Face Recognition based Attendance System

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Abstract – Attendance marking is a very essential task for faculty today in schools and colleges. It takes a lot of time if the faculty is going to take attendance manually. As a result, we've been relying on technology. This will help tremendously in demonstrating the quality of our education system. Physically having to take attendance comes with a lot of effort and time. The attendance sheet can extremely be boring work for the faculty to maintain and it took a lecture time as well. A smart computerized attendance system can be useful in managing the attendance of the students. It will assist in reporting the biometric ways. Face recognition technology is one of a kind and probably the most renowned of this day and age. It replaces the old typical sheets using this new technology. This Model Can Be Used To Crack The Problem Of Forged Attendance And Proxy. In the previous system, students simply card in and then skip classes. The proposed work monitored students' real-time attendance. Proposed work will explain the effective algorithm for marking attendance itself without any human interference. Face detection and recognition becomes the most crucial step of this system. As we can compare the attending method which we have seen up to now and currently proposed system then we can say that, the current system is effective in monitoring attendance of students properly. It will be true assistance to keep the attendance and assist to faculty for record the students.

Keywords: - ***Deep Learning, Automation, Attendance System, Face Recognition, Image Processing. Online Enrolment system, Machine Learning Algorithm***

I. INTRODUCTION

Marking attendance in schools and universities is a major responsibility of faculty. Most schools and colleges still stick to the old ways of taking attendance by calling out the enrolment number of the student. However, some universities now have initial biometric simple devices like punch card, swipe cards, RFID Cards and Thumbprint scanners on campus. Punch cards have become old-school and the school and university now head towards Biometric devices for attendance. but the enrolment calls out and punch card methods have some drawback because the enrolment method is done my faculty so its a very time consuming process and sometime it creates human errors other thing punch card method is not accurate because any one can punched anyone's id card and sometimes mistakes happens if present students marked absent or if student lose his/her punch cards then he/she will have to wait for 34 working days to get new card which is a very difficult time period of student to mark attendance. In this post, I am going to [1] suggest a new face recognition system. Face recognition system is one of the most resourceful ways to do enrolment of students. If the class has that many students then it is very difficult task to maintain attendance. The school and college with the total number of students have very difficult work to take attendance manually because there are some chances of student's proxies and time-consuming by the faculty. The face recognition system helps to mark being present of the student by identifying their faces. This system will close the proxies and human error. Face recognition is one of the best methods for proof of the identity of a student. We can implement in the ground of schooling for supervision being present of students. The face recognition system is separated into multiple phases. The significant phase in face recognition is to detect the face of the student, which uses real-time face recognition [2]. In the first phase for marking the attendance, we have the image of class students, then we can capture the student faces by the electronic camera which is kept at the highest point in the class where the electronic camera will capture an image without leaving out

any student. This camera image is the input of the system. For accurate results, we have to perform image enhancement and image acquisition by using some techniques. To identify the last bench students, we have to use the histogram equalization of photo desires to be completed. In the second phase, we get the image after the image enhancement and image acquisition, and then it will go for face detection where we can apply some famous algorithms like neural networks, ad-boost algorithms, and HAAR algorithms. After applying algorithms, we can detect the faces of the student by these famous algorithms. In the third phase, we are working to recognize the face of the student after detecting his/her face from the image. In face recognition, different techniques help to recognize the student's image like PCA, Eigen, and some other algorithm. The best algorithm according to me is Eigen. In this technique when the student's face is cropped from the image. We have separated each student's image by using Eigen Features like every student has different facial, eyes, nose, and hairs. After performing the Eigen algorithm, we compare the generated image from the database to recognize the students. So, comparing with the database we will create the database by enrolling the student. In that database, we can keep the student information like name, class, enrolment number, his/her photo for verification.

Generally speaking, there are two ways to sustain the human attendance system [3]: • Manual Attendance System (MAS) • Automated Attendance System (AAS) The term "manual human face attendance management system" refers to the Manual Attendance System (MAS) method of personally calling a person by name and noting their attendance [4]. Manual attendance is sometimes thought to be a time-consuming process, and it is occasionally easy to forget about someone or answer questions incorrectly in the absence of friends. As a result, when we consider how the office typically tracks attendance, the issue arises [5]. The answer to all of these problems is the automatic attendance system (AAS).

