PEHCHAN E-LEARNING

A Major Project Report submitted,
In partial fulfillment for the award of the degree
Of

Bachelor of Technology in Computer Science & Engineering

Submitted By

Mr. Ankit Roy (1801298043)

Under the Guidance of

Mrs. Rani Dubey
(Asst. Prof. Department of CSE)
Gandhi Institute For Technology (GIFT), Bhubaneshwar

For the Session
(2021-2022)

DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING
GANDHI INSTITUTE FOR TECHNOLOGY (GIFT),
BHUBANESHWAR

Affiliated To

BIJU PATNAIK UNIVERSITY OF TECHNOLOGY, ODISHA

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DECLARATION

I, hereby declare that the project work entitled **"Pehchan E-Learning"** submitted to the GIFT, Bhubaneshwar, is a record of an original work done by me under the guidance of **Mrs. Rani Dubey**, Asst. of Computer Science & Engineering, and this project work is submitted in the partial fulfillment of the requirements for the award of the degree of Bachelor of Technology in Computer Science & Engineering. The results embodied in this project have not been submitted to any other University or Institute for the award of any degree or diploma.

Mr. Ankit Roy (1801298043) **(** **)**

DEPARTMENT OF COMPUTER SCIENCE

GANDHI INSTITUTE FOR TECHNOLOGY

(AFFILIATED TO BIJU PATNAIK UNIVERSITY OF TECHNOLOGY, ODISHA)

BONAFIED CERTIFICATE

This is to certify that the project work titled "**Pehchan E-Learning**" is a bona-fide record of the work done by **Mr. Ankit Roy (1801298034)** in partial fulfillment of the requirement for the award of the Bachelor of Technology degree in Computer Science and Engineering from Gandhi Institute For Technology, Bhubaneswar affiliated under Biju Patnaik University of Technology, (BPUT), Rourkela, Odisha.

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EXTERNAL

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DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING
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BHUBANESHWAR

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I would also like to appreciate the help of various venue for providing me essential data required for my project as well as their time in guiding me so as to how my project will be more effective in users prospective. I am also grateful to my teachers for their constant support and guidance.

At the end I would like to express my sincere thanks to all the friends and others who helped me directly or indirectly during this project work.

Mr. Ankit Roy (1801298043) **(** **)**

ABSTRACT

In the fast-developing world, there is always a need for authentication for most systems. **Pehchan E-Learning** one such system. **Pehchan E-Learning** is the process of identifying or verifying a person from an image captured from either image capturing device or an individual frame in a video. A computer is not capable of processing such high-level processes by itself. For detecting and recognize faces, advanced concepts like deep learning can be used. **Pehchan E-Learning** is used in several fields such as login mechanism, unlock the device, User Authentication, etc. They can also play a pivotal role in recognition of multiple areas such as Student Attendance, Entry Cameras, etc. where the multiple persons may enter/present at a single instance of time. Also, there is a vulnerability for security breaches using still images of printed or digital images. The multiple face recognition and liveness detection models detect multiple faces in the image and recognize them based on the sample images provided and also verifies the liveness of identified person in the frame.

Index Terms**: Multiple Face Recognition, Liveness Detection, Convolutional Neural Network.**

LIST OF FIGURES

LIST OF ABBREVIATION

AFR	Automated face recognition
CNN	Convolution Neural Network
GUI	Graphical User Interface
LBPH	Local Binary Pattern Histogram
MYSQL	My Structured Query Language
RAM	Random Access Memory
ReLU	Rectified Linear Units
RFID	Radio frequency identification
SQL	Structured Query Language
OpenCV	Open Computer vision

1. INTRODUCTION

The technology aims in imparting a tremendous knowledge oriented technical innovation these days. Generally, in the classroom the attendance was taken by the teachers manually at the beginning and ending of the class. The problem with this approach is that it requires some time to take attendance and the manual process will have chances to make mistakes in most of the cases. To overcome that problem, RFID (Radio Frequency Identification) was introduced in the past years. But those are also having the fail proof of attendance system. So, we are introducing the concept of Face Recognition Based Student Attendance System. The main objective of proposed system is to allot attendance to the students using face recognition-based algorithms to achieve fool proof attendance system.

