DEPARTMENT OF INFORMATION TECHNOLOGY

Synopsis of Minor Project On

DOOR SECURITY SYSTEM

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DEPARTMENT OF INFORMATION TECHNOLOGY

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Abstract

In an increasingly interconnected world, ensuring the security of one's home has become a paramount concern. The "Smart Door Security System" project is designed to address this concern by providing an innovative, comprehensive, and user-friendly solution for enhancing door security while embracing the convenience of modern technology.This project leverages the power of cutting-edge technologies such as Internet of Things (IoT), facial recognition, and mobile applications to create a robust and user-centric door security system. The primary objective is to develop a system that not only prevents unauthorized access but also simplifies the daily lives of users.The " Door Security System" offers a sophisticated yet accessible approach to home security, bridging the gap between traditional locking mechanisms and the demands of the digital age. With its intuitive interface and advanced features, it empowers users to have complete control over their door's security while simplifying their daily routines.By combining convenience with state-of-the-art security measures, this project sets out to redefine the concept of home security, making it smarter, more adaptable, and more user-friendly. As we move forward in an era of technological progress, the "Smart Door Security System" exemplifies the potential to enhance our daily lives through innovative security solutions.This project has the potential to significantly contribute to the ever-evolving field of home security, ensuring that homes remain safe and secure while adapting to the dynamic nature of our modern world.

Chapter 1: Introduction

In an era marked by technological advancement and interconnected lifestyles, the need for robust home security systems has never been greater. The "Smart Door Security System" project emerges as a response to this pressing concern, offering a forward-thinking solution that seamlessly merges cutting-edge technology with the fundamental necessity of safeguarding our homes. This innovative project is a testament to the power of the Internet of Things (IoT), facial recognition, and mobile applications, all working in harmony to create a comprehensive and user-centric approach to door security.The primary goal of the "Door Security System" is not only to deter unauthorized access but to elevate the daily lives of its users. It signifies a transformative shift in how we perceive and implement home security, striking a balance between the traditions of physical locking mechanisms and the evolving demands of our digital age. Through its intuitive interface and advanced features, this system empowers users to take complete control of their door's security while streamlining their daily routines.This project does more than just secure doors; it embodies the embodiment of convenience harmonized with state-of-the-art security measures. By doing so, it redefines the very essence of home security, making it smarter, more adaptable, and undeniably user-friendly. As our world advances in the realm of technology, the "Smart Door Security System" emerges as a beacon of possibility, demonstrating how innovative security solutions can enhance our lives. In a time when our homes must remain safe and secure, this project has the potential to make a significant contribution to the ever-evolving field of home security, ensuring that our living spaces not only endure but thrive in our dynamic, modern world.

The Modern Landscape of Home Security

The evolution of home security has witnessed a remarkable transformation. Gone are the days when a simple lock and key sufficed to protect our homes. In our interconnected world, where the boundaries between physical and digital realities blur, home security demands a more comprehensive and adaptable approach. The "Smart Door Security System" is a response to this paradigm shift, leveraging the Internet of Things to create a security ecosystem that is deeply integrated into our daily lives. This system takes home security beyond the traditional and into the digital realm, ensuring that as our world advances, our homes remain sanctuaries of safety and convenience.

The User-Centric Approach

Innovation is most potent when it empowers the end-users. The "Smart Door Security System" is built with a deep commitment to user-friendliness. Its intuitive interface, accessible mobile applications, and advanced features ensure that users are not only protected but also in complete control of their security. This user-centric approach is at the heart of the project, bridging the gap between the complexities of modern technology and the simplicity of everyday life. As we move forward in an era of constant technological progress, this project exemplifies how security solutions can be tailored to enhance the lives of individuals and families, ensuring that the concept of home remains a place of safety, comfort, and convenience.

1.1 Motivation

The driving force behind the "Smart Door Security System" project is a profound commitment to reimagining home security for the modern age. In a world marked by rapid technological advancement, urbanization, and an ever-increasing need for convenience, the traditional notion of home security has become inadequate. The motivation behind this project is rooted in a deep-seated belief that our homes should be sanctuaries, places where we find not only safety but also seamless integration with the technologies that define our lives.We are motivated by the desire to bridge the gap between the security needs of today and the innovative capabilities that technology offers. This project is a response to the evolving threats faced by homeowners, from physical break-ins to digital vulnerabilities. It envisions a future where homes are not only protected but also adapt to the dynamic nature of our modern world. The "Smart Door Security System" seeks to empower individuals with a sense of control and convenience, reinforcing the idea that technology can enrich our daily lives while ensuring our homes remain impenetrable fortresses of security.This motivation is driven by a recognition that as the world changes, so too must our approach to security. By embracing the potential of IoT, and user-centric design, we aim to make homes more secure, adaptable, and user-friendly. Our project's purpose is to set a new standard for home security and, in doing so, to inspire a safer and more connected future for all.

1.2 Problem Analysis

The "Smart Door Security System" project emerges from a thorough analysis of the critical issues plaguing traditional home security measures. The problems that drive this project are multifaceted and deeply ingrained in the changing landscape of modern living. Traditional locks and keys, while reliable to a certain extent, are no longer sufficient to protect our homes in an era marked by urbanization, increased mobility, and evolving security threats.Firstly, the rising frequency of break-ins and property-related crimes is a cause for alarm. Traditional locks can be bypassed, and criminals are becoming more sophisticated. It is essential to have a security system that offers real-time monitoring, instant alerts, and remote access to mitigate these threats effectively.Secondly, in our fast-paced lives, convenience and security should not be mutually exclusive. Traditional systems often fail to offer the seamless integration of technology and daily life that is expected in the digital age. The need to juggle multiple keys, remember codes, or engage in cumbersome entry procedures is not only frustrating but also inefficient.

