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Enhancing Security through an Intelligent Locker System

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ABSTRACT: In the present contemporary society, the need for secure storage solutions has become paramount, especially in environments such as offices, educational institutions, and public spaces. Traditional locker systems are effective to some extent, are susceptible to various security vulnerabilities such as unauthorized access, tampering, and inefficient monitoring.

Multiple layers of security is required to provide efficient protection against unauthorized access keypad locks, GSM technology and face recognition can make a bigger difference .In our prototype the first layer of security is provided by the keypad lock, which requires users to input a predefined code to unlock the locker The second layer utilizes GSM technology, enabling remote monitoring and control of the locker system. The third layer employs sophisticated face recognition technology, which adds an additional biometric authentication factor to the security system.

I. INTRODUCTION

Security systems encompass a comprehensive array of technologies and protocols aimed at safeguarding individuals, assets, and sensitive information from various threats and risks. Security systems continue to evolve with advancements in technology, incorporating automation, artificial intelligence, and cloud-based monitoring capabilities to enhance effectiveness and responsiveness in reducing risks and protecting assets. Traditional locker systems, can provide proper authentication up to certain point but they cannot track the data. This has led to an increased demand for an Intelligent Locker System that not only addresses these existing challenges but also leverages advanced technologies to enhance overall security. The front view of the project is shown in fig 1.1.

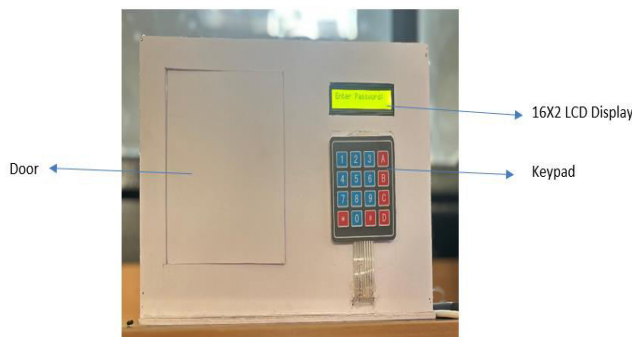


Fig-1.1-Front view of the prototype



Overall, security systems continue to evolve with advancements in technology, incorporating automation, artificial intelligence, and cloud-based monitoring capabilities to enhance effectiveness and responsiveness in mitigating risks and protecting assets. In current scenario safety has become an essential issue for most of the people. Increase in threats has case of concern as valuable assets are always targeted by criminals. In order to overcome this type of threats, authentication of the person who uses locker is very important

II. LITERATURE REVIEW

Biometric fingerprint technology ensures that only authorized individuals can access the lockers, as each person's fingerprint is unique and serves as their digital key. This eliminates the need for traditional keys or passwords, which can be lost or stolen. Additionally, fingerprint scanning offers a quick and efficient method of authentication, saving time for both customers and bank staff [1].

The image that is captured in the web camera is used as a key which is sent to the registered E-mail. The access is given through the request sent, leveraging image identification technology and email communication. The image captured is sent to registered e-mail where access is allowed [2].

Real-time communication ensures that any suspicious activity can be addressed promptly, enhancing overall security measures. Overall, the smart ATM security system proposed in the paper combines the reliability of biometric fingerprint technology with the connectivity of GSM technology to create a robust and user-friendly solution [3].

Banks can offer their customers a secure and convenient way to access their valuables, while also enhancing the overall safety of their facilities. Instead of traditional methods like keys or passwords, users are authenticated using image identification. When a user attempts to access the locker, the system captures their image using a camera installed at the locker interface which requires IOT based technology [4].

Image captured is taken for face recognition using open CV. This approach helps in providing real-time monitoring and can provide proper authentication [5].

Bank locker Security system is equipped with face recognition which takes the image of the user and compare it with the registered image. If the image of the user is already registered then the user can access the locker [6].

The system integrates electronic locks with password protection, offering a reliable and convenient means of safeguarding homes against unauthorized access. By combining advanced technology with user-friendly features, the project aims to address the increasing demand for effective security solutions tailored to the modern smart home environment [7].

Bank locker equipped with finger print ,OTP and threshold weight provides a unique layer of authentication. In which the data is stored using data base and is used for providing security [8].

Dual-level secured autonomous bank locker system. It likely discusses the design and implementation of a bank locker system that incorporates multiple levels of security measures to ensure the safety of deposited items [9].