Face detection is used for many applications for the identification of human faces in digital images or video. It is defined as specific case of object-class detection; where it is used to find the locations and sizes of all objects in an image that belong to a given class. The technology is can be able to predict fontal or near-frontal faces in a photo, regardless of orientation, lighting conditions or skin color.

Face Recognition is a form of biometric software that maps an individual's facial features mathematically and stores the data as a face print. The software consists of Deep Learning algorithms to compare a live capture or digital image to the stored face print in order to verify an individual's identity.

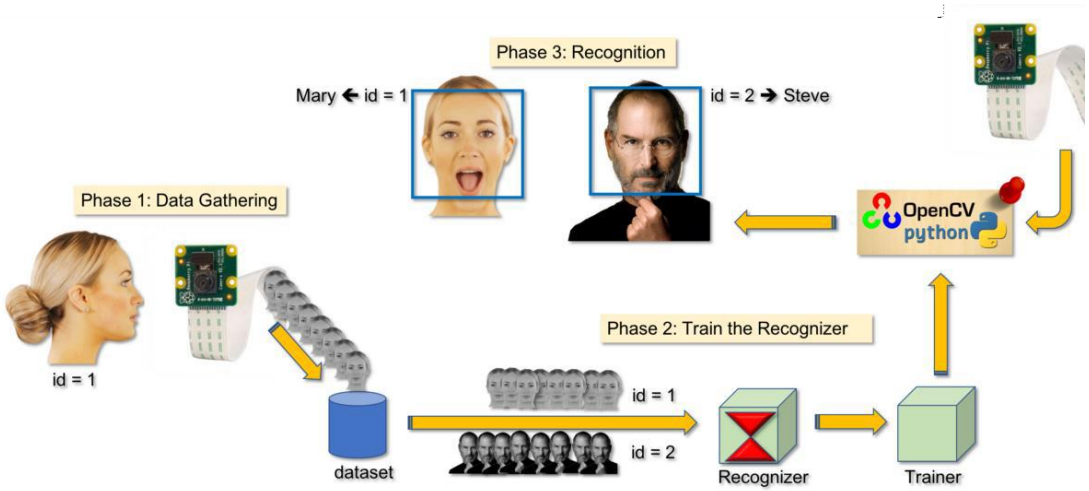


Figure 1: Real time face recognition

1.1 Background

Maintaining the attendance is very essential in all the educational institutions for checking the performance of students. Many biometric systems are available in the market but the key authentications are same in all of the techniques. Every biometric system consists of enrollment process in which the unique features of a person is stored in the database and after that, there are some processes of identification and verification of the person. These two processes compare the biometric feature of a person with previously stored template captured at the time of enrollment of a student.

1.2 Problem Statement

According to the previous attendance management system, the accuracy of the data collectedis the biggest issue. This is because the attendance might not be recorded personally by the original person, in another word, the attendance of a particular person can be taken by a third party without the realization of the institution which violates the accuracy of the data. For example, student A is lazy to attend a particular class, so student B helped him/her to sign for the attendance which in fact student A didn't attend the class, but the system overlooked this matter due to no enforcement practiced. Supposing the institution establish an enforcement, it might need to waste a lot of human resource and time which in turn will not be practical at all. Thus, all the recorded attendance in the previous system is not reliable for analysis usage. The second problem of the previous system is where it is too time consuming. Assuming the time taken for a student to sign his/her attendance on a 3-4 paged name list is approximately 1 minute. In 1 hour, only approximately 60 students can sign their attendance which is obviously inefficient and time consuming. The third issue is with the accessibility of those information by the legitimate concerned party. For an example, most of the parents are very concerned to track their child’s actual whereabouts to ensure their kid really attend the classes in college/school. However, in the previous system, there are no ways for the parents to access such information.

Therefore, evolution is needed to be done to the previous system to improve efficiency, data accuracy and provides accessibility to the information for those legitimate party.

1.3 Objectives

The proposed system will reduce the paperwork where attendance will no longer involve any manual recording. The new system will also reduce the total time needed to do attendance recording. The new system will acquire individual attendance by means of facial recognition to secure data accuracy of the attendance.

