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Face Recognition Based Metro Pass Authentication

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ABSTRACT: In an age filled with rapid technological development, incorporation of human facial recognition systems is revolutionising the conventional approaches to metro pass validation. By using a system that recognises faces, this study suggests a novel way to improve the efficiency and safety of the metro pass authentication. The system does not require actual passes or tokens because it employs deep neural network methods to accurately detect passengers. The three primary parts of the suggested system includes of facial comparing, picture extraction of characteristics, and identification of faces. The method guarantees robustness to various environmental elements, including variations in stance, occlusions, and lighting. Secure data processing procedures and adherence to legal requirements also help to address privacy issues. By providing easy and secure access to metro services, this system's installation enhances user satisfaction overall and guarantees effective transportation operations.

KEYWORDS: Face detection, Face recognition, Alert mechanism.

I. INTRODUCTION

Modern technology has made it more difficult for traditional ways of identity verification to function in today's world metro stations which are important hubs for local transportation are not exempt from these difficulties using physical metro passes and ID cards is not only inconvenient but also vulnerable to problems like fraud and impersonation which can jeopardize the security and legitimacy of the pass and card verification. Face recognition technology, like a skilled detective, sifts through the crowd, identifying faces with pinpoint accuracy. It's like having a super-smart brain that instantly recognizes people by their distinct facial features. This technology dives deep into the nuances of each face, unravelling the mysteries that make each person unique. In the following section, we'll peel back the layers to reveal the secrets behind its incredible abilities. Think of it like a journey through a bustling city each step revealing a new aspect of face identification by spotting faces in the crowd then carefully pick out the distinctive features that make each person special along the way well explore tried-and-true methods like eigen faces which simplify the complexity and cutting-edge techniques like convolutional neural networks CNN's which dive deep into the details like a detective solving a mystery.

II. RELATED WORKS

By examining several earlier similar works a new functioning technology is offered by taking into account the issues that travellers at metro stations experience.

From Paper [1], from the initial days to the most recent advancements, the intriguing background of identifying people is explored in this paper. It reveals the prospect of nearly limitless invention and utilises with a sharp eye towards the future. In the study of Ainampudi Kumari paper [2], as images and videos flood our digital landscape, the need for smart systems to evaluate data skyrockets. Automated facial recognition is crucial for tasks like identification, appearance assessment, and humancomputer interaction, bridging the gap between humans and machines. This study delves into improving facial recognition algorithms and their real-world applications, leveraging tools like OpenCV and Python libraries to enhance image quality and accuracy.

In the referred paper [3], in today's world, face identification has become more vital with its applications spanning across industries governments and everyday life offering immense benefits to society this ground breaking technology which pinpoints individuals through their unique facial features employs a spectrum of techniques ranging from analysing specific features to consider the whole face with research in this field accelerating driven by global developments there's a pressing need to assess and contrast various algorithms this paper sets out to provide a thorough examination of the literature from the last decade honing in on holistic approaches to face detection shedding light on its evolution and future possibilities.

In the study of paper [4], faces emerge most frequently in our day-to-day experiences and they build a tapestry of visual memories throughout our lives because the human face is multidimensional facial recognition. The capacity to recognise and identify people based on their facial features relies on intricate mathematical computations with a variety of application areas in mind this project aims to improve facial recognition systems even while existing methods have been created they frequently have low accuracy and a high false alarm rate which makes the development of more accurate and efficient systems necessary particularly in light of the growing security concerns and widespread use of mobile devices this paper explores the development of a face recognition system with python and the OpenCV library highlighting the need of sharing health data with healthcare practitioners for personalised and informed decision-making.

In the study of paper Ping Zang [5], We presented a method in our work that uses Python's PCA (principal component analysis) and Two-Dimensional PCA (2DPCA) to identify faces. We chose Python since it's easy to obtain and free, even though many researchers use MATLAB. In addition, Python has some excellent libraries that we may use to solve recognise faces problems, such as OpenCV, PIL, and Scikitlearn. Python is lighter and executes programmes more quickly than MATLAB, thus working with big datasets won't slow it down. Using the EIF-I and Facial 94 data bases, we tested our approaches and discovered that 2DPCA outperformed the others, particularly with the Face 94 database.

In the study of paper [6], detecting and recognizing faces in videos is like solving a puzzle in a race against time in our study we introduce a fresh approach to this challenge using three speedy cascade face verification modules and a special ensemble classifier first we check if a person's head passes through three verification stages checking the skin symmetry and eyes these steps help filter out faces that aren't facing forward or are obscured only the clear front-facing images make it to the next stage then we use three different sets of features to recognize faces combining them with a clever ensemble classifier our experiments showed that even in low-quality videos we can detect frontal faces with up to 95 accuracy plus our ensemble classifier boosts the overall face identification accuracy and reliability making our system even more effective.

