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Locker Key Management System

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Abstract: ***This project presents a smart and secure RFID-based Locker Management System integrated with Wi-Fi connectivity for real-time monitoring and control. The system is designed to ensure multi-level access security using RFID authentication for both the client and the admin (master). The core functionality is managed using an Arduino connected to an ESP-01 Wi-Fi module, enabling seamless communication with a Node.js backend server.***
A key feature of the system is its mandatory internet connectivity; the locker system will not operate without an active Wi-Fi connection. A white LED indicator confirms successful Wi-Fi connection. Upon scanning the admin RFID, the locker opens. However, to close the locker, the system requires an additional level of verification: both the client's RFID and the admin's RFID must be scanned again, ensuring that both parties are present and authorizing the closure.
The system also includes real-time alerts, activity logs, and status updates through the server. It is designed for use in environments such as co-working spaces, gyms, hostels, and smart offices, where secure and monitored storage is essential. This solution improves traditional key-based systems by adding intelligent control, remote monitoring, and enhanced security.
Keywords: RFID, Wi-Fi Connectivity, Arduino, ESP8266, Node.js, Internet of Things (IoT), Real-time Monitoring, Cloud Communication, Embedded System.

I. INTRODUTION

The security system plays a significant role to keep out unknown user to access protected physical and logical places with no permission. A useful solution is an automatic password based door locks which have been commonly utilized in Banks.
The security system applies identification technologies which is Radio Frequency Identification (RFID), RFID Tags.
Also uses Arduino uno r3, 12 volt solenoid lock, LCD and 12C Module.
One of the most quickly rising segments of automatic identification data compilation, manufacturing and emerging technology is a Radio Frequency Identification (RFID) in these days.
The door is opened when the RFID Reader reads the correct RFID tag and permit a concerned person to access.
On the other hand another person who scans an incorrect RFID tag the Locker would not open.

II. TECHNICAL SPECIFICATIONS

Sr.No	Category	Specfications
1	Microcontroller	Arduino Uno(ATmega328P)
2	RFID Reader	RC522(13.56 MHz)
3	RFID Tags	ISO 14443A compliant cards
4	Solenoid lock	12V DC lock
5	LED indicators	Red and Green LEDs
6	Buzzer	5v Buzzer

III. LITERATURE REVIEW

Traditional locker systems were based on mechanical locks and keys, which often led to issues like lost keys, unauthorized duplication, and the need for manual supervision. Over time, technology improved, and electronic locking mechanisms were introduced to enhance security. One of the most significant advancements was the use of RFID (Radio Frequency Identification), which allowed users to access lockers using unique RFID cards. While this reduced the dependency on physical keys, standalone RFID-based systems still lacked features like real-time monitoring, remote access, and automated security alerts.

With the emergence of IoT (Internet of Things) a, locker systems have become more advanced. Modern smart lockers now integrate web applications and cloud databases, enabling users to control and monitor their lockers remotely. WebSockets play a crucial role in ensuring real-time communication between the locker system and the server, providing instant updates about locker access and security alerts. Additionally, cloud storage solutions such as MongoDB allow secure record-keeping of user activities, ensuring better tracking and management of lockers.