The following are objectives of the project:

- To develop a portable Smart Attendance System which is handy and self-powered.
- To ensure the speed of the attendance recording process is faster than the previous system which can go as fast as approximately 3 second for each student.
- To detect unique faces with the help of computer's camera
- Able to recognize the face of an individual accurately based on the face database.
- Allow parents to track their child's attendance.
- Develop a database for the attendance management system.
- Provide a user-friendly interface for admins to access the attendance database and for non-admins (parents) to check their child's attendance by mailing the attendance.
- Allow new students or to store their faces in the database by using a GUI

1.4 Project Features

1. Long term storage of records
2. High accuracy in calculation
3. Time saving
4. Optimize the resources
5. Efficiency in modification, sorting and retrieval of data
6. Inexpensive updating in facilities and terms of organizations.

1.5 Scope and Limitations

As with any technology, there are potential drawbacks to using facial recognition, such as threats to privacy, violations of rights and personal freedoms, potential data theft and other crimes. There's also the risk of errors due to flaws int the technology. Though there are some weaknesses of this system, there is a tremendous scope in present world. Here we discuss about scope and limitations of our project.

1.5.1 Scope of project

1. The main intention of this project is to solve the issues encountered in the old attendance system while reproducing a brand new innovative smart system that can provide convenience to the institution.
2. Provides facility for the automated attendance of students.
3. An excel sheet is created which contains the student attendance and is mailed to the respected faculty.

1.5.2 Limitation of project

1. The main problem of face recognition is large variability of recorded image due to pose, illumination condition, facial expression, different hairstyles, presence of glasses, beard.
2. Difficulties in code writing.
3. Difficulty to overcome ambiguity.

2. LITERATURE REVIEW

2.1 Introduction

The literature review deals with the topics and the researches that would help to understand Face Recognition Based Student Attendance System from the existing systems that are similar to Face Recognition Based Student Attendance system. The objective of this literature review is to analyze the related work to this project and mechanisms used in previous studies.

2.2 Signature Based Attendance System

According to our first research, we have "Smart Attendance Management and Analysis with Signature Verification." This project is the Smart Attendance Management and Analysis System where after getting individual's signature of the student, the signature is scanned and converted into an image file. After segmentation, features are extracted from the signature. Verification of signature is made with the Database of student's Signature and Excel sheet of absence and presence of student's attendance is generated. Signature is one of the most popular and legally accepted biometrics used in one's person identification. A handwritten signature is one of the ways to verify person's identity in legal, financial and administrative areas.

2.3 Fingerprint Based Attendance System Using Microcontroller and LabView

According our next research journal "Fingerprint Based Attendance System Using Microcontroller and LabView" proposed a solution of using fingerprint to mark the attendance. This system is using 2 microcontrollers to deal with the fingerprint recognition process. Firstly, the fingerprint pattern will be obtained through a fingerprint sensor, then the information will be transmitted to microcontroller 1. Next microcontroller 1 will pass the information to microcontroller 2 to do the checking with the database that resides in it. After finding a student's match, the details are sent to the PC through serial communication to be displayed. This design is good as it accelerates development while maintaining design flexibility and simplifies testing. But again, this system is attached to a PC which make it not portable. Other than that, the database information cannot be accessible easily.

2.4 Face Detection

Face detection algorithms are a very integral part of any facial analysis system depending on the ability to identify the human face part on an image. Due to the increasing demand for face recognition

systems in the past, face detection algorithms are used in many real-life applications.

2.5 Face Recognition

Although the face recognition method for in-depth learning has high accuracy, the model is complex and the recognition speed is slow. To realize real-time face recognition of students while learning video, a real-time face recognition method based on Dlib is proposed. The researchers describe the actual methods and technologies for all stages of the development of the recognition system since in the field of recognition, a huge number of unique solutions have been developed.

2.6 Liveness Detection

The face is most significant according to these properties so the face is also used for recognition systems due to its unique property and is widely used in the area which needs security .To protect from the attacks, it is necessary to carry out liveness detection in the recognition system. Liveness detection or spoof detection improves the robustness of the recognition system by determines whether the input image is of a real subject or non-real subject i.e. the image of a real subject.

