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Bank Locker System using Raspberry PICO Authentication and GSM

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Abstract: *In modern banking systems, the security of lockers is very important. Traditional locker systems mostly rely on mechanical locks or passwords, which can be vulnerable to theft or unauthorized access. To improve security, a biometric-based system can be used. This project presents a bank locker security system based on fingerprint authentication and GSM-based OTP verification using Raspberry Pi Pico. The system uses an AS608 fingerprint sensor to authenticate the user. After successful fingerprint verification, an OTP (One Time Password) is sent to the user's mobile phone through a GSM module (SIM800A). The user must enter the received OTP through a 4x4 keypad. If the OTP is correct, the locker door opens using a servo motor. If the OTP is incorrect, the system triggers a buzzer and red LED alert. The system also uses an LCD display to show messages such as "Place Finger", "Enter OTP", and "Access Granted". This project improves security by combining biometric authentication with GSM-based verification*

Keywords: Raspberry Pi Pico: Microcontroller board. Authentication: RFID, Fingerprint, or Password-based access. GSM Module (SIM800/SIM900): For SMS alerts and remote access . Lock Mechanism: Servo motor or solenoid lock. User Management: Add, remove, or modify user access

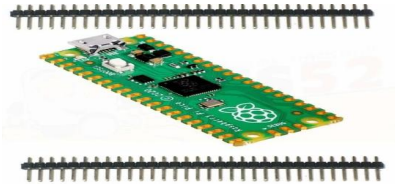
I. INTRODUCTION

Security systems play a crucial role in protecting valuable items in banks and personal lockers. Traditional locking systems based on keys or passwords have several limitations. Keys can be lost or duplicated, and passwords can be guessed or stolen. To overcome these limitations, biometric technology provides a more secure solution.

Biometric authentication uses unique physical characteristics of a person such as fingerprints, iris patterns, or facial recognition. Among these methods, fingerprint authentication is widely used because it is reliable, inexpensive, and easy to implement.

This project develops a bank locker security system that integrates fingerprint recognition with GSM-based OTP verification. The system uses Raspberry Pi Pico as the main controller to manage fingerprint authentication, OTP generation, SMS communication, and motor control for the locker door. By combining biometric verification and mobile authentication, the system provides a high level of security and prevents unauthorized access.

II. COMPONENTS REQUIRED



Raspberry Pi Pico (Main Controller)

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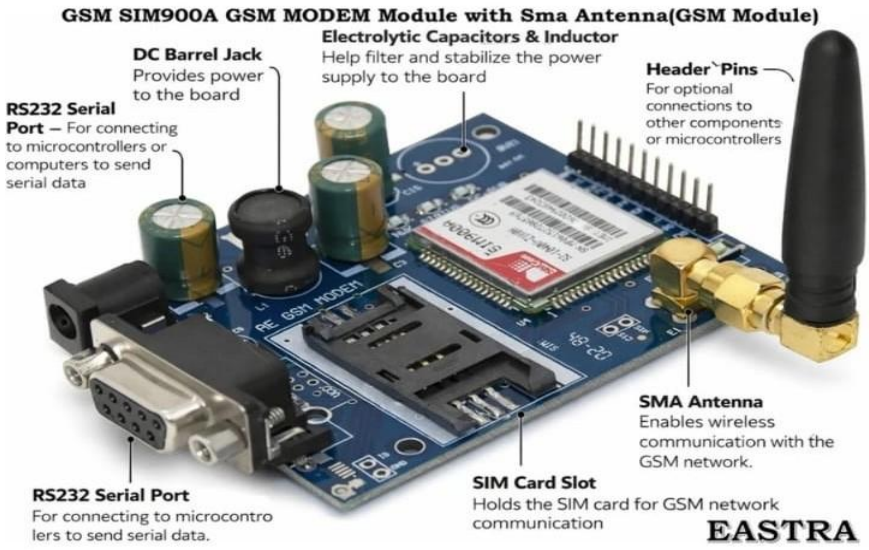
AS608 Fingerprint Sensor
SIM800A GSM Module16x2 LCD Display with I2C
4x4 Keypad
SG90 Servo Motor
Buzzer

Universal Buzzer 12VDC

Red and Green LEDs

Hardware Components
Raspberry Pi Pico
The Raspberry Pi Pico is a microcontroller board based on the RP2040 chip. It controls all operations of the system including fingerprint scanning, OTP generation, SMS communication, and servo control.