By addressing these issues head-on, the "Smart Door Security System" project aims to offer a comprehensive, user-centric solution that redefines home security for a more secure and convenient future.

1.3 Objectives

The "Smart Door Security System" project seeks to achieve a range of interrelated objectives, including the development of a highly secure and accessible door security system that integrates state-of-the-art technologies such as IoT, provides real-time monitoring and alerts, and simplifies daily life for users. This system aims to not only prevent unauthorized access but also offer remote access control, secure access sharing, and a seamless user experience, ultimately

redefining the concept of home security and contributing to the evolution of smarter, more adaptable, and user-friendly living spaces in the digital age.

- Develop a smart door security system that combines traditional security measures with advanced technology to enhance protection and convenience for homeowners.
- Utilize the Internet of Things (IoT) to enable real-time monitoring, remote access control, and instant notifications for any suspicious activity or unauthorized access.
- Create a user-friendly interface and mobile application that allows homeowners to manage access permissions, monitor security, and receive alerts from anywhere at any time.
- Improve the overall security and safety of homes, reducing the risk of break-ins, and offering peace of mind to homeowners.
- Streamline access control for family members, guests, and service providers, simplifying the process of granting and revoking access privileges.
- Embrace the potential of smart home integration, ensuring that the security system can interact with other connected devices and adapt to the evolving needs of homeowners.
- Establish a benchmark for modern home security systems, contributing to the advancement of the home security industry by combining cutting-edge technology with user-centric design principles.

1.4 Scope

The scope of the "Smart Door Security System" project encompasses the design, development, and implementation of a comprehensive door security solution that leverages the Internet of Things (IoT), and mobile applications. The system will include features for real-time monitoring, remote access control, and access authorization management. It will be designed to provide a secure, user-friendly, and integrated approach to home security. The project will also involve the creation of a user interface that allows for intuitive control and monitoring.However, it's important to clarify the aspects that are out of scope for this project. The "Smart Door Security System" will not include broader home automation functionalities beyond door security, such as managing lighting, climate control, or other smart home devices.. Additionally, the project will not involve physical door construction or installation. The primary focus is on the development of the security system itself, leaving the installation and integration of physical hardware to the end-users or professionals in the field. This project aims to deliver a sophisticated door security system, enhancing home security and convenience, while recognizing the limitations of its scope.

Chapter 2: Literature Review

2.1 Related Work

Door Lock Security Systems: 2 Security is becoming an important issue everywhere nowadays. Every person wants his house, factory, bank etc. to be secured. House security is becoming necessary as the possibilities of intrusion are increasing day by day. Here in this paper, we are trying to present research made on various door locking systems that have been used at homes, offices, shops, industries, etc. The advance in technology in each passing day can help us come across various technologies that can be used in the door lock security system. Since security is the major concern of the majority of the people at present, we feel research made on the various system relevant to the topic can help people to choose the best technology for their upcoming projects or make changes in the past projects and use effective door lock systems for their needs.[1]

Smart Door Locking System:A well-secured household is of prime importance in today's world. Even after using heavy and hard-to-open metal locks, there are a lot of reasons for which people have to be concerned like losing the keys and robbery. Nowadays a lot of new technologies have emerged to overcome the drawbacks of traditional door locking systems. These alternatives not only help to keep the house secure but also allows for remote access of the door with just one click. The Internet of things is one such technology that has brought a lot of ease in everyday life by providing solutions for various such problems. In this paper, an RFID-based door lock system along with OTP driven technology is discussed to provide a high-security solution for households. In this device, the OTP is generated for door access and this OTP will expire after the expiration time provided. The working model of the proposed system is discussed in this paper.[2]

A Smart Door Lock Security System using Internet of Things: Security is a key concern across the world, and it has been a common thread for all critical sectors. Nowadays, it may be stated that security is a backbone that is absolutely necessary for personal safety. The most important requirements of security systems for individuals are protection against theft and trespassing. CCTV cameras are often employed for security purposes. The biggest disadvantage of CCTV cameras is their high cost and the need for a trustworthy individual to monitor them. As a result, a solution that is both easy and cost-effective, as well as secure has been devised. The smart door lock is built on Raspberry Pi technology, and it works by capturing a picture through the Pi Camera module, detecting a visitor's face, and then allowing them to enter. Local binary pattern approach is used for Face recognition. Remote picture viewing, notification, on mobile devices are all possible with an IOT based application. The proposed system may be installed at front doors, lockers, offices, and other locations where security is required. The proposed system has an accuracy of 89%, with an average processing time is 20 seconds for the overall process.[3]

Smart Door Locking System Using IoT: The Internet of Things (IoT) has gained widespread attention among many research areas. Modern automation has made life more sophisticated and

easier. An IoT based smart digital automated system plays a crucial part that assists people by reducing workload and implementing interactive technology in everyday life. Through our project, Smart Doors, we are making a small contribution to the enormous efforts being made to improve and simplify our lives. This is a simple project that helps users in accessing the doors within a specific range. Android software will access the door lock and the transfer of data will be performed by using the bluetooth technique. So, the end users need not to bother about the door lock as they can manage it through their cell phone within a certain proximity, and additionally, users need not to be concerned about handling a physical key. This work comprises software and hardware development. This approach intends to do away with the need for keys to open doors and the everyday struggle involved in carrying a lot of keys and preparing them for installation anywhere and everywhere with the greatest haste. This helps to create a secure environment inside and outside by preventing security breaches.[4]

2.2 Existing System

Ozone is a provider of digital door locks known for offering a diverse range of solutions that combine high-level security, convenience, and style. These locks are compatible with a variety of door materials, including aluminum, wood, and glass. Made with corrosion-resistant stainless steel finishes, Ozone's digital locks are renowned for their strength and durability. They are designed for easy installation and user-friendliness, making them a popular choice for those seeking modern door security solutions. Godrej, a trusted brand in the lock industry, offers a range of locks suitable for single-panel doors with varying thicknesses. Constructed from stainless steel, Godrej locks are versatile and can be used for both residential and commercial main entrances. They feature a key-operated securing mechanism, allowing operation from both inside and outside, catering to the needs of both right and left-handed individuals.

