Advance OTP Based Door Lock System

Vaibhav Subhash Kale[1], Vinayak Prakash Jagadale[2], Trinkal Dilip Patil[3]
Ajay Shivdas Mali[4], Sakshi Sunil Bhoi[5]
[1]*Assistant Professor, Department of Electrical Engineering, P. S. G. V. P. Mandal's D. N. Patel College of Engineering Shahada, Dist. Nandurbar*
[2,3,4,5] *Students, Department of Electrical Engineering, P. S. G. V. P. Mandal's D. N. Patel College of Engineering Shahada, Dist. Nandurbar*

***Abstract*—This project proposes an OTP-based locker operation system which provides secure access to lockers using one-time passwords (OTP). The system is designed to enhance the security of locker access by ensuring that only authorized personnel can access the lockers. It also eliminates the need for physical keys and provides a more efficient way of managing locker access. This project is expected to provide a secure, efficient, and cost-effective locker access system. The main aim of the project is to provide a system wherein a person can access the locker only with the help of a valid OTP and the locker stays open only for a specified time. The user will be given a unique OTP which will be used to open the locker. The system will include an authentication process to verify the user's OTP and then unlock the locker. The system will provide an efficient and secure way of locker operation. Once the user enters the wrong OTP for a specified number of times then the locker will be disabled for a certain period. Every movement of the system will be conveyed to the main user. This project could be used for the safe and efficient delivery purpose of any commodity whenever no one is physically available to collect the commodity.**

***Index Terms*—Arduino, OTP, authentication, smart home, security, encryption**

I. INTRODUCTION

The growing global demand for sustainable and renewable energy sources has spurred innovative research and development in the field of energy harvesting. One area of interest is the utilization of human kinetic energy as a potential power source. Among various approaches, the harnessing of footstep energy has emerged as a promising avenue for generating electricity from everyday human activities. The concept of generating electricity from footstep energy is rooted in the principle of piezoelectricity. Piezoelectric materials have the unique property of generating an electric charge when subjected to mechanical stress. By integrating these materials into flooring or shoe systems, it becomes possible to convert the mechanical stress produced by human footsteps into usable electrical energy. The advancements in piezoelectric materials, coupled with innovative engineering designs, have led to the development of an advanced footstep power generation system. This system aims to capture and convert the energy generated by footfalls into a renewable and sustainable source of power. To optimize energy conversion and ensure a seamless integration with existing infrastructure, sophisticated power conditioning circuits are employed. These circuits process the generated electrical energy, converting it into a suitable form for immediate use or storage. Energy storage units, such as batteries or supercapacitors, are utilized to store excess energy for later use, enabling a consistent power supply during periods of low foot traffic or increased power demand.

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In recent years, the need for secure and efficient access control systems has become increasingly important. One of the most common applications of access control systems is in the management of lockers. Traditional locker systems rely on physical keys, which can be lost, stolen, or duplicated, compromising the security of the lockers. To address this issue, this paper proposes a One Time Password (OTP) based locker operation system. The OTP-based locker operation system provides secure access to lockers by using unique one-time passwords generated for each user. The system eliminates the need for physical keys and provides a more efficient way of managing locker access. The main aim of the project is to provide a system where a person can access the locker only with a valid OTP and the locker stays open only for a specified time. The user will be given a unique OTP which will be used to open the locker. In this paper, we describe the design and implementation of the OTP-based locker operation system.

An Advance digital lockup system is intended to make a microcontroller based mostly Digital Code Lock that serves the aim of security. want of safety may be achieved by creating locks which might be electrical or mechanical with one or some keys, except for lockup a giant space several locks area unit needed. As everybody is aware of quaint locks area unit significant weight and fragile additionally counting on the tools thus electronic locks area unit given additional price than those of mechanical locks. These lockup systems area unit wont to management the movement of door and area unit useful while not requiring a key to lock or unlock the door. These lockup systems area unit controlled by a keyboard. The microcontroller based mostly Digital Code Lock is associate degree access system that permits solely approved persons to access are stricted space. Security may be a prime concern in our day-today life.

