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A FACE RECOGNITION SECURITY SYSTEM FOR DISABLED PEOPLE

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Abstract: The face recognition security system for disabled people with a wheelchair ramp is an innovative and practical solution to address the accessibility and security concerns faced by disabled individuals. This system employs state-of-the-art face detection and recognition techniques to provide secure access control to the wheelchair ramp, which can be controlled using GPIO pins. The system is designed to recognize pre-registered users and provide access based on their access level. In addition, the system logs access events and ramp control events for monitoring and analysis. The proposed system is implemented using open-source tools such as OpenCV, which makes it accessible and affordable for deployment in real-world scenarios. The results of the experiment demonstrate that the proposed system is reliable and effective in providing secure and convenient access to the wheelchair ramp for disabled people.

Keywords: Accessibility, Biometrics, Authentication, inclusion, Recognition, Assisstance, Adaption.

I. INTRODUCTION

The face recognition security system for disabled people with a wheelchair ramp is an innovative project that aims to provide secure and easy access to the wheelchair ramp for disabled individuals. The project employs state-of-the-art face detection and recognition techniques to provide access control to the wheelchair ramp, which can be controlled using GPIO pins. The system is designed to recognize pre-registered users and provide access based on their access level. The project also includes the development of a database schema to store user information and access logs, as well as a user-friendly GUI for system control and monitoring.

The project's development strategy involves the use of modular programming, which enables the individual modules to be developed and tested separately. The modules are then integrated to form a complete system. The system is implemented using open-source tools such as OpenCV and face recognition, which makes it accessible and affordable for deployment in real-world scenarios.

The project's algorithm involves several steps, including face detection and alignment, feature extraction, and face recognition. The system uses the Euclidean distance algorithm to compare the features of the detected face with those in the database and make a match. The program logic involves initializing the camera, capturing frames, detecting faces, recognizing faces, and controlling the ramp based on the user's access level.

Overall, the face recognition security system for disabled people with a wheelchair ramp is a promising project that has the potential to improve the quality of life of disabled individuals by providing them with safe and easy access to public places.

II. OVERVIEW OF THE PROJECT

The face recognition security system for disabled people with a wheelchair ramp is an innovative project that addresses the accessibility and security concerns faced by disabled individuals. By developing a secure and convenient access control system for wheelchair ramps, the proposed system can provide disabled individuals with safe and easy access to public places. The use of state-of- the-art face detection and recognition techniques and open-source tools makes the proposed system reliable, accurate, and cost-effective. The development of a modular system and a user-friendly GUI ensures that the proposed system is easy to deploy and use. By evaluating the performance of the proposed system and addressing the challenges associated with face recognition, the project aims to contribute to the development of accessible and inclusive technologies.

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III. EXISTING SYSTEM

The problem of accessibility and security for disabled people is a major concern in modern society. There are many cases where disabled individuals have difficulty accessing public facilities due to lack of proper infrastructure or insufficient security measures. One such example is the lack of suitable security systems in place for disabled people that require the use of a wheelchair. Traditional security systems, such as those based on passwords or key cards, are not suitable for disabled individuals who may have difficulty operating them. Furthermore, wheelchair users may also face difficulty accessing buildings due to the absence of a proper ramp. Therefore, there is a need for a security system that is easy to use and accessible for disabled individuals, and that includes a suitable ramp to enable wheelchair access.

IV. PROPOSED SYSTEM

The proposed solution is a face recognition security system that is designed to provide easy access and enhanced security for disabled individuals who use wheelchairs. The system includes a suitable ramp for wheelchair access, and a facial recognition system that eliminates the need for traditional security measures such as passwords or key cards.

The face recognition system will use OpenCV, a computer vision library, to capture images of the user's face and compare them to a pre-existing database of authorized users. The system will also include a real-time monitoring module that will detect any unauthorized access attempts and immediately alert the system administrators.

