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Notification Based Facially Recognisable Attendance System

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Abstract: Effective attendance management is crucial in both educational and professional settings, as it directly impacts performance assessment and accountability. Conventional methods such as manual roll calls or paper-based tracking systems are inefficient, prone to errors, and time-consuming. This research introduces an automated attendance system designed to overcome these limitations. The proposed system leverages modern software solutions to simplify the process of recording attendance, incorporating features like real-time data entry, secure authentication, and automated generation of attendance reports. Additionally, the system can be integrated with biometric or RFID technologies for enhanced accuracy and security. By automating the attendance process, this system significantly reduces administrative burdens, decreases the likelihood of human error, and provides immediate access to detailed records and analytics. Designed to be scalable and user-friendly, the system can be adapted for a variety of institutional contexts. This paper discusses the system's architecture, functionality, and potential benefits, demonstrating its capacity to improve attendance tracking processes

Index Terms **- Face Recognition, Education, Anti Spoofing Check, Email Notification Send.**

I. INTRODUCTION

Traditional attendance tracking methods, such as manual sign-ins, paper-based registers, and card systems, often suffer from inefficiency, time consumption, and vulnerability to errors or fraudulent activities. These methods frequently result in inaccurate attendance records, decreased productivity, and increased administrative burden. Moreover, they often lack adequate security measures to safeguard against unauthorized access or manipulation of attendance data.

In academic settings, imprecise attendance tracking can negatively impact student performance and hinder proper institutional reporting. Similarly, in corporate environments, inadequate attendance management can result in payroll errors and diminish the overall effectiveness of workforce administration.

There is a clear demand for a more reliable, efficient, and secure solution to handle attendance tracking. This project addresses these challenges by developing an attendance system that utilizes facial recognition technology. This innovative solution ensures seamless, accurate, and tamperresistant attendance monitoring, overcoming the limitations of conventional methods .

II. LITERATURE REVIEW

2.1LIBRARY USED

Significant progress has been made in face detection and recognition, especially with the use of OpenCV and deep learning techniques. Singh et al. (2022) emphasize the flexibility of OpenCV for real-time face detection, demonstrating its effectiveness across multiple platforms when integrated with Python. This combination is particularly useful in applications such as video surveillance, biometric systems, and image processing(Face Detection Using OpenCV). Earlier methods like Eigenface,

Fisherface, and Markov models were instrumental in shaping facial recognition technologies, but modern approaches, such as convolutional neural networks (CNNs), have greatly enhanced real-time detection accuracy(Face Detection Using OpenCV).

Face recognition is now commonly applied in biometric systems, including automated attendance tracking, security systems, and identity verification. Gupta et al. (2020) showcased an automated attendance system utilizing face recognition, which minimized human errors and improved the efficiency of tracking attendance in real-time(Face Detection Using OpenCV). Despite these advancements, issues such as variations in lighting and face angles remain areas that require further exploration.

2.2 Face Recognisation

The document titled "Face Recognition System" outlines an automated system designed to detect, extract, and recognize human faces using a combination of algorithms. The system employs the **Viola-Jones algorithm** along with the Haar Cascade classifier to identify faces in real-time from captured video frames(face-recognition-system). This method focuses on detecting prominent facial features, such as the eyes and nose, using machine learning to distinguish faces from other objects. The system is optimized for accuracy, even in varying lighting conditions.

For feature extraction, the system uses **Principal Component Analysis (PCA)**, a technique that reduces the complexity of facial images by focusing on essential features needed for recognition. Also known as the Eigenface approach, PCA simplifies the data, allowing the system to efficiently identify individuals by comparing stored face data(face-recognition-system).

Overall, the document presents a comprehensive face recognition framework that integrates algorithms like KLT and Viola-Jones for face detection and tracking, with PCA for feature extraction, making it suitable for applications in security, attendance systems, and other biometric-based identification systems(face-recognition-system).

O.

Table 1. Subset of functionalities in our system

Category Authentication	Functionality
recognition	Face Verification Face Spoofing Face Structure Eye track Spoof Checking

As per our knowledge, there is no previous work that has integrated all about Authentication and recognition provided in Table 1.

