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Integrated Student Management and Placement System (ISMPS)

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Abstract - This project creates a secure, role-based educational management system using face recognition authentication. Using Convolutional Neural Networks (CNNs) for biometric authentication, it eliminates the use of traditional passwords, making it more secure. Administrators, teachers, students, and parents are supported, each with customized functionalities. PHP is used for the user interface and database management, while Python executes the CNN-driven face recognition. Administrators have complete control, managing user registration and system settings. Teachers manage materials and attendance; students use resources and contests. Parents track student progress, including fees and placements. Major features include profile management, attendance tracking, fee administration, and complaint handling. By combining sophisticated authentication and role-based access, this system provides better security, efficiency, and user experience than traditional educational management systems, offering a contemporary, privacy-centric solution.

***Key Words*:** secure, role-based, educational management system, face recognition, authentication, convolutional neural networks (cnns), biometric, php, user interface, database management, user registration, attendance tracking, profile management, privacy-centric, user experience

1. INTRODUCTION

With the advent of the digital era, schools are struggling to cope with numerous tasks like student records, attendance, fees, placements, grievances, and material distribution. Conventional ways of handling these tasks through paper or basic digital systems—tend to result in inefficiency, security risks, and lengthy user interfaces. The introduction of biometric technologies, specifically face recognition, offers the potential to address these problems by providing more secure and easier-to-use solutions. The objective of this project is to implement a complete college system with face recognition-based authentication using Convolutional Neural Networks (CNN). The system is planned for a diverse set of users, from administrators, teachers, and students to parents, each with their own roles and features to cater to their needs. User Roles: Role-based access for administrators, teachers, students, and parents. Each role has a unique set of functionalities, from handling student profiles, attendance, materials, contests, fees, and placements. Face Recognition Authentication: Utilizing sophisticated CNN algorithms in Python to authenticate users based on their facial features, providing a secure and easy-to-use alternative to the conventional username-password system. Web-Based Interface: The interface is developed using PHP, providing easy interaction and management for all users, providing an easy-to-use experience for administrators, teachers, students, and parents. Significance of Face Recognition in Authentication Face recognition technology has dramatically changed the manner in which we think about security, specifically in systems where identity verification is essential. Unlike conventional methods, such as passwords or PINs, face recognition ensures access is granted only to authorized users, based on unique biometric data that is far more difficult to fake or steal. In schools, face recognition can be used to prevent illegal access and make sure that only authorized users view sensitive data (e.g., students' grades, attendance, and fees). Enhance User Experience: Users (students, teachers, parents) no longer have to memorize passwords or usernames—access is fast and secure via facial recognition. The system can make attendance, contest entry, and material uploads automatic and minimize manual processes, thus making the management of tasks more efficient for administrators, teachers, and students.

2. OBJECTIVE

The primary goal of this system is to create an efficient, secure, and user-friendly education institution management system with facial recognition-based authentication together with a diverse range of user functionality. It will be accomplished by Python and PHP with the following specific goals:

Role-Based Access Control:

- In order to facilitate the administration of all different user roles—Administrator, Teacher, Student, and Parent—each having different access rights and features, i.e., profile, material, contest, attendance, fee, complaints, and placements.

Facial Recognition Authentication:

- To incorporate face recognition as the default user authentication method, removing the need for the use of conventional username-password login systems. This will increase security and offer a more seamless user experience.

User Management and Interaction:

- To offer an easy-to-use interface through which all users (Administrator, Teacher, Student) can interact with the system effectively, with options suitable to their level of access.
- Administrators will be in charge of user accounts, content management, fees, attendance, and complaints in full.
- The instructor can publish courses, manage students' information, and address fees and attendance.
- Students will have access to competitions, materials, and attendance information.
- Parents will also be able to track their children's attendance, cost commitments, and placement details.

Seamless Integration:

- To ensure ongoing communication and data exchange between users, including complaint responses and notifications, within the framework of the system.