In this project, Python was used as the core programming language. OpenCV, a powerful computer vision library, handles real-me face detection, while the machine learning model responsible for face recognin on is built using scikit-learns KNeighborsClassifier. Flask, a micro web framework for Python, provides the user interface for both administrators and users to interact with the system. The system saves a enhance data in CSV format, allowing easy storage and retrieval. This ensures a smooth process for taking, tracking, and reporting a enhance with minimal human intervene on. The overall goal of this project is to provide a more reliable, convenient, and scalable solution on for a enhance tracking. Face recognin on eliminates the possibility of proxy a enhance (someone else marking a enhance for another), thus ensuring integrity and accuracy in the process.

II. RELATED WORKS

There are many CNN architectures and many techniques, which improves the accuracy of face recognition process almost to human accuracy. Face Net [6] is a convolutional neural network model introduced by Google Inc. Similar to other CNN models, Face net also converts the facial features to vectors. But it also applies an extra triplet loss calculation, which improves the overall accuracy of the system. A triplet is created with one anchor image, one negative image and one positive image. Then calculates the loss of this triples by mini mazing the distance between anchor image and positive image. As well as maximizing the distance between anchor image and negative image. Face net has achieved a classification accuracy 99.63% [7] on LFW dataset. There are many system which uses face recognition in a classroom scenario for marking attendance. In this paper [8] the author proposes an idea to mark classroom attendance us Ing face recognition technology where a camera is fixed in the classroom and attendance is recorded so as to generate reports. Eigen value method is used to recognize faces. PCA/LDA is done to reduce dimensionality and extract necessary features. Face detection is done using HAAR Classifiers. Face detection ratio is used to calculate the accuracy of face detection. The ratio is calculated as no of faces divided by total no of faces. Features are extracted from these detected faces and are used for recognition using the eigen vector method. In this paper the author proposes an idea to

install a stationary camera at a fixed location and take attendance automatically. The group image captured in the classroom may have to do some pre- processing like contrast enhancement and noise filtering [9] for better result. The recent neural network methods are automatically taking care of these scenarios [10], System Architecture the have trained in these complicated scenarios and works well in low light and resolutions scenarios very well. By applying additional verification mechanism like RFID, Finger print scanner we can even improve the accuracy of the attendance marking system. In this paper [11] the authors has introduction an additional security using RFID. They have used a GSM based face recognition techniques for recording student attendance

III. LITERATURE SURVEY

Software that built on face Recognition. This system has design in such a way to work where users can easily understand all functionalities. the system has some phase to access by the user [12]. To resolve the problem of old manual attendance, the author proposed a simple and reliable system. No special hardware requirement.

I used some algorithms and technology to improve the system performance [13]. In this author have proposed a system which helps to take attendance easily. The system takes observation of every student at the entry and exit point. I focused to upgrade the system in the future by mobile based face recognition with proper authorization and a centralized database [14]. The author proposed a smart system, that system was implemented into two phases: uncontrolled and controlled environment. The methods were used to vary the existing ARS system more effectively, and user Friendly is never wind-up [15]. To resolve the manual attendance methods, the author proposed a system that performs fittingly with dissimilar face terminologies, expressions, and posture of the person. The system has made it movable for simple usage smooth when the meetings are on, without disturbing the lecture [16]. This author proposed a system that is a more reliable and efficient attendance system that system effort for one-to-many face recognitions at a single period [17]. To resolve a manual attendance problem, the author makes a system that runs on some algorithms which help to distinguish the student's easy way. He had made a system with no specific hardware [18]. This author presents a set of experiments on a difficult face detection dataset. The system results of detection rate are 94.7 % which is improved by about 18.5 % [19]. This author proposed a system that helps a divergent combination of algorithms. This system benefits us to complete desired results with better exactness and less time consumption [20]. Author wproposed a system that helps to save the faculty time for marking the attendance. He made full software in MATLAB. He solves the problem of attendance for making the facial recognition system [21].

