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Chapter 1 Introduction 1.1 Introduction : In today's digital age, the need for robust security systems has become increasingly vital. Traditional methods of door-locking systems, such as keys and passwords, are gradually being replaced by innovative technologies that offer enhanced convenience and security. One such cutting-edge technology is face recognition, which utilizes artificial intelligence (AI) algorithms to authenticate individuals based on their unique facial features. Face recognition has gained significant attention and has become a prominent research area in computer vision and AI. It has found applications in various fields, including surveillance, law enforcement, and access control systems. This technology has the potential to revolutionize the way we secure our homes, offices, and public spaces, offering an advanced level of security while eliminating the need for physical keys or passwords. This report aims to explore the concept of a door-locking system using face recognition technology and its benefits over conventional methods. By understanding the fundamentals and mechanics of face recognition, we can gain insights into its applications, limitations, and potential future advancements. Furthermore, we will discuss the impact of face recognition systems on security, convenience, and privacy, addressing concerns that arise with the adoption of this technology. The primary objective of implementing a door-locking system using face recognition is to provide a secure and seamless access control mechanism. This system typically consists of a camera or a set of cameras, an AI-powered facial recognition algorithm, and a locking mechanism. When an individual approaches the door, 1

the camera captures their face, and the algorithm analyzes the facial features to determine their identity. If the face matches an authorized user's data, the locking mechanism grants access; otherwise, it remains locked. The advantages of a face recognition-based door-locking system are numerous. Firstly, it eliminates the need for physical keys or to remember complex passwords, reducing the chances of unauthorized access due to lost or stolen credentials. Secondly, face recognition offers a high level of accuracy in identifying individuals, making it difficult to bypass the system through impersonation. Additionally, the system can be seamlessly integrated with other security measures, such as alarms or surveillance cameras, enhancing overall security. However, while face recognition technology brings several benefits, it also raises concerns regarding privacy and the potential misuse of personal data. Issues such as data protection, consent, and storage of facial images need to be addressed to ensure the responsible implementation of this technology. In conclusion, a door-locking system using face recognition offers an advanced and convenient approach to access control, enhancing security while simplifying the authentication process. By delving into the mechanics and implications of this technology, we can better understand its potential and the considerations that need to be taken into account when implementing such systems.
1.2 Aim: The aim of this report is to explore and evaluate the concept of a door-locking system using face recognition technology, with a focus on understanding its benefits, limitations, and implications. By studying the fundamentals of face recognition and its application in access control systems, we aim to assess the potential of this technology in enhancing security and convenience. Additionally, we aim to address concerns surrounding privacy and data protection, ensuring that the implementation of face recognition systems is done responsibly and ethically. Ultimately, this report aims to provide valuable insights into the effectiveness and viability of a face recognition-based door-locking system as a modern security solution.
1.3 Objectives : • To study a wise and secure door protection system that works by capturing the face of the traveler and checking it into its information. • To develop a system within which whenever someone rings the bell, the image of the person is captured and would be sent to the homeowner. • To analyze that if a person's image is present in information, then consequently perform its practicality. • And if the image isn't gifted within the information, then the good lock system can send the image to IOT website to the owner

Chapter 3 Methodology 3.1 Introduction : The methodology section of this report aims to outline the approach taken to investigate and evaluate the door locking system using face recognition technology. By understanding the methodology employed, readers can gain insights into the experimental design, data collection process, and analysis techniques used to obtain the results presented in this study. The primary objective of the research was to explore the effectiveness and feasibility of a door-locking system based on face recognition technology. The study involved a combination of theoretical analysis and practical implementation to assess

the security, convenience, and potential limitations of the system. To begin, an extensive review of existing literature was conducted to understand the underlying principles of face recognition technology, its applications in access control systems, and the current state-of-the-art techniques. This literature review formed the foundation for establishing the theoretical framework and identifying key research questions. The experimental setup involved the implementation of a prototype door locking system using face recognition. The system consisted of a camera or a set of cameras, an AI-powered facial recognition algorithm, and a locking mechanism. The hardware and software components were carefully selected and configured to ensure optimal performance. The collected data underwent pre-processing to enhance the quality and consistency of the images. Techniques such as normalization, noise reduction, and
alignment were applied to ensure accurate facial feature extraction and comparison during the recognition process. Overall, the methodology employed in this study enables a comprehensive analysis of the face recognition-based door-locking system, contributing to a better understanding of its capabilities, limitations, and practical implications.
3.2 Methodology : Figure 3.1: Basic Understanding of the working of the project. The figure above illustrates the system methodology of a face recognition-based door lock system. The image of the person standing in front of the door will be captured by the camera. Then this image will be compared with the images in the database. The door will open automatically only for authorized access i.e., only if the face of the person matches with that in the database. If the face of the person does not match with images in the database, the system will conclude that the person at the doorstep is an intruder or trespasser, and the door will remain closed. The image is captured using the webcam and all the processing is done on the laptop. As discussed LBPH is used for face recognition. • The Microcontroller Unit during this diagram i.e., RASPBERRY PI is the brain of the whole design. because it connects each part of the project with one another. • The person who arrives outside the door, his/her image is captured victimization the Pi Camera. Then that image is checked within the info that the owner has already created. This all is completed through the GSM module. • If the image matches with the pre-stored image within the databases, then through raspberry pi the message is distributed to the relay module to open the door. And if the image doesn't match them the message can move to the owner through the portal. • Then the owner can have full authority regarding what to try and do, whether to permit the person or not and consequently, save that person's information within the prestored info.
3.6 Algorithms : 3.6.1 Face Recognition: • Local Binary Pattern Histogram (LBPH). The LBPH algorithm assigns the pixels of an image with binary values by comparing each pixel with the neighborhood. Suppose that we are interested in calculating the LBPH value for the pixel. The Local Binary Pattern Histogram (LBPH) algorithm is illumination invariant. If the lighting condition of the scene is changed, all the pixel values will vary but the relative difference between the pixels will remain the same making the algorithm illumination invariant.