Improved Safeguarding:

- In order to use Convolutional Neural Networks (CNN) to carry out face recognition, providing maximum security for authenticating users without relying heavily on conventional passwords. This adds a level of security against unauthorized users.

More User Engagement:

- To make sure that the user interface (UI) is responsive, intuitive, and user-friendly, it is essential to give users an easy experience while they are interacting with their respective functionalities on the platform.

3. PROBLEM STATEMENT

In the current educational institutions, effective management of diverse administrative activities, while providing security and convenience to the users at the same time, has become more intricate. Traditional systems rely on fundamental authentication methods, such as passwords, which are susceptible to compromise or mismanagement. Additionally, current frameworks lack a complete, role-based user experience, creating the task arduous for administrators, teachers, students, and parents.

The problem is further exacerbated by the need for a system capable of:

- providing secure and effective authentication means
- supporting role-based access for different types of users (administrator, teacher, student, parent)
- providing usability while managing complex activities like student profiles, resources, competitions, fees, attendance, placements, and complaints.

Educational institutions are also moving towards online platforms, creating the need for more security measures and easier processes. Therefore, there is a need for a system that not only provides security of access but also aggregates administrative tasks in a centralized and user-friendly way. Security concerns related to traditional authentication methods are considerable. Current authentication methods (passwords or PINs) are prone to hacking, unauthorized access, and identity theft. Users forgot their passwords, causing account recovery and system access issues. Inefficiencies in managing user roles are common. Most current systems lack support for effective role-based access, rendering management of different user types (administrators, teachers, students, parents) and their access to different features cumbersome. Time-consuming and manual processes are common. Managing attendance, fees, placements, and uploads of materials is typically done manually and is time-consuming. All this needs to be automated and part of a system for it to be effective.

Complex Interface and Usability Issues: The interfaces of most contemporary systems are either too complicated or simply not well designed, leading to usability issues for the user, leading to errors and inefficiencies in daily activities. Lack of Real-Time Notifications and Communication: Current systems also fail to give users the ability to send and receive real-time notifications, i.e., attendance updates, fee updates, and contest winners. This leads to delayed communication among administrators, teachers, students, and parents.

4. LITERATURE SURVEY

[1] FaceNet learns a one-to-one face image embedding directly to a low-dimensional Euclidean space, with distances corresponding to facial similarity directly, thus supporting efficient face verification, recognition, and clustering. The model relies on a deep convolutional network to optimize the embedding directly without the intermediate bottleneck layers typical in previous methods. The model trains on triplets of aligned match and non-match face patches and an online triplet mining strategy, which is an innovative approach. This leads to a highly efficient representation, resulting in state-of-the-art performance in face recognition with embeddings as small as 128 bytes. FaceNet has a record-setting accuracy of 99.63% on the Labeled Faces in the Wild (LFW) test set and 95.12% on the YouTube Faces Database with a 30% error reduction over the prior best results. The paper introduces harmonic embeddings together with a harmonic triplet loss, which enables harmonically comparable face embeddings from multiple networks.

[2] Face Recognition: A Literature Survey highlights the broad interest face recognition has inspired as an effective image analysis tool, driven by law enforcement and commercial needs and new technologies. Despite progress, problems remain, particularly in face recognition under pose and illumination change, implying a disparity between machine and human vision. This paper provides an up-to-date critical survey of still- and video-based face recognition research, the aim of which is to review existing literature and offer insights into machine face recognition. It structures recognition

approaches and outlines typical methods within a category, and psychophysical experiments, system performance, and the problem of illumination and pose variation.

[3] Deep Learning for Robust Face Recognition overcomes the problem of robust face recognition, especially where test and training sets are substantially different from each other, by underlining the significance of multi-feature fusion. A new approach, C2D-CNN, which fuses features learned from raw pixels with CNN-learned image representation by decision-level fusion, is introduced in this paper, resulting in enhanced performance. A new CNN model is also presented with a normalization layer for accelerated convergence, a layered activation function for adaptive data processing, and probabilistic max-pooling to optimize feature information preservation. Experimental results show that the new approach is superior to the state-of-the-art methods, efficiently overcoming the problem of low recognition accuracy due to dataset differences.