Many different IQA based techniques are developed by authors for presentation attacks. Another texture-based approach is static and dynamic. The multi-task cascaded convolutional neural networks (MTCNN) are used to achieve rapid face detection and face alignment, and then the ResNet with improved loss function is used for face recognition

3. METHODOLOGY

3.1 Introduction

A methodology is a development system of methods that is used to plan, structure, and control the process of developing an information system. A wide variety of published development methodologies have evolved over the years, each with its own recognized strength and weakness. Different types of system project use available methodologies thatbest suits a specific project based on the project's various technical developmental process.Below are the types of methodologies applied in developing this project.

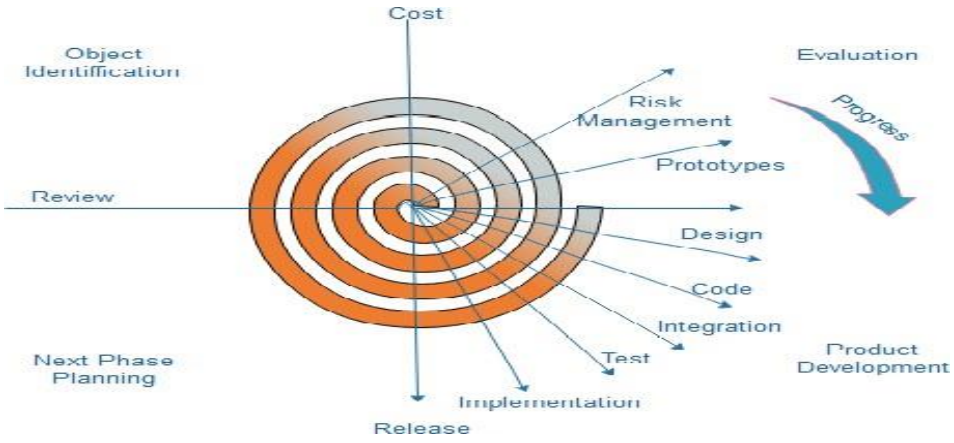


Figure 2: Spiral Model

The spiral model, initially proposed by Boehm, is an evolutionary software process model that couples the iterative feature of prototyping with the controlled and systematic aspects of the linear sequential model. It implements the potential for rapid development of new versions of the software. Using the spiral model, the software is developed in a series of incremental releases. During the early iterations, the additional release may be a paper model or prototype. During later iterations, more and more complete versions of the engineered system are produced.

Each cycle in the spiral is divided into four parts:

Objective setting: Each cycle in the spiral starts with the identification of purpose for that cycle, the various alternatives that are possible for achieving the targets, and the constraints that exists.

Risk Assessment and reduction: The next phase in the cycle is to calculate these various alternatives based on the goals and constraints. The focus of evaluation in this stage is located on the risk perception for the project.

Development and validation: The next phase is to develop strategies that resolve uncertainties and risks. This process may include activities such as benchmarking, simulation, and prototyping.

Planning: Finally, the next step is planned. The project is reviewed, and a choice made whether to continue with a further period of the spiral. If it is determined to keep, plans are drawn up for the next step of the project.

3.2 Hardware and software requirement

3.2.1 Hardware Requirement

- I.P. Camera
- RAM (8GB or above)
- GPU (NVIDIA 2GB or above with CUDA installed)
- CPU (2.50 Ghz , Multicore or above)

3.2.2 Software requirement

The software is the non-physical part of the system that uses the hardware components to successfully run the system that has been built. The system must have word processor. The system will run windows Operating System.

Operating system: Windows, Linux

Different software we used are:

- opencv-python==4.5.5.62
- pandas==1.3.5
- python-dateutil==2.8.2
- cmake==3.22.1
- dlib
- face-recognition==1.3.0
- face-recognition-models==0.3.0
- tensorboard==2.4.0
- tensorflow==2.3.0

3.3 Proposed System

To use Multiple Face Recognition and Liveness Detection using CNN, the face must be detected. The camera must be placed in the way that person's face appears clear enough. Then it is frame by frame analyzed to detect the face and recognized by the face recognition module. Finally, it checked for liveness detection.