AS608 Fingerprint Sensor
The AS608 fingerprint sensor is used to capture and verify the fingerprint of authorized users. Each fingerprint is stored in the sensor's memory and used for authentication.



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SIM800A GSM Module
The SIM800A module is used for GSM communication. It sends OTP messages to the user's mobile phone using SMS.

LCD Display

The 16x2 LCD display shows system messages such as system status, instructions, and authentication results.

Keypad

The 4x4 keypad is used for entering the OTP received on the mobile phone.

Servo Motor
The servo motor acts as the locking mechanism for the locker door. When authentication is successful, the servo rotates to unlock the door.
Buzzer and LEDs
The buzzer provides an audible alert when an incorrect OTP is entered. LEDs indicate system status such as access granted or denied.

III. SOFTWARE REQUIRED

The system software is developed using Micro Python programming language and uploaded to the Raspberry Pi Pico using the Thonny IDE. The program controls communication with the fingerprint sensor, GSM module, keypad input, and servo motor.
The system uses UART communication for both the fingerprint sensor and GSM module. Random OTP numbers are generated using a random number function and sent via SMS using AT commands.

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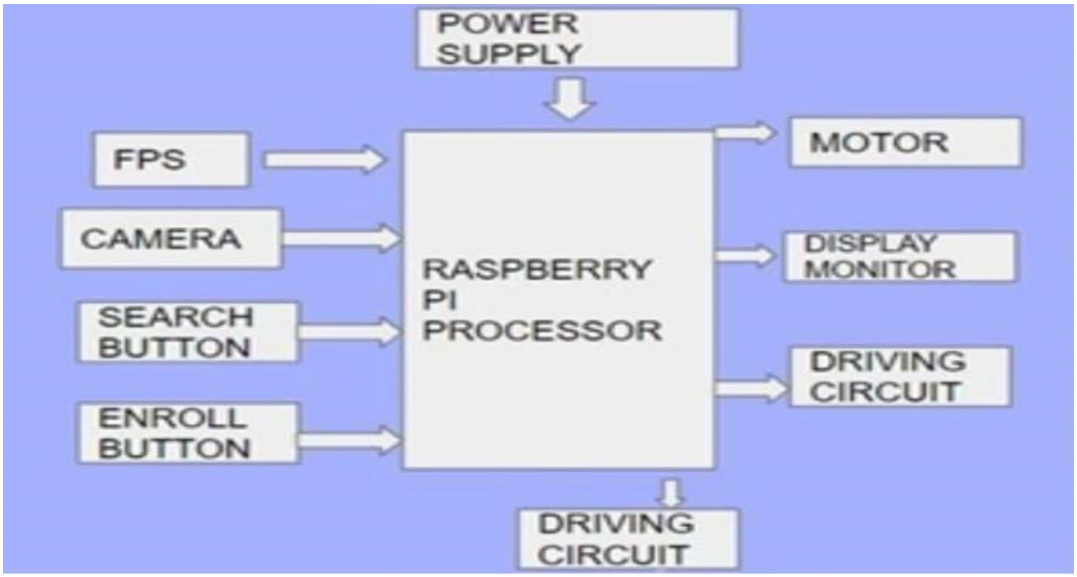
IV. BLOCK DIAGRAM



VI. WORKING

The working process of the system is as follows:
The system starts and displays the message "Place Finger" on the LCD display.
The user places a finger on the fingerprint sensor.
The fingerprint sensor compares the scanned fingerprint with stored fingerprints.
If the fingerprint is matched, the system generates a random OTP.
The GSM module sends the OTP to the registered mobile number via SMS.
The user enters the OTP using the keypad.
If the OTP is correct, the servo motor rotates and opens the locker door.
If the OTP is incorrect, the buzzer sounds and the red LED turns on.
After a few seconds, the door automatically closes again

VII. APPLICATION

This system can be used in several applications including:
Bank locker security
Home security systems
Office security systems
Safe boxes and vaults
Restricted access areas

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