III. DATASET

For the development and validation of the face recognition module, we used the dataset referenced in [9]. This dataset includes 100 recorded sessions from 10 male and 10 female subjects, with each subject being recorded five times. For each subject, two sessions were conducted with controlled movements, where the yaw, pitch, and roll angles were adjusted individually. The remaining three sessions were entirely spontaneous. The total size of the dataset is approximately 130k. Sample images from the Pandora dataset are shown in Fig. 1

Face Detection and Recognition Using Face Mesh and Deep Neural Network

Name of the person	(a) Tripty S	(b) Neelima	(c) Shivalila	(d) Abdel_Nasser_Assidi
Training image				
Test image				
Output				

The UTKFace dataset consists of over 20,000 facial images, covering a wide age range from 0 to 116 years. Each image is labeled with attributes like age, gender, and ethnicity, and the dataset captures diverse variations in pose, facial expressions, lighting, occlusion, and image resolution. It is suitable for a variety of tasks including face detection, age estimation, age progression/regression, and facial landmark localization. Sample images are provided below in fig 2

Fig. 2. Example images from UTKFace

To enhance the diversity of the dataset and prevent the model from overfitting, we applied several color and geometric augmentation techniques. These included horizontal flipping, random zooming, adding random noise (Gaussian, salt, and pepper), color adjustments (like random changes in brightness, contrast, and saturation), and random image translations.

IV. PROPOSED SYSTEM

4.1Population and Sample

Your project aims to create an advanced face recognition system using a diverse dataset that captures various facial features and conditions. By employing color and geometric augmentations, the model's accuracy and generalization are enhanced, minimizing the risk of overfitting. The ultimate goal is to build a face recognition module that consistently performs well across different poses, lighting conditions, and facial expressions fig 2 is showing how different types ages and gender faces are tested in this project and fig 1 shows how the trained on the faces of different environment.

