IJARSCT
ISSN (Online) 2581-9429
International Journal of Advanced Research in Science, Communication and Technology (IJARSCT)
International Open-Access, Double-Blind, Peer-Reviewed, Refereed, Multidisciplinary Online Journal
Impact Factor: 7.53
Volume 4, Issue 3, February 2024

Office Access System using RFID and Smart Lock

Sakshi Supekar[1], Shruti Velhal[2], Gargi Vyawahare[3], Prof. Rajeshwari M. Malekar[4], Mr. Avinash Magdum[5]
Department of Electronics and Telecommunication[1,2,3,4]
Marathwada Mitra Mandal's College of Engineering, Pune, Maharashtra[1,2,3,4]
Founder & Director, Whiz Key (OPC) Pvt. Ltd[5]
sakshisupekar2019.etc@mmcoe.edu.in, shrutivelhal2019.etc@mmcoe.edu.in, gargivyawahare2019.etc@mmcoe.edu.in

Abstract: *The RFID Door Access Control System ensures the security and dependability of numerous secure medical and scientific facilities, official premises, and locker rooms that house confidential files, granting access only to restricted individuals. The system combines various access methods and fortified security measures, ensuring convenient user access while remaining in-penetrable to unauthorized individuals. This research paper aimed to design a prototype of 3-layer authentication security system based on a solenoid door lock, 4x4 Keypad, RFID cards, Relay Module, 16x2 LCD, ESP32 micro-controller, RC-522 Reader module, and Blynk application. The project focuses on designing and implementing a robust system that integrates RFID technology with smart locks to grant authorized personnel access to numerous sections within the office premises.*

Keywords: RFID, Smart door lock, Blynk, IoT, Security, Telegram, OTP

I. INTRODUCTION

This research paper aims to present implementation of an RFID-based access control system for office premises using a keypad, Blynk server, and solenoid lock. This system is designed to providesecure access control to secure facilities by integrating various technologies. The RFID and keypad allow authorized personnel to gain entry by scanning their RFIDtags, while the Blynk server provides remote access controland monitoring. The solenoid lock ensures that only authorized employees can access the office. The paper will discuss the design and implementation of the system, including the hardware and software components used. It will also detail the testing process, results, benefits, applications, and system limitations.

Overall, this demonstrates the feasibility and effectiveness of using an RFID keypad, Blynk server, and solenoid lock in office access systems, providing an efficient and secure solution for access control in office environments. In the Electrically Erasable Programmable ROM [EEPROM], the crucial security phase of this innovation is initially stored. A randomly generated OTP is sent to the client's device for two-way verification if the client enters the correct password. If the OTP is matched, thesystem grants access to the user, ensuring a secure authentication process [1]. This IOT-based RFID room security solution offers the convenience of global monitoring,allowing users to remotely track door status in real-time from any location [2]. Turak worked on the internet and security of objects and shared them by mentioning a few problems [3]. This paper introduces a Smart Lock System designed utilizing Bluetooth technology as its core focus, leveraging the ubiquity of Bluetooth in various devices. The system harnesses low-power Bluetooth Technology, incorporating advanced security measures and user-centric features to enhance users' security and convenience [4]. We can find in-depth info in this paperon the Automatic Door Lock System using different electronic parts, and their implementations of the security framework using Bluetooth devices and Microcontroller technology. They have developed a framework that offers round-the-clock services, utilizing aregistered password [5]. This paper details deploying a door-unlocking system based on Arduino Technology.A central server is utilized to implement the system, housing a centralized database that collects comprehensive information about authorized personnel.Employing RFID technology, this cost-effective system assigns RFID tags to each door, allowing for real-time updates and storage of door status in the database [6]. Thisprototype can be implemented in hostels for security purposes. This technology can enhance response time by using controller processes and real-time images [7]. The proposed paper introduces a security system that employs passive RFID technology and incorporates an actuator-based door lock system [8]. The

IJARSCT
ISSN (Online) 2581-9429
International Journal of Advanced Research in Science, Communication and Technology (IJARSCT)
International Open-Access, Double-Blind, Peer-Reviewed, Refereed, Multidisciplinary Online Journal
Impact Factor: 7.53
Volume 4, Issue 3, February 2024

paper gives detailed information about the system in which we can unlock the door using pre-decided passwords. This automatic password-based lock system will give users a more secure way of locking-unlocking system. First, the user combination will be compared with prerecorded passwords stored in the system memory [9].

