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Automatic Payment Using Face Recognition System

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ABSTRACT- This abstract introduces an innovative system for automatic payments using face recognition, eliminating the need for traditional payment cards. In this proposed system, users authenticate transactions by presenting their faces to the recognition system, prioritizing Face ID for its effectiveness in identification. The technology relies on advanced biometric techniques, including OpenCV for image processing, Haar Cascade Classifier for face detection, and Local Binary Pattern for facial recognition. Upon successful face verification, the payment is automatically processed, streamlining transactions, and eliminating the necessity for physical payment cards and PINs.

The system continually refines its accuracy through model training based on successful face recognition instances. This forward-looking approach not only enhances security but also provides a convenient and efficient alternative to traditional payment methods, offering a glimpse into the future of seamless and secure financial transactions.

KEYWORDS- Haar cascade, OpenCV, Machine learning, Eigen Faces, Fisher Faces.

I. INTRODUCTION

An Automatic Payment System (APS) is a computerized mechanism that enables automatic payments and other banking transactions. As more financial users depend on APS for their banking activities, it becomes crucial to implement secure measures against criminal activities and unforeseen events. Despite continuous advancements in science and technology, APS security remains a constant concern. The traditional APS model, which relies on cards and PINs, has vulnerabilities such as card theft, statically assigned PINs, card duplication, and other potential risks. PIN hacking and fraudulent activities like eavesdropping, spoofing, brute force attacks, and user blackmail add even more security challenges for financial institutions. To address these issues, the proposed project is to develop an "Automatic Payment System Security System based on Face Recognition, PIN, and OTP." The system will integrate conventional security features like Personal Identification Numbers (PIN) with more advanced elements such as face recognition and one-time passwords (OTPs). The database will store comprehensive information about a user's account details, facial images, and mobile numbers, significantly enhancing overall security measures.

II. LITERATURE REVIEW

A. P. Jonathon Phillips, paper:

An Introduction to the Good, the Bad, and the Ugly Face Recognition Challenge Problem, presents the Good, the Bad, and the Uglychallenge Problem which aims to promote the development of robust algorithms for recognizing frontal faces captured outside of studio-style image collections. The GBU Challenge Problem consists of three partitions that highlight the range of performance possible when comparing faces photographed under these conditions. This structure allows researchers to focus on the challenging aspects of the problem without compromising the performance on the easier aspects.

B. *Yaniv Taigman'spaper:*

*Deep Face: Closing the Gap to Human-Level Performance in Face Verification*demonstrates that combining a 3D model-based alignment technique with large-capacity feed-forward models can effectively overcome the limitations of previous methods. By learning from many examples, this approach has shown significant improvement in face recognition and has the potential to become significant in other vision domains as well.

C. *InAndrew Wagner's paper:*

*Toward a Practical Face Recognition System: Robust Alignment and Illumination by Sparse Representation*the system achieves extremely stable performance under a wide range of variations in illumination, misalignment, and even under small amounts of pose and occlusion. We achieve very good recognition performance on large-scale tests with public data sets and our practical face images while using only frontal 2D images in the gallery and no explicit 3D face model. Our system could potentially be extended to better handle large poses and expressions, either by incorporating training images with different poses or expressions or by explicitly modeling and compensating the associated deformations in the alignment stage.

III. PROPOSED SYSTEM

A. Motive:

The purpose of this text is to present an up-to-date review of the literature on facial recognition and highlight the advancements in computer vision technology for recognizing human faces. A facial recognition system is a computer program that automatically identifies or verifies someone from a digital image.

B. Goal of the system:

Object detection is a process of identifying and locating all the occurrences of a particular object class, such as people, cars, or faces in an image. Usually, only a few instances of the object are present in the image, but some numerous potential locations and scales require exploration.

C. Problem Definition:

Nowadays, ATM cards are easily susceptible to hacking and fraud. To combat this issue, we are in the process of developing a face-unlocking transaction system that utilizes image processing. The user's face is first captured and stored in the system's dataset. Following this, a model training operation is performed with the help of ML algorithms, which grant permission for transactions to take place.

D. Objectives:

The main objective of object detection is to identify and locate all the occurrences of an object from a known category, such as human beings, cars, or faces in a given image. Typically, the number of instances of the object present in the image is relatively small, but there is a vast number of potential locations and scales at which they can occur, and they need to be thoroughly explored. Each detection is accompanied by some form of pose information. This information could be as straightforward as the object's location, its location, and scale, or the extent of the object defined in terms of a bounding box.

E. Scope of the work:

The study aims to investigate how age impacts the accuracy of a face biometric system. Additionally, it seeks to evaluate the available face biometric technology on PDAs and laptops. The study is significant for prospects as it will allow recognitionof faces at different ages. This will be particularly helpful as a person's face changes as they age, and the system can detect the face at a specific age.