Users can access the lockers using a mobile app or web interface, which communicates with the IoT devices to authenticate and grant access. The system also includes features such as RFID, where sensors can detect any unauthorized attempts to open if the proper reader card is not used and also GSM Technology is used. In such cases, automated notifications are sent to designated personnel to take appropriate action [10].

A multi-level bank locker security system that utilizes digital signature authentication and integrates with the Internet of Things (IoT). The system likely aims to enhance the security of bank lockers by leveraging digital signatures and IoT technologies [11].

The open CV is used for maintain attendance record in which face id is captured and the attendance is marked based on the open CV algorithm [12].



Based on the literature survey the gap identified was that many of the locker security are developed using single level authentication. A proper security is not seen so far. In this project a prototype of locker system is developed integrating multiple layers of security. The flow of the proposed project is shown in fig 1.2

III. METHODOLOGY OF PROPOSED PROJECT

Flow of the proposed Project:

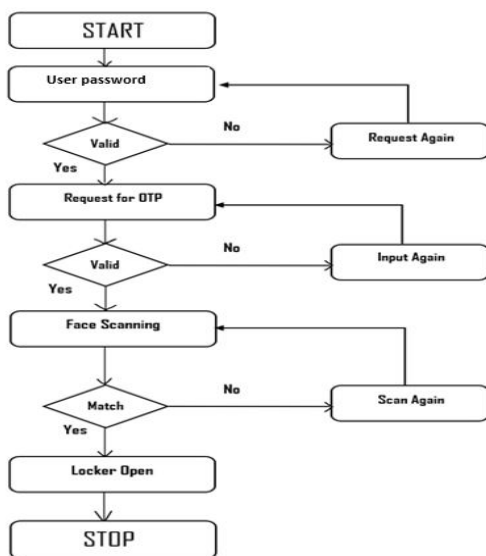


Fig 1.2 Flow diagram

The Security Locker System is designed to provide a secure storage solution for valuable items such as documents, cash, jewelry, electronic devices, and sensitive data. It employs a multi-layered approach to ensure the integrity and confidentiality of stored belongings, incorporating features such as biometric authentication, keypad access, electronic locks, and intrusion detection systems.

With its user-friendly interface and customizable access controls, the Security Locker System offers convenience without compromising on security. Users can easily authenticate their identity through biometric scans, PIN codes, and OTP based granting them access to their designated lockers swiftly and secure the belongings.

User Password:

- a) The user starts by entering their predetermined password.
- b) This password is checked against the stored password in the system.
- c) If the password is incorrect, the system returns to the primary layer, prompting the user to enter the password again.

OTP (One-Time Password):

- a) Upon successful entry of the correct password, the system triggers the second layer of authentication.
- b) A unique OTP is generated and sent to the user's registered mobile number.
- c) The user receives the OTP and enters it into the system.



d) If the OTP entered is correct, the system proceeds to the third layer of authentication.

Face Recognition:

- a) After successful verification of the password and OTP, the system activates the third layer of authentication, which involves face recognition.
- b) The system prompts the user to position themselves in front of a camera for face detection.
- c) The user's facial features are scanned and compared against the stored facial template.
- d) If the face recognition is successful and matches the stored template, the system grants access to the user.

Hardware Components :

Arduino UNO: The Arduino Uno is 32KB flash memory, 2KB SRAM, and 1KB EEPROM open-source microcontroller. It is intended for prototyping and learning, and it has digital and analogy input/output ports, PWM output, and sensor compatibility. The arduino uno is shown in fig 1.3



Fig-1.3-Arduino UNO

Keypad (4x4): A 4x4 keypad is a type of input device consisting of a grid of 16 keys arranged in a 4x4 matrix format. Each key represents a unique character or function, typically including numbers 0-9, letters A-D, and special symbols. The keypad is shown in fig1.4



Fig-1.4-Keypad(4x4)

LCD I2C (16x2) :16x2 LCD is named so because; it has 16 Columns and 2 Rows There are a lot of combinations available like, 8x1, 8x2, 10x2, 16x1, etc. but the most used one is the 16x2 LCD. The 16X2 LCD is shown in fig1.5.

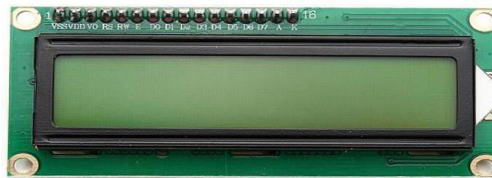


Fig-1.5-16x2 LCD with I2C

GSM Module: A GSM (Global System for Mobile Communications) module is a hardware component that enables devices to communicate over cellular networks. It typically consists of a GSM modem and a SIM card slot for connecting to the network. The GSM is shown in fig-1.6



Fig-1.6-GSM module

Servo Motor: A servo motor is a type of motor that is commonly used in various applications, including robotics, automation, and remote-control systems. The servo motor is shown in fig-1.7.