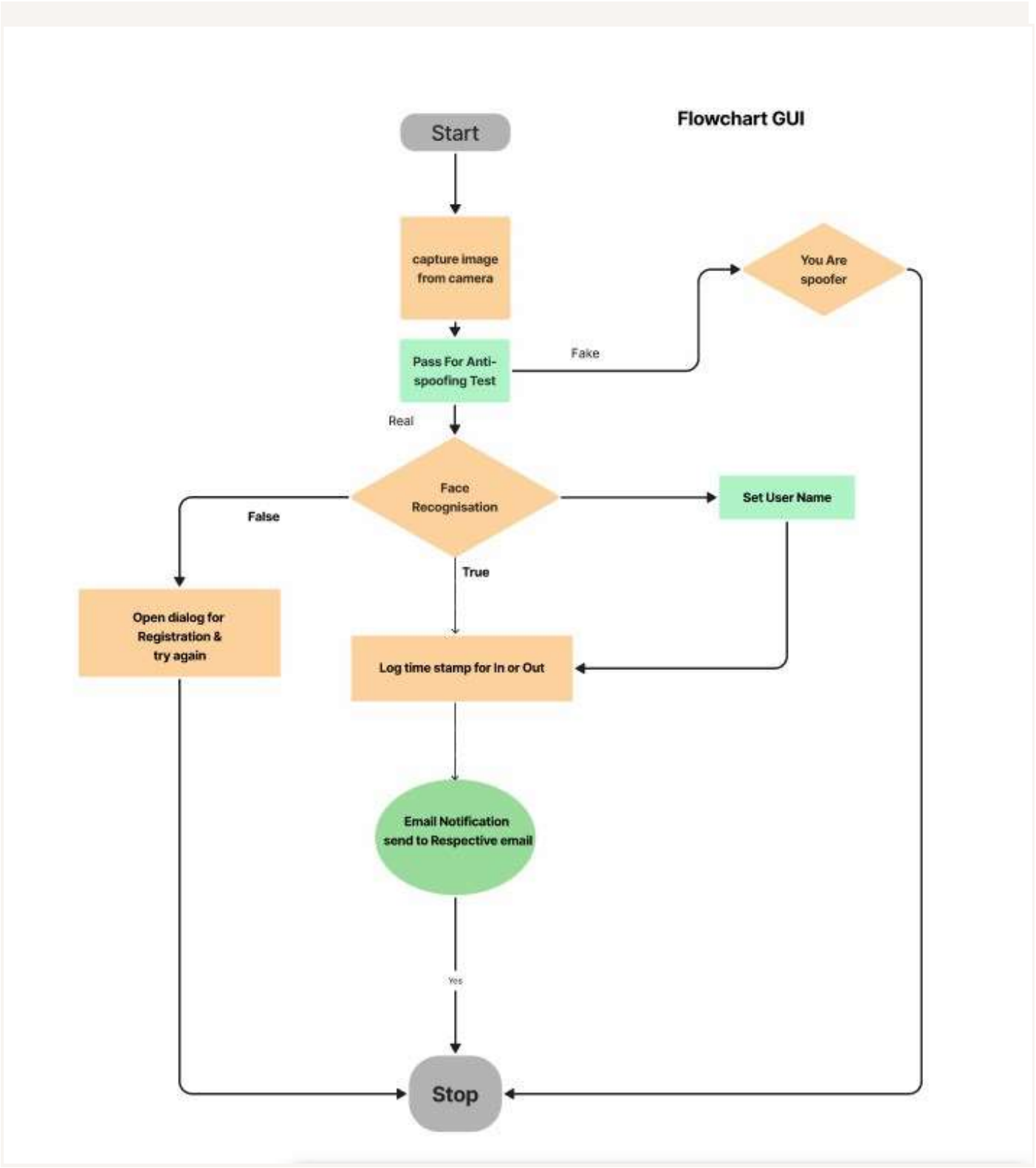


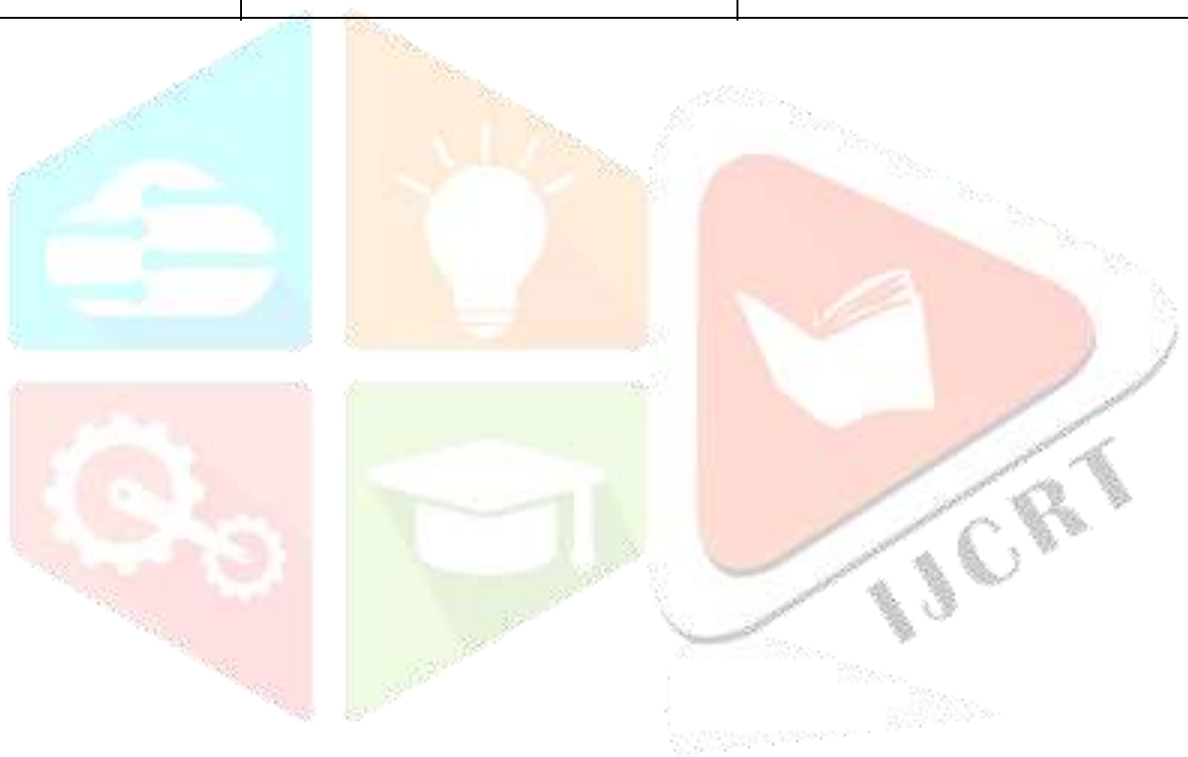
Fig. 3. Architecture of the proposed Face Detection Systems GUI