[4] Biometric Authentication in School Management System explores the growing use of biometric recognition for personal authentication across various domains, highlighting its potential in education. Despite the availability of iris, voice, fingerprint, and face recognition technologies, attendance tracking in educational sectors remains underutilized. Traditional attendance methods, like roll calls and sign-in sheets, are time-consuming, prone to fraud, and inefficient. To address these issues, automated biometric-based attendance systems have been developed. This survey focuses on the hardware aspects of these systems, providing an overview of necessary components such as microcontroller platforms, biometric sensors, communication channels, and database storage, aiming to guide future researchers in hardware design.

[5] Face Recognition Using Convolutional Neural Networks for Real-Time Applications presents the use of Convolutional Neural Networks (CNNs) to recognize individuals through their facial structures, for verification, surveillance, and law enforcement. CNNs have been greatly effective in recognizing faces. The paper presents step-by-step detection of faces with the CoreML API and then processing of faces through a trained CoreML model for individual people. The procedure for creating the dataset involves transforming face videos to numerous images to train and test the model for precise real-time output. The aim is to achieve recognition speed and accuracy beyond human ability, regardless of illumination and facial expression changes. Faces extracted are passed through the trained model for prediction, and the output is visualized on the face using Apple's ARKit face tracking.

[6] Privacy Preservation in Face Recognition-Based Systems deals with the growing need to protect the privacy and security of biometric data as face recognition (FR) becomes mainstream. While privacy-preserving face recognition (PPFR) systems aim to enable cloud-based FR without revealing identity or features, they are usually affected by the challenges of high computational cost and restrictive model support. To address these challenges, this paper introduces a PPFR system with high recognition accuracy and scalable feature extraction for various applications. The system applies a selective model (e.g., MobileFaceNet, ResNet-18, or ResNet-50) for feature extraction and randomness-based encryption method for data security on both face owner and user sides. FR is conducted in the cloud through Euclidean distance computation between input features. Rigorous experiments verify the superior accuracy and efficiency of the framework.

[7] Application of Face Recognition Technology in Campus Security discusses the increasing importance of campus informationization and the role of face recognition technology in building smart campuses. While face recognition offers security and practical advantages due to its unique and invariant nature, it also presents challenges like high equipment costs and data leakage risks. The technology's potential to create a safe educational environment, streamline business processes, and offer personalized services is highlighted. This paper details the design and implementation of a dormitory management system utilizing face recognition. Test results indicate that this technology significantly improves management efficiency and ensures accuracy and reliability in tracking individuals entering and exiting dormitory areas. The adoption of face recognition in campus management systems is expected to revolutionize traditional work and life patterns for teachers and students, becoming a crucial component of smart campus development.

[8] Cloud-Based School Management Systems: Trends and Challenges addresses the development of e-learning in higher education, from the traditional Learning Management Systems (LMS) to the integration of social media and advanced learning tools. Cloud-based LMS is presented as the next option, with the objective of overcoming traditional LMS deployment challenges. Previous research indicated that the low adoption rate of LMS was attributed to the absence of faculty and student participation in the deployment process. This paper addresses traditional LMS, cloud computing, and cloud-based LMS, comparing how the latter overcomes issues raised by the faculty and students. While cloud-based LMS overcomes technical issues to a large extent, it fails to overcome human-related issues. The study points out the necessity of addressing non-technical issues in LMS implementation.