II. PROBLEM STATEMENT

The project's main aim is to satisfy the fundamental need regarding SECURITY. It can be used for office grounds, Locker rooms, homes, or jewelry shops to protect data and avoid theft. The traditional lock-key methods are prone to security breaches, such as unauthorized duplication or loss of keys. Therefore, 3-layer authentication is provided by the system to be more efficient.

OBJECTIVE

We aim to improve overall security, streamline access management processes, enhance the convenience for authorized personnel, and align with data privacy regulations while minimizing security risks associated with Traditional key-based systems. By implementing this three-layered authentication system, we aim to create a highly secure environment, reducing the risk of unauthorized entry and potential security breaches.

MOTIVATION

By implementing an office access control system that combines a smart lock, RFID technology, multi-layer authentication with a keypad, and integration with the Blynk server, businesses can address the critical need for enhanced security while ensuring convenience, scalability, and real-time monitoring capabilities. This comprehensive solution empowers organizations to safeguard their valuable assets, protect confidential information, and maintain a secure working environment for their employees.

III. SYSTEM REQUIREMENT

RFID RC-522 Reader: RFID stands for Radio Frequency Identification. Each RFID card has a unique ID embedded in it, and an RFID reader is used to read the RFID card number. The RC522 RFID reader module is designed to create a 13.56MHz electromagnetic field and communicate with RFID tags.

RFID Tags: RFID (Radio Frequency Identification) tags are small electronic devices with microchips and antennas. When an RFID reader emits radio frequency signals, the RFID tag within range picks up the signals through its antenna and transmits its unique identification number to the RFID RC-522 reader.

Solenoid Lock: A solenoid lock of 12V is an electromechanical device designed to secure doors, gates, cabinets, etc. A Solenoid lock comprises a copper wire with an armature. A relay or transistor switch connects or disconnects the 12V power supply to the solenoid coil.

Relay Module: A 5V relay module is an electronic device that controls high-voltage or high-current circuits using a low-voltage signal. The 5V relay module controls a load such as a lighting system, motor, or solenoid. It generates an electromagnetic field that causes the contacts to switch between open and closed positions.

LCD Display (16x2): A 16x2 LCD (Liquid Crystal Display) is a commonly used alphanumeric display module that can display 16 characters in each of its two rows. The LCD can be interfaced with a microcontroller or other devices using various communication protocols, such as parallel or serial (e.g., I2C) communication.

Keypad (4x4)**:** A 4x4 keypad is an input device consisting of a matrix of buttons in a grid. When a button is pressed, it creates a unique row-column intersection, which can be decoded to determine the specific key pressed. The keypad is often used as a user interface component to input data, such as entering a password or selecting options in a menu-driven system.

ESP32 microcontroller: The ESP32 is a powerful microcontroller developed by Espressif Systems. It has various applications, including IoT projects, due to its versatility and capabilities. The ESP32 is based on a dual-core Xtensa LX6 microprocessor, which operates at a clock speed of up to 240 MHz. The ESP32 provides a rich set of 38 general-purpose input/output (GPIO) pins.

Blynk server: Blynk Server is a powerful and flexible server infrastructure that enables the development of Internet of Things (IoT) applications and projects. It provides a platform for remotely connecting and controlling devices, sensors,

IJARSCT
ISSN (Online) 2581-9429
International Journal of Advanced Research in Science, Communication and Technology (IJARSCT)
International Open-Access, Double-Blind, Peer-Reviewed, Refereed, Multidisciplinary Online Journal
Impact Factor: 7.53
Volume 4, Issue 3, February 2024

and actuators using mobile applications. Blynk Server facilitates seamless communication between the devices and the Blynk mobile app, allowing users to monitor and control their IoT projects anywhere.

