Lock Mart - Smart Locker System

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***Abstract*— Security is very important in today's world. Even though there are various approaches, there is no solution that will restrict the access to only users in a secure and effective manner. With the advancement of technology, this system suggests an alternative strategy to the traditional process that is based on the internet of Things and application. The Smart Locker System is an inventive and cutting-edge technical solution created to improve convenience, security, and effectiveness in a variety of settings including businesses, residence complexes, retail malls, and more. For a seamless and safe user experience, this system combines contemporary technology including the Internet of Things (IoT), mobile applications, and electronic locking mechanisms.**

Keywords - Secure Access, Lockers, Internet Of Things (IOT), User Authentication, Sensors.

I. INTRODUCTION

Our project's primary goal is to guarantee the security of users' or customers' valuables. It mainly secures their expensive things in crowded areas. And through this objective we can cut off the old traditional token system. By this we can do time and keep our items secure. This locker can be kept in Home, gym, marriage halls, swimming pools, temples etc. IoT, often referred to as the "Internet of Things," embodies the interconnectedness of devices and objects through the internet, allowing them to seamlessly communicate, gather, and exchange data. In the context of locker systems, IoT manifests as a catalyst for reinventing the user experience and operational dynamics.The convergence of IoT and locker systems is not merely a technological novelty; it's a fundamental shift that addresses the demands of an increasingly digital and fast-paced society. Airports, universities, corporate offices, shopping malls, and an array of public spaces are embracing IoT-powered lockers to streamline processes, enhance security, and provide an enhanced user journey. As IoT-enabled lockers seamlessly blend physical storage with digital connectivity, they represent a compelling example of how technology enriches our daily interactions with the physical world. The advent of the Internet of Things (IoT) has brought forth a wave of transformative possibilities, altering the very fabric of our daily lives. One remarkable arena where IoT's potential shines brightly is in secure storage solutions. Traditional lock-and-key systems are giving way to an era of innovation where lockers, equipped with IoT capabilities, are seamlessly connecting physical spaces with the digital realm. This paper embarks on a journey into the world of locker applications enhanced by IoT technology, exploring the myriad ways in which this convergence is reshaping convenience, security, and efficiency. Ultimately, the synergy between IoT and locker applications is not just about technological advancement; it's about enhancing our daily interactions with physical spaces.By illuminating the path that IoT technology has carved in the realm of secure storage, this paper contributes to a comprehensive understanding of how innovation is shaping the way we store and access our belongings.

The following are some applications of Iot in Locker System,

A. *Smart Locker Access and Reservations*: Users can conveniently reserve lockers through a mobile app or web interface, selecting the desired size, location, and duration. IoT-enabled lockers grant access through digital keys, QR codes, eliminating the need for physical keys and enhancing security.

B. *Real-Time Locker Monitoring:* IoT sensors embedded in lockers provide real-time data on locker occupancy, availability, and status. Users and administrators can receive notifications about locker usage, ensuring timely access and minimizing wait times.

C. *Remote Locker Management:* IoT technology allows administrators to remotely manage locker systems. They can monitor usage patterns, change access permissions, and troubleshoot issues without being physically present at the locker location.

II. LITERATURE SURVEY

[1] "Automated smart locker for college". Authors: Hanan F. Alqahtani, Jeehan A. Albuainain, Badriayh G. Almutiri, Shahad K. Alansari, Ghaliah B. AL-awwad, Nada N.Alqahtani, Samia M. Masaad and Rania A. Tabeidi, Year: 2020. In this study, interfaces that help to improve security and convenience are designed for the Bluetooth-based Smart Locker that is presented. This interface can be remotely managed using a mobile phone application. In

addition, if the cell phone is not available, another method to open the lock will be offered using a Keypad 4x4.

[2] "Smart Bank Locker Using Fingerprint Scanning and Image Processing". Authors: Arvasu Chikara, Pallavi Choudekar, Ruchira, Divya Asija. Year: 2020. A smart locker for the banking industry has been created in the current work. The primary characteristic of this work is that it records the time, date, and quantity of times a user accesses a locker in the bank. Your image and fingerprint will be compared to information already saved in the database by the smart lock programme. The microcontroller (Arduino), after verifying the user's legitimacy, will signal the lock to open. It also delivers a notice when the number of authorized access turns grows in a given duration.

