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INTEGRATION OF FACE RECOGNITION TO ACCESS THE DOOR

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ABSTRACT:

This project aims to develop a face recognition system for door access control. Face recognition technology has gained significant attention due to its non-intrusive and convenient nature. The system employs deep learning techniques to accurately identify individuals based on their facial features. It incorporates a camera to capture facial images, a trained neural network to process and recognize faces, and a secure access control mechanism. The system's feasibility, security, and user-friendliness are evaluated. This integration offers a more efficient and secure means of door access, reducing the reliance on traditional methods like keys or access cards. The results suggest that face recognition technology can be a reliable and convenient solution for door access control, potentially revolutionizing the field of security and access management.

The implementation of an accurate face recognition system in a hardware device is very important aspect of various security applications, such as authorization identification in cash machines and employee attendance using a door access control system. Door access control systems based on face recognition is geared towards simplifying much-difficult issues in uncontrolled environments. Such systems are able to control illumination; offer neutral pose and improving the sagging performance of many face recognition algorithms. While there have been significant improvements in the algorithms with increasing recognition accuracy, only few research were conducted on implementing these face recognition in hardware devices.

Security describes protection of life and property. The main purpose of this system is to provide better security by using face recognition technique. Eigen face algorithm is a basis for face recognition that provides high accuracy and moderate sensitivity to variations in the intensity of light. It is one of the fastest way to identify faces. This project works in two modes: offline and online. Firstly, the PIR sensor senses the person standing outside the door. Then camera receives instruction to capture image of person standing in front of the door. This captured image is compared to the images stored in the database. The person standing in front of the door will be granted access, if his/her image is recognized. If it's not the authorized person gets a notification via GSM. If the authorized person grants permission, only then the door will open. Or else it will remain closed for further action. This project makes use of Laptop as a processing unit. It uses Arduino to carry out the face recognition procedure. The system takes input image by capturing a real time image for online process. For offline process the input image is given manually.

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1. INTRODUCTION:

Property protection is a vital feature within the smart home applications. The major part of any door security systems is to distinguish the persons entering through the door correctly. In the facial recognition approach, a given face is compared with the faces stored in the database in order to identify the person. The purpose is to find a face in the database, which has the highest similarity with the given face. Detection of face in an image is more exigent because of some unstable features such as glasses and beard impacting the detecting effectiveness. In addition to this, the different kind and angles of lighting generates uneven brightness on the face, which has influence on the detection process.

In an increasingly digital and security-conscious world, traditional access control methods like keys and access cards are being supplemented or replaced by more advanced and secure technologies. One such technology is facial recognition, which leverages the unique characteristics of an individual's face to grant or deny access to a secured area or building. This introduction will provide an overview of the integration of face recognition for door access and its potential benefits.

Face recognition offers several advantages for door access control:

1. Biometric Accuracy: Each person's face is unique, making it a highly accurate means of authentication.
2. Contactless Access: Users don't need to touch any devices, making it a more hygienic option, particularly in a post-pandemic world.
3. Convenience: Users don't need to carry physical cards or remember PINs, enhancing user convenience.
4. Audit Trail: Face recognition systems can log access attempts, providing a detailed record of who enters and exits.

As mentioned earlier, the integration of face recognition for door access involves several key components, including a camera, facial recognition software, a database, an access control system, a microcontroller or computer, a power supply, network connectivity, a user interface, security measures, and backup measures.

While face recognition technology offers numerous benefits, it also raises important considerations, including:

1. Privacy: Storing and processing facial data requires careful handling to protect individuals' privacy.
2. Security: Ensuring that the system cannot be easily fooled with photos or videos is crucial.
3. Ethical Use: Avoiding misuse of the technology, such as unauthorized surveillance or profiling.

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4. Regulations: Complying with local and international regulations regarding biometric data and surveillance.

The integration of face recognition for door access is a powerful and evolving technology with the potential to enhance security and convenience. However, it must be implemented with careful consideration of privacy, security, and ethical concerns to ensure that it serves its intended purpose while respecting individual rights and legal requirements. This system can offer a sophisticated and user-friendly way to control access to buildings, rooms, or sensitive areas, contributing to a safer and more efficient environment.