IV. METHODOLOGY

The Haar Cascade algorithm is a commonly used object detection algorithm that can be used to detect faces in real-time video streams or images. It uses features proposed by Viola and Jones, such as edge or line detection, to identify objects. This algorithm is based on machine learning principles, where a classifier is trained using a vast dataset of positive and negative images. The Haar Cascade algorithm recognizes that not all parts of a face are equally essential for face recognition. Certain facial features such as the eyes, nose, cheeks, and forehead play a more critical role in distinguishing one face from another. The algorithm focuses on areas of maximum change or variation between these features. For example, there is a significant change from the eyes to the nose and from the nose to the mouth. When dealing with multiple faces, the algorithm compares these key areas across faces to differentiate them effectively. This approach is like the Eigenfaces recognizer, which examines all training images as a collective entity to extract relevant and useful components while discarding irrelevant ones. By identifying and focusing on the areas with the most significant variation among faces, these algorithms can effectively differentiate between different individuals.

In this study, we utilized machine learning algorithms to create a face recognition system that automatically processes payments. Initially, we explain the significance of facial recognition in this context and highlight its role in improving security and convenience in payment transactions. Our approach involved using various machine learning algorithms that were specifically tailored to the task. We utilized supervised learning algorithms, such as Convolutional Neural Networks (CNNs), which have demonstrated superior performance in facial recognition tasks due to their ability to learn intricate patterns from labeled training data. Furthermore, we employed unsupervised learning techniques for feature extraction, which enhanced the robustness of the models. The training process began with the selection of appropriate datasets comprising diverse facial features, which were preprocessed to ensure consistency and enhance model generalization. Hyperparameters were carefully tuned, and optimization techniques such as grid search and cross-validation were applied to optimize model performance. The training procedure entailed multiple epochs with meticulously chosen batch sizes, executed in a high-performance computing environment to expedite convergence. To assess the models' performance rigorously, we employed evaluation metrics such as accuracy, precision, and recall. To validate our approach, extensive validation and testing procedures were conducted, comparing our models' performance against established benchmarks. Additionally, we addressed ethical considerations such as privacy, bias mitigation, and societal implications thoroughly. Despite the effectiveness of our approach, we acknowledge certain limitations, such as dataset biases and computational constraints, which warrant further investigation. In conclusion, our methodology establishes a robust framework for training face recognition models in automatic payment systems. We emphasized the importance of employing diverse machine-learning algorithms and rigorous evaluation protocols to ensure efficacy and ethical integrity.

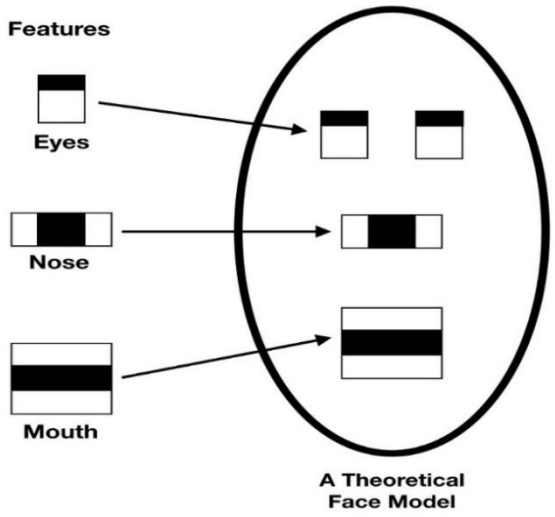

Figure 1: Haar Cascade Representation

A. System Architecture:

- ***Face Detection:***

This module detects and locates faces within the camera's view. The ATM software manages transactions and interacts with the facial recognition system and user interface.

- ***Transaction processing:***

If the user is successfully authenticated, the ATM software proceeds with the requested transaction, such as cash withdrawal or balance inquiry.