Godrej's use of pin technology enhances security, further establishing its reputation as a reliable and reputable choice.Dorset stands as one of the world's top suppliers of door hardware, locking mechanisms, safety solutions, and security access control systems. Their locks are constructed from stainless steel, available in matte or gloss finishes. Notable for their ease of installation, durability, and attractive design, Dorset locks are suitable for doors with thicknesses ranging from 35mm to 50mm. They are often employed for interior doors in residential and commercial settings, contributing to the security and aesthetics of various spaces. These existing door security systems encompass a wide range of materials, features, and styles, catering to the diverse needs and preferences of consumers in the realm of home and commercial security.

Ring is a US-based company known for its door security systems. They offer a range of innovative security solutions designed to enhance the safety of homes and businesses. Ring's products often include video doorbells, security cameras, and home monitoring systems, which allow users to monitor their properties remotely through mobile devices and computers. Ring is widely recognized for its user-friendly technology that adds an extra layer of security and peace of mind to its customers.

Chapter 3: Proposed System

Introducing a cutting-edge access control system that combines the convenience of keypad entry, remote management through a web app, and visual guest authentication using an integrated camera. This multifaceted system redefines the way you control and monitor access to your property. With the keypad, users can securely input their passwords to gain entry, while owners enjoy the flexibility of remote door management via the web app, allowing them to unlock the door, change access credentials, and receive real-time access logs and notifications. The integration of a camera enables visual verification of guests at your doorstep, putting the power to grant or deny access directly into your hands. This comprehensive solution offers both security and convenience, ensuring that you have full control over who enters your property, whether you're at home or miles away.

1. Keypad Access Control:

   - Password Entry: Users enter a password via a keypad.

   - Password Verification: The system checks whether the entered password is correct.

   - Access Decision: If the password is correct, the system allows access by unlocking the door.

   - Access Denial: If the password is incorrect, access is denied.

2. Web App for Remote Access Control:

   - User Authentication: Owners can log in to the web app using their credentials.

   - Door Status: Owners can check the current status of the door (locked/unlocked).

   - Remote Unlocking: Owners can remotely unlock the door using the web app.

   - Password Management: Owners can change the access password as needed.

   - Logs and Notifications: Owners can view access logs and receive notifications for access events.

3. Camera-Based Guest Authentication:

   - Visual Verification: The camera captures an image of guests outside the door.

   - Image Transmission: The image is sent to the owner's app for verification.

   - Owner Verification: Owners receive the image and decide whether to grant access or not.

   - Access Control: Owners can remotely unlock the door for verified guests.

   - Access Denial: Owners can choose not to unlock the door for unverified guests.

   - Notifications: Owners can receive notifications of guest activity at the door.
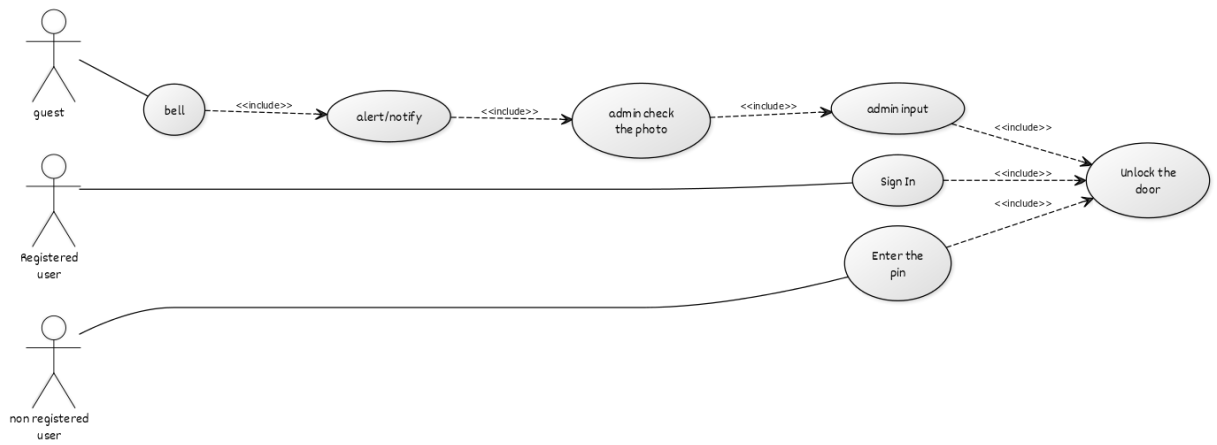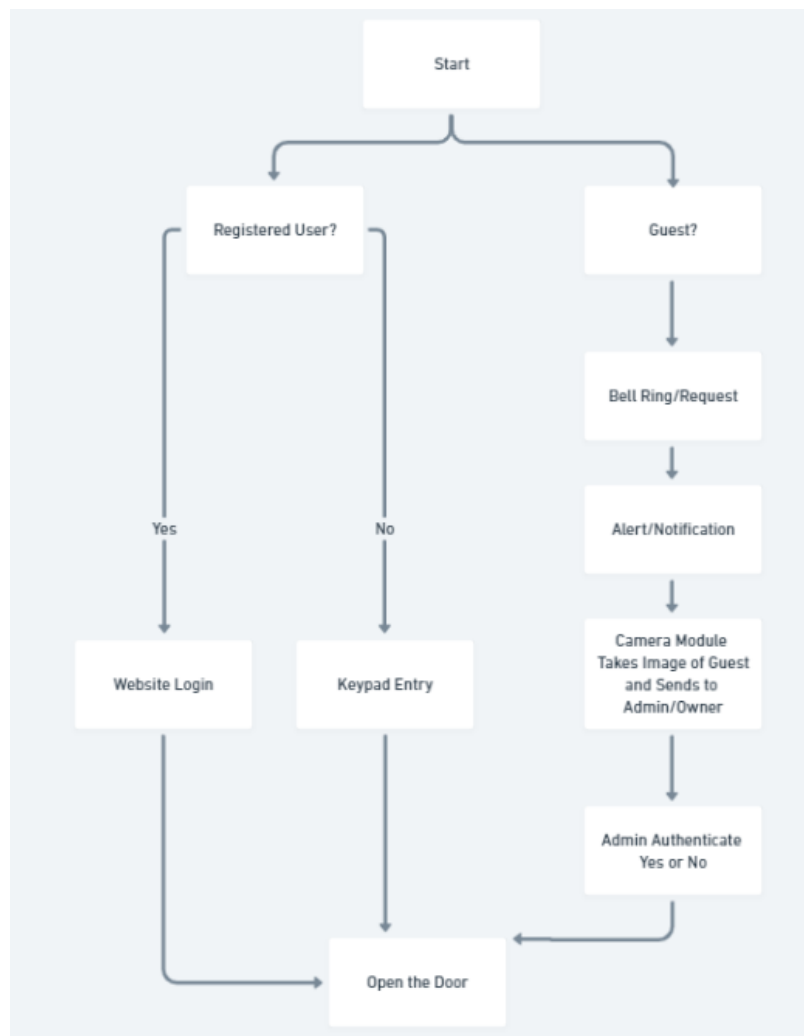
Fig 3.1 Use case diagram.