[3] "An IoT-based Smart Locker System with Access Sharing". Authors: J. Sa-ngiampak, C. Hirankanokkul, Y. Sunthornyotin, J. Mingmongkolmitr, S. Thunprateep, N. Rojsrikul, T. Tantipiwatanaskul, K. Techapichetvanich, A. Pongsawang, T. Prayoonkittikul , U. Wattanakulchart, N. Prompoon, C. Ratanamahatana and M. Pipattanasomporn, Year: 2020, This project focuses on using full stack software development and the Internet of Things (IoT) to provide LockerSwarm, an alternative smart locker solution. Each locker's lock can be opened without a physical key by scanning a Quick Response code (QR code), and access can be distributed among specific people. Users can look up the locations of all lockers, find the ones that are closest to them, and check the availability of lockers. This project, which is a component of the smart campus effort, throws new insight on the integration of IoT technology to convert conventional lockers into smart lockers. The entire LockerSwarm concept is thought to be easily reproducible at any other university campuses based on the prototype development and testing experience at Chulalongkorn University, Thailand.

[4] "Digital (Electronic) Locker". Authors: Hitesh Prasad, Dr. R.K. Sharma, Uddish Saini. Year: 2020. In this paper, a four-digit key or password that is correctly sequenced will lock or open an electronic lock. These passwords and keys are changeable at any moment. Also, if the incorrect key combination is typed, an alarm signal will be generated. Moreover, a timed-out signal will be sent if the user presses the next two correct keys in more than 10 seconds. Using finite elements, the entire design of the electronic locker is created.

[5] "Biometric Authentication for Safety Lockers Using Cardiac Vectors". Authors: Rama Moorthy H, Shrinivasa, Chetan R, Deepak Rao M, Avinash N J, Krishnaraj Rao N S. Year: 2020. In this study, we provide a fresh method for identifying people using their biometrics that is based on ECG features. The database enrollment, denouncing, feature extraction, and verification stages make up the ECG-based biometric system. ECG signals were obtained from the Physionet QT database and used in the experiments for this work. To record finger-based ECG for use in real-time implementation, a device can be created. To boost the system's accuracy rates, multiple features might be extracted. The system can also be strengthened and made more secure by using bio-hashing.

III. SYSTEM MODEL

This paper suggests a smart locker system with a variety of sensors and an Arduino nano controller. Using the WIFI module, the information is delivered to the respective Locker owner. Vacancy of a locker is controlled via the Internet of Things.

