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Anti-Theft Recognition using Raspberry PI

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Abstract: *The Anti-Theft Face Recognition system using Raspberry Pi is a cost-effective and efficient security solution that combines facial recognition technology with the capabilities of the Raspberry Pi platform. This system aims to prevent unauthorized access and combat theft by utilizing a camera module to capture real-time images of individuals approaching a secured area. The captured images are then processed by a facial recognition algorithm, which compares them with a pre-registered database of authorized users. If a match is found, access is granted; otherwise, appropriate security measures can be implemented. The Raspberry Pi, a small-sized and low-power single-board computer, serves as the central processing unit for the system. Its GPIO pins enable the integration of a camera module for image capture. Open-source facial recognition algorithms, such as OpenCV, are utilized to perform the face identification and verification process. The system's key components include the Raspberry Pi board, camera module, facial recognition algorithm, database for storing pre-registered facial images, and a user interface for displaying captured images and system status. The system can be customized to suit various security scenarios, including access control in buildings, secure areas, or personal devices. The implementation of this system offers numerous advantages, such as affordability, flexibility, and scalability. The use of Raspberry Pi enables the integration of additional security features based on specific requirements. By leveraging the power of facial recognition technology and the accessibility of Raspberry Pi, the Anti-Theft Face Recognition system provides an innovative solution to enhance security systems and deter theft.*

Keywords: Security System, OpenCv, Raspberry Pi, Raspberry Pi Camera, Door Lock, Face Recognition

I. INTRODUCTION

The advancements in technology have made it possible to enhance security systems and provide efficient solutions to combat theft and unauthorized access. One such innovative solution is anti-theft face recognition using Raspberry Pi. This system combines the power of facial recognition algorithms with the affordability and versatility of Raspberry Pi, creating a cost-effective and reliable security solution.

The Raspberry Pi is a credit card-sized single-board computer that can be easily integrated into various projects. Its small size, low power consumption, and GPIO (General Purpose Input/Output) pins make it an ideal platform for building customized security systems.

Anti-theft face recognition using Raspberry Pi utilizes a camera module to capture images of individuals approaching a secured area. These images are then processed by a facial recognition algorithm, which identifies and verifies the person's identity against a pre-registered database. If the person's face matches an authorized user, access is granted; otherwise, appropriate security measures can be taken, such as sounding an alarm or sending notifications to the authorities.

The key components required to build an anti-theft face recognition system using Raspberry Pi include:

- Raspberry Pi board: It serves as the central processing unit for the system, running the facial recognition algorithm and controlling the overall functionality.
- Camera module: A compatible camera module, such as the Raspberry Pi Camera Module, is used to capture real-time images of individuals.
- Facial recognition algorithm: Various open-source facial recognition algorithms are available, such as OpenCV (Open Source Computer Vision Library), which can be used to identify and match faces.

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- Database: A database is used to store the pre-registered facial images of authorized users. The algorithm compares the captured image with the database to determine if access should be granted.
- User interface: An interface can be created using a monitor or web-based application to display the captured images, recognition results, and system status.

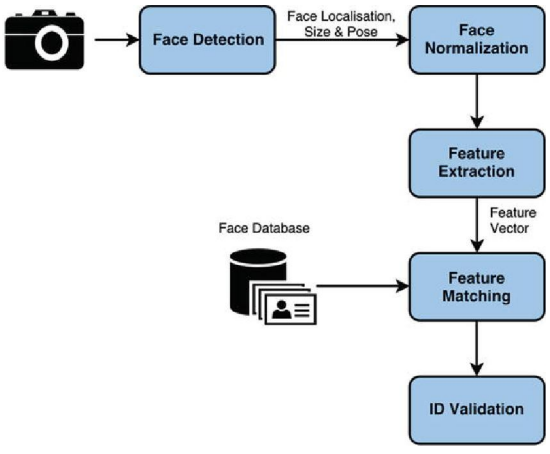
The anti-theft face recognition system can be customized to fit various scenarios. It can be used for access control in buildings, secure areas, or even personal devices. The integration of Raspberry Pi enables flexibility, scalability, and the possibility of incorporating additional features based on specific security requirements

In conclusion, anti-theft face recognition using Raspberry Pi offers an innovative and affordable solution to enhance security systems. It combines the power of facial recognition algorithms with the versatility of Raspberry Pi, providing an effective means of preventing unauthorized access and combating theft.

