Smart Car Security System Using Face Recognition

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***Abstract*—The use of Face Recognition technology in Smart Car Security systems has been the subject of active research in recent years. This paper presents a comprehensive review of major Smart Car Security systems that employ Face Recognition. We first provide an overview of the Smart Car Security System Using Face Recognition and its applications. Then, we review the latest techniques used in Smart Car Security Systems that utilize Face Recognition technology. In addition, we summarize a large-scale evaluation of automatic face recognition technology in Smart Car Security Systems and its findings. Overall, this paper aims to provide an up-to-date review of major Smart Car Security systems that use Face Recognition technology and their effectiveness.**

***Keywords* - Automatic Face Recognition, smart car security system**

I. INTRODUCTION

Car theft is a widespread issue that affects millions of people every year. In the United States alone, a car is stolen every 44 seconds, resulting in significant financial losses for car owners, insurance companies, and the economy as a whole. Car thefts can also cause emotional distress and inconvenience to victims, making it a serious concern for everyone.

Traditional car security systems like alarms, immobilizers, and mechanical locks are no longer enough to deter car thieves. Criminals have become more sophisticated in their techniques, making these systems vulnerable to unauthorized access. As a result, there is a need for more robust and reliable car security systems that can provide better protection.

To address this challenge, face recognition technology has emerged as a promising solution. Face recognition algorithms can accurately identify individuals based on their unique facial features, offering a highly accurate and reliable method for distinguishing between authorized and unauthorized individuals. This technology has the potential to revolutionize car security by providing a personalized and tamper-proof authentication mechanism that can significantly reduce the risk of car theft.

The successful implementation of this project will significantly reduce car thefts, improving the safety and security of vehicles and their owners. Additionally, it will advance the application of face recognition technology in the automotive industry, paving the way for future innovations in vehicle security and access control. Grossman2012.

II. LITERATURE SURVEY

This system proposes automatic door access using facial recognition and detection. A MATLAB program identifies faces, and a micro controller controls the door access system based on data received from the PC. After the person's identity is verified, the door opens immediately and automatically closes after 2 seconds. The system can detect and recognize an image within one second, enhancing door security without relying on security guards [1].

In recent years, the occurrences of car thefts and identity fraud have posed a significant issue. To address this problem, it is imperative to develop a facial recognition system. Face detection is achieved through the use of Haar-like features, while face identification utilizes the HOG + SVM method. The Raspberry Pi-based embedded device is utilized for training and authentication purposes [2].

The research presents a system for ignition that utilizes facial recognition, fingerprint authentication, and alcohol detection to instantly notify drivers. The primary aim of this proposed system is to reduce the occurrence of accidents caused by tired or intoxicated drivers, enhance transportation security, and protect vehicles from theft [3].

A novel method for implementing face detection in security applications through the use of Raspberry Pi 4 andOpen CV is proposed in this paper. The compact design and powerful computational abilities of the Raspberry Pi 4 make it an ideal tool for real-life situations. Open CV offers a range of algorithms for face detection and recognition, and the utilization of cascade classifiers, specifically the Haar cascade classifier, is crucial for accurate identification of facial attributes. In summary, the integration of Raspberry Pi 4, Open CV, and cascade classifiers offers a promising approach to strengthening security measures by enabling efficient face detection and recognition [4].

Authors who proposed a security system based on wireless communication and Bluetooth module used the GSM module for sending messages. The vehicle's owner can control the engine/ignition and turn it off at any time. Additionally, the system uses a password through the keypad (with ¡= 3 chances), which controls the safety of the vehicle locker door and the wearing of a seat belt. The controller is connected to a Bluetooth module [5].

As per the authors' proposal , the system should consist of a face detection subsystem, a GPS module, a GSM module, and a control platform. The face detection subsystem is a crucial component of the system as it helps in recognizing the faces of the individuals present in the vehicle. The optimized Haar cascade algorithm is used in this subsystem to detect faces and make an alarm soundlessly in case of any unauthorized entry. The GSM module it helps in tracking the vehicle's

location. This information can be useful in case of theft or any other emergency situation. The GSM module is used for communication purposes and helps in sending alert messages to the owner of the vehicle in case of any suspicious activity. Overall, the proposed low-cost expendable framework for an embedded smart vehicle security system is a comprehensive solution that can help in enhancing the safety and security of the vehicle [6].