CNN in Multiple Face Recognition and Liveness Detection involves three modules:

- ✓ Multiple Face Detection
- ✓ Face Recognition and
- ✓ Liveness Detection.

3.3.1 Multiple Face Detection

To detect multiple faces in the given image, frame the model should be capable and the detected faces must be recognized based on the given dataset. Finally, faces must be evaluated for liveness and classified whether it is life or not.

To recognize face the following steps are to be followed to generate video with face-recognized labels from input videos:

- ➢ Dataset
- ➢ Encoding
- ➢ Working
- ➢ Encode
- ➢ Compare faces
- ➢ Label

.

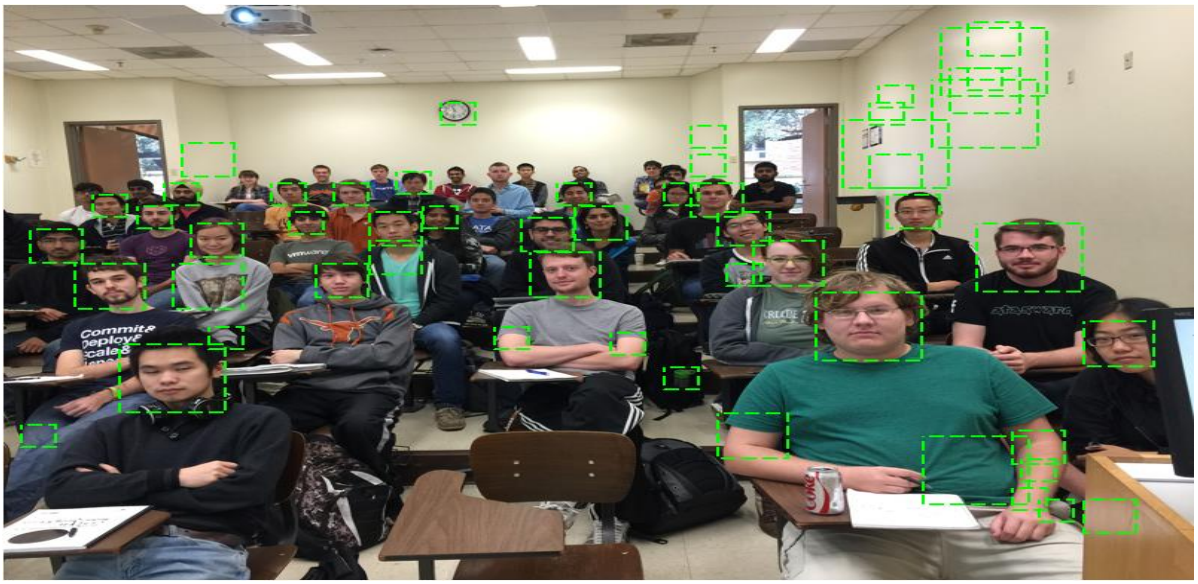


Figure3: Some face detection results from using our Multiple face system

3.3.2 Liveness Detection

The following steps are involved in Liveness Detection which takes the image frame as input and generates output as image frame labeled with detected class.

- ✓ Dataset
- ✓ Training
- ✓ Encodings
- ✓ Working
- ✓ Encodings
- ✓ Predict Class
- ✓ Label

The dataset consists of 4 classes namely Genuine, Mask, Paper Print, and digital Photo. The Genuine class is considered real and Paper Print and Digital Photos are together considered fake. Here the mask is not considered, since it falls under paper print.

For Class Classification, 3350 Videos of four classes are reduced to 1781 Videos of two classes. Each class contains the following number of images