Fig 1.7-Servo motor

Software Components: We have used Arduino Ide and Visual Studio Code.

IV. RESULT AND DISCUSSION

The new security setup adds extra layers to keep user's information safe. It works like this: first, user enter the predetermined password. If it's right, the system sends an OTP to your phone. This OTP changes every time, so it's hard for anyone to guess. Once the user enter the OTP, the system then scans your face. If it's matches, the locker is Unlocked and in this state for certain duration and after that the locker locked automatically. The top view of the project is shown in fig-1.8.

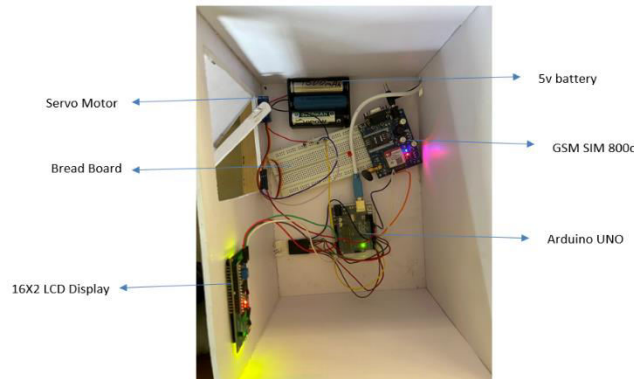


Fig-1.8-Top view of the project

The first layer of security is provided by the keypad lock which requires users to input a predefined code to unlock the locker. This adds a basic yet effective level of authentication, ensuring only authorized individuals can gain access to the contents within. The fig 1.5 displays the message as enter the password for the user



Fig-1.9-Enter the password

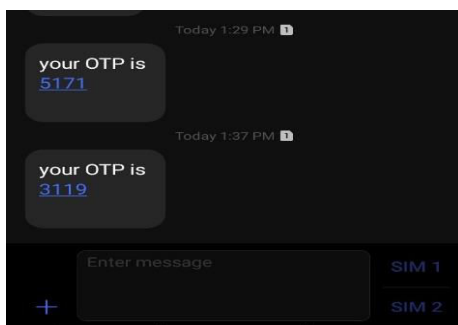


Fig-1.10-OTP sent to registered mobile number



Fig-1.11-Entering the OTP



The third layer employs sophisticated face recognition technology, which adds an additional biometric authentication factor to the security system. By analysing facial features and matching them against stored data, the locker system can accurately identify authorized users and deny access to unauthorized individuals, further enhancing the overall security posture. The fig1.12 shows the message as show face only when the correct OTP is entered, fig 1.13 shows the message as door is opened when face is matched with reference user image.



Fig-1.12-Requesting the user to show the face

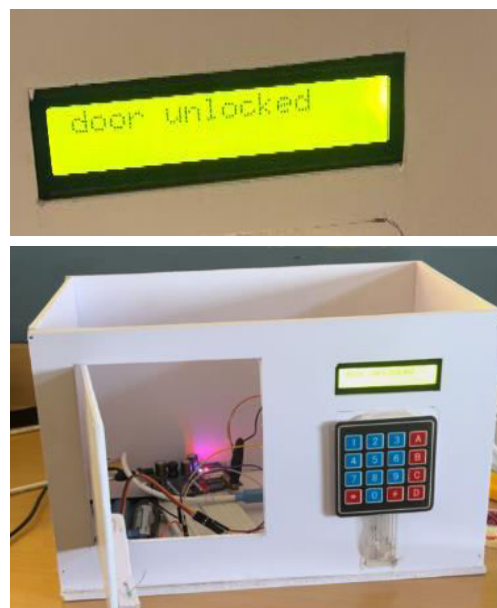


Fig-1.13-Door is opened

IV.CONCLUSION AND FUTURE WORK

In this paper, we have proposed a novel approach to provide an authenticated security against unauthorized access. The three-level locker security system combining keypad lock, GSM, and face recognition technologies offers a efficient and comprehensive solution for enhancing security and access control. By integrating these advanced technologies, the system ensures multi-factor authentication, making unauthorized access nearly impossible. The prototype can be upgraded using AI, GPS tracking and also integrate the project with fingerprint authentication for better security. Using generative AI can also help in developing a real time futuristic project. Tracking the data can also be using data base which can enhance the provide better support towards security.

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