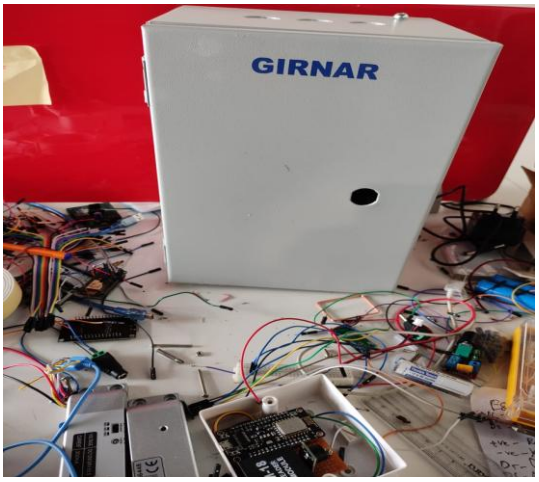

Fig. 1. Real time image of locker

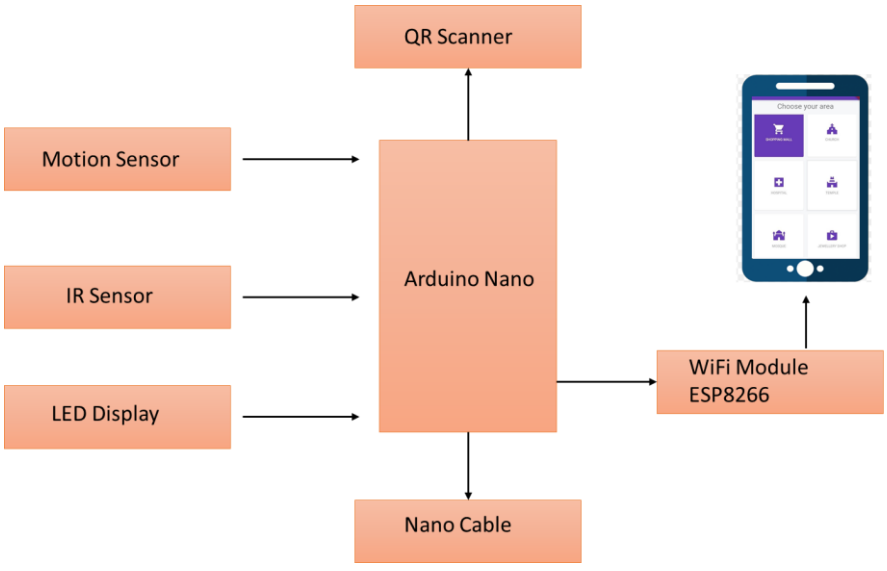

Fig. 2. General structure

The sensors situated here are,

1) Motion sensor: A device that detects movement inside its defined region and, in reaction to that movement, initiates a response or action. So that it is used in this paper by finding whether there are things or users trying to keep in the locker.

2) IR sensor: It is a sensor that monitors and measures the infrared radiation that nearby objects and living things release. Despite being invisible to the human eye, infrared radiation is a form of electromagnetic radiation that may be detected and measured by specialized sensors. Through this sensor we can identify whether things are kept or not. That means whether the locker is vacant or not.

3) Wifi module: The module is based on the ESP8266 microcontroller and integrates a TCP/IP stack, making it capable of connecting to WiFi networks and communicating over the internet. Set up alerts and notifications to notify users of locker status changes. Users might be informed, for instance, when their locker is entered or when they neglect to secure it.

4) Arduino Nano Cable: The Arduino Nano, can interface with a variety of sensors, actuators, and communication modules to enable connectivity and information exchange with the internet. The locker's locking and unlocking mechanism can be controlled by the Arduino Nano by employing the proper actuators, such as servo motors, solenoids, or electronic locks. To lock or unlock the locker, it receives instructions from a central server or user interface (through IoT connectivity).

5) LED Display: The Internet of Things (IoT) smart locker system's LED display can offer real-time information and improve the user experience in a number of ways.The status of each locker, including whether it is occupied or available, can be displayed on LED screens. Instead of needing to check each locker individually, users may quickly determine which ones are available for use.

6) QR Scanner: Typically, when a user wishes to use a smart locker, they get a QR code via a mobile app. Their electronic "key" to the locker is this QR code. The locker system unlocks the correct locker door or compartment as soon as the QR code is verified. The user can then take something out of the locker or put it there. Users can access lockers easily and without making a physical contact by using QR codes. Users are not required to memorize PINs or physical keys.

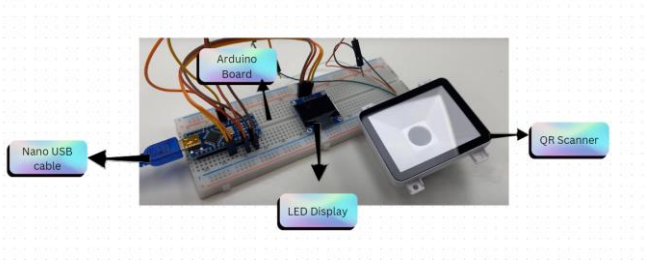

Fig. 3. Model of Smart Locker System

This formula is to determine whether an item is present in a locker:

IF locker_door_status = "open"

THEN locker_status = "occupied"

ELSE locker_status = "empty"

This is the main source code.