- ✓ Real
- ✓ Genuine - 2668
- ✓ Fake
- ✓ Photo print – 1315
- ✓ Digital - 1430

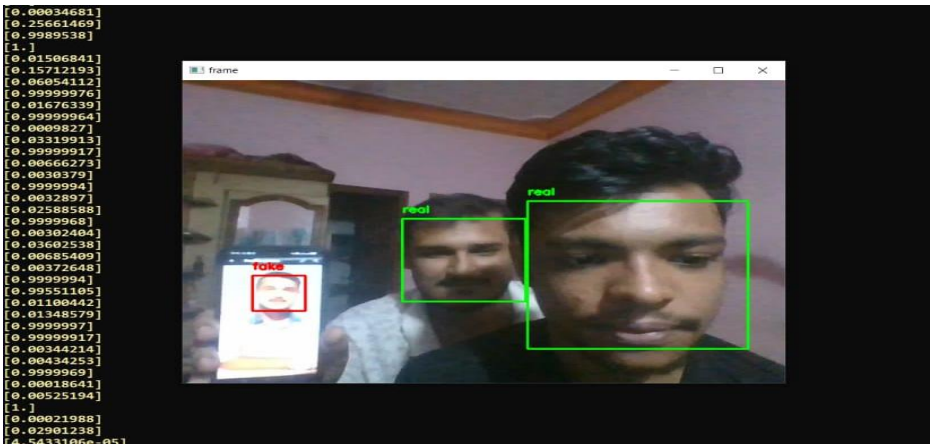


Figure 4: Face Liveness Detection

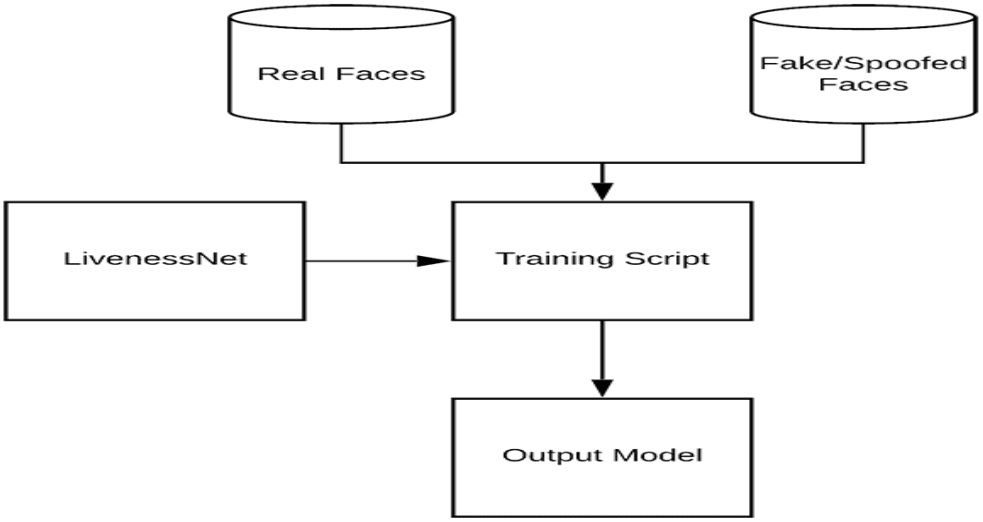


Figure 5: Check the Liveness Accuracy

3.3.3 Face Recognition:

To recognize face the following steps are to be followed to generate video with face-recognized labels from input videos:

- ✓ Dataset
- ✓ Encoding
- ✓ Working
- ✓ Encode
- ✓ Compare faces
- ✓ Votes
- ✓ Label

Figure 6: Some face detection results from using our Recognition face system

3.4 System analysis

Systems analysis is a process of collecting factual data, understanding the processes involved, identifying problems and recommending feasible suggestions for improving the functionality of the system. This involves studying the business processes, entity relationships gathering operational data, understand the information flow, finding out bottlenecks and evolving solutions for overcoming the weaknesses of the system to achieve the organizational goals. System Analysis also includes decoupling of complex processes that make up the entire system, identification of data store and manual processes.