Table 2. Functionalities in our system

Category	Functionality	Technique
Base	Face Spoofing	Pre-trained

Face Detection Pre-trained

Attendance Generation csv file Generation	Log	realtime realtime
Email Notifi login email logout email	Based on log Generation	request raised after log dependent on Attendance log dependent on Attendance log



4.2 users Registration

We used OpenCV CNN for user registration. If the user is not available in the previous data set then it will generate the output that it is not present in our system. so at that time we have to register the user first of all for the login and logout purpose. in fig 4 we have shown that how system react when unknown user and in fig 5 we have shown the process of registration of the user in the proposed model.

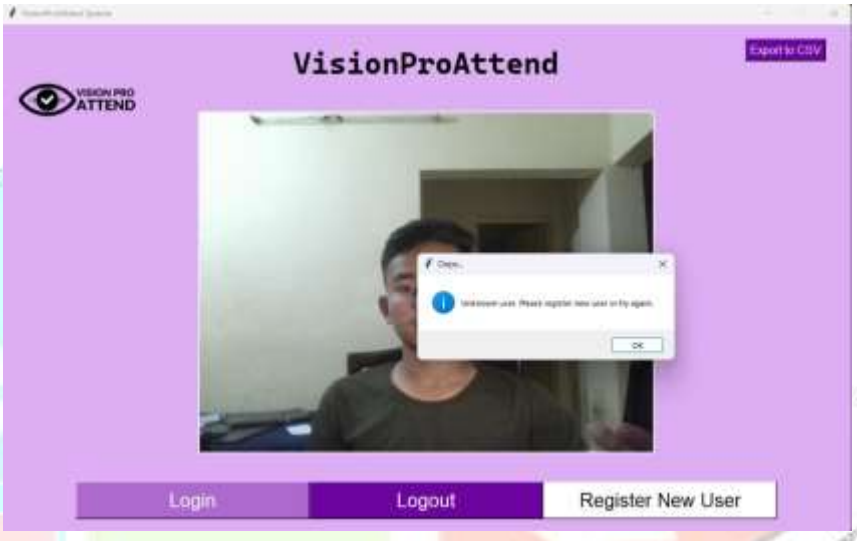


Fig. 4. person is not registered with the system so the module showing registered it and try again .