IV. APPLICATION FLOW

This system was implemented using Arduino IDE Android studio for mobile application implementation and firebase for backend connectivity for effective usage of smart locker systems. The system starting user interface will ask the user he/she to enter their username, password and enter the OTP for user-verification. The user enters the locker page where the lockers are chosen according to their needs of size and select a locker that is empty. The user can enter the password and it will generate QR code for your password then the user can keep their things in the locker and lock it,they can scan the QR code and take their items when they need to take their belongings .If any other user tries to unlock the user will get a alert message and the user will not give access to them. If the user wishes any other user to unlock they can verify and give access to the member.

Fig. 4. GUI of our application

This is the two main GUI of this project that is choosing locker and setting password as qr code.

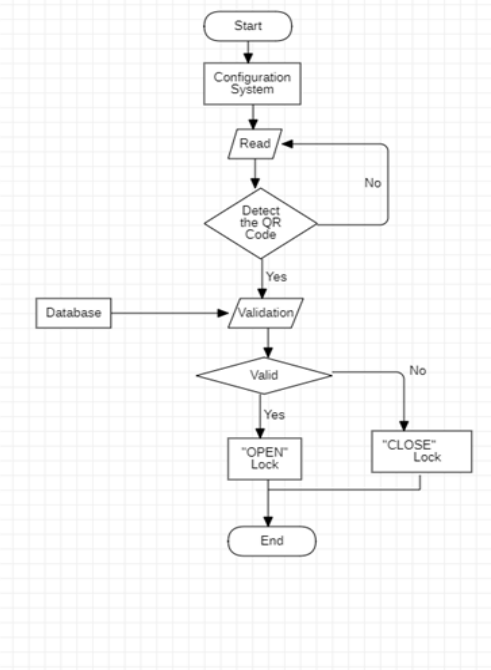

Fig. 5. Flowchart of Smart locker system

V. RESULT AND DISCUSSION

In the implementation of the smart locker system, one of the significant challenges encountered was the efficient allocation of physical space for accommodating an increasing number of lockers. As the demand for the locker service grew, the need for more lockers arose, which posed spatial constraints within the designated area. To address this challenge, the system's expansion was carried out by carefully analyzing the available space, optimizing the locker layout, and leveraging innovative design approaches. The implementation resulted in a successful integration of additional lockers to meet the increasing demand, while maintaining user convenience, security, and accessibility.

Discussion: The challenge of accommodating more lockers within a limited physical space is a common issue faced by smart locker systems in various applications such as parcel delivery, key exchange, and personal storage. This challenge gives rise to several considerations and strategies:

User Experience: While adding more lockers, maintaining a positive user experience remained a priority. Users should be able to easily locate and access their assigned lockers without confusion. An intuitive numbering or labeling system, along with a user-friendly mobile app interface, helped streamline the user experience. Occupancy and Utilization Analysis: Implementing occupancy sensors within each locker enabled real-time monitoring of locker availability. By collecting data on locker utilization patterns, administrators could identify peak usage times and optimize locker allocation accordingly. Efficient Locker Sizing: Careful consideration was given to locker dimensions. Balancing the need for larger lockers for bulkier items and smaller lockers for envelopes and small packages was crucial. A variety of locker sizes provided flexibility for users' storage requirements. Technology Integration: Leveraging IoT technology played a pivotal role in overcoming spatial constraints. IoT-enabled lockers allowed for centralized control and monitoring, enabling efficient allocation and management of lockers even in a densely packed environment. Future Scalability: As the demand for locker services continues to evolve, the system was designed with future scalability in mind. The modular design allowed for seamless integration of additional lockers as needed, minimizing disruptions during expansion.

VI. CONCLUSION

In conclusion, the evolution of locker systems, driven by technological innovation and the integration of IoT, has ushered in a new era of secure storage and access. What once was a simple repository for belongings has now transformed into a dynamic, interconnected ecosystem that enhances user convenience, heightens security, and optimizes operational efficiency. The journey through the realm of locker systems, as explored in this discourse, has unveiled a tapestry of possibilities that underscore the transformative power of technology.

In essence, the future of locker systems has arrived, and it is one that promises a convergence of convenience, security, and efficiency. As these systems continue to evolve, embracing new advancements and meeting emerging challenges, they are poised to become an integral part of the modern landscape, seamlessly connecting the physical and digital realms in ways that enhance our everyday lives.

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