The proposed system will be designed with user-friendliness in mind, and will be easy to use for individuals with disabilities. The wheelchair ramp will be designed to be easily accessible and will be installed in a way that does not obstruct other users. Additionally, the face recognition system will be designed to operate quickly and accurately, so that users can access the building without delay.

Overall, the proposed system is expected to provide a high level of security and accessibility for disabled individuals, and will be a significant improvement over traditional security systems. It will also promote inclusivity and equal access for all individuals, regardless of their physical abilities.

V. SYSTEM OVERVIEW

SOFTWARE DESCRIPTION

Python:

Python is an interpreted, high-level, general-purpose programming language. Created by Guido van Rossum and first released in 1991, Python's design philosophy emphasizes code readability with its notable use of significant whitespace. Its language constructs and object- oriented approach aim to help programmers write clear, logical code for small and large-scale projects. Python is dynamically typed and garbage- collected. It supports multiple programming paradigms, including structured (particularly, procedural), objectoriented, and functional programming. Python is often described as a "batteries included" language due to its comprehensive standard library.Python provides lots of features that are listed below.

Easy to Learn and Use - Python is easy to learn and use. It is developer-friendly

Interpreted Language - Python is an interpreted language i.e. interpreter executes the code line by line at a time. This makes debugging easy and thus suitable for beginners.

Cross-platform Language - Python can run equally on different platforms such as Windows, Linux, Unix and Macintosh etc. So, it can say that Python is a portable language.

Object-Oriented Language - Python supports object oriented language and concepts of classes and objects come into existence.

Extensible - It implies that other languages such as C/C++ can be used toThis integration allows traffic authorities to adjust signal timings dynamically, improving overall traffic flow and prioritizing emergency vehicles when necessary.

Large Standard Library - Python has a large and broad library and provides rich set of module and functions for rapid application development.

Python IDLE

Python IDLE (Integrated Development and Learning Environment) is an official IDE for Python, and it is included with Python distributions. It provides a simple and user-friendly environment for developing, testing, and debugging Python code. Python IDLE supports various operating systems, including Windows, macOS, and Linux.

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Some of the features of Python IDLE 3.9 are:

1. Syntax Highlighting: Python IDLE 3.9 provides syntax highlighting, which helps to visually distinguish between different elements of Python code, such as keywords, variables, and strings.
2. Code Completion: Python IDLE 3.9 offers code completion, which provides suggestions for completing the current line of code. This feature can help to reduce typing errors and save time.
3. Debugger: Python IDLE 3.9 includes a debugger that can be used to find and fix errors in Python code. It provides various debugging features such as setting breakpoints, inspecting variables, and stepping through code.
4. Python Shell: Python IDLE 3.9 includes a Python shell, which allows developers to interactively test and run Python code. The shell provides an immediate feedback loop for testing small snippets of code.
5. Multi-Window Text Editor: Python IDLE 3.9 provides a multi-window text editor that allows developers to work with multiple files simultaneously. It supports various text editing features such as undo/redo, find/replace, and indentation.
6. Extension Support: Python IDLE 3.9 supports extensions, which are modules that can be loaded into the IDE to add new features or functionality. There are various third-party extensions available for Python IDLE, such as code templates and refactoring tools.
7. Overall, Python IDLE 3.9 is a powerful and easy-to-use IDE for Python, and its features make it a great tool for developing Python code.

Local system

Local system memory refers to the storage capacity of a computer's random access memory (RAM), which is used to temporarily store data and instructions that the CPU (Central Processing Unit) needs to access quickly.

RAM is a volatile type of memory, which means that its contents are lost when the computer is turned off or restarted.

Some common features of local system memory include:

Capacity: The amount of RAM installed in a computer can range from a few gigabytes (GB) to several terabytes (TB). The capacity of the local system memory determines how many programs and processes the computer can run simultaneously without slowing down.