IV. IMPLEMENTATION

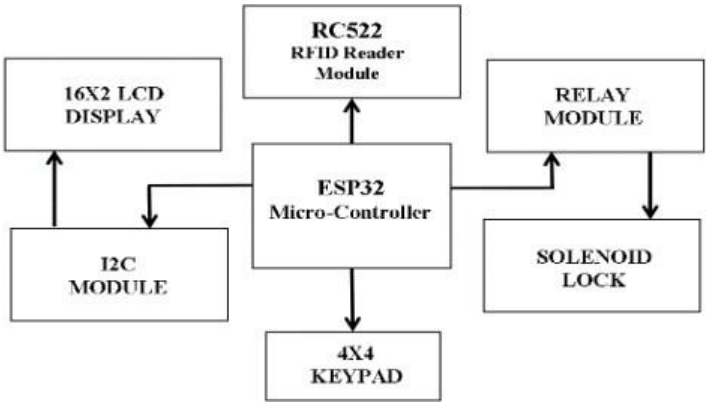

Fig. 1: BLOCK DIAGRAM

RFID reader RC522, 4x4 keypad (for password entry), and 5V Relay (which controls the solenoid lock for opening and closing) are connected to the ESP32 microcontroller using the appropriate pins. Furthermore, the I2C module is connected to the ESP32 microcontroller, which will provide additional pin support for the LCD. The 16x2 LCD is connected to the I2C module to display the login credentials and password input. Using Arduino IDE and ESP32 board libraries, a new Arduino sketch is created, and the necessary libraries for RFID, LCD, keypad, and Blynk are included. The RFIDreader is initialized and configured to read the RFID tags. Also, the keypad functionality is implemented to enter the OTP using the authentication token. The Blynk server and ESP32 are connected. After the connection is established, we Configure the Blynk virtual pin callbacks to receive the server's data and trigger actions accordingly. Upon successful RFID tag scan, a function is created to generate and send a 6-digit OTP to the user's Telegram bot. Logic implementation is done to compare the entered password with the expected password. After the comparison, the relay can open or close the solenoid lock based on the password validation.

The user presents their RFID tag to the RFID reader. Uponsuccessful tag scan, the ESP32 generates a 6-digit OTP and sends it to the user's Telegram bot. The LCD prompts the user to enter the password with the help of a keypad. The user enters the password on the keypad, which is assimilated with the expected password. When the OTP is correct, the ESP32 triggers the relay to open the solenoidlock, allowing access. If it is incorrect, the solenoid lock remains closed, denying access.

The Blynk server acts as a central hub for authentication and permission management in this system. Administrators can add or remove users from the Blynk server to control access permissions, i.e., they can monitor and manage the system remotely using the Blynk app or web interface. The ESP32 communicates with the Blynk serverto authenticate the user and obtain permission to open the lock. After successful communication, the Blynk server stores user credentials and verifies them during authentication.

IJARSCT
ISSN (Online) 2581-9429
International Journal of Advanced Research in Science, Communication and Technology (IJARSCT)
International Open-Access, Double-Blind, Peer-Reviewed, Refereed, Multidisciplinary Online Journal
Impact Factor: 7.53
Volume 4, Issue 3, February 2024

V. FLOWCHART

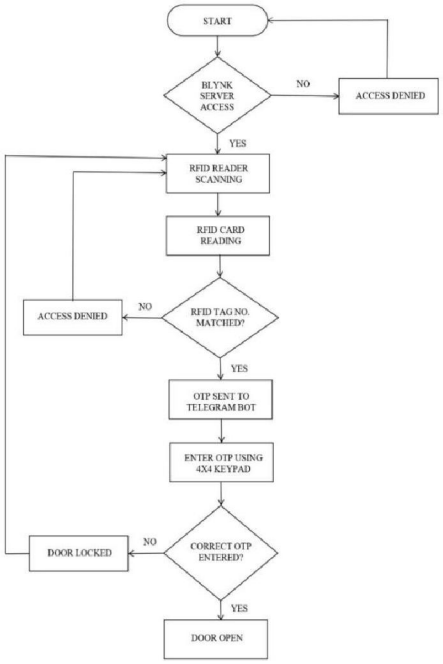

Fig. 2: Flow Chart

VI. RESULT

The implemented Automated Office Access System using RFID and Solenoid Lock with Blynk Server has been tested and evaluated satisfactorily. During testing, the RFID reader accurately detects and reads the RFID tags, initiating the login process. The 6-digit OTP generation andtransmission to the user's Telegram bot function as intended, ensuring an additional layer of security. The LCD effectively displays the login credentials and produces the password entry, while the keypad enables users to input the password easily. The password validationmechanism performs accurately, allowing access only if thecorrect password is entered. When the relay receives the command from the ESP32, it controls the solenoid lock, effectively opening or closing the access point. The Blynkserver seamlessly integrates into the system, providingauthentication and permission management functionalities.