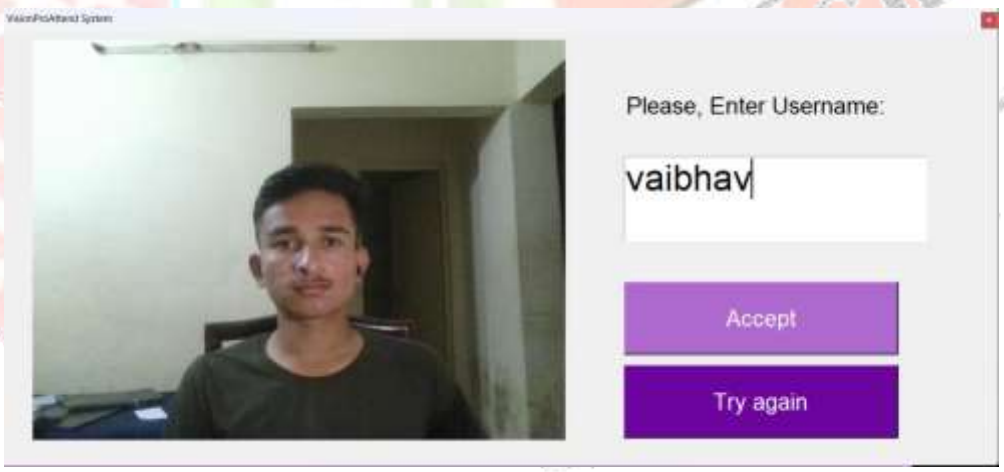


Fig. 5. Showing the process of registration of the user in the system

4.3 Face Recognition

We used OpenCV CNN for registered users face recognition. here the model checks if the image captured by the camera is already available in our dataset or not. if it is present then the model shows the welcome popup on the window and the entry of that user registered in the system is marked. fig 6 shows that the user is already registered with the system and window shows the popup message.

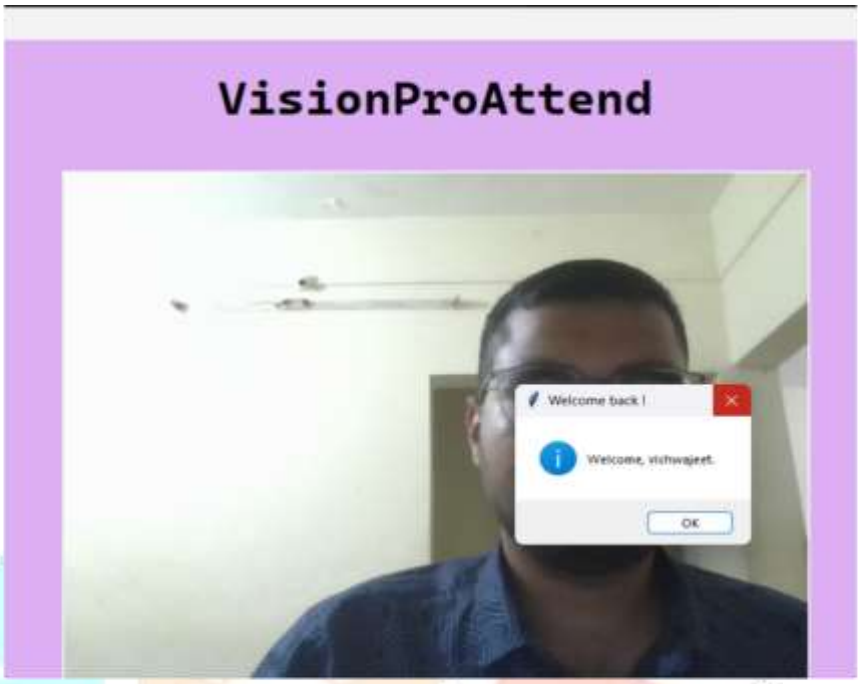


Fig. 6. output As registered user is logged in in the model

4.4 Face Detection

We utilized OpenCV's DNN (Deep Neural Network) module to detect the user face in the image. The face detection is powered by the Single Shot Detector (SSD) framework, which uses a ResNet model as its base network

4.5 Authentication

4.5.1 Face Spoofing

To identify whether the user is real or a photograph, we implemented face spoofing functionality. After capturing the user's face image using the Face Detection module,the code is conducting inference on the cropped image using models stored in the specified model directory. It shows that multiple is combined to produce the final prediction, as mentioned the loop that iterates through each model file in the given directory: The use of models that predict depth can also help identify whether the input image is a 2D object (e.g., photo) or a 3D face.The model may use texture-based features to distinguish between real skin and fake surfaces (like printed photos or screen displays)This can include methods such as detecting subtle facial movements, blinking, or changes in lighting to differentiate between a real face and a static image or video fig 7 shows the output when you shown the photo of the any person it show that it is fake