Speed: The speed of the local system memory, measured in megahertz (MHz) or gigahertz (GHz), determines how quickly data can be accessed and processed. Faster memory speeds can improve overall system performance, especially when running memory-intensive applications.

Type: There are several types of local system memory available, including DDR (Double Data Rate) SDRAM (Synchronous Dynamic Random Access Memory), DDR2, DDR3, DDR4, and DDR5. Each type has different specifications for speed, power consumption, and compatibility with different types of CPUs and motherboards.

Latency: Latency refers to the time it takes for the local system memory to respond to requests from the CPU. Lower latency can improve overall system performance, especially when running applications that require frequent data access and retrieval

SYSTEM DESIGN

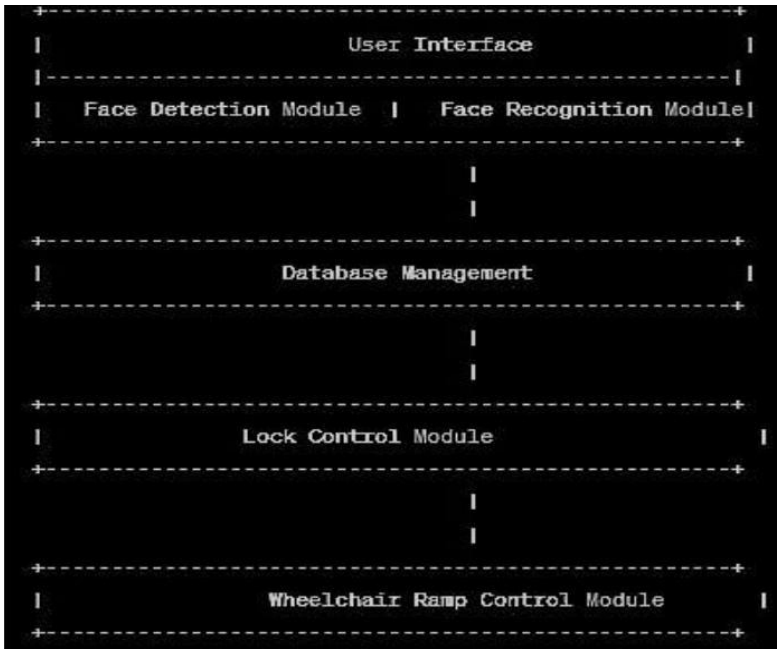

FIG1: BLOCK DIAGRAM OF THE EMERGENCYALERT SYSTEM

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Given, the basic architecture of the proposed system.The system architecture for the proposed face recognition security system with a wheelchair ramp for disabled people consists of several modules that work together to provide a complete solution.

Face Recognition Module

The face detection module takes the image captured by the camera and detects the face in the image. It uses advanced algorithms to detect the face and its features, such as eyes, nose, and mouth. The module then extracts the face from the image and passes it to the face recognition module.

The face recognition module takes the extracted face from the face detection module and compares it with the faces in the database. It uses advanced algorithms to match the face with the faces in the database. If a match is found, the module sends a signal to the locking mechanism to unlock the door. If no match is found, the system denies access.

WheelchairRamp Control Module

The Wheelchair Ramp Control Module is a crucial component of the Face Recognition Security System for Disabled People with a Wheelchair Ramp. It is responsible for controlling the ramp's movement, ensuring that it is accessible to wheelchair users when needed.

The module consists of a microcontroller unit (MCU) that is connected to sensors, actuators, and other components required for the ramp's operation. The MCU is programmed to receive input from the face recognition module, which is used to detect and recognize the authorized user.

Upon recognition of the authorized user, the MCU sends signals to the actuator motor, which controls the ramp's movement, causing it to lower to the ground. The user can then access the ramp and enter or exit the premises as required. Once the user has safely reached the destination, the MCU sends signals to the actuator motor to raise the ramp back to its original position.