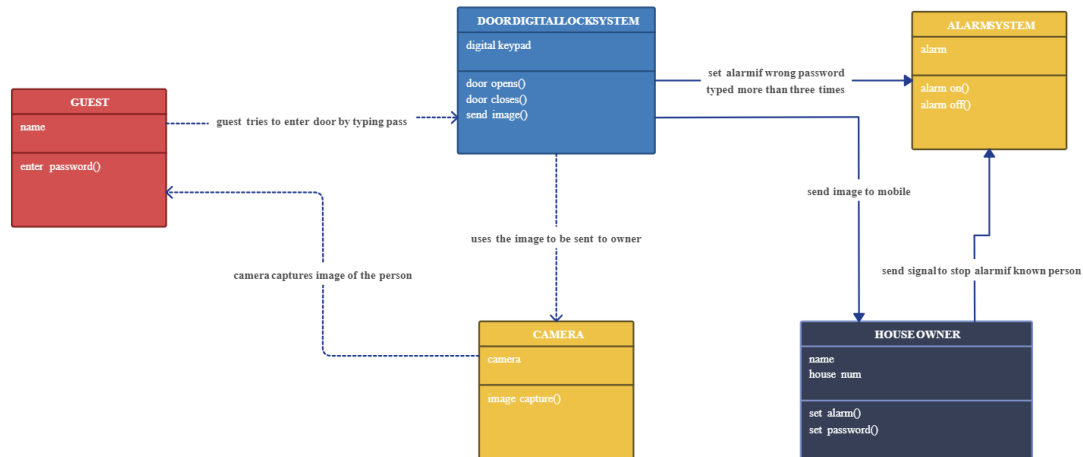Fig 3.2 Activity diagram

3.1 Proposed Approach and Details

Fig 3.3 Class diagram

3.2 Innovation in Idea

The system's primary objective is to revolutionize traditional door security by incorporating state-of-the-art features that enhance both convenience and safety. It introduces remote access capabilities, enabling authorized users to control and monitor the door security system remotely, while also integrating live photo authentication, which allows administrators to visually confirm the identity of visitors before granting access. This paper delves into the technical details, implementation, and the potential impact of these features, highlighting the system's potential to significantly improve security in residential and commercial settings.

1. Remote Access: Implement a cutting-edge remote access feature that allows authorized users to control and monitor the door security system from anywhere in the world through a mobile app or web interface. This enables homeowners to grant access to guests or service providers remotely, enhancing convenience and security.

2. Live Photo for Authentication from Admin: Incorporate live photo authentication by linking the system with an admin's smartphone or device. When someone requests access, the admin receives a real-time photo of the person standing at the door. This image-based authentication adds an extra layer of security, as the admin can visually confirm the visitor's identity before remotely unlocking the door, ensuring a safer and more reliable security system.This enables homeowners to grant access to guests or service providers remotely, enhancing convenience and security

3.3 Timeline

Fig 3.4 Gand chart

3.4 Roles and Responsibilities

Following is the description:

Hardware Setup: The Hardware setup was done by Manan and Gagan

Web app: Web app designing was done by Jeneel and Mujtaba

Documentation: making of synopsis and logbook was done by Jeneel and Manan

Backend integration: Integration with Mujtaba and Gagan

3.5 Software Development Lifecycle Model

For the completed IoT-based door security system project, an iterative and agile approach to the Software Development Life Cycle (SDLC) proved to be the most suitable. The iterative nature of Agile enabled regular testing, adaptation, and close collaboration with faculty,team ensuring that the security system met evolving needs while maintaining a strong focus on security and quality throughout the development process. This approach also accommodated changes in technology, standards, and user expectations, making it the best choice for developing and maintaining a robust and secure IoT door security system.
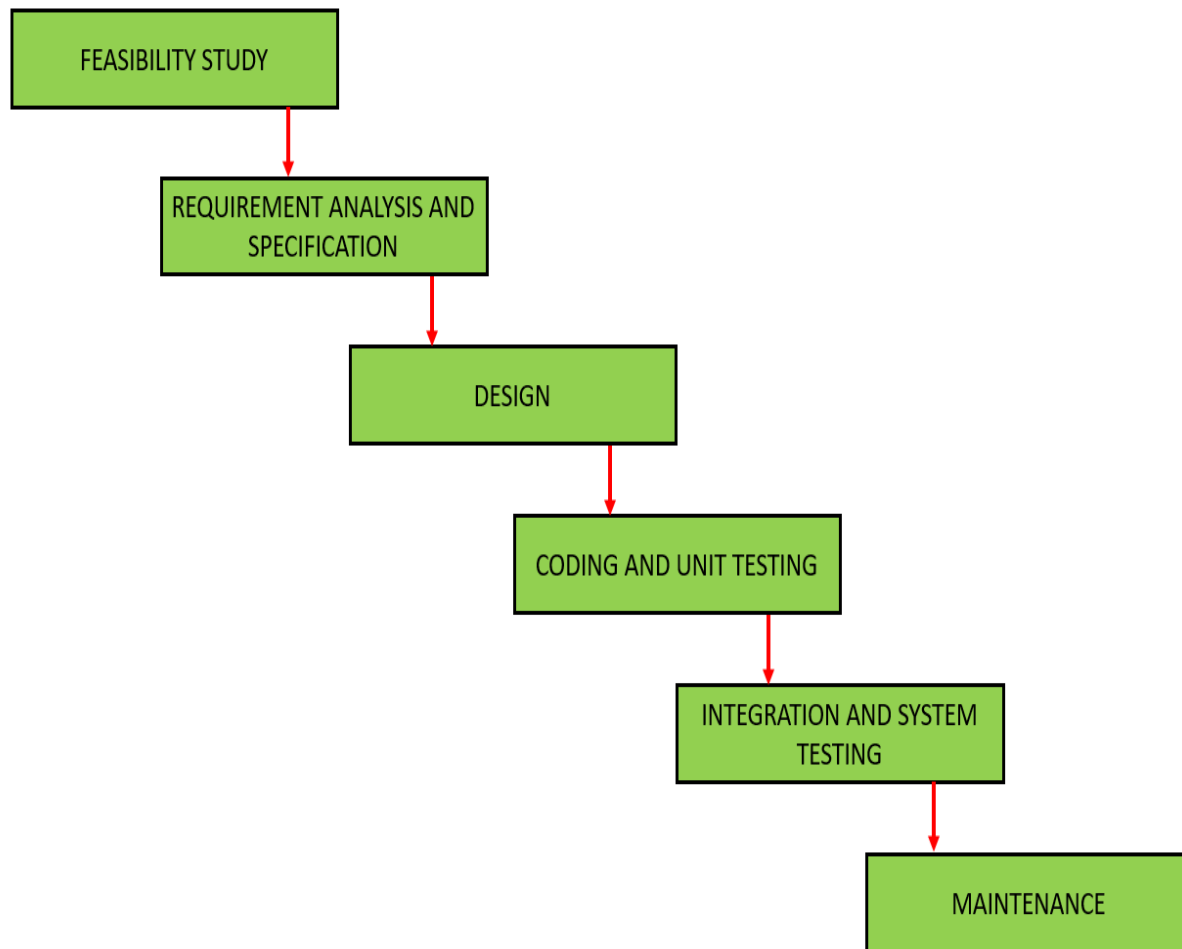
Fig 3.5 Waterfall Model

Stage 1: Planning and requirement analysis

To understand the nature of the programs to be built, we firstly understood the information domain for the software, its functions, interfaces and performance. With the requirements given to me I decided to make the interfaces like forms to allow users to enter the information and other interfaces to view the details. The information domain is decided as the attributes of various tables.

Stage 2: Designing the software

In this process we translated the requirements into representation of the software that can be accessed for quality before we start coding. The interfaces are designed in VISUAL BASIC and are tested for quality and requirements. This phase is the product of the last two, like inputs from the customer and requirement gathering. We started creating individual templates of each webpage and structure (backend working) for our project.

Stage 3: Developing the project

The next phase was actual development where the programming is built. The implementation of design begins concerning writing code. We followed the coding guidelines described collectively earlier and programming tools like compilers, interpreters, debuggers, etc. are used to develop and implement the code.

Stage 4: Testing

The testing process focuses on the internals of the software, ensuring that all statements have been tested, and on functional externals, that is conducting tests to uncover errors and ensure that defined input will produce actual results that agree with the required results.

Stage 5: Deployment

Once the software is certified, and no bugs or errors are stated, then it can be deployed.

Stage 6: Maintenance

Once the customers start using the developed systems, then the real issues come up and requirements to be solved from time to time.

Chapter 4: Implementation Details and Results

4.1 Technology Stack

For an IoT-based mini project like a door security system, we will need to select a technology stack that can handle various components and functionalities effectively. Here's a suggested technology stack for our project.

1. Microcontroller: Arduino and ESP32

- Arduino can be used to control the LCD, keypad, and relay module.
- ESP32 can be used for Wi-Fi connectivity, data processing, and communication with the cloud.

2. User Interface:

- 4x4 LCD membrane for local status display and user input.
- UART module for serial communication with the ESP32 for configuration or monitoring.

3. Camera:

- You can use a compatible camera module with the ESP32, like the OV2640 or OV7670, to capture images or stream video.

4. Lock Control:

- 12V solenoid lock can be controlled using one of the relay modules.

5. Relay Module:

- The 2-relay module can control the solenoid lock and possibly another device, like a buzzer.

6. Power Supply:

- A 12V battery or a suitable power supply for the solenoid lock and other components.