Authors presented a design and develop face recognition system. They used Haar cascade for detecting faces from a given image and Artificial Neural Networks (ANN) for face recognition. The system was claimed to have an accuracy of 88.6 percentage in recognizing human faces [7].

The security system under investigation in this study makes use of facial recognition and identification via the Raspberry Pi, the FRS algorithm, and a database of images that the vehicle owner has contributed. If the recently scanned image does not match the previously uploaded image to the database, the system will shut down immediately. Every stage of this process is managed via programming on the Raspberry Pi. While the previous approach relied on basic geometric models, facial recognition technology is used nowadays [8].

The skin color information and Adaboost algorithm are used in the architecture design of the real-time car theft detection application. The suggested video frame for the vehicle security system will be recorded, and the PCA principle component analysis technique will be used to determine the face of the person attempting to open the vehicle. If the person is not using the car, the door will not open, and it will notify the authorized person about the theft details right away by sending a message to him or her over GSM. If the person is using the car, the door will open and allow permitted entry. The theft vehicle's current location is tracked using GPS technology [9].

In Nicolas Morizet's work Currently available automobile alarm and flashing light anti-theft systems employ many types of sensors, including pressure, tilt, and shock and door sensors, but the disadvantages are that they are expensive and only deter vehicle theft; they cannot be used to track down the burglar. Conventional auto security systems depend on a multitude of sensors When the "Car Alarm System" was originally created, it was mostly made up of electromechanical components. They developed into fully integrated microprocessor-based systems employing numerous electronics sensors as technology advanced. The GPS and GSM networks' hardware and software were created in [10].

III. METHODOLOGY

This project has been designed with three phases to ensure secure management of car door access. To begin with, a high-resolution Raspberry Pi camera captures images at a frame rate of 30 frames per second, when an individual approaches the car door. The camera takes a picture of the person or object nearby.

In the next phase, the captured image undergoes scrutiny through a face detection module that utilizes advanced algorithms such as Haar-like features to examine the image for any discernible faces. If a face is detected, the module isolates and extracts it from the rest of the image for further processing.

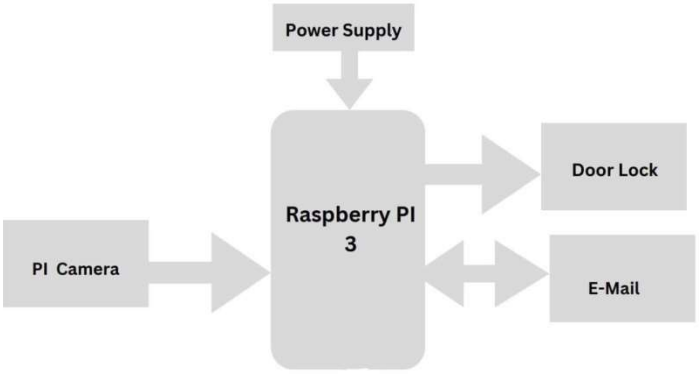

Fig. 1: Block Diagram.

Finally, the isolated face is compared to a pre-existing dataset that the system has been trained on, to determine if the individual is authorized to access the vehicle. If a match is found, the individual is recognized as a visitor, and the system alerts the car owner of their presence via email.

This security system is designed to enhance automobile safety and implement preventive measures for both authorized and unauthorized access attempts, by integrating image capture, facial recognition, and data comparison features. If an individual is identified as an outsider due to their facial features not matching any data in the set, the system initiates protective actions to ensure the vehicle's security. It sends an email to the vehicle owner with an image of the intruder and a notification describing the unauthorized entry attempt. Additionally, it activates an audio alarm to detect the intruder and alert those in the vicinity of the security breach.