IV. PROPOSED METHODOLOGY

Algorithms Used:

I: CNN:

CNN are architectures that automatically learn to extract features from input data. In the case of image recognition, input data would be the image while features are learned by convolving the image with a set of filters or kernels. Each kernel represents a feature that the network learns to detect, like edges, corners, or blobs. The convolution operation is followed by a non-linear activation function, which integrates non-linearity into the model, allowing it to learn richer features. The output from this operation is pooled to down-sample the feature map, effectively reducing its dimensionality and making the model more computationally efficient. Convolution, activation, and pooling processes are repeated multiple times, progressively detecting higher order features. The final layer of the network is usually a fully connected layer which maps the learned features into output class labels. In the case of the Automated Smart Attendance Monitoring System, a CNN is used in conjunction with the Face Net pre-trained model in order to ensure

accurate recognition and tracking of an individual's attendance. The contribution as a method in the Automated Smart Attendance Monitoring System, combination with pre-trained Face Net was made using CNN. The Face Net is a deep learning model aimed at identification as well as at feature extraction from human faces. The camera of the system gets images of faces where each image would be subjected to Anglicized Convolutional Neural Network. These images were passed to Face Net's pre-trained model to extract attributes-to be used for identity capture and detection. The pre-trained model is trained based on a specific dataset which the attendance-monitoring system was based on to enable modifying the additional deep learning model-ID Mode: Retain identification in employment; High Vs. Low; Clark, PC identity for attendance monitoring. Continuing is the Attendance Registration phase and if not emotively attended, a space is provided for user input! The attendance roll is submitted, along with the noted attendance number. Per machines, all changes in attendance should be converted as any resultant attendance numbers. A description follows in attendance roll-on the final amendment. Only facial features are extracted and the person is recognized. Every face the system recognizes need to pass the same procedure. 3. Real-time Attendance Tracker: The system can detect and recognize any face with the help of a CNN(CNN4ASMART) and the Face Net's pre-trained feature extractor which makes it a very strong attendance tracker in a variety of environments and scenarios.

II: Student Behaviour Detection

Input:
· Video feed or: Images from a classroom camera
· Pre-trained behaviour classification models: (face detection, pose detection, and engagement analysis).

Output:
· Behaviour status of each student: (attentive, distracted, et cetera)

Steps:
1. Initialization:
   o Set up the Camera feed or IoT sensors to capture student activities in real-time.
   o Load pre-trained models for:
      . Face detection.
      . Eye-gaze tracking.
      . Pose detection.
      . Emotion recognition.
2. Pre-processing:
   o Extract frames from the video feed.
   o Apply object detection to isolate students within the classroom scene.
   o Enhance image quality: (denoising, scaling, et cetera).
3. Face Detection:
   o A face detection algorithm (such as Haar Cascade, YOLO, or DNN-based) is used within the frame to detect faces.
   o After a face region has been detected:
      To identify facial landmarks - that is, eyes, nose, mouth, et cetera.
4. Engagement Analysis:
   o Eye Gaze Tracking:
      · Check if: The student is looking at the board, teacher, or somewhere else.
      · Classify gaze as "on task" or "off task."
   o Pose Analysis:
      · Use pose detection models such as Open Pose to detect head position and body posture.

· Identify signs of distraction: (slouching, head down, et cetera).

o Emotion Recognition:

· Perform facial expression analysis to classify emotions (happy, confused, bored, et cetera).

o Activity Detection:

· Check for hand-raising, writing, or using a phone for classifying engagement.

5. Behaviour classification:

o Combine features from the above analyses.

o Feed extracted features into the behaviour classification model.

· Example categories:

· Attentive: Looking at the board/teacher; upright posture.

· Distracted: Looking away; slouched posture.

. Asleep: It is characterized by closed eyes and lowered head.

. Confused: Confused or frustrated-looking emotional expression.

. Post-Processing:

o What you do is: Aggregate the data over a time window to smooth out noise (for sudden distractions).

o Assign a behaviour label to each student for that window.

. Real-Time Alerts (Optional): Inform the teacher if a student looks perpetually disengaged or distracted.

Technology/Tooling/Hardware:

Libraries and Frameworks:

* OpenCV (image and video processing)
* Mediapipe or OpenPose (pose detection)
* TensorFlow or PyTorch (for custom model training)
* Dlib (facial landmark detection)
* A good-quality camera

This is a scalable approach. This can also be improved with the development of features to include speech recognition for tracking participation and environmental analysis for noise levels.

