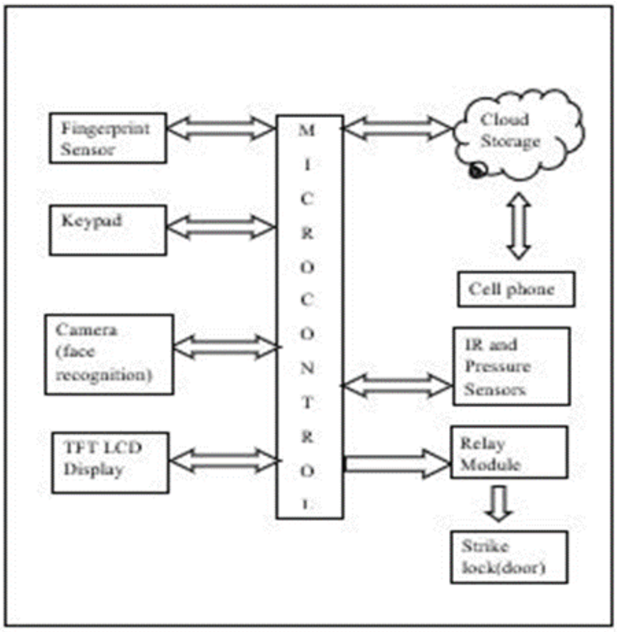


Fig. 1. Block Diagram of the system

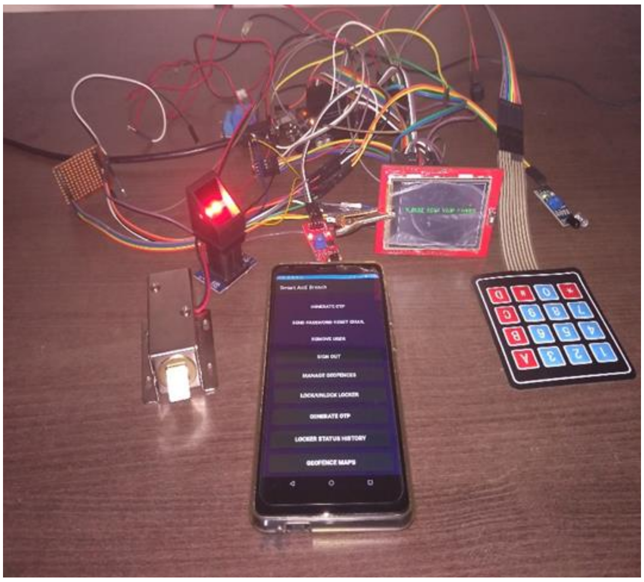
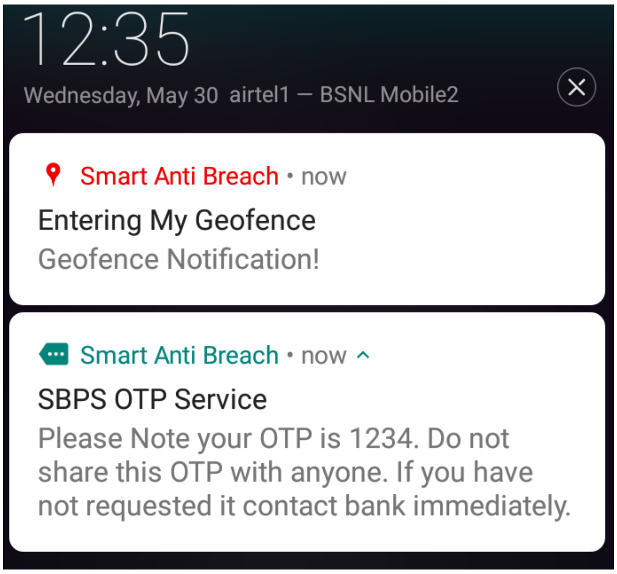


Fig. 2. System output

Working:

The first step would be scanning the fingerprint of the user and comparing it with the fingerprint data in the database. Once this condition is satisfied, user will receive an OTP on their registered mobile number which they have to enter using the keypad. After successful verification of these parameters, the mobile app will be given an alert for authenticating whether the user is really trying to access the locker and the IR and vibration sensors will turn off and the strike lock will receive the signal from Arduino through relay to open the door.



12:35
Wednesday, May 30 airtel1 — BSNL Mobile2

Smart Anti Breach • now
Entering My Geofence
Geofence Notification!

Smart Anti Breach • now
SBPS OTP Service
Please Note your OTP is 1234. Do not share this OTP with anyone. If you have not requested it contact bank immediately.

Fig. 3. System notification

IV. Future Scope

- Designing of a system which will be power supply independent i.e. can produce its own power or which works on a battery.
- Enhancing the security levels by addition of retinal or iris scan and providing for trusted nominees enlisted by the users themselves.
- Additional measures in order to make the system cyber-security compliant as per international standards.

V. Conclusion

The problem with the presently available lock and key system for providing security to bank lockers is unreliable. The advanced systems developed using engineering techniques such as fingerprint scan, RFID reader etc. are efficient but trade-offs between various parameters such as power consumption, cost and complexity are inevitable in such systems. The said design was implemented using Arduino microcontroller and basic devices used for security strengthening such as sensors and alarms. Signal conditioning, amplification, filters etc. are not needed as of now.

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