3.5 System design

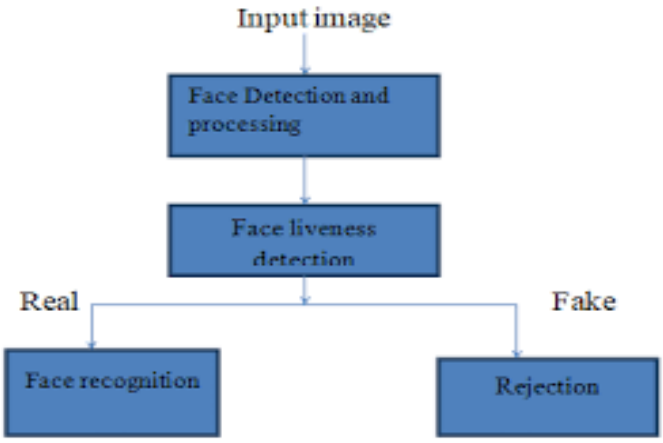


Figure 7: Use-case diagram for Face recognition attendance system

3.6 Block diagram

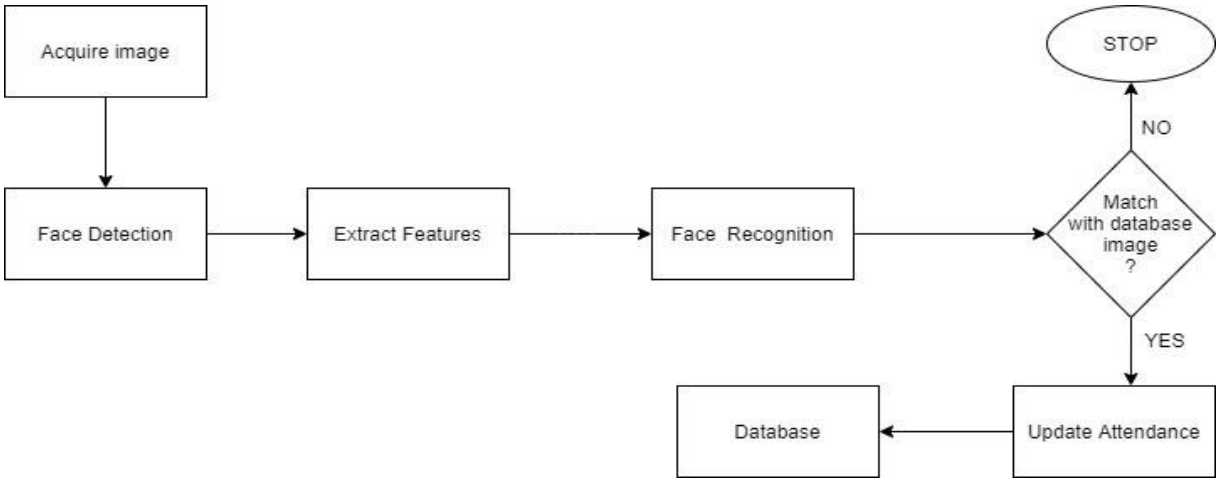


Figure 8: Block Diagram for Face recognition and detection-based attendance of student