3.1 ARCHITECTURE

This architecture has a better implementation of marking the student attendance in school and college. This system is also known as a smart attendance system. It's very helpful for the teacher to mark the attendance without taking extra time from the lecture. To implement this system into exertion, we essential both computer hardware and software requirements for our development. To implement this system in the school or college, we need a classroom where we will have to require a high-definition camera that we will be secure in the maximum height where it will capture all students' pictures. When the camera captures the image of all students, that image becomes input. The input image is going to be processed by image processing. First, it will do image acquisition where the image transforms Real-World Data into an array of numerical data which could be far ahead wrought on a computer, previously any image processing can originate an image must be captured by the camera and transformed into a practicable entity. Second, we will convert the image into a grayscale image because a grayscale image has intensity is kept eight-bit integer giving two hundred fifty-six possible dissimilar shades of grey from black to white. If the stages are consistently spaced out then the modification among uninterrupted grey levels is more expressive than the grey level to make up your mind for the power of the human eye. The third thing we can do is histogram equalization, which improves contrast in images. It will work like enlarging out the intensity range of the image. Then we have an output image that was generated in MATLAB after that we consider that output image as a new input image for the second process. Now take the input image for detecting the faces of every student. The detecting of the student's face is done by some face algorithm. Then

after detection of the student's face. We will recognize the student faces through each student's face and will be cropped by the output image, after the cropped faces then we will compare that image from the database of the faces. The database has stored all students' face information and that database is maintaining all information of the student images. So, we will be comparing the output student face with the database student faces one by one, after comparing the faces the system will automatically mark the attendance of that student on a server with time, date, and particular subject.

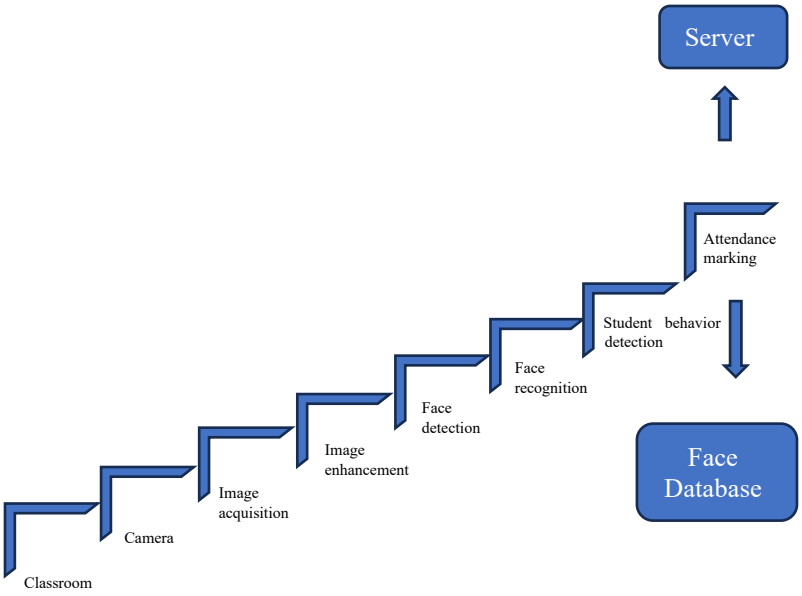


Fig 1. The architecture of the Face Recognition System

3.2 Methodology

We have some methodologies for implementing the system which helps to perform the process. We need some stages are as follows Stages for Face Recognition Based Attendance System:

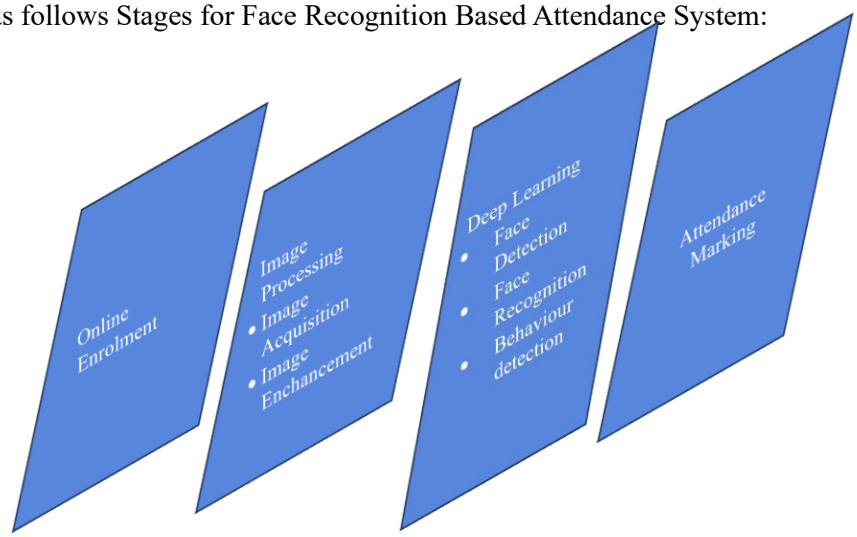


Fig 2. Steps to Implement the Face Recognition System

3.3 Online Enrolment

The above diagram explains the steps which help to effectively the marking the student's attendance. Online Enrolment:

The first step is enrolment; the student has to enrol in the system. the student has to capture their photo then store that photo in the database. Students have to store his/her data and unique biometric features. This data is store in the different packets of each student. Each student to fill a form where he/she will store the student's college details like enrolment, name, subject,10-15 photo. The enrolment includes: The first camera will capture the photo of students in the classroom. Then we will perform an enhanced technique using image processing after that enhancing process is completed. We will do extract the image and store that image into the database that database is called the face database. Afterimage store of every student then each student gets a unique enrolment number.

3.4 Image processing

We are using image processing in our project because image processing helps to get an enhanced image or to citation some useful data from the image.it helps to evaluating and manipulating the image. We have used MATLAB software because in MATLAB. We have a pre-defined algorithm and package

3.4.1 Image Acquisition:

The image acquisition work is to capture the image. First, we have to install a high-definition camera in the classroom. The camera will be installed at the maximum height in the classroom. So, we can get every student's image on the camera. After capturing the image of each student that image becomes the input image for the system.

3.4.2 Image Enhancement:

Image Enhancement is the process that helps to manipulate the image so that we have got a suitable image than the original. Grayscale Conversion: After capturing the image from the camera. Sometimes that image is not clear or high contrast. So, we have to manage that image. the grayscale conversion is very simple. It's a colour grey in which the red, green, blue colours are easily adjusted or we can say all colours have equal intensity. so, the input image will be converted into a grayscale image.

3.5 Histogram Equalization

Histogram equalization is a technique used to improve image quality. It helps to improve the contrast in the image and stretching out the intensity range of the image. the use of histogram equalization is removing the contrast of the image so we can see the faces of every student in the classroom. It represents the image in the graphical which helps to distribute the intensity. It will help to recognize the face of the student.it generates the histogram of the image which was capture by the camera after histogram equalization.

3.6 Noise removal and skin clear

Image noise is an inescapable result of capturing an image. In a camera, if the light that passes through the lens does not align accurately with the sensors, it will generate image noise. though image noise is not so clearly appearing in a picture, it is thought that a particular type of image noise is already there. So, the effort pictures are collected by the camera, the noise might be the one that should be eradicated from pictures. the median filter is one of the most vital filters that can be applied to an image to remove noise from it. Skin Clear is a method, which is the additional way to enhance the face

detection algorithm. Eigenvector algorithms are the ones that we use in our system for face detection of students and in addition the skin if it is classified before the scanning procedure of face images. The accuracy of the face algorithm is better improved after skin clear.

3.7 Deep Learning

Deep learning is nothing but an ordinary example of machine learning, more indeed -one of its algorithms.

3.7.1 Face Detection:

It's a technology used to discover and classify human faces in digital images. Face Detection is used algorithms and Machine learning to detect the student's faces in the input images. After the image processing part, we will get an image for face detection. The face detection will distinguish the face of each student from the output pictures. we will be applying some algorithms to detect the student's faces like Viola and Jones algorithms.

3.7.2 Face Recognition:

Face Recognition is a technique of categorizing or authenticating the identity of a specific using their face. Face recognition systems use computer algorithms to preference out precise individual details about a student's face. Face recognition is the following stage afterward face detection. Face recognition can be accomplished by gathering the face as of the images. After cropping the image, we have to compare that image from the face database. that database had been enrolled by the students. The student's face is check one by one using Eigen Algorithms.