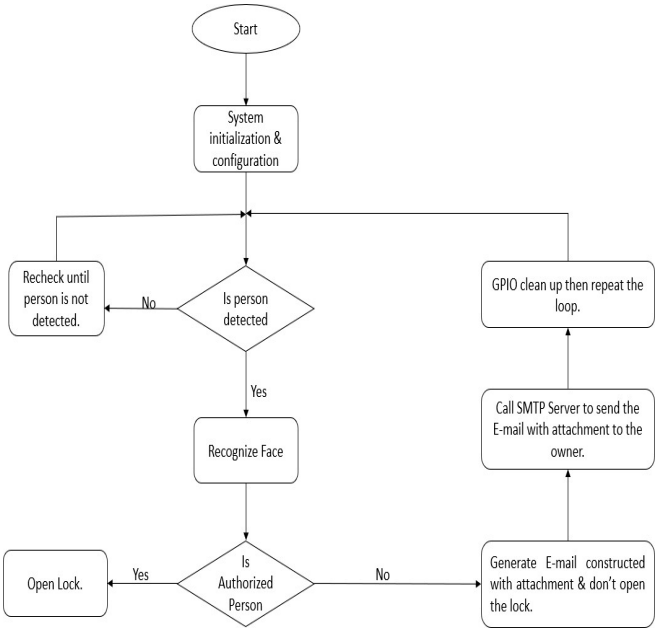

Fig. 2: Basic flowchart of Smart Car Security System Using Face Recognition

Fig. 3 presents the basic flowchart of image capture and save. 1.Initialize the Camera: Open the camera device and con- figure it for capturing images. 2. Capture Image: Capture a

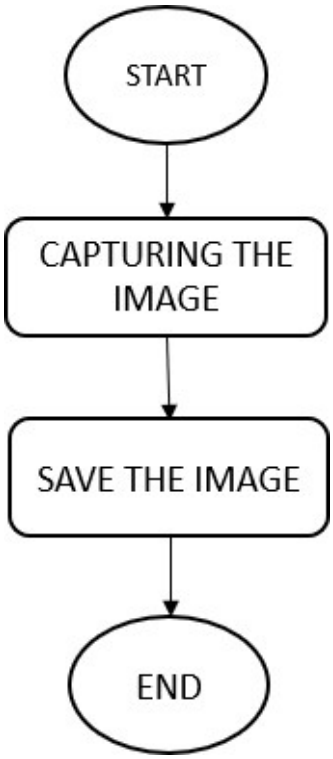

Fig. 3: Image capture and save.

single frame/image from the camera. 3. Save Image: Save the captured image to a file on the device.

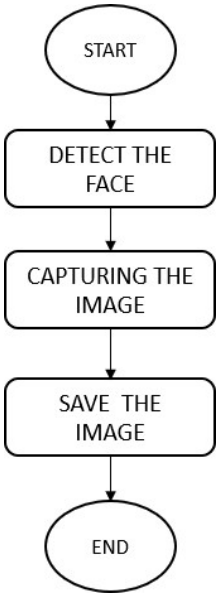

Fig. 4: Face detect and save.

Fig. 4 presents the basic flowchart of Face detect andsave

1. Initialize Object Detector: Load a pre-trained object detection model 2. Capture Frame: Capture a frame/image from the camera or video stream. 3. Detect Objects: Use the object detection model to detect the target image within the captured frame. 4. Capture and Save: If the target image is detected, capture the portion of the frame containing the detected image and save it to a file.

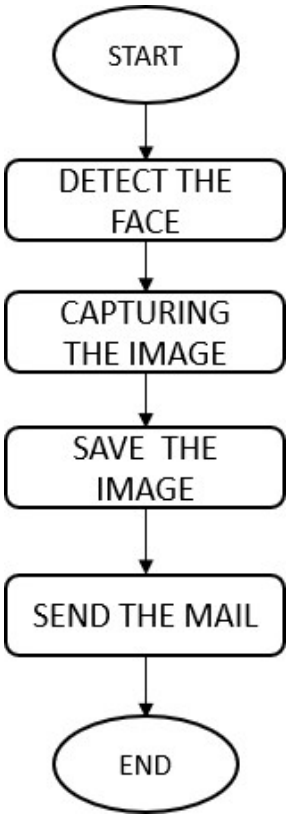

Fig. 5: Image capture and save and send the mail.

Fig. 5 below presents the basic flowchart of Image capture and save and send the mail

1. Initialize Object Detector: Load a pre-trained object detection model. 2. Capture Frame: Capture a frame/image from the camera or video stream. 3. Detect Objects: Use the object detection model to detect the target image within the captured frame. 4. Capture and Save: If the target image is detected, capture the portion of the frame containing the detected image and save it to a file. 5. Send Email: Use an email library to compose an email with the saved image as an attachment and send it to the owner's email address.