7. Connectivity:

- ESP32 can handle Wi-Fi connectivity to send data to a cloud platform or communicate with a mobile app.

8. Cloud Integration:

- You can use cloud platforms like AWS IoT, Google Cloud IoT, or Azure IoT to store data, control the system remotely, and receive alerts.

9. Mobile App or Web Interface:

- Develop a mobile app or web interface for remote access, monitoring, and control of the door security system.

10. Programming Language:

- Use C/C++ for programming the Arduino and ESP32.
- For mobile app development, you can use languages like Java (for Android), Swift (for iOS), or a cross-platform framework like React Native or Flutter.

11. Keypad:

- Use a 4x4 LCD membrane keypad for user input and code entry to control the door security system. This keypad can be connected to the Arduino for local access control.
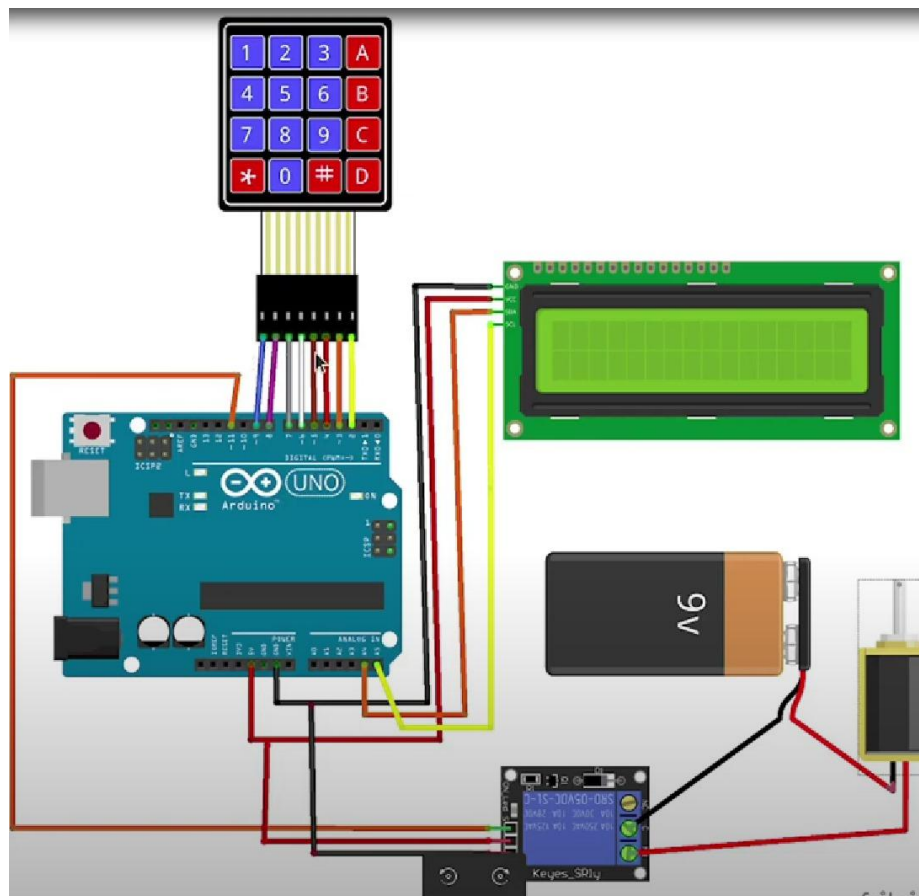

Fig 4.1 Circuit diagram

4.2 Implementation Parameters

"Implementing an IoT-based door security system requires careful attention to various critical parameters to ensure the system's functionality and security. First and foremost, the selection and

integration of hardware components, such as the door lock mechanism, keypad, doorbell, and camera module, must be carried out meticulously to ensure compatibility and reliability. The choice of communication protocols and networking infrastructure, including Wi-Fi, Bluetooth, or other IoT-specific protocols, is vital to enable seamless data exchange between system modules. Additionally, strong encryption and authentication mechanisms should be employed to protect sensitive user data and maintain the system's integrity.

Furthermore, the system's software and firmware must be developed with robust user management, access control, and user authentication features to cater to registered, unregistered, and guest users. Implementation parameters related to the camera module should address image capture quality, image storage, and retrieval methods for authentication. Data logging and access event recording should be a part of the implementation to maintain a comprehensive record of user activities.

The choice of a reliable cloud or server infrastructure is crucial for hosting the system, ensuring scalability and remote access capabilities. In addition, backup power supply solutions, such as battery backup or uninterruptible power supplies (UPS), should be implemented to ensure system functionality during power outages. Lastly, regular system maintenance, updates, and security audits should be considered as part of the long-term implementation strategy to address potential vulnerabilities and ensure the system's continued effectiveness."
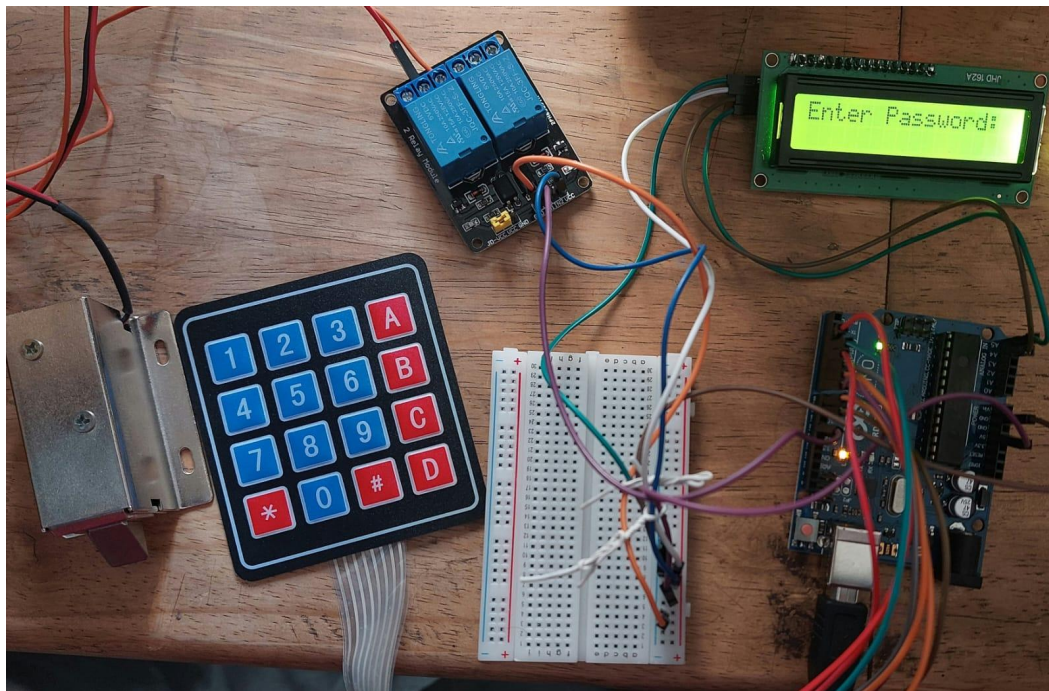
4.3 Preliminary Result