3.7.3 Detecting Student Behaviours:

Student behaviour detection analyse and interprets the movements, emotions, and engagement levels of students while in class. Such technology is gaining acceptance in educational systems toward maximizing pedagogical effectiveness and improving student outcomes. By the use of computer vision, machine learning, and IoT sensors, teachers gain real-time insight into how students behave during lessons, enabling them to focus on areas that require attention or intervention.

Key Objectives of Student behaviour Detection

Engagement Monitoring: A measure set for distinguishing students who are engrossed in the lecture from those who are really not.

Emotion Analysis: Identifying if the state of mind of a student leans to confusion, boredom, or frustration so as to tweak the methods of teaching applied.

Behaviour Classification: This entails categorizing behaviour as being either attentive, distracted, participative, or inactive.

Proactive Intervention: Timely giving of feedback to teachers for appropriate support and re-channelling of students.

Future of Student Behaviour Detection

The future of behaviour detection is identified as bright with the advancements highlighted in AI and IoT. Emerging trends indicate trends in multimodal data integration (e.g. voice and text analysis), the use of wearable devices, and more immersive educational environments enabled by augmented reality (AR) and virtual reality (VR).

In addressing the current limitations, student behaviour detection can become a game-changer for the future of education and an enhancement for more inclusive and effective learning environments.

3.8 Attendance Marking

The attendance marking is the last step where students get the mark for their class. Completing the verification of all student faces effective recognition is completed, the attendance had been noticeable on the server or in csv file.