Chapter 4 Results & Discussions 4.1 Results : The experimental results show that the system detects and recognizes the face for different poses and illumination variations. Using LBPH for face recognition helped in achieving a good result in terms of recognizing faces at varying lighting conditions since LBPH is inherently illumination invariant. The pose invariant system has been achieved by training the algorithm by feeding the database with images of persons with varying poses so that the system is capable of recognizing faces with different head orientations up to ±45° (along the Z axis). The result of our project is that with recognition of stored images in the database after recognizing the face the door lock will get open. If any other person comes to the home whose image is not stored in the database that time the image of the person will get captured and sends the image to the user portal. Also, it saves all the entries of the person that is given access in the CSV file or Excel form with the time of their entry.
4.2 Project Prototype : The project prototype developed for this study was based on the Raspberry Pi 4 Model B single-board computer. The prototype integrated various components, including a high-resolution camera module, an LCD display, and a custom-designed face recognition algorithm. The Raspberry Pi's processing power and connectivity options provided a solid foundation for building the door-locking system using face recognition technology. The camera module captured facial images of individuals approaching the door, which were then processed by the face recognition algorithm running on the Raspberry Pi. The LCD display provided real-time feedback, displaying the recognition results and the status of the locking mechanism. The prototype successfully demonstrated the feasibility and functionality of the

system, showcasing the potential of using face recognition for secure access control.

Chapter 5 Conclusions 5.1 Conclusions : The door-locking system using face recognition technology represents a significant advancement in access control systems. By leveraging AI algorithms and analyzing unique facial features, this technology offers enhanced security and convenience over traditional methods such as keys and passwords. The system eliminates the need for physical credentials and reduces the risk of unauthorized access due to lost or stolen items. Moreover, the high accuracy of face recognition ensures that only authorized individuals gain entry, making it difficult to bypass the system through impersonation. This work has demonstrated the effectiveness of working with Raspberry Pi to implement an initial version of a low-cost embedded facial recognition system for controlling an electromagnetic lock using deep learning techniques. However, the implemented system can be improved not only based on the purpose described on this work, such as an even more reliable facial recognition with a lower error rate, and implementing a more robust face spoofing detection algorithm such as the one presented in. Extra biometrical parameters for access control, such as voice authentication, can also be incorporated to increase security for authorized-only personnel However, it is essential to address concerns regarding privacy and data protection when implementing face recognition systems. Strict protocols should be in place to ensure responsible handling and storage of facial images, and individuals' consent must be obtained before capturing and using their biometric data. By prioritizing privacy and transparency, we can foster trust in the technology and mitigate potential misuse of personal information.
5.2 Future Scope : The door-locking system using face recognition technology has immense potential for further development and integration. Here are some areas of future scope for this technology: 1. Enhanced Accuracy: Continued research and advancements in AI algorithms can further improve the accuracy of face recognition systems. This includes better handling of variations in lighting conditions, facial expressions, and occlusions, making the system more robust and reliable. 2. Multi-Factor Authentication: Integrating face recognition with other biometric modalities, such as fingerprint or iris scanning, can create a multi-factor authentication system that offers even higher levels of security. Combining multiple biometric factors ensures a more comprehensive and reliable identification process. 3. Real-Time Threat Detection: By integrating the system with advanced surveillance technologies, such as video analytics and machine learning, it becomes possible to detect and respond to potential security threats in real-time. The system can identify suspicious individuals or behavior patterns and trigger appropriate actions or alerts. 4. Integration with Smart Home Technology: The door locking system can be integrated with other smart home devices and automation systems. This allows for seamless control of access, such as remotely granting access to trusted individuals or receiving notifications when unauthorized access attempts occur. 5. Accessibility and Adaptability: Future developments should focus on making face recognition systems more accessible and adaptable to different environments. This includes accommodating individuals with disabilities, addressing diverse facial features, and optimizing performance across various lighting and environmental conditions. In conclusion, the door locking system using face recognition technology offers a secure and convenient approach to access control. With ongoing research and development, along with responsible implementation practices, this technology has the potential to transform the way we secure our homes, offices, and public spaces, providing an advanced level of security and convenience while respecting privacy and data protection..