II. METHODOLOGY

- **Development of Database:** Database development is very essential step in this project. The different images of individuals will be taken in different angle, light intensity, expressions with their personal details like Name, Contact No., Date etc. This database will be used for comparing with the captured image of present person.
- **Image Capture:** Image Capturing is the first step in this project. The Camera will be placed inside the car which will cover whole area. This captured image will be processed for further operations.
- **Background Subtraction:** Background subtraction is one of the most common method in all detection techniques. Generally the background of a place remains static. Hence the background is subtracted only once in a set of image. For the purpose of accurate face detection we go for Background Subtraction Background subtraction is done for both the grey scale image as well as binary image. But most commonly the image is converted to grey scale and then the background is subtracted. This is done to get good accuracy in detecting faces.
- **Face detection and cropping:** The image after background subtraction is used for face detection. In face detection the face ofimages are marked with the help of rectangle or circle. The face detected after Background Subtraction is accurate as compared to the face detected from an image which is not background subtracted. The detected face is then cropped. Finally all the faces of individuals are detected and cropped from the image. Each cropped image is taken for comparison of images in the database
- **Face recognition:** Face recognition is used to identify the detected faces. There are many methods available for
- face detection. But the Eigenvalue method is the more suitable method. This method is more suitable because of its speed. Hence here we are going to Eigenvalue method to recognize the faces.

III. BLOCK DIAGRAM



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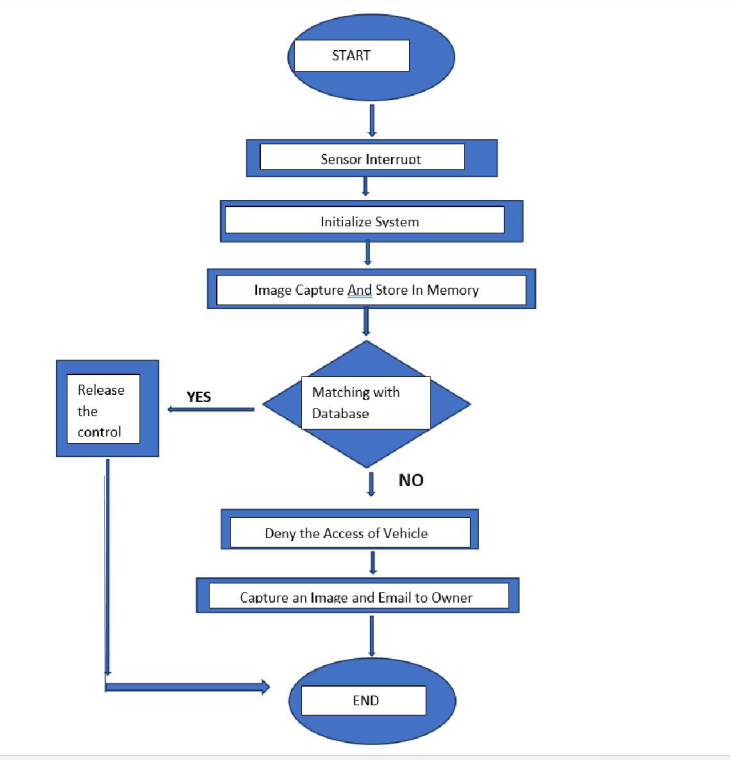
FLOWCHART



Application

Haar-cascade is an object detection algorithm used to locate faces, pedestrians, objects, and facial expressions in an image and is mainly used for face detection. In Haar-cascade, the system is provided with several numbers of positive images (like faces of different persons at different backgrounds) and negative images (images that do not face but can be anything else like a chair, table, wall, etc.), and the feature selection is done along with the classifier training using Adaboost and Integral images

Advantages

- It is easy to use as we do not have to do many hyperparameters tunning as compared to other algorithms.
- Adaboost increases the accuracy of weak machine-learning models.
- Adaboost has immunity from overfitting data as it runs each model in a sequence and has a weight associated with them.