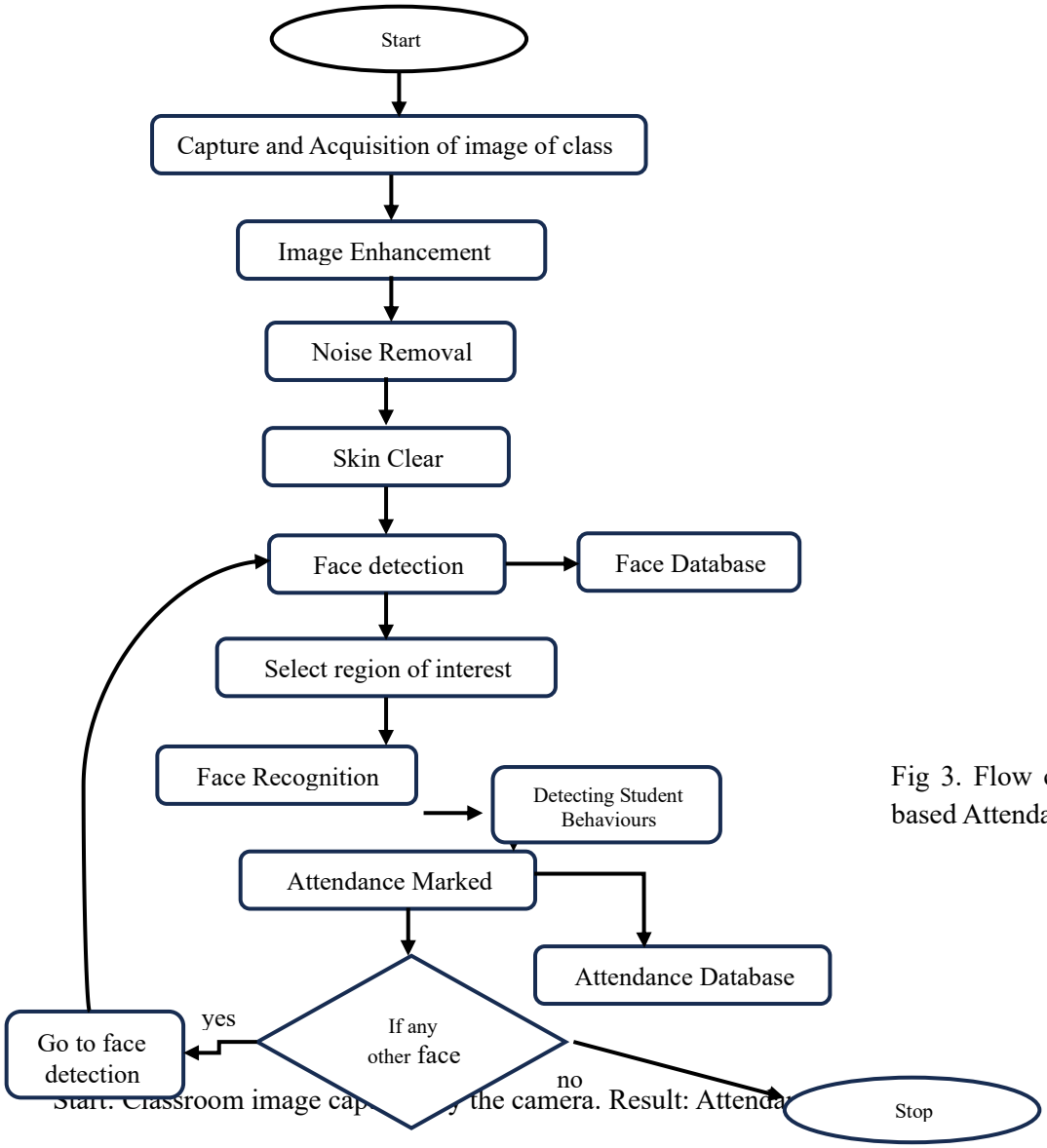


Fig 3. Flow chart of the Face Recognition-based Attendance System.

Start: Classroom image cap[illegible] the camera. Result: Attenda[illegible]

PROBLEM EXPLANATION: Identification and Verification of School and College Student.

Stage 1: Start

Stage 2: Tell the student to enrol the credential information and picture store in the face database.
Stage 3: Install the camera at the quiet place where it will cover all student pictures.
Stage 4: Input the picture taken by the camera.

Stage 5: Image Processing

5.1 Acquired the input picture and perform image acquisition
5.2 Convert the input picture into a grayscale image after converting then perform histogram equalization.
5.3 Then remove the noise from the picture, after removing the noise then perform skin clear, this process a & b come under image enhancement.

Stage 6: Face Detection

6.1 Crop the student's faces from the input picture which collect from the upper stage.
6.2 Select the portion of the interest.

Stage 7: Face Recognition

7.1 Equate the cropped pictures with face database pictures. Spot the attendance-on-attendance server.
7.2 If the picture does not match or there are any new faces, then go to stage 6 again

Stage 8: Behaviour Detection

8.1 Student behaviour detection analyse and interprets the movements, emotions, and engagement levels of students while in class.

Stage 8: End.

V. RESULTS AND DISCUSSION

This system is to recognize, whether the person entered in to the room is trained person or not. The system identifies the person is a recognized one then marking will be for attendance with date and time.

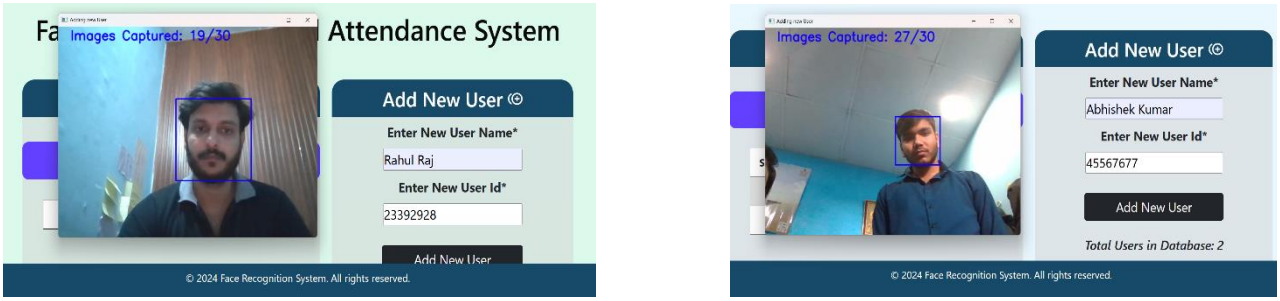
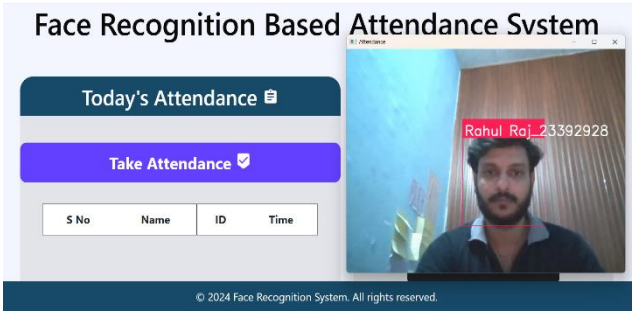


Fig 4. Result of capturing image to train Automatic Attendance System.