Fig 4.2 Circuit connection

In the IoT door security system, circuit connections link sensors, controllers, and locking mechanisms to enable remote monitoring and control of the door's security status.

Fig 4.3 Enter Password using keypad

In the IoT door security system, users must input a password using a keypad to gain access to the controlled area.
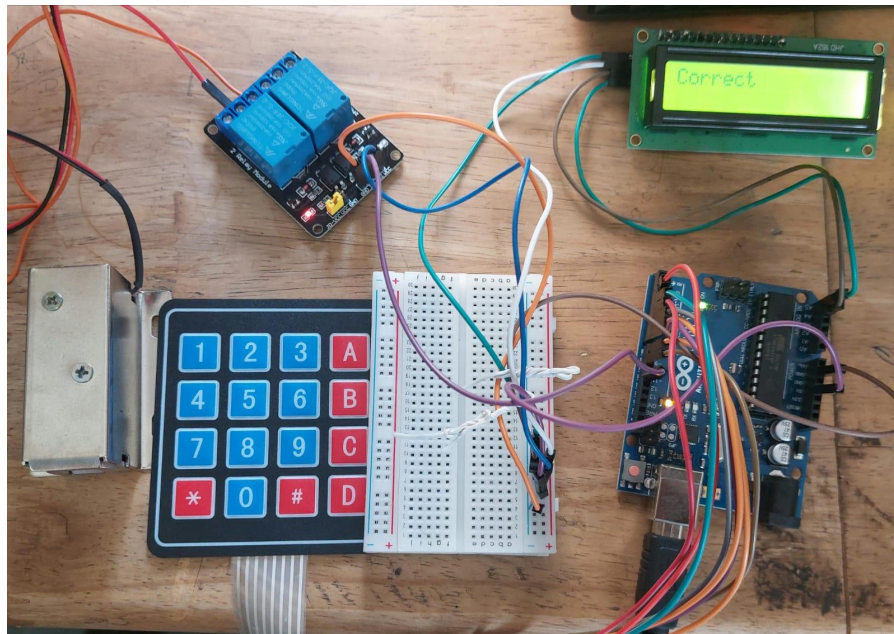

Fig 4.4 Password is correct

The IoT door security system has confirmed that the entered password is correct, granting access to the user by unlocking the door.
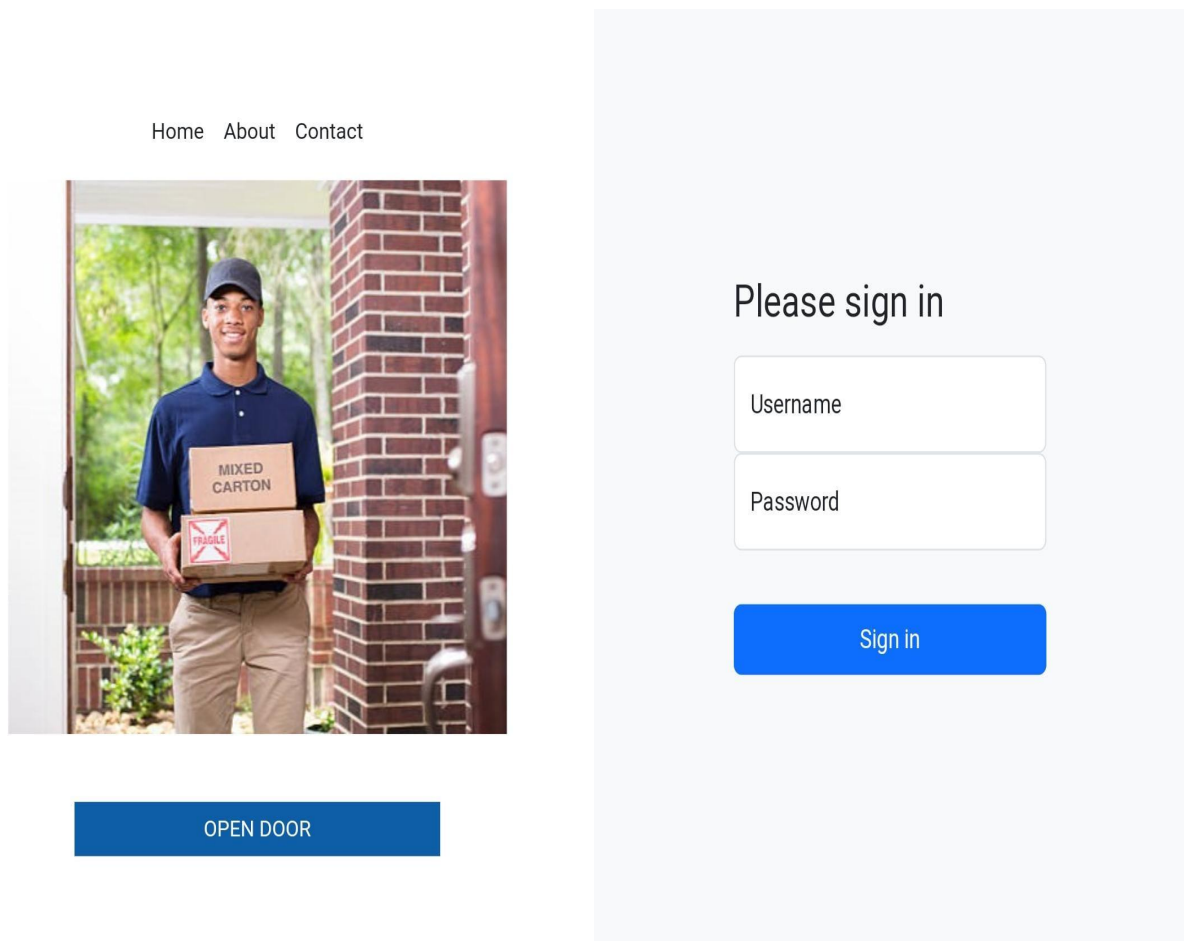
Home   About   Contact