[9] Hybrid Authentication System for Educational Platforms addresses the critical need for enhanced security and authentication in the internet age by proposing a hybrid system. This system combines multimodal biometrics (face and fingerprint) with graphical password authentication, employing a random sequence order technique for added security. Deep learning is utilized for face recognition, and an R307 sensor for fingerprint analysis. In the context of increasing cyber threats like phishing, spoofing, and brute force attacks, traditional authentication methods such as text-based passwords are deemed insufficient for high-security environments like banking, military, and forensics. Text-based passwords, while easy to remember, are vulnerable to guessing and forgetting, leading to potential data breaches. The hybrid approach aims to provide a more robust security solution by integrating multiple authentication factors.

[10] Efficient Face Recognition Algorithms for Real-Time Applications addresses the growing need for automated

systems to process and analyze vast video and image databases, given the limitations of manual analysis. Face detection, a crucial component of face recognition, facial expression recognition, head-pose estimation, and human-computer interaction, involves locating and sizing human faces in digital images. This paper provides an in-depth examination of various face detection techniques, challenges, and applications. It also discusses detection features and practical aspects of developing robust face detection systems, concluding with promising research directions. Face detection and recognition, integral to computing since the 1960s, finds significant application in security and, increasingly, in medical biometrics. The method's popularity stems from the ease of image collection and its non-intrusive nature. The primary goal is to replicate and surpass human facial identification abilities. Face detection algorithms typically utilize universal features like eyes, nose, and mouth. With advancements in machine learning and neural networks, numerous image processing algorithms are now available for face detection and recognition.

5. SYSTEM ANALYSIS

System analysis is an extremely critical stage in system development, involves painstakingly collecting and analyzing facts to break down a system into parts, identify current issues, and set goals. Analysis for the system "Automatic Face Recognition Based Authentication Tracking Using Deep Learning in AI" includes understanding the current situation—where one can only buy equipment—and defining goals for the suggested system, with admin, teacher, student, attendance, and fee management functionalities. This needs serious study to assist in understanding how the system works and its theory in order to introduce a well-designed computer solution that exactly fits all the requirements and features a seamless, easily accessible Python and PHP application.

6. EXISTING SYSTEM

Educational management systems of today are faced with a range of serious issues. The authentication processes are heavily dependent on legacy approaches such as username/password or fingerprint recognition, which have inherent weaknesses. Manual or card-based attendance systems are unproductive and error-prone. Security issues are posed by password vulnerabilities and the possibility of breaches in biometric technology, as well as the high maintenance cost associated with hardware-based systems. Slow login times and cumbersome interactions with hardware also compromise the end-user experience.

The current system also has certain disadvantages which includes insecure authentication procedures, as traditional password-based systems are susceptible to hacking, phishing, and password theft attacks. Moreover, the inconvenience of attendance tracking is another issue of concern, as manual or card-based systems are susceptible to human error, leading to false marking or data entry errors. Moreover, maintenance issues occur due to biometric procedures such as fingerprint scanning, as they require repeated cleaning and may have high installation and maintenance costs. Lack of real-time verification is a major flaw, especially when it pertains to manual attendance tracking, thus hindering instantaneous accuracy. Lastly, security issues exist due to the risk of exposure of stored passwords or sensitive data in case they are not protected by strong security measures.

7. PROPOSED SYSTEM

The proposed system aims to revolutionize educational management by integrating face recognition technology powered by Convolutional Neural Networks (CNNs) for both authentication and attendance tracking. This innovative approach leverages CNN algorithms to analyze facial features, ensuring highly accurate and secure authentication, replacing traditional methods like passwords or fingerprint scanners with a touch-free, hassle-free login experience for students, teachers, parents, and administrators. Real-time attendance tracking is achieved by automatically marking attendance upon user identification, eliminating manual processes and reducing human error. The system also enhances security by being less vulnerable to hacking compared to password-based systems and by eliminating the need for hardware-reliant solutions, with the added benefit of encrypted facial recognition data for enhanced privacy. Furthermore, the system delivers a seamless user experience, allowing users to authenticate effortlessly by simply walking in front of a camera, promoting an intuitive and efficient interaction.