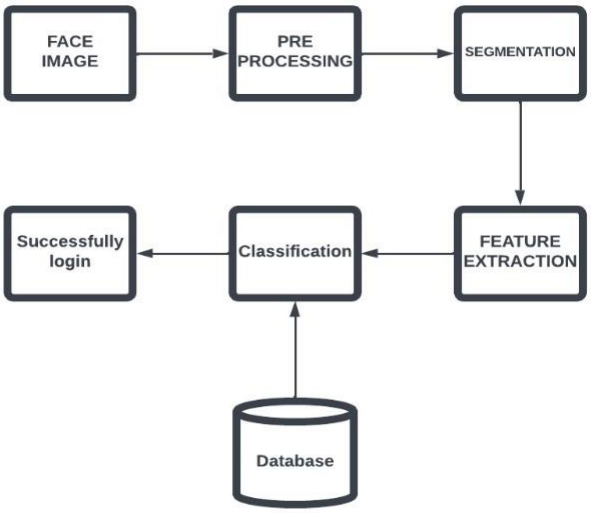

Figure 2: System Architecture

V. IMPLEMENTATION PLAN

The proposed implementation begins with establishing the system architecture, comprising hardware and software components. Key to this architecture is the selection and integration of an efficient face detection algorithm, such as Viola-Jones or Convolutional Neural Networks, ensuring real-time performance. Integration with secure payment gateways like PayPal or Stripe, alongside custom payment APIs, forms the backbone of the payment processing module, emphasizing secure transactions and user authentication protocols. A robust database management system is implemented to store user profiles, transaction history, and other pertinent data, prioritizing encryption, backup, and scalability. User interface development encompasses intuitive interfaces for customers and merchants alike, facilitating seamless account registration, profile management, and access to transaction records. Rigorous testing under varying conditions ensures the system's accuracy and reliability, with particular attention to security and privacy measures, including encryption protocols and compliance with GDPR and PCI DSS regulations. Deployment in real-world scenarios is accompanied by ongoing maintenance and updates, with future enhancements and research avenues considered for continuous improvement.

A. Model Training:

A diverse dataset of images containing faces and payment information is collected to train a model for automatic face detection payment. After preprocessing the data, an appropriate model architecture is selected based on factors such as accuracy, speed, and resources. The dataset is split into training, validation, and test sets, and the model is trained using optimization techniques like stochastic gradient descent (SGD) or Adam optimization with data augmentation. Evaluation metrics guide the improvement of the model's architecture and training parameters.

B. Model Testing and Evaluation:

Testing and evaluating the face detection model is crucial to ensure its effectiveness and reliability in automatic payment systems. The model is rigorously tested against various datasets that simulate real-world scenarios, assessing its ability to identify faces across different lighting, angles, and facial expressions. Evaluation metrics such as precision, recall, and F1-score are used to measure performance and adjust the model's parameters and architecture. User feedback and real-world scenarios further refine the model to meet accuracy and reliability standards for practical implementation in payment systems.

C. Graph

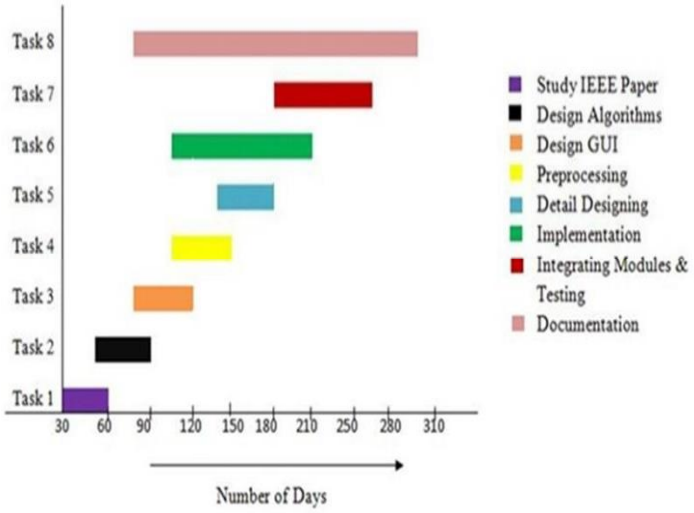

Figure 3: Model Training

VI. RESULT

This paper proposes a system that uses biometric face recognition for all kinds of payments. This means that users who want to make online payments won't need to use debit or credit cards. Instead, they can use facial recognition to authenticate their transactions. This system is not only more secure but also easier to use. To access the system, an authorized person's identity must be verified. If the identity is verified and the buffer value is up to 3.5e+04, the account will be accessed. The buffer value is a range of values that can be used to ensure the security of the system. If an unauthorized person tries to access the account by submitting their face for verification, the buffer value (min and max values) will exceed 4.0e+04, and the account will not be accessed. This ensures that the system is highly secure and that only authorized persons can access their accounts.

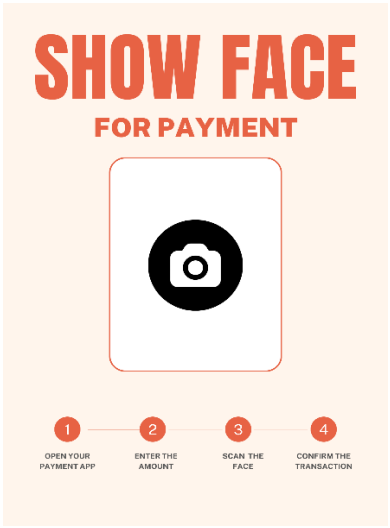

Figure 4: Result

VII. CONCLUSION

The primary objective of this project is to create an automated system with a specific emphasis on automatic payment functionalities and security measures.

In this project, we are developing a system where the user's face is detected. After the detection, the system grants permission to proceed with the transaction or the next process.Facial recognition has proven to be one of the most secure methods of all biometric systems to a point for high-level security to avoid scams and robberies and provide security for payment gateways.

Face recognition payments create a unique code for the image that can be used if the recognition is down or any other issue arises. With new and improved techniques in the field of artificial Intelligence that help eliminate more disturbances and distortions, the rate of effectiveness of the system can be improved.

CONFLICTS OF INTEREST

The authors declare that they have no conflicts of interest

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