Please sign in

Username

Password

Sign in
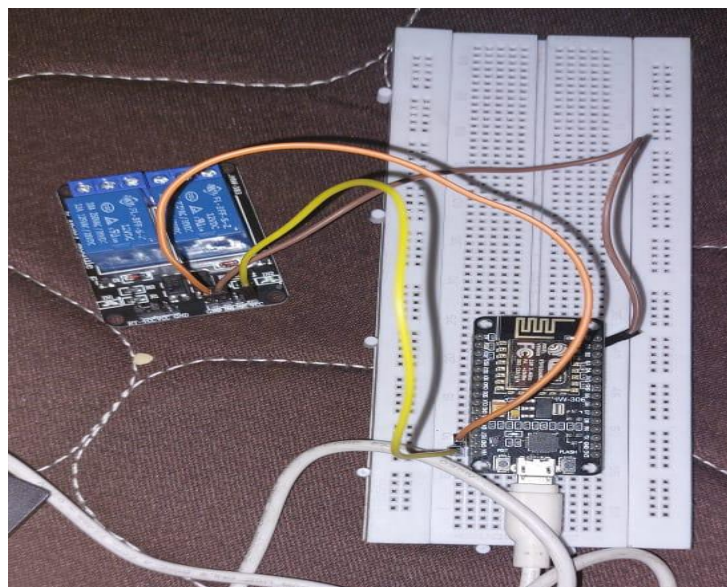
OPEN DOOR

Fig 4.6 Relay module

Fig 4.5 Node mcu connection

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Chapter 5: Conclusion

5.1 Conclusion

The world of home security is undergoing a profound transformation, ushered in by the Internet of Things (IoT). With the rapid advancement of technology, the way we protect our homes has evolved, and the IoT-based door security system stands as a shining example of this paradigm shift. This innovation represents a culmination of modern security needs, seamlessly integrating cutting-edge technology with user-centric design to provide an unparalleled level of security and convenience.

While the IoT-based door security system represents the future of home security, it's important to recognize that with great power comes great responsibility. As these systems become more prevalent, it's crucial to address concerns related to data privacy and security. Protecting the data generated by these systems is as important as protecting the physical security of your home. Robust encryption, secure data storage, and user data protection should be paramount in the development of these systems.

In conclusion, the IoT-based door security system marks a watershed moment in the evolution of home security. It's not just about locks and keys; it's about a comprehensive, connected, and intelligent approach to safeguarding our homes.The IoT revolution is here, and it's not just changing how we secure our homes; it's changing the way we live. As we move forward in this era of technological progress, innovations like this system exemplify the potential to enhance our daily lives through smart and secure solutions. In a world that constantly demands more convenience and connectivity, this system ensures that our homes remain safe and adaptable, poised for the dynamic nature of our modern world.

5.2 Future Scope

The IoT-based door security systems have already made a significant impact on the field of home security. However, their potential for growth and innovation is vast, and the future scope of these systems holds great promise.

1.Enhanced Integration: As IoT continues to evolve, these security systems can integrate with an even wider array of smart home devices. From smart lighting and climate control to voice assistants and automated home appliances, the security system can become the central hub for home automation.

2.Artificial Intelligence (AI) and Machine Learning: The integration of AI and machine learning can take these systems to the next level. AI can enable more advanced facial recognition algorithms, allowing for even higher accuracy in identifying authorized individuals.

3.Cybersecurity Measures: With the growing reliance on IoT, the need for robust cybersecurity measures becomes paramount. The future of IoT-based security systems should focus on ensuring the protection of user data and the system itself from cyber threats.

4.Scalability: The ability to scale these systems to fit different types of residential and commercial spaces will be essential.

5.Energy Efficiency: Sustainable living is a growing concern, and IoT-based security systems can contribute to energy efficiency.

6.Predictive Maintenance: The future of IoT security systems may include predictive maintenance features.

7.Ecosystem Expansion: In case of a security breach or emergency, the system can automatically alert local authorities or emergency services, providing an additional layer of safety.

8.Customization: Future systems will focus on offering high levels of customization. Users will be able to tailor the security settings, access control, and automation features to align with their specific needs and preferences, providing a truly personalized experience.

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