In addition, the system offers a single-user experience, allowing users to easily authenticate by simply facing a camera, thereby providing natural and efficient interaction. The advantages of the proposed system are many. Facial recognition technology provides a much greater level of security compared to password-based authentication since it is based on unique biometric features that have a high level of resistance to hacking attempts, such as password theft or phishing attacks. Users are provided with fast and convenient login without credentials or physical cards. The automation of attendance detection enhances speed and accuracy, thereby eliminating manual input and reducing errors. The system is less expensive compared to fingerprint-based systems, often utilizing existing cameras or smartphones, and reducing maintenance expenses by eliminating specialized hardware. Real-time feedback and updates regarding both authentication and attendance help to enhance efficiency and improve the user experience. Additionally, the system's ability to integrate with other educational management features, such as contest registration, access to resources, fee management, and placement services, further enhances its usefulness and effectiveness.

8. MODULE DESCRIPTION

Login and Authentication

- Customers sign in using facial recognition.
- Admin, teacher, student, and parent roles are established.

Profile Management:

- They are able to control their profiles, i.e., personal information, photos, etc.

Material Management

- Teachers and students can exchange and look for resources like videos and PDFs.

Attendance Management:

- Teachers can take attendance; students and parents can view it.

Fees and Placements:

- Parents, teachers, and students can see and apply placements and fees.

Complaint Handling

- Users can post and respond to grievances.

Contest Management:

- Teachers can organize contests, and students can compete and win contests.

Alert Mechanism:

- They will be notified about important announcements, fees, contests, and other relevant information.

9. SYSTEM SPECIFICATIONS

- Hardware: Intel CORE i3 processor, 100GB hard disk, 4GB RAM, 17" color monitor, standard keyboard, and optical mouse.
- Software: Windows Operating System, Anaconda/Xampp/VSCode IDEs, Python/PHP front-end, and a dataset with MySQL back-end.