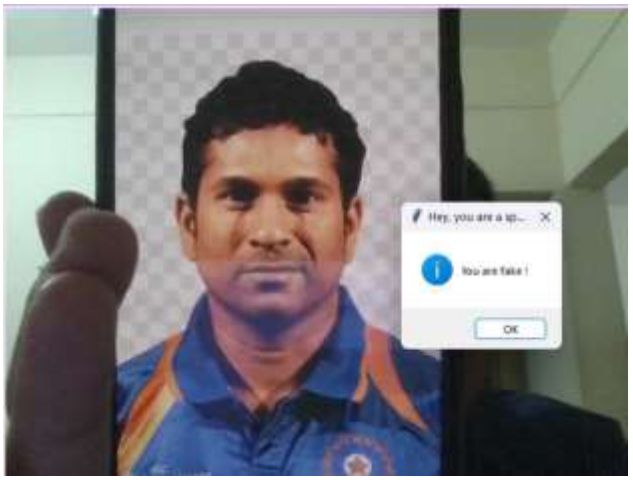


Fig.7 Output with spoofed face

4.6 Experimental Setup
4.6.1 Convolution Neural Network

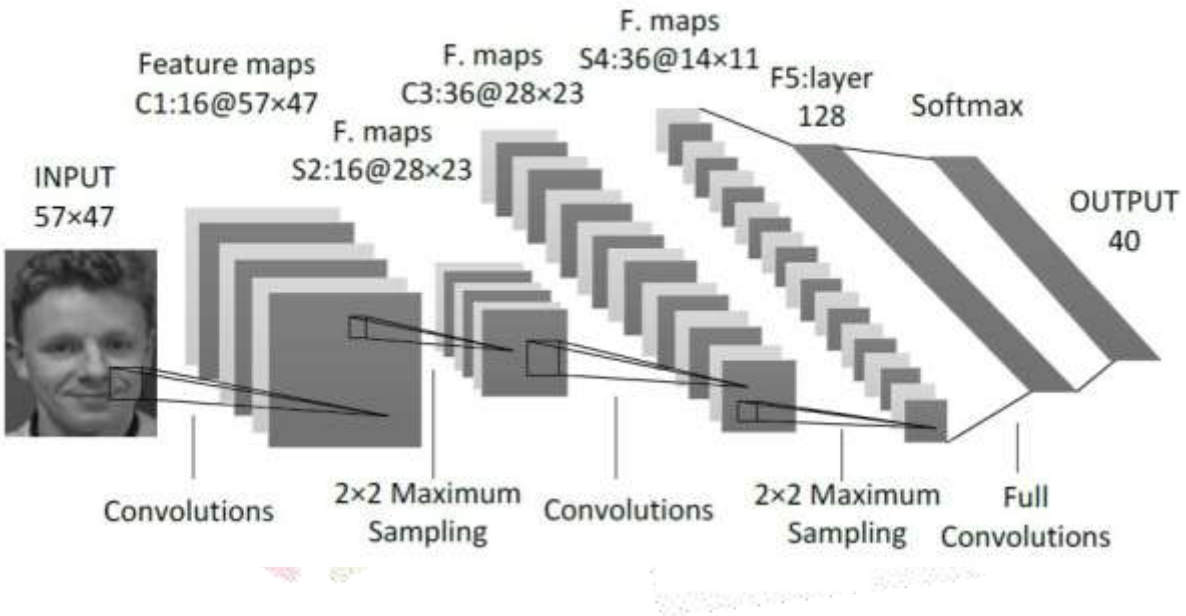


Fig. 8. Convolutional neural network infrastructure model designed for experiment.

Convolution layer: Convert image into the matrix pixel to represent the image it used for colour density for finding outliner, shape of the image and curves in the image.Activation Function: it use to help to find the non-linear relationship between the feature in the images pooling layer: it use to pool the most significant information or feature from the convolution matrix this reduce the dimensions use less memory while training the data fully connected layer: it is the last layer of cnn it go through the the multiple layers to generate by the pooling layer fig 8 represent about the cnn process.