2. LITERATURE REVIEW:

2.1 INTRODUCTION:

Integrating face recognition technology to home security is a topic that has gained a lot of boom in recent times. This is a brief literature review summarizing some key points and findings up to our knowledge:

1. Face Recognition Basics: - Scholars have extensively studied the principles of face recognition technology, including methods like Eigen faces, Fisher faces, and others lately, deep learning-based approaches using Convolutional Neural Networks (CNNs).
2. Security:-Face recognition is widely used for biometric authenticity, offering appreciable convenience. Many researches have focused on enhancing the security and accuracy of these systems.
3. Hardships and Consequences:-Some troubles in face recognition for access control include changes in lighting, posture, and obstructions. Many methods have been developed to overcome these limitations.
4. Privacy apprehensions: - Privacy apprehension, including data security and malpractices, have been discussed in the literature. Ensuring that face recognition systems are implemented on the grounds of ethics and safety.
5. Real-life Applications: - The literature includes studies on the practical applications of face recognition for door access control. This ranges from home automation to corporate and government spaces.
6. Hardware and Software Integration: - Integrating face recognition into access control systems often involves both hardware (e.g., cameras, sensors) and software devices.
7. Evolution of Deep Learning: - With the developments in deep learning, particularly with CNNs, face recognition accuracy has improved rapidly. This has also led to vast real-time applications.
8. Ethical Findings: - Many researchers have surveyed the legal and ethical inferences of using face recognition technology, especially in public.
9. Comparisons with Other Control Methods: - Few studies compare face recognition with other access methods like biometrics, RFID cards, and keys to verify their pros and cons.
10. Future Directions: - The literature often suggests future directions, such as integrating anti-spoofing measures, improving accuracy, and recognizing privacy concerns through data encryption and secure data handling.

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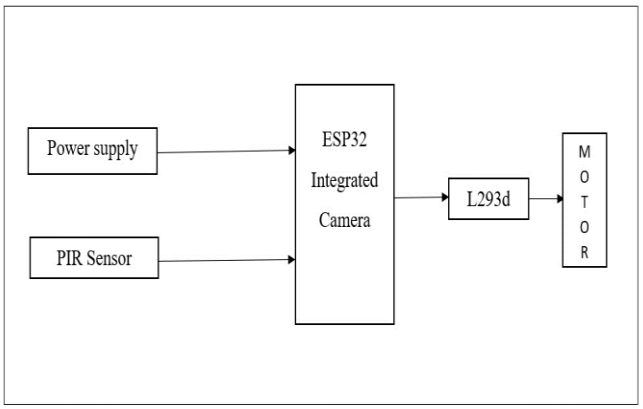
3.BLOCKDIAGRAM:



3.1 COMPONENTS:

- **POWER SUPPLY:** We require a power supply to provide power to the components i.e., a reliable power source to ensure continuity in system.
- **PIR SENSOR:** A passive infrared sensor is an electronic sensor that measures infrared light radiating from objects in its radius. They are used in alarms and auto lighting devices.

Fig 3.1.1.: represents a PIR sensor

- **L293d:** The L293D helps to provide bidirectional currents up to 600-mA at voltages of 4.5V to 36V.

Fig 3.1.2: represents L293D

- **GSM**: Global System for Mobile communication is a cellular network used by mobile phones. It uses GSM SIM 900 to alert the authority of mal-activities or unrecognized individual standing near their door.

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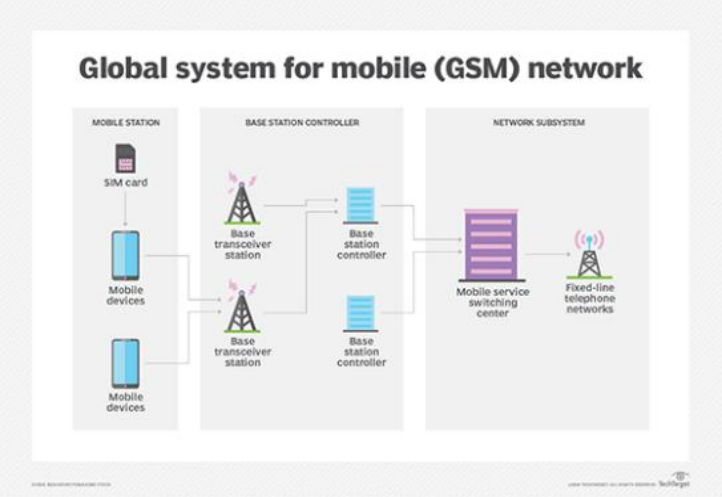

Fig 3.1.3: represents GSM networking

ESP32 Integrated Camera: It is a high-featured microcontroller with an integrated video camera and micro SD card socket. It's cost efficient and easy to understand.