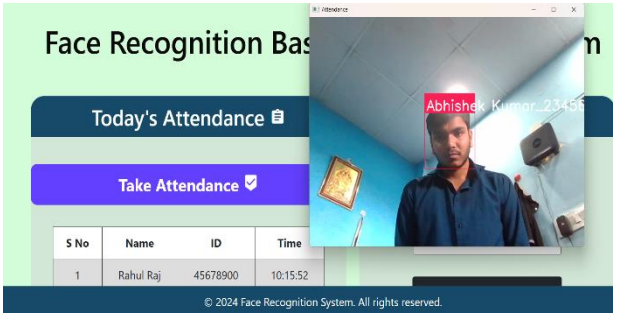
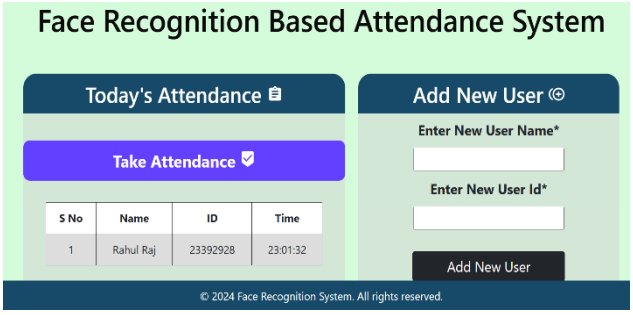


Fig 5. Result of Taking Attendance.



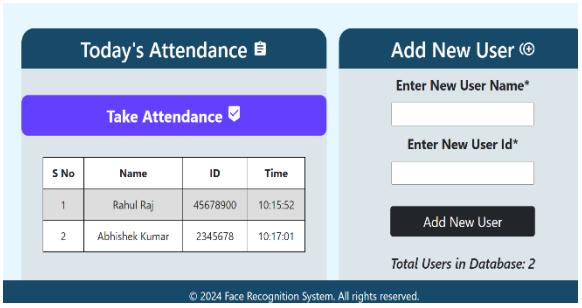


Fig 6. Result of sowing the name, id and time of attendance.

The proposed system results are validated with two different cases.

Case 1: In first person have to add them on database at real time which is shown on Fig. 4 here person write their name and id and click on add new user bottom.

Case 2: Now when we click on Take Attendance shown in Fig.5 then if that person is in data base then model will make the attendance of that person and generate the csv file and shows the time and date on interface also shown in Fig 6.

Case 3: It will monitor students in class for all time and rate their behaviour and send that record also to teacher as in form of csv file.

VI. CONCLUSION

In this proposed system, I have developed a system for Smart Attendance System using Face Recognition. This paper presents the effective and precise method of attendance in the classroom atmosphere that can replace the old traditional manual methods. The system takings attendance of individual students by nonstop observation at the entrance and exit point or by CCTV of class. Via this model, the probabilities of fake attendance and proxies can be abridged. It protects time and effort, especially if it is a class with a massive number of students. Similarly, to implement this model, not a little specific hardware is required. A camera device & a single Personal Computer, database servers are enough aimed at making the smart attendance system. Current work is attentive to the face detection algorithms from images or video frames. I would also try to implement geolocation so that a person can mark their attendance using their mobile device, all they need to do is to scan their face using an application and if they are within the location and their faces are recognized then their attendance would be marked automatically. I develop one more thing in this It will monitor students in class for all time and rate their behaviour and send that record also to teacher as in form of csv file it can over come the naughty behaviour of student.

VII. FUTURE WORK

To set up a CCTV camera system in a classroom and automate the camera's image-capture process. The creation of a mobile application and the integration of facial recognition technologies could be future initiatives for a CNN-based Automated Smart Attendance Monitoring System and will work on a enhance student behaviour detection algorithm.

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