II. MOTIVATION OF THE RESEARCH

Getting a delivery when there is no one at home is always a hustle. Usually, the delivery is left at the doorstep which is not at all safer thing to be done. To eliminate this problem, a locker is fixed to the wall beside the house which is equipped with the programmed system which opens the lock only upon entering the right OTP. Recently, electronic key systems have become one of the most popular security systems installed in many residents and business areas. A key feature of such programs lies in the credibility with which authorized persons can obtain access to departments throughout the secure system with interactive communication.

III. OBJECTIVE

Enhanced Security: To provide superior protection against unauthorized entry, burglary, and key duplication by generating a unique, one-time-use password for every access attempt.

Keyless Convenience: To eliminate the need for physical keys, thereby solving the issues of lost, stolen, or misplaced keys.

Remote Access Control: To enable homeowners or administrators to grant temporary, time-limited access to visitors, service personnel, or guests via SMS or mobile application, even when away from the location.

Real-Time Monitoring & Alerts: To provide immediate notifications via GSM or IoT to the user's mobile device regarding access attempts, including alerts for incorrect password attempts.

IV. LITERATURE REVIEW

[1] OTP Based Locking System using IOT is a system that combines OTP (One Time Password) technology with Internet of Things (IoT) technology to offer secure access to a physical or digital area. This method can be used to manage entry to a physical entrance or gate as well as to manage access to a website or other digital place.

[2] A very secure method created to prevent unauthorized access to locker contents is the Locker Security System using Facial Recognition and One Time Password (OTP). To make sure that only authorized users can access the locker's contents, it combines facial recognition technology with onetime passwords (OTPs).

[3] Designing and implementing an OTP-based (One Time Password) IoT Digital Door-lock System and Applications is the goal of this project. This system, which uses Internet of Things (IoT) technology to protect access to personnel and assets, is safe, practical, and automated.

[4] The Symbolic-OTP Based Security System for Domestic Use is a security system that improves user data and personal information security by combining symbolic and one-time passwords (OTP). A group of experts from the University of Science and Technology in South Korea created the system.

[5] A more secure method of securing doors is offered by the Iot Based Smart Door Lock System, a relatively new piece of technology. It offers a safe and practical solution to safeguard doors by combining Bluetooth and internet of things (IoT) technology. The system enables remote door lock control from any device. The system also comes with an easy-to-use mobile app that enables users to manage door locks, create access schedules, and get alerts when doors are opened.

[6] Design a user interface for the system that allows users to enter a one-time password (OTP) and select a locking action (e.g. lock, unlock, etc.). Design a secure communication protocol between the OTP system and the locking system. Determine the methods for the OTP system to verify the identity of the user. Create a database for storing user information, including passwords, lock status, and other relevant data. Design a system for securely storing and managing OTPs. Develop algorithms for generating and validating OTPs. Implement the OTP system's secure communication protocol with the locking system. Create a database to keep track of user data and OTPs.Create formulas for creating and verifying OTPs.

V. PROPOSED SYSTEM

The system includes the following components:

A. Arduino Uno Arduino Uno is a microcontroller board based on the ATmega328P microcontroller. The Arduino Uno has 14 digital input/output pins, 6 analog inputs, a 16 MHz quartz crystal, a USB connection, and an integrated power supply. The board can be programmed using the Arduino Integrated Development Environment (IDE) and supports C/C++ programming languages. The Arduino Uno is compatible with a wide range of sensors, actuators, and other components, which makes it an ideal platform for a variety of projects.

B. 4x4 numerical keypad A 4x4 numerical keypad is a type of input device that consists of 16 buttons arranged in a 4x4 matrix. The buttons are typically labeled with the numbers 0 to 9, as well as with other symbols such as *, #, A, B, C and D . The 4x4 numerical keypad is commonly used for numerical data entry and control applications, such as for entering PIN numbers, accessing secure systems, or controlling electronic devices. The 4x4 numerical keypad works by using a matrix scanning technique to detect which button is pressed. When a button is pressed, the corresponding row and column lines are connected, which allows the microcontroller to detect the button press.