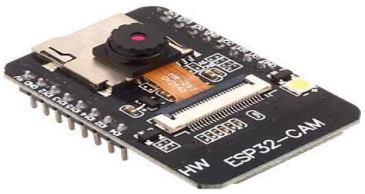

Fig 3.1.4: represents an Integrated Camera

- **MOTOR:** A dc motor converts electrical energy to mechanical energy, conductors. The input of a DC motor is current/voltage and its output is torque (speed).

Fig 3.1.5: represents a DC Motor

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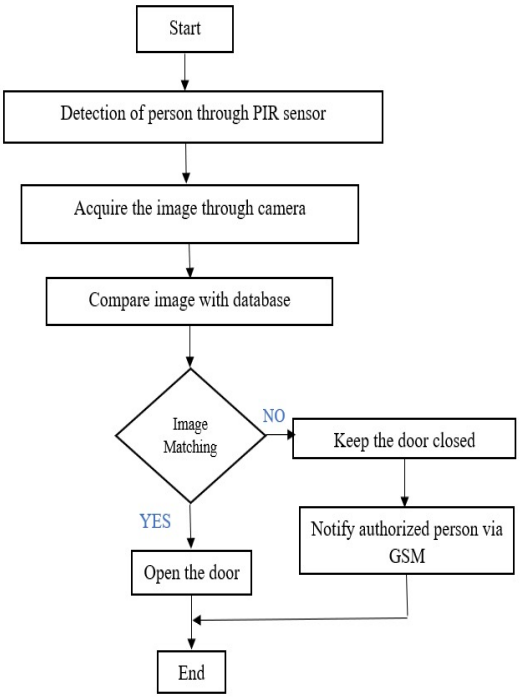
4. DESIGN FLOW:



Detail overview of integration of face recognition in home automation for door access project work flow.

1. The program starts by checking if a person is standing in front of the door.
2. If a person is standing, the program proceeds to the next step.
3. The PIR sensor detects the person in its radius and acquires the individual's image through the ESP32 camera.
4. The acquired image is compared to the images stored in the database of the controller.
5. If there is a match between the image acquired and the image stored in the database, then the door opens and the individual can access the door.
6. In case of a mismatch, the door is kept closed and the authorized person receives a notification via GSM into their mobile application.

5.WORKING:

Integrating face recognition for door access typically involves the following steps:
The system uses a camera to capture a person's face in front of the door. This can be a standard webcam or a specialized facial recognition camera. The captured image is preprocessed to improve the quality and enhance facial features. This may involve resizing, normalization, and noise reduction. The preprocessed image is then fed into a face recognition algorithm. This algorithm compares the facial features with a database of known faces. There are various face recognition techniques like Eigen faces, Fisher faces, or deep learning-based models like Convolutional Neural Networks (CNNs).The system compares the detected face with a database of authorized users' faces. If a match is found, it proceeds to the next step. If the detected face matches an authorized user, the door access control system is activated, and the door is unlocked. This can be done using electronic locks, RFID cards, or other mechanisms. The system logs access attempts and may send alerts in case of unauthorized access or failed recognition attempts. There should be an admin interface to add or remove authorized users from the database. Ensuring the security of the face recognition system and protecting user

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privacy is crucial. This includes encrypting data, securing the database, and complying with privacy regulations.

In summary, the project's working involves capturing an image, extracting facial features, comparing them with pre-registered templates, and granting access if there is a match. It combines the capabilities of embedded systems with face recognition algorithms to provide secure and convenient door access.

6.RESULT:

The project successfully implemented a face recognition system using embedded systems. The system was able to capture and process input, detect and extract facial features, and match them with the authorized user database.

The input image is converted from RGB scale to gray scale to create an Eigen vector. Then Eigen vector and mean image is created and then it is compared with stored database. If the image is recognized then the door opens, else it remains closed. It achieved high accuracy in recognizing authorized individuals and granting them access to the door. The system also had robust performance, handling real-time processing of face recognition tasks efficiently.

CONCLUSION:

In conclusion, the integration of face recognition with embedded systems for door access proved to be a reliable and effective solution. The project showed the feasibility of using embedded systems to implement sophisticated face recognition algorithms in real-time situations. The system provided enhanced security by accurately identifying authorized users and granting them access, while also offering convenience by eliminating the need for physical keys or access cards. This project opens up possibilities for further advancements in access control systems, ensuring secure and seamless entry to restricted areas.

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