IV. RESULT

1. The person will be detect. Then we get preview of camera. 2. After that camera will detect the face and capture the image. 3. Captured image compared with data set. 4. If the image will matched with dataset Then Car will unlock

automatically 5. Otherwise Our system send mail to owner that unknown person want to access your car and the access is not given to that person.

Fig. 6: Face detect and save

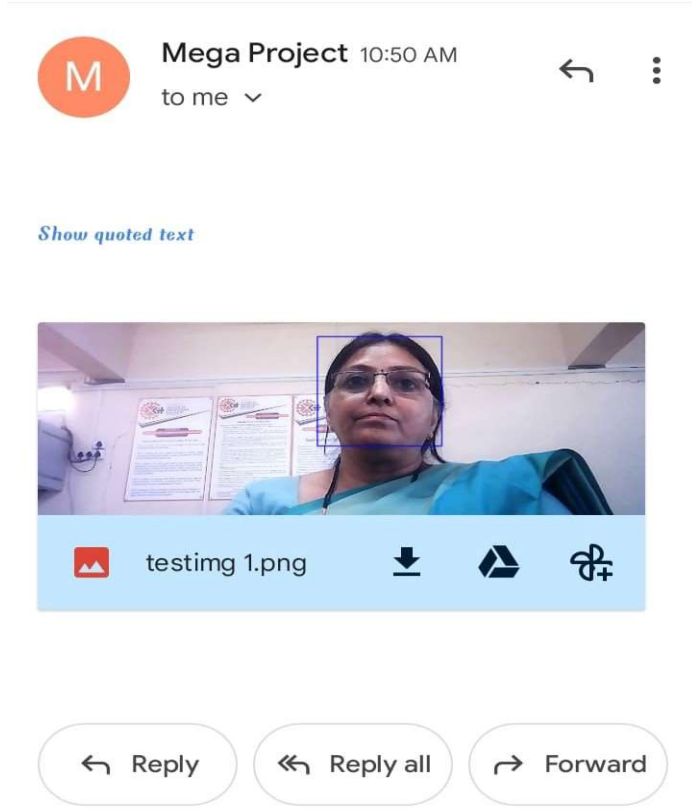

Fig. 7: Image capture, save and send the mail.

V. SUMMARY

To sum up, the use of face recognition technology in smart car security systems shows great potential in strengthening vehicle safety and security. With the help of accurate and dependable face recognition algorithms, these systems provide a strong defense against unauthorized access and car theft. Apart from preventing crime, these systems can also bring wider benefits like improved public safety and reduced financial losses due to car-related crimes. As the automotive industry continues to adopt the latest advancements in face recognition technology, we can expect a major shift in how vehicles are protected and operated, resulting in safer and more secure transportation options.

VI. FUTURE SCOPE

Looking forward, there are numerous avenues for enhancing and expanding smart car security systems that rely on face recognition technology. One area for further development is refining the accuracy and efficiency of face recognition algorithms to ensure reliable performance in diverse environmental conditions and facial variations. Integrating emerging technologies like biometric authentication methods and artificial intelligence could also improve the security and usability of these systems. Additionally, exploring applications beyond vehicle security, such as personalized vehicle settings and seamless access control, presents exciting opportunities for innovation. To achieve widespread adoption and acceptance, it's essential to address privacy concerns and regulatory frameworks surrounding facial recognition technology. Overall, the future potential for smart car security systems using face recognition technology is vast. To sum up, the use of face recognition technology in smart car security systems shows great potential in strengthening vehicle safety and security. With the help of accurate and dependable face recognition algorithms, these systems provide a strong defense against unauthorized access and car theft. Apart from preventing crime, these systems can also bring wider benefits like improved public safety and reduced financial losses due to car-related crimes. As the automotive industry continues to adopt the latest advancements in face recognition technology, we can expect a major shift in how vehicles are protected and operated, resulting in safer and more secure transportation options.

VII. CONCLUSION

This proposal helpful for face recognition technology has the potential to revolutionize car security, providing a highly accurate and reliable method for identifying authorized individuals and preventing unauthorized access to vehicles. The implementation of smart car security systems using face recognition can significantly reduce the number of vehicle thefts, enhancing public safety and minimizing the financial and emotional impact of these crimes. As face recognition technology continues to advance and costs decrease, we can expect to see this technology become increasingly prevalent in the automotive industry, transforming the way we secure and interact with our vehicles.

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