3.7 Entity Relationship diagram

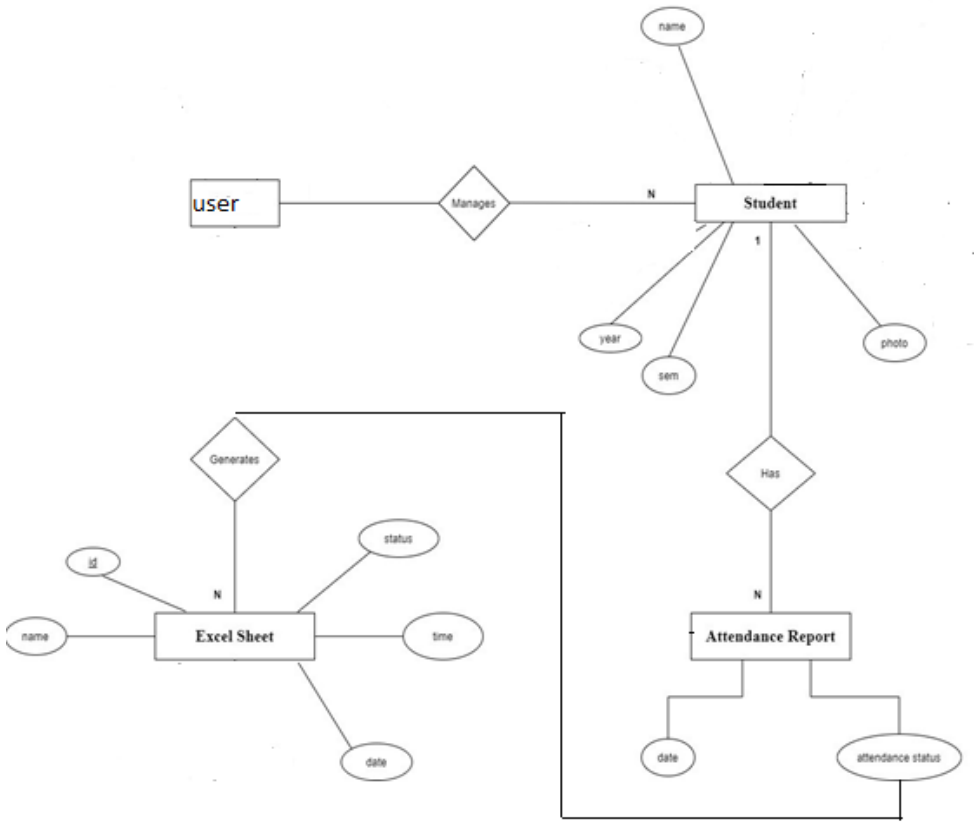


Figure 9: ER Diagram for Face recognition attendance system

3.8 Sequence diagram

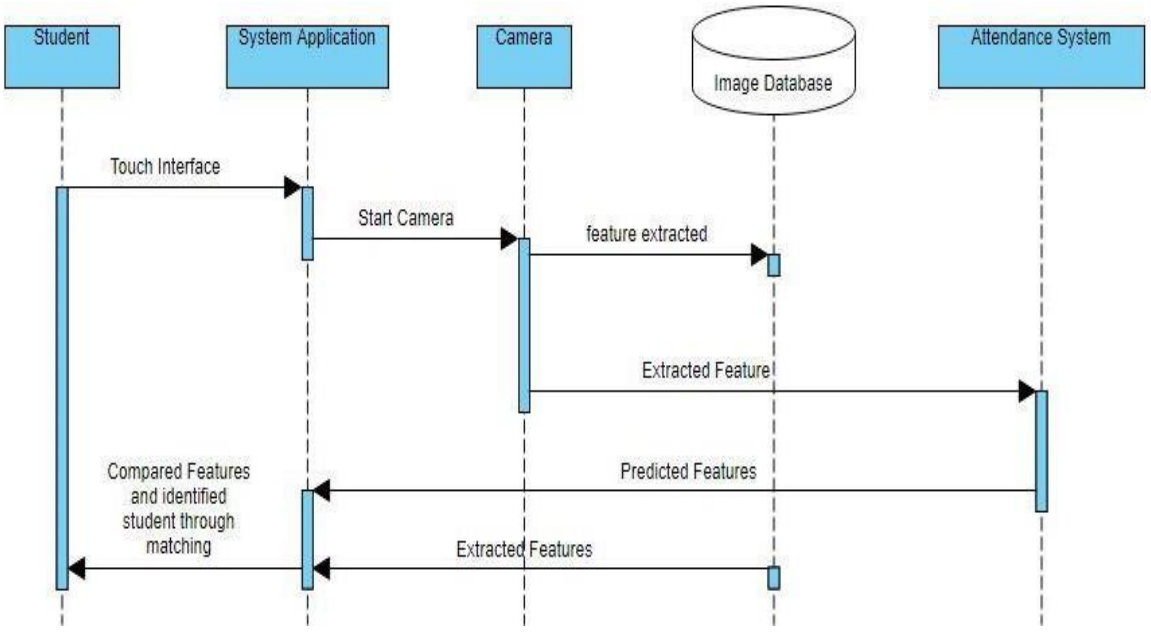


Figure 10: Sequence Diagram for Face recognition attendance system

3.9 Working Principle

- ✓ Face Recognition involves in series of steps given below
- ✓ Load and detect the faces (Face Detection).
- ✓ The detected faces are compared with all the encodings stored previously.
- ✓ For every match, the count of that label is incremented.
- ✓ Label with the maximum count is considered as the desired label.
- ✓ Then face is labeled with the desired label or 'Unknown' if there are no matches.

Algorithm: For Face recognition and detection-based attendance

Step1: START

Step2: Image stored in System data base

Step3: Recognition Process start

Step4: Camera Capture the User image

Step5: Compare With database image