III. BLOCK DIAGRAM AND METHODOLOGY

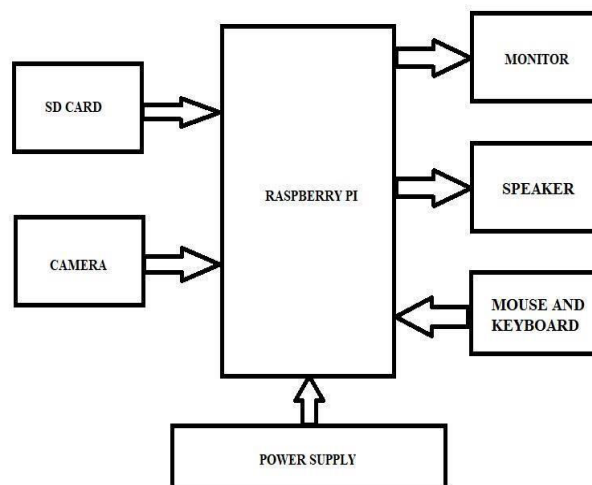


Fig 1: Block diagram of proposed methodology

Fig 1 shows the block diagram of the proposed system. The hardware and software components are as follows. Picture the Raspberry Pi as a clever photographer, ready to snap live video using its connected camera and tools like Open CV. As it continuously grabs frames from the camera feed, it's like taking a series of snapshots. Now, imagine it's on the lookout for faces, just like a detective scanning a crowd. It uses a special algorithm, like MTCNN, to spot faces in the snapshots. Once it finds a face, it's like zooming in and capturing its unique features, almost like making a sketch. Then, these features are compared with those of authorized people to see if they match, just like checking IDs at the door. Imagine setting a standard for how much a face needs to resemble an authorized person's face to get into the metro station. If the face passes this similarity test, it's like getting the green light to enter. But if it doesn't match up, it's a red flag, and an alert goes off. This alert isn't just a silent alarm—it's like a loudspeaker announcing that someone's

trying to sneak in. This way, not only are unauthorized entries prevented, but the metro station staff are also quickly informed to take action.

IV. HARDWARE COMPONENTS

1. Raspberry Pi



2. SD Card (16 GB or Higher)



3. Camera





4. Speaker



5. Power Adapter



6. Python



7. PyCharm Editor



8. OpenCV



9. Dlib

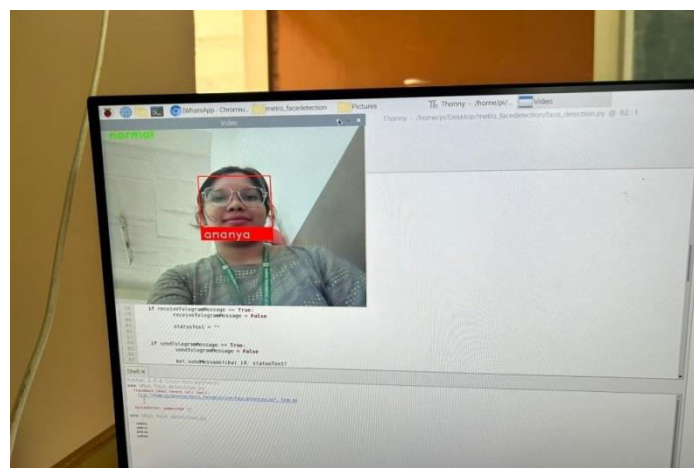


V. RESULTS AND DISCUSSIONS

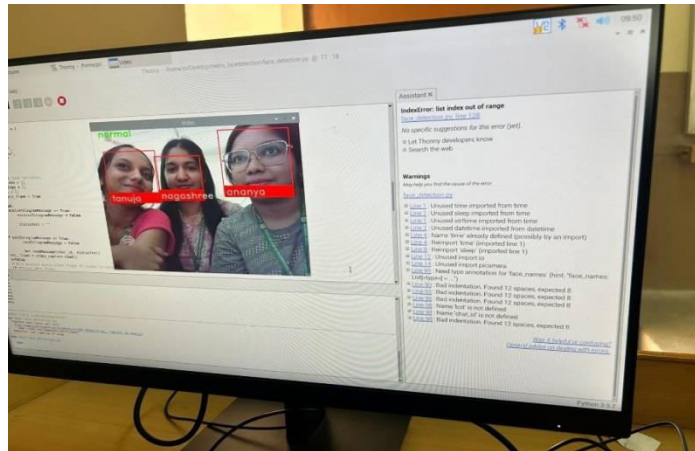
The camera has been connected to Raspberry Pi and has been set it up with the Raspberry Pi OS.



Recognized face

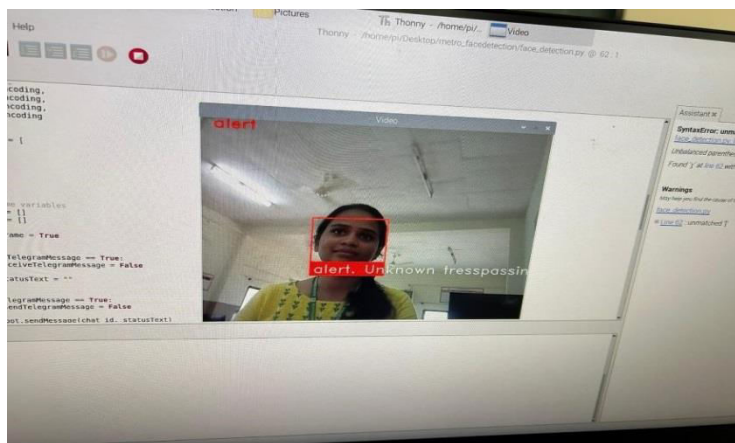


single face detected at once



Multiple faces detected at once

Unrecognised face



Unrecognised face with alert sound

The faces have been successfully detected by employing the algorithms and coding that had been integrated into the Raspberry Pi board. This process led us to achieve the final result by recognizing the known person and when an unauthorized person is detected, an alert sound is played through a connected speaker.

VI. CONCLUSION

In wrapping up introducing a face recognitionbased metro pass authentication system brings exciting prospects for boosting safety and efficiency in metro travel. With cutting-edge facial recognition technology at its core, the project promises a convenient and dependable authentication experience, doing away with the need for traditional cards or tokens. Moreover, it holds the potential to make commuting smoother, curb fraudulent behaviour and make the journey more pleasant for everyone. Yet its crucial to keep testing, refining, and ensuring privacy regulations compliance to make sure that users embrace and trust the system fully.

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