Limitation

- We have seen the cascade performing very well, but there are several limitations of the haar cascade.
- High false-positive detection
- Less accurate than deep learning-based techniques
- Manual tuning of parameters.

Hardware Requirements

- Raspberry Pi
- breadboard
- Screen
- Buzzer
- Camera

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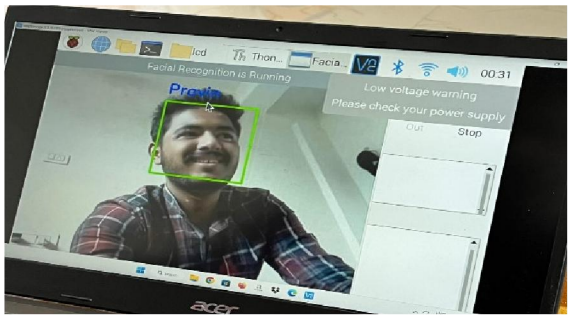
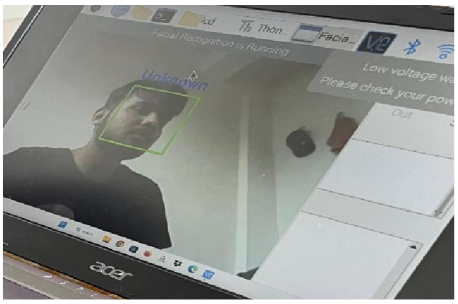
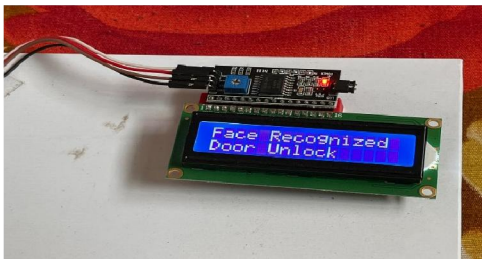
Software Requirements

- Python
- Open cv

IV. RESULTS







IV. LITERATURE SURVEY

Year	Title	Author	Problem statement
2015	Real-Time Face Recognition System Using Raspberry Pi	Priyanka Wagh, Jagruti Chaudhari	This paper proposes a real-time face recognition system using Raspberry Pi and OpenCV. The system uses Haar cascades for face detection and Local Binary Pattern Histogram (LBPH) algorithm for face recognition.The results showed that the system can recognize faces in real-time.
2017	Design and Implementation of a Smart Door Security System using Raspberry Pi	A. S. Kavitha and P. Sathya.	This paper proposes a smart door security system using Raspberry Pi and face recognition. The system uses the Eigenface algorithm for face recognition and a servo motor to control the door lock. The results showed that the system can accurately recognize faces and control the door lock.
2020	A Real-Time Face Recognition System using Raspberry Pi and OpenCV	S. Shafaei, R. K. Shukla, and M. S. Islam.	This paper proposes a real-time face recognition system using Raspberry Pi and OpenCV. The system uses Haar cascades for face detection and the LBPH algorithm for face recognition. The results showed that the system can recognize faces in real-time .

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V. CONCLUSION

Anti-theft face recognition using a Raspberry Pi project can provide a range of benefits, including increased security, improved efficiency, cost-effectiveness, customization, ease of setup, and versatility. By using facial recognition technology, the system can provide a highly secure means of authentication, reducing the risk of unauthorized access to the system or device.

Moreover, using Raspberry Pi as the platform for the project makes it affordable, customizable, and easy to set up, allowing users to tailor the system to their specific needs and preferences. Overall, anti-theft face recognition using Raspberry Pi can provide a reliable, efficient, and cost-effective solution for various applications, making it a valuable technology for individuals and businesses alike.

The arrangement of a facial recognition system using raspberry pi had used theoperating system that can make the system littler, lighter and work successfully utilizing lower control use, so it is more convenient than the PC-Windows based face recognition system. Also, it triggers the security alarm for unauthorized persons whose faces data doesn't match with the stored data inside its database. The main concern was to create a face recognition-based door access controlling system that would be able to identify knowing persons with their ID, then it will give access to known persons and alarm for the unknown one

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