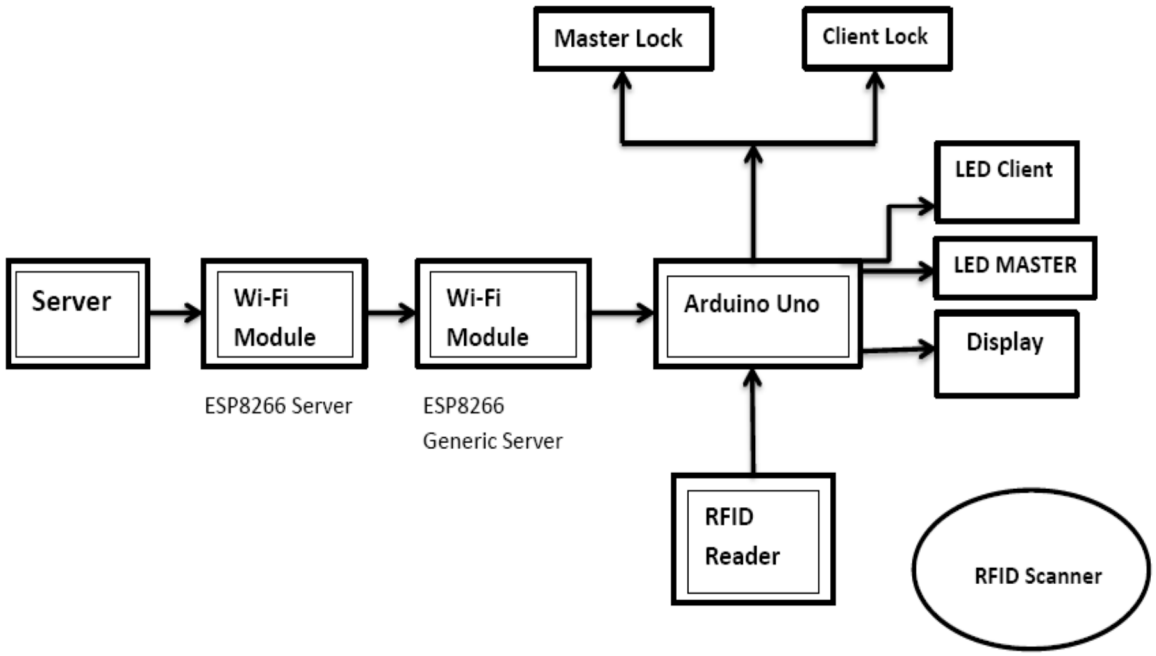
Despite these advancements, some gaps still exist in current locker management solutions. Many systems do not offer real-time security notifications, multi-user authentication, or integration with mobile applications for remote access. Moreover, security threats such as unauthorized RFID card cloning or hacking attempts pose risks to data integrity. To address these challenges, our project implements a secure and scalable RFID-based locker system, combining real-time monitoring and cloud-based data management. By integrating RFID authentication, WebSocket-based communication, and a web interface for remote access, this system enhances security, efficiency, and user convenience.

This research builds upon existing technologies but takes a step further by ensuring real-time access notifications, remote locker control, and a secure database system. It aims to provide a reliable, user-friendly, and efficient solution for locker management in institutions, offices, and public spaces.

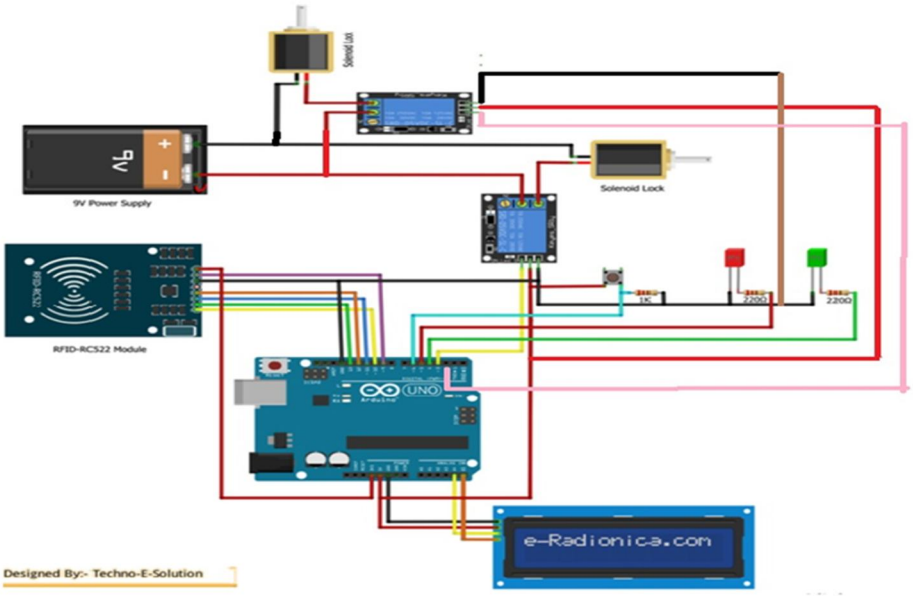
IV. ADVANTAGES

1) Enhanced Security
2) Real-Time Monitoring
3) Remote Access Control
4) User Friendly Interface
5) Log tracking for Security
6) Cost Effective
7) Low Maintenance
8) Flexibility and Scalibility

V. ARCHITECTURE DIAGRAM



VI. CIRCUIT DIAGRAM



VII. CONCLUSION

The locker key management system using Arduino Uno and RFID has proven to be an effective solution for securing and managing access to lockers. By integrating RFID technology with Arduino, we've created a system that ensures only authorized users can access the locker, with real-time monitoring and alerts. The system also includes multiple layers of security, such as the manager's control over client locker access and the use of LEDs and a buzzer for notifications. Additionally, the integration of email notifications and data logging ensures that both clients and managers are promptly informed of any unauthorized access attempts. The decision to move away from MongoDB to a custom-built website further enhances the system's flexibility, providing a more tailored interface for managing locker access. Overall, this project demonstrates the powerful potential of combining hardware and software to create an intuitive, secure, and real-time access management system.