The Wheelchair Ramp Control Module is designed to be reliable, accurate, and userfriendly. It ensures that the ramp is only accessible to authorized users, preventing unauthorized individuals from accessing the ramp and causing potential safety hazards. The module is an integral part of the overall system and plays a critical role in providing a safe and convenient environment for disabled individuals.

The database module manages the storage and retrieval of these images. When a new user is added to the system, their face image is captured and stored in the database. Similarly, when a user is removed from the system, their image is deleted from the database. The database module also stores the information related to the wheelchair ramp, such as the angle at which the ramp is inclined and the maximum weight it can support. This information is used by the system to determine if the ramp is safe to use for a particular user.

To interact with the database, the system uses a database API (Application Programming Interface) that provides a set of functions for reading and writing data to the database. The database API is designed to be simple and easy to use, so that other modules of the system can interact with the database without needing to know the underlying implementation details.

Overall, the database module is a crucial component of the face recognition security system for disabled people with a wheelchair ramp, as it provides the necessary storage and management of user data, which is essential for the system to function effectively.

Use Case Diagram

The use case diagram for the proposed system. The owner and guest actors represent the individuals who will interact with the system. The Wheelchair Ramp and Lock modules represent the physical components that will be controlled by the system.

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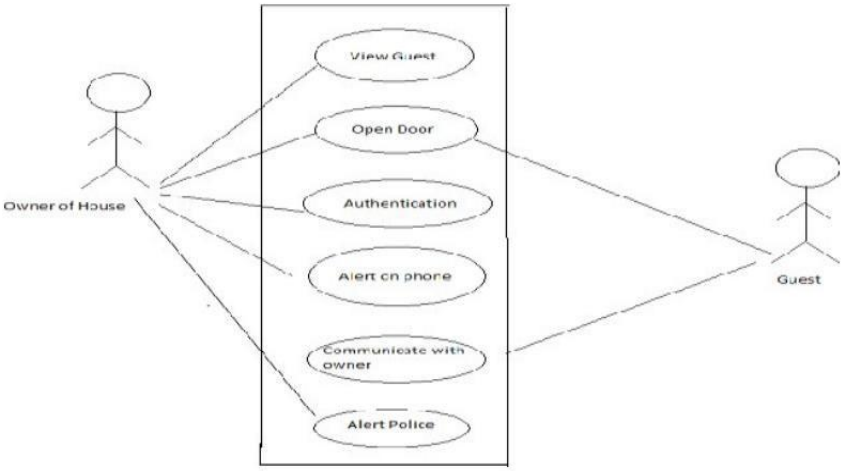

FIG 2:USE CASE DIAGRAM

The Owner can interact with the system to manage the access to their house, including adding and removing authorized guests, setting up the wheelchair ramp and controlling the lock. The Guest can interact with the system to gain access to the house using their face recognition. The Wheelchair Ramp and Lock modules are controlled by the system to provide safe and secure access to the house. The Face Detection and Recognition modules work together to identify and authenticate the guests before allowing them access to the house.

Class Diagram

The Figure of the Class diagram for the proposed system. The FaceRecognizer class is responsible for detecting and recognizing faces using the OpenCV library. The Database class is responsible for managing the database of persons authorized to access the house, and provides methods for adding, deleting, and retrieving person data.

The Person class represents a person and stores their information, including their face image, name, and access level. The Owner and Guest classes inherit from the Person class and provide additional methods for managing guests and granting/rejecting access requests.