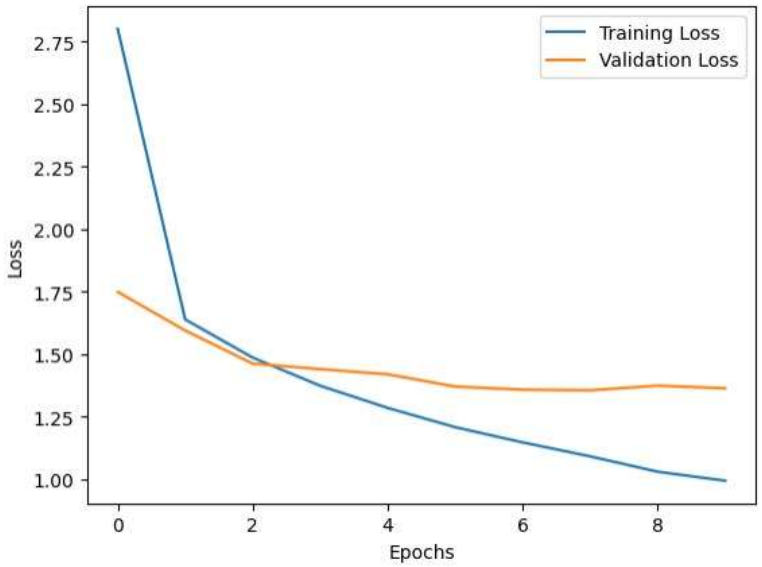


fig 9 epochs and loss of the model

4.6.2 python imaging library or Pillow Library

We utilized Dlib's pre-trained organization for recognizing and anticipating 68 facial points of interest on the user confrontation. Cleared out eye is characterized by the taking after points of interest - 36,37,38,39,40,41. Right eye is characterized by the taking after points of interest - 42,43,44,45,46,47. To begin with, we fragmented the eye locales by utilizing a cover. At that point we connected twofold thresholding on the eye locales to isolate the eyeballs from the rest of the eye locales. Eyeballs have gotten to be dark and the rest locales remain white. At that point a vertical separator was made at the center of each eye. At long last, to decide if the examinee is looking cleared out or right, we characterized an eye-tracking proportion as:

.
$$AvgETR = \frac{RightEyeETR + LeftEyeETR}{2}$$

.
$$RightEyeETR = \frac{No.\ of\ white\ pixels\ on\ left\ side}{No.\ of\ white\ pixels\ on\ right\ side}$$

.
$$LeftEyeETR = \frac{No.\ of\ white\ pixels\ on\ left\ side}{No.\ of\ white\ pixels\ on\ right\ side}$$

After broad trial and testing, we settled the taking after limits for the AvgETR: ≤0.35 (looking outside the screen), 0.36 to 3.9 for the center (looking at the screen), ≥4 for cleared out (looking exterior screen). If the examinee is looking outside the screen for more than 10 continuous outlines, at that point the examinee is said to be cheating. Yield from the Eye-tracking module is appeared

4.6.3 Face Recognition Library

for identifying and detecting faces in photos and videos the face recognition module provides a powerful and intuitive python tool constructed using the dlib library it makes difficult facial recognition jobs manageable for researchers and developers of all skill levels one of its main functions is the capacity to identify faces in pictures and provide the exact locations of each face that is found the library uses facial embeddings which are distinct representations of faces in a high-dimensional space to identify individual faces after detection by comparing them to known images furthermore the library recognizes facial landmarks like the mouth nose and eyes which might be helpful for applications that need in-depth facial analysis or manipulation the face recognition libraries simplicity of usage is among

V. EXPERIMENTAL RESULTS

5.1 Face Detection

Our model was trained using images from the Pandora dataset. The system accepts a facial crop rescaled to 100 x 100 as input. The face detection bounding box output is enlarged by 100%, and the resulting bounding box is used to crop the head region, which is then input to the network. We used the Adam optimizer with a learning rate of 0.001 for training. The model was either trained for 100 epochs or employed early stopping, which monitored the validation loss with a patience of 20 epochs. The corresponding training loss and validation loss achieved for the best model. The model was trained using Mean Squared Error (MSE) as the loss function and evaluated on the test dataset using Mean Absolute Error (MAE). To prevent overfitting, we applied dropout regularization after each convolutional and dense layer.