VIII. ACKNOWLEDGMENT

The Successful completion of this Project mark the beginning of an ever-going learning experience of converting ideas and concepts into real life, practical system. This Project was a quiet a learning experience for us at each and every step.
First of all I would like to give thanks to our Principal
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I would like to give thanks to our Head, Mr. A.P.Shinde for giving us the opportunity to have this new experience, which not only has increased our awareness about latest fields but also taught us the importance of learning new updated things which may benefit me in my upcoming career .
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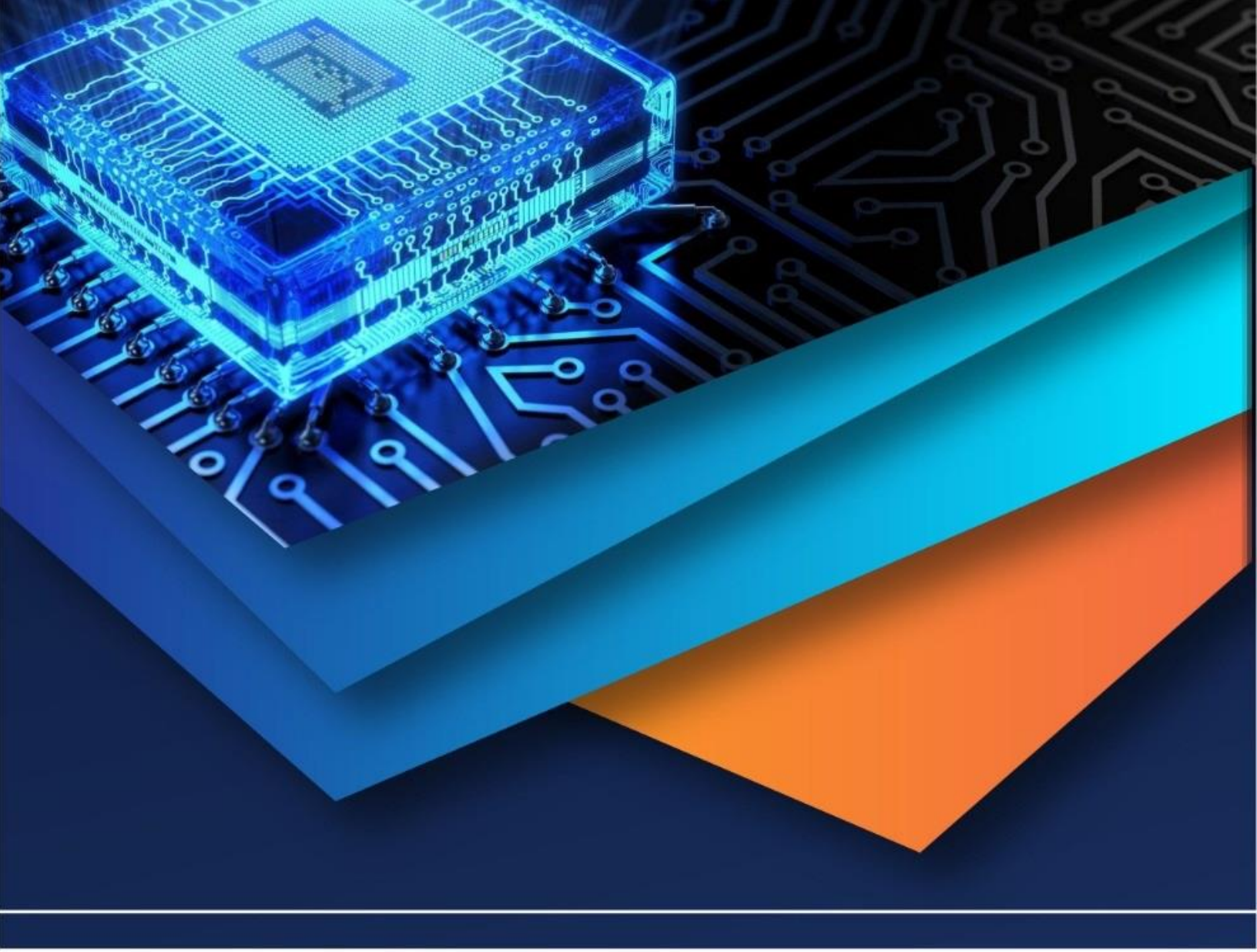

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