Fig 3: Front View of System

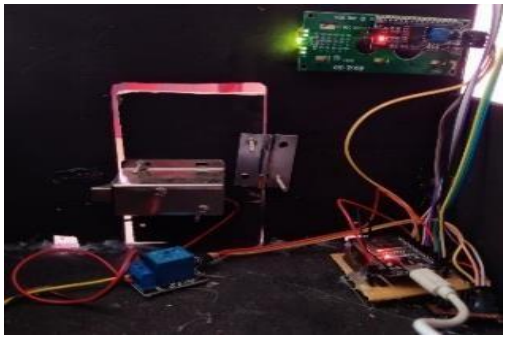

Fig 4: Back View of System

VII. CONCLUSION

Implementing the Automated Office Access System using RFID and Solenoid Lock with Blynk Server demonstrates the successful integration of various components to create a secure and automated access controlsystem. By combining RFID technology, keypad input, andBlynk server authentication, the system provides a robust solution for managing access to office or facility premises.

IJARSCT
ISSN (Online) 2581-9429
International Journal of Advanced Research in Science, Communication and Technology (IJARSCT)
International Open-Access, Double-Blind, Peer-Reviewed, Refereed, Multidisciplinary Online Journal
Impact Factor: 7.53
Volume 4, Issue 3, February 2024

It can be further improved by incorporating user logs, time-based access restrictions, and integration with other smart office systems.

VIII. FUTURE SCOPE

In the future, the Android application should offer assistance in controlling more doors, windows, and basic home electronic appliances. Battery backup systems and database storage can also be considered to ensure the system's completeness. Additional Face Recognition, biometric systems, voice detectors, and motion sensors can be installed.

REFERENCES

[1]. Mr. L. David William Raj, M. Deepika, V. Bhuvaneshwari, R. Harshitha, K. Haripriya, "A DESIGN OF OTP BASED WIRELESS SMART DOOR LOCKING SYSTEM" International Research Journal of Engineering and Technology (IRJET) e- ISSN:2395-0056 Volume: 08 Special Issue Apr 2021.

[2]. Shrinidhi Gindi, Naiyer Shaikh, Kashif Beig, Abdeali Sabuwala, "Smart Lock System Using RFID" International Research Journal of Engineering and Technology (IRJET) e-ISSN: 2395-0056 Volume: 07 Issue: 07 | July 2020

[3]. Turak, Y., Nesnelerin Internetive Guvenligi," http://www.yigitturak.com/wpcontent/uploads/IoTGuvenligi.pdf, Nisan 2, 2021.

[4]. Muhammad SabirinHadis," Design of Smart Lock System for Doors with Special Features using Bluetooth Technology," in 2018 International Conference on Information and Communications Technology (ICOIACT). Pages[396-400]

[5]. Priyanka Bandagale," Automatic Door Locking System" in International Journal of Engineering Development and Research.2016 IJEDR | Volume 4, Issue 1 | ISSN: 2321-9939,Pages[495-499].

[6]. Somjit Nath, Paramita Banerjee, Rathindra Nath, Swarup Kumar Mitra, Mrinal Kanti Naskar," Arduino Based Door Unlocking System with Real Time Control",2016 2nd International Conference on Contemporary Computing and Informatics, Pages[358-362].

[7]. Umar Farooq, Mahmood ul Hasan, Muhammad Amar, Athar Hanif, and Muhammad Usman Asad, (2014), "RFID Based Security and Access Control System" IACSIT International Journal of Engineering and Technology, Vol. 6, No. 4, August 2014.

[8]. Gyanendra K Verma, Pawan Tripath, A Digital Security System with Door Lock System Using RFID Technology, International Journal of Computer Applications (0975 – 8887) Volume 5– No.11, August 2010.

[9]. Dibyendu Sur, Sayani Sengupta, Sarmistha Ray, Sucheta Routh, Saborni Das, Soumika Ghosh, Shilpi Banerjee, "Digital password door, National seminar on Advances of Security Issues (ASICN 2013) July19, 2013, DSCSDEC, Kolkata