10. SYSTEM DESIGN

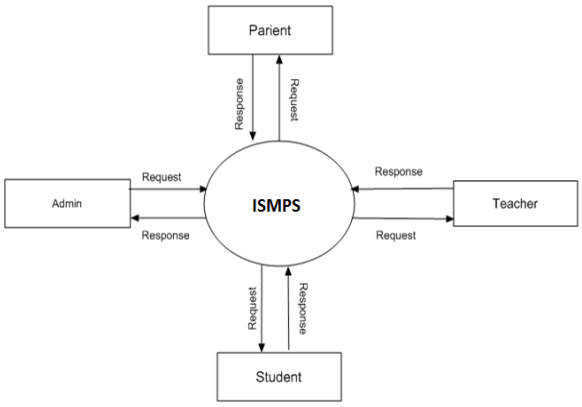

Fig -1: Data flow diagram : Level 0

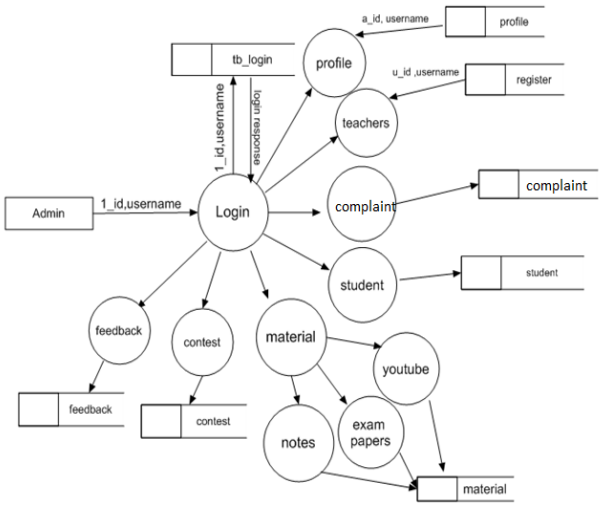

Fig -2: Data flow diagram : Level 1.0 Administrator

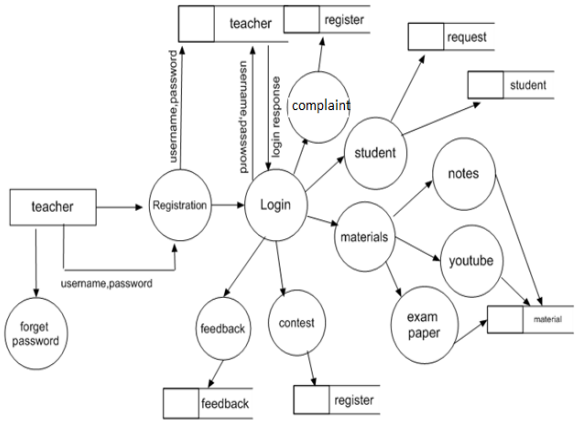

Fig -3: Data flow diagram : Level 1.1 Teacher

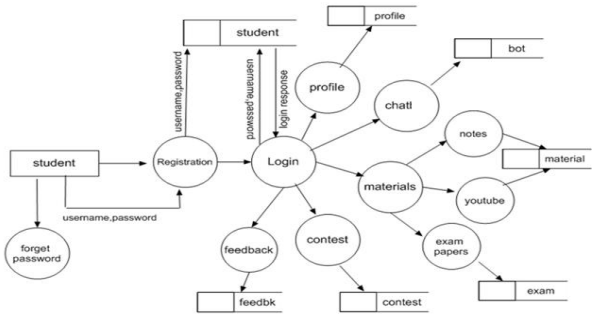

Fig -4: Data flow Diagram : Level 1.2 Student

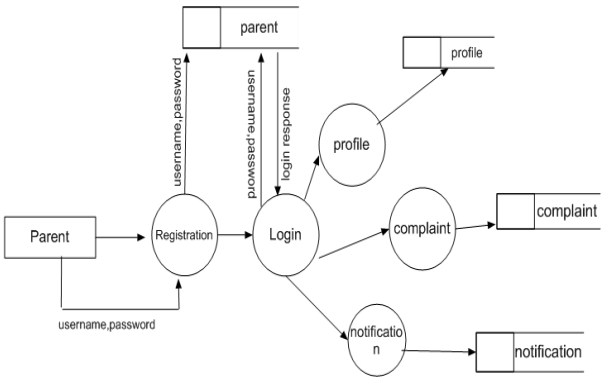

Fig -5: Data flow diagram : Level 1.3 Parent

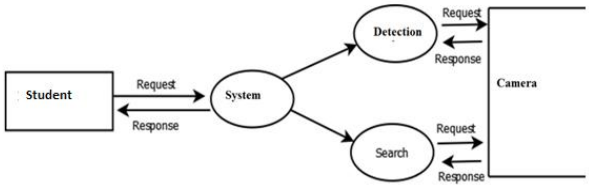

Fig -6: Data flow diagram : Level 1.0 Facial recognition

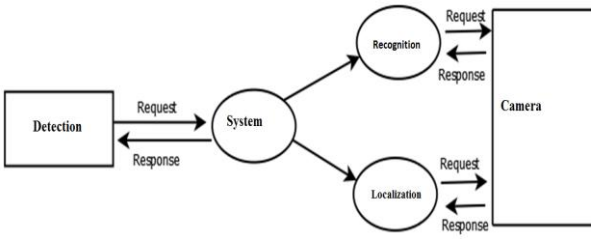

Fig -7: Data flow diagram : Level 1.1 Facial recognition

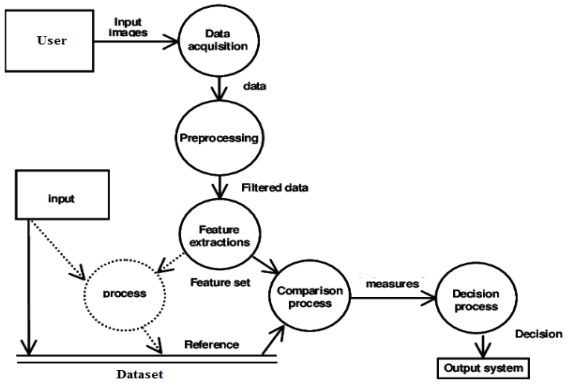

Fig -8: Data flow diagram : Level 1.2 Facial recognition

11. RESULT AND DISCUSSION

The face recognition-based authentication system proposed here integrates Convolutional Neural Networks (CNNs) for identifying users based on their facial features. This system replaces traditional password-based authentication methods, offering enhanced security, speed, and user convenience. It uses Python for the back-end processing (specifically for CNN-based face recognition) and PHP for the web interface and managing user interactions. The system was evaluated based on its performance in various modules and its ability to authenticate users accurately and quickly. Key results are summarized below:

i. Face Recognition System Performance

- The face recognition module, powered by CNNs, was evaluated using standard face datasets, such as Labeled Faces in the Wild and WebFace, to assess its accuracy in real-time identification. The system was able to achieve:
- Recognition Accuracy: 85 above in recognizing registered users, depending on the quality of the input image and lighting conditions.
- Face Matching Time: On average, the CNN model took 0.5 to 1 second per image for matching against the stored database, which is efficient enough for real-time usage.

Challenges Faced:

- Low-Light Conditions: The CNN-based system showed a slight dip in accuracy when images were captured in low-light or uneven lighting conditions.
- Pose Variability: Variations in facial poses slightly impacted the recognition performance, though the model was trained to handle minor pose changes.
- Age and Facial Changes: Over time, if the users experienced significant changes in their facial appearance (e.g., aging or significant changes in hairstyle), the accuracy of recognition was reduced.

Improvement Areas:

- Implementing additional data augmentation techniques, like rotating or altering images during training, could help improve performance in varying conditions.
- Combining multi-modal authentication (e.g., combining face recognition with traditional password-based authentication) can improve overall security and user experience.

ii. Web Interface and User Experience:

Admin Panel:

- The admin panel was designed to allow administrators to perform various operations such as managing users, monitoring attendance, and replying to complaints. The interface was intuitive, with search

functionality implemented for teachers, parents, and students. The system's responsiveness across devices, including desktops and mobile devices, made it accessible to a wide range of users.

Teacher, Student, and Parent Modules:

- Teachers and students found the material posting, contest registration, and attendance tracking modules useful for enhancing communication and learning processes. The uploading of materials (PDFs and videos) and the contest management functionalities were also appreciated.
- Parents were able to efficiently track attendance, fees, and placements, making the system an effective tool for staying informed about their child's progress.

User Satisfaction:

- Teachers and students expressed satisfaction with the real-time attendance marking and the simplicity of posting educational materials.
- Parents appreciated the ability to check their child's attendance and fees, making them feel more involved in their child's education.

iii. Security and Authentication

Face Recognition Authentication:

- The face recognition system provided an additional layer of security, reducing the reliance on password-based authentication. This biometric system enhanced security by making it difficult for unauthorized users to access the platform. Some additional points discussed:
- Password-less Login: Eliminating passwords mitigates the risk of credential theft or phishing attacks.
- Real-Time Face Matching: The CNN algorithm ensured that users were authenticated in real time, providing a quick and seamless login experience.

Challenges Faced:

- Environmental Conditions: As previously mentioned, lighting and image quality were actors that sometimes hindered the face recognition accuracy. This could result in false rejections (where a legitimate user is not recognized).
- User Acceptance: Some users were initially skeptical about using face recognition, citing privacy concerns. However, after explaining the system's security and privacy features, most users were willing to embrace the new login system.