C. I2C 1602 module A I2C 1602 module is a type of LCD (Liquid Crystal Display) module that is commonly used for displaying text and characters in a variety of applications. The 1602 in the name refers to the number of characters that the module can display, which is 16 characters per line and 2 lines in total. The I2C in the name stands for Inter-Integrated Circuit, which is a type of communication protocol used to transfer data between the module and a microcontroller or other type of device. The I2C 1602 module typically includes an LCD display and a control circuit that is capable of communicating with other devices using the I2C protocol. The module can be easily connected to a microcontroller, such as the Arduino, by using only a few pins, allowing for easy integration into a wide range of projects.

D. LCD LCD stands for Liquid Crystal Display, which is a type of flat panel display technology that is commonly used in a variety of electronic devices. An LCD display works by using a liquid crystal material that is sandwiched between two transparent electrodes. When an electric field is applied to the liquid crystal material, it changes its orientation and allows or blocks light from passing through, creating an image.

E. Relay A relay is an electrically-operated switch that opens or closes a circuit by means of an electromagnet. The term "relay" refers to the switching mechanism that is activated by an electrical signal, which in turn opens or closes the contacts of the switch. Relays are commonly used in a variety of electrical and electronic applications as a means of controlling electrical circuits without the need for direct human intervention.

F. SIM800L It is a compact, low-power and cost-effective cellular communication module that supports GSM/GPRS networks. It is designed to provide a simple and efficient way of adding wireless communication capabilities to a wide range of devices

G. Solenoid Lock A solenoid lock is a type of lock that uses an electromagnetic coil, known as a solenoid, to control the movement of a latch or lock. When the solenoid is energized, it creates a magnetic field that pulls a plunger or armature towards it, which in turn actuates the lock mechanism. This mechanism can be used to lock or unlock doors, cabinets, safes, or other types of enclosures that require secure access control. Solenoid locks offer several advantages over traditional mechanical locks, including improved reliability, faster lock/unlock times, and the ability to remotely control the lock.

H. IR Sensor: An IR sensor, or Infrared sensor, is a device that detects infrared radiation and converts it into an electrical signal. Infrared radiation is a type of electromagnetic radiation with a wavelength longer than visible light, but shorter than microwave radiation. IR sensors are commonly used in a wide range of applications, including remote controls, security systems, obstacle detection and avoidance systems, and temperature sensing.

I. DC-DC buck converter A DC-DC buck converter is an electronic power converter that is used to convert a higher voltage DC (direct current) power source into a lower voltage DC power source. It works by controlling the amount of power that is transferred from the input to the output by changing the duty cycle of a switch. The name "buck converter" comes from the fact that it reduces, or "bucks," the input voltage. The converter consists of a switch, an inductor, a capacitor, and a control circuit. The switch is typically a metal-oxide-semiconductor field-effect transistor (MOSFET) that is used to regulate the amount of current flowing through the inductor. If the lock is opened, the Arduino is programmed in such a way that the locker closes automatically after a certain time without users' intervention.

VI. METHODOLOGY

The locker system requires the user of the locker to wave at the IR sensor to trigger the locker system. This action will generate the One Time Password in the system and send it to the owner of the locker and also stores the one-time password in the RAM of the Arduino board. Once the owner gets the One Time Password and if he believes the user to be authentic, he sends the One Time Password to the user. The user must enter the One Time Password provided by the owner on to the 4x4 numerical keypad provided and can observe whatever is being entered through the LCD display. Once the user enters the 4 digits completely, the system verifies the password entered with the password stored in the Arduino's RAM. This is done for password authentication and verification. The solenoid lock opens only if the entered password is valid else remains closed. If the locker is opened, the microcontroller is programmed in such a way that the lock closes automatically without the intervention of the user or the owner. The system automatically locks after a certain period of time. Whatsoever actions are performed on the system, all the activities are notified to the owner of the locker. Be it the locker successfully opening after authentication, the locker not opening on entering wrong password, multiple entries of wrong password to gain access to the locker or request for a new password, all such actions are notified to the owner.

