

Microcontroller Based Bank Locker Security System

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Abstract This research presents the design and implementation of a microcontroller-based bank locker security system that enhances protection through biometric and One-Time Password (OTP) authentication. The system utilizes a microcontroller (such as Arduino or PIC) to control a fingerprint scanner for biometric verification, ensuring that only authorized users can access the locker. Additionally, an OTP is generated and sent to the user's registered mobile number via a GSM module, adding a second layer of security. This dual-authentication approach prevents unauthorized access and provides a higher level of protection. The GSM module also allows real-time alerts to be sent to both the bank's security team and the locker owner in case of any suspicious activity or tampering. The system is designed to ensure continuous operation through a backup power supply, making it reliable even during power outages. This paper discusses the architecture, implementation, and advantages of combining fingerprint recognition with OTP-based security in banking environments. The proposed system is cost-effective, scalable, and offers a significant improvement in safeguarding customer valuables.

Keywords: Microcontroller, Bank Locker, OTP, GSM Module

1. INTRODUCTION

With advancements in embedded systems and microcontroller technologies, there is an opportunity to enhance the security of such systems, making them smarter, more reliable, and harder to compromise. A **Microcontroller-Based Bank Locker Security System** aims to integrate modern technology to provide a secure, user-friendly, and efficient solution for protecting valuable assets in bank lockers.

The central processing unit of this system is a microcontroller, which is connected to a number of security modules such as keypad entry, biometric (fingerprint) recognition, and automated locking systems. By limiting access to the locker to authorized users only, these solutions can greatly lower the dangers associated

with conventional locking systems. The system utilizes the capabilities of contemporary microcontrollers to provide a full solution for more advanced, intelligent, and scalable bank locker security.

2. METHODOLOGY

2.1 BIOMETRIC

Bio (life) and metric (to measure) are Greek terms from which the word "biometrics" is formed. The ability to identify and recognize an individual based on behavioral or physiological traits is known as biometrics. Nowadays, biometrics is a fascinating subject in relation to network and computer security. Nonetheless, biometric concepts have existed for a long time.

2.2 FINGERPRINT TECHNOLOGY

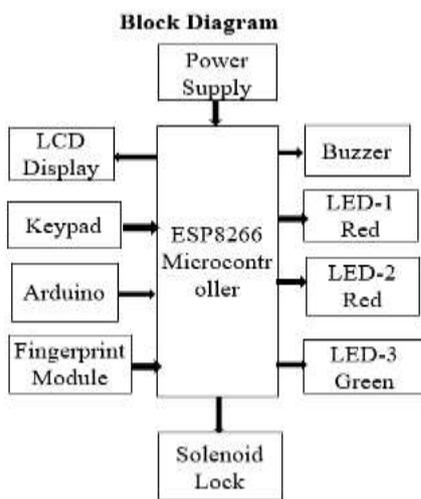
Alphonse Bertillon, an anthropologist, turned biometrics into a separate field of study in the 1890s in an attempt to solve the issue of identifying convicted criminals. 'Bertillon age' is a body measurement technique that bears his name. Because serial offenders sometimes provided various names each time they were apprehended, it was difficult to identify them. Bertillon came to the realization that some aspects of the body, like the size of the cranium or the length of the fingers, remained constant despite changes in names, hairstyles, and weight.

His system was used by police authorities throughout the world, until it quickly faded when it was discovered that some people shared the same measurements and based on the measurements alone, two people could get treated as one. Following this, the police adopted finger printing, which was created by Scotland Yard's Richard Edward Henry. Essentially reverting to the same methods used by the Chinese for years. There are many steps in the history of fingerprinting as a way to identify criminals



3. PROPOSED METHOD

3.1 Block Diagram of Microcontroller based bank locker security system. The block diagram consists of ESP8266 microcontroller, Power supply, LCD display, Keypad, Arduino, Fingerprint Module, Solenoid Lock, Buzzer, LED.



3.2 WORKING

The fundamental component of the Microcontroller-Based Bank Locker Security System is a microcontroller, which manages the entire locking mechanism and authentication procedure. The user first authenticates the system using one of three options: an optional RFID reader, a fingerprint scanner for biometric authentication, or a keypad for password entering. The microcontroller compares the input to stored data when the correct credentials are entered. The locking mechanism, usually a solenoid, receives a signal to unlock the locker if the authentication process is successful. A feedback system notifies the user of the access status using visible and auditory cues, such as LED indications and a buzzer. The system has tamper detection sensors for enhanced security, which notify it in the event of any unwanted physical intervention. Additionally, it may include a backup power supply to ensure continuous operation during power failures. The system also features a logging function that records all access attempts, storing data for future audits. Optionally, a communication module like

GSM can be included, allowing remote monitoring and real-time alerts to the bank's security team. With these integrated features, the microcontroller-based system offers a secure, efficient, and reliable way to control access to bank lockers.



4. CONCLUSIONS

In conclusion, by integrating fingerprint identification with One-Time Password (OTP) for access control, the Microcontroller-Based Bank Locker Security System improves on conventional security. The microcontroller manages authentication and operates the locking mechanism, ensuring that only authorized users can access the locker. The system also includes tamper detection, real-time alerts, and backup power to ensure reliability. This solution offers a secure, efficient, and user-friendly method for protecting bank lockers, with the potential for future improvements such as cloud monitoring and enhanced biometric features.

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