Privacy Considerations:

- Data Storage: Facial data was stored securely, with encryption applied both to stored data and during transmission. Regular security audits were conducted to ensure compliance with privacy regulations (such as GDPR).
- User Consent: Prior to enrolling facial data, users had to explicitly consent to its use, and they could withdraw their consent at any time, ensuring transparency and control over personal data.

iv. System Integration and Deployment

- The system was designed to be scalable, able to accommodate growing numbers of users (students, teachers, and parents). Using a modular approach for each module (user management, attendance, fees, contests, etc.), the system could easily be extended in the future to include additional features, such as integration with other academic systems or even integration with mobile applications.
- The face recognition system had low latency in processing user data, and the web interface was responsive across devices. Server-side optimizations ensured that the platform could handle multiple concurrent users without significant degradation in performance.
- The database queries related to user management, attendance records, and fees were fast and efficient, contributing to an overall smooth user experience.

12. CONCLUSION

This project aims to address the growing issues for schools in managing various activities, such as student records, attendance, payments, placements, grievances, and material distribution. Utilizing face recognition-based authentication, we can enhance security and user experience to a considerable extent, making the system more efficient and user-friendly. Employing Convolutional Neural Networks (CNN) for face recognition, not only does it enhance security by eliminating the password, but also eases the login process, providing all users—administrators, teachers, students, and parents—a seamless experience. The role-based access control provides each user with the right level of access to the relevant features, boosting efficiency and minimizing the risk of unauthorized access to sensitive data. The web-based interface, implemented with PHP, offers ease of use, while Python's machine learning component for face recognition offers a high degree of security. The system also features the ability to automate essential processes, such as attendance tracking and grievance management, boosting efficiency for teachers and administrators. Overall, this project opens the doors to a more secure, efficient, and user-friendly education administration system, addressing both the security and operational issues institutions are facing now. By leveraging the power of cutting-edge technologies such as face recognition and CNNs, schools can implement an edge-cutting solution that brings a higher degree of safety and ease of use to their digital systems.

13. FUTURE SCOPE

Future Scope of the system while the system in place today is a big leap from legacy management systems, there are many areas for future growth and development. As institutions expand, the system can be adapted to accommodate a larger user base, leveraging cloud-based storage for data to provide better performance. Cloud storage would allow the system to store large amounts of data, such as students' records, materials, and attendance records. The system can be integrated with data analysis functions, enabling administrators to create reports on student performance, attendance, fee payments, and so on. This would aid in decision-making and further improve management. Machine learning algorithms can be utilized to forecast student performance, attendance, and other trends that can be leveraged to improve institutional outcomes.

Creating a mobile application would further make the system accessible on-the-move for users. Students, teachers, and parents can view attendance, grades, and materials directly on their smart phones. Real-time messages for events, contests, attendance, and fees can be sent directly to the users' handsets, further streamlining communications. To further improve security, the system can be integrated with multi-factor authentication. This can be achieved through a combination of face recognition and another biometric attribute (fingerprint scanning, for example) or a one-time password sent via SMS or email for multiple factors of security.

The system can be extended to accommodate interface with other learning tools and software that are widely used in institutions, such as Learning Management Systems (LMS), Examination Management Systems (EMS), and Library Management Systems. API integrations could make for more seamless data exchange between these systems, providing an integrated platform for the institution. To serve an international community, the system can be internationalized to support multiple languages and regional settings. This would enable institutions from various regions of the world to utilize the platform effectively.

The system can be integrated with AI-based chatbots to support students, teachers, and parents in real time. These bots can respond to common questions, guide users through the platform, and even assist with basic troubleshooting. The system can be designed to offer personalized learning pathways to students based on their performance and interests. Depending on the analysis of user data, the system can suggest materials, contests, and other learning aids based on each student's needs and capabilities. Blockchain technology can be utilized to ensure the integrity and security of student records and transactions. By decentralizing sensitive information, the system can offer an added layer of protection against tampering and ensure records are immutable.

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