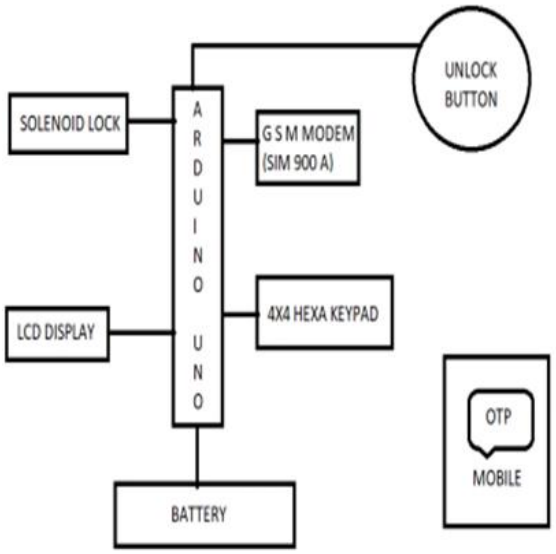

Fig: Block Diagram of Proposed System

The Fingerprint or Password alone based methods have some cons now a day. To overcome this in our present proposed model we use both the fingerprint and OTP to provide more security. Initially, the authorized user's fingerprints are enrolled and stored in the fingerprint sensor memory. If the fingerprint of the user got matched then the user will get the random number as an OTP to his mobile from SIM in the GSM. In our proposed model, more locks are added to a single system and each lock is unlocked with specific address IDs.

So, by this instead of implementing separate door locks for every individual door, we can use only single lock system. The sensors are placed in such an arrangement, so as to generate maximum output voltage. This is then provided to our monitoring circuitry. We also know the monitoring circuit is a microcontroller based that allows the user to monitor the voltage generated and this voltage is given to a rechargeable battery and here the energy was stored.

VII. ADVANTAGES

- Provides high security using one-time, unique passwords
- OTP is valid for a short time, reducing misuse
- Eliminates the need for physical keys
- Prevents unauthorized access effectively
- Easy to use and user-friendly
- Can be accessed remotely via mobile network
- No risk of key loss or duplication
- Supports real-time authentication
- Suitable for residential and commercial use
- Low maintenance requirement
- Provides quick and secure access control

VIII. FUTURE SCOPE

The future scope of the OTP door lock system is very promising due to the increasing demand for smart and secure access control solutions. With advancements in IoT and wireless communication technologies, OTP door lock systems can be integrated with mobile applications and cloud platforms to enable remote monitoring and control from anywhere in the world. Biometric authentication such as fingerprint, face recognition, or iris scanning can be combined with OTP verification to provide multi-factor security.

The system can also be enhanced using AI-based intrusion detection, real-time alerts, and activity logging for improved safety. Integration. with smart home ecosystems, voice assistants, and centralized security systems will further increase usability and automation. Additionally, future versions can support faster communication networks, improved encryption methods, and energy-efficient designs, making the OTP door lock system more reliable, scalable, and suitable for high-security environments. The system can be enhanced by combining OTP authentication with biometric technologies such as fingerprint, facial recognition, or iris scanning to provide multi-level security. Artificial Intelligence (AI) and Machine Learning (ML) can be used to detect suspicious access patterns and generate instant alerts. Integration with smart home systems will allow automatic door locking, lighting, and alarm activation based on user authentication.

IX. CONCLUSION

In conclusion, the One-Time Password (OTP) based locker system is a cutting-edge technology that has revolutionized the way organizations manage access to their lockers. This system provides a secure, convenient and cost-effective solution for locker management. One of the key benefits of this system is its high level of security. By generating a unique

OTP for each transaction, the system ensures that only authorized users can access the lockers, reducing the risk of theft or unauthorized access. This added layer of security is especially important in industries where sensitive and confidential information is stored in lockers. Another advantage of the OTP-based locker system is its ease of use. Users simply need to enter the OTP into the locker system, and the locker will automatically unlock. This eliminates the need for users to remember multiple passwords or carry physical keys, making the system highly user-friendly. The system can also be easily integrated with existing security systems, such as biometric authentication or smart cards, making it a flexible and scalable solution. This makes it an ideal choice for organizations that need to manage a large number of lockers, as the system can be easily customized to meet their specific needs. Finally, the OTP-based locker system is a cost-effective solution for organizations.

Our "Fingerprint and OTP based multi-door lock security system" is very secure and flexible. As through OTP, we have given additional security to the system, so there is no chance of accessing unauthorized user. In our design, as we have executed by assigning more locks to a single system, we can control access to several doorways. Hence no need to spend so much on individual doorways. Overall, the OTP door lock system is an efficient and scalable security solution that meets the growing demand for enhanced safety and automation.

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