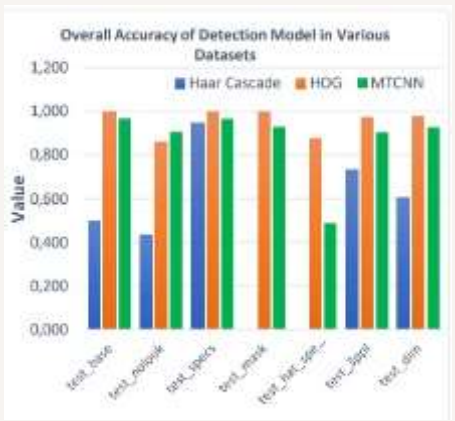


fig 10 Accuracy of model in different dataset

5.2 Face Recognition

We evaluated our lightweight head posture estimation model on the BIWI benchmark dataset, which consists of approximately 15,000 RGB images with ground truth head posture angles. The Pandora dataset's owners also provided the cropped face regions for the BIWI dataset, so we used these directly without manually cropping from the original benchmark dataset. Our lightweight model achieved superior accuracy compared to well-known landmark-based methods and 3D dense model-based techniques. Table 3 illustrates the comparative results of our model with Dlib [12] and 3DFFA [6] models. Performance evaluation results for Dlib and 3DFFA were sourced from Hopenet's (a state-of-the-art model) paper. Hopenet, a deep learning-based classification method for fine-grained head posture estimation, demonstrated higher accuracy than our lightweight model. However, we did not use Hopenet in our online proctoring system due to its high computational complexity, driven by using ResNet as the backbone feature extractor, making it unsuitable for real-time performance on low-cost systems. Consequently, Hopenet's performance is not included in Table 3. All models were evaluated using Mean Absolute Error (MAE).

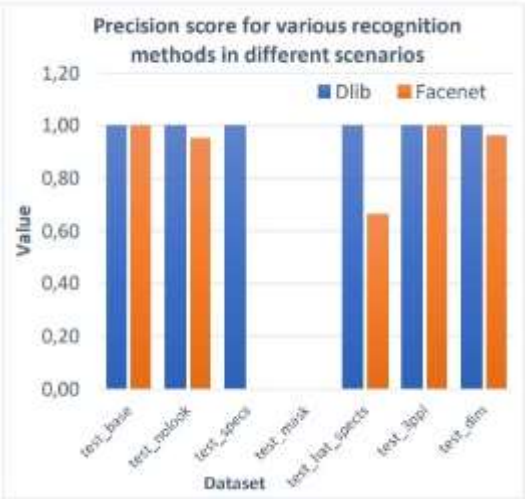


fig 11 precise Score for different scenarios in different methods.

Table 3. Comparison of proposed head pose estimation model accuracy (MAE) with other available models

Model	Pitch	Yaw	Roll	MAE
Our model	7.471	10.799	6.190	
Dlib	11.000			12.249
3DFFA		13.92	8.776	19.068
	7 13.802			
		16.75		
	6			
	12.252			
		36.17		
	5			

V. CONCLUSION AND FUTURE WORK

The Notification-Based Facially Recognizable Attendance System is a security, efficient, and user friendly solution of combined facial recognition and real time notification for automated attendance tracking. Manually attendance errors are eliminated, proxy attendance prevented, and instant notification sent to users and administrators alike making the system more transparent and easier to use. Especially in environments with need for high hygiene standards such as schools, offices and hospitals, its contactless feature comes into its own. The system is very secure since anti spoofing measures are already implemented such that the identification is accurate and no misuse. The system will be made more future ready by integrating it with other notification channels such as SMS, email and chat applications to communicate with more flexibility. They still don't roll up attendance into management reports, and personalized notifications based on user roles or attendance patterns, if implemented, could allow management to get even more actionable insights. Also, while enhancing the functionality of the system by providing a mobile app for remote access and management, as well as moving to a cloud based system, would extend the scalability and accessibility making the system adaptable to evolving organizational needs.

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