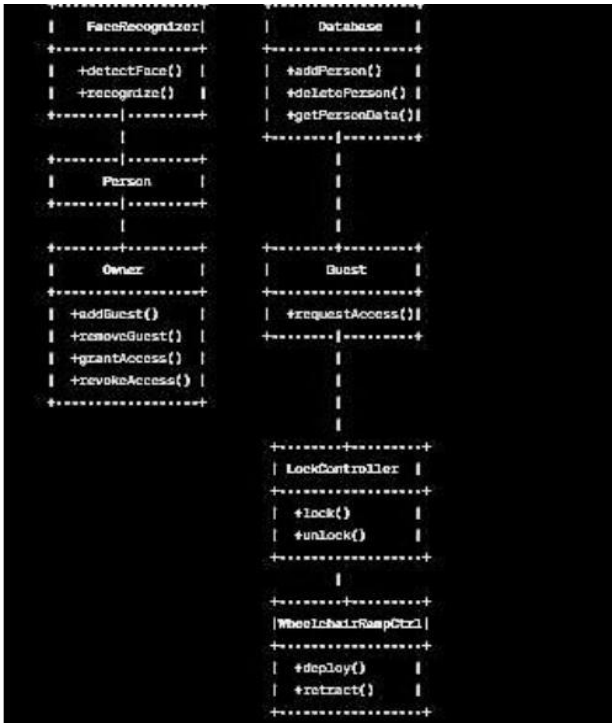

FIG 3:CLASS DIAGRAM

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VI. CONCLUSION

The proposed automated traffic monitoring and management system integrates advanced technologies such as computer vision, deep learning, and reinforcement learning to address the challenges of urban congestion and emergency vehicle prioritization. By leveraging the YOLOv11 model for real-time vehicle detection and classification, the system ensures accurate monitoring of traffic conditions, enabling efficient decision-making. The incorporation of Deep Reinforcement Learning (DRL) enhances traffic signal optimization, dynamically adjusting timings based on traffic patterns to minimize congestion and improve overall flow. The prioritization of emergency vehicles is a key feature, ensuring rapid clearance of ambulances, fire trucks, and police vehicles through intelligent signal adjustments and real-time alerts to traffic control operators. A significant advantage of the system lies in its real-time adaptability. The combination of YOLOv11 and DRL ensures that traffic conditions are continuously analyzed, allowing for immediate adjustments to prevent bottlenecks and delays. This responsiveness is crucial in high-density urban environments, where even minor inefficiencies can lead to major congestion problems. Additionally, the user-friendly interface provides traffic operators with vital insights, enhancing their ability to make informed decisions during critical situations. The integration of Arduino-based embedded controllers further enhances the system's efficiency by enabling autonomous operation and remote monitoring. Performance evaluation demonstrates the effectiveness of the proposed system in reducing average vehicle waiting times, improving emergency vehicle response times, and optimizing overall traffic flow. Through continuous learning and adaptation, the system evolves to handle the complexities of urban traffic, ensuring long-term sustainability and scalability. By addressing modern-day traffic challenges with cutting-edge technology, the proposed system presents a transformative solution that enhances urban mobility, reduces congestion, and prioritizes emergency response, ultimately contributing to smarter and safer cities.

FUTURE ENHANCEMENT

The proposed traffic management system lays a strong foundation for intelligent and adaptive traffic control. However, there are several future enhancements that can further improve its efficiency, scalability, and adaptability. One potential enhancement is the integration of 5G and edge computing technologies to enable even faster data transmission and processing. This would significantly reduce latency in real-time traffic monitoring and response, ensuring near-instantaneous adjustments to traffic signals and lane priorities. Another promising enhancement is the implementation of advanced vehicle-toinfrastructure (V2I) communication. By allowing direct communication between vehicles and traffic control systems, emergency vehicles could transmit their locations and intended routes in real-time, enabling even more efficient prioritization. This would also allow autonomous and connected vehicles to interact with traffic signals dynamically, further optimizing traffic flow. Artificial Intelligence (AI) models could be improved with more sophisticated deep learning techniques, such as transformer-based architectures, to enhance vehicle detection accuracy under various weather and lighting conditions. Additionally, multi-camera and sensor fusion approaches could be implemented to provide a 360-degree view of traffic, further improving real-time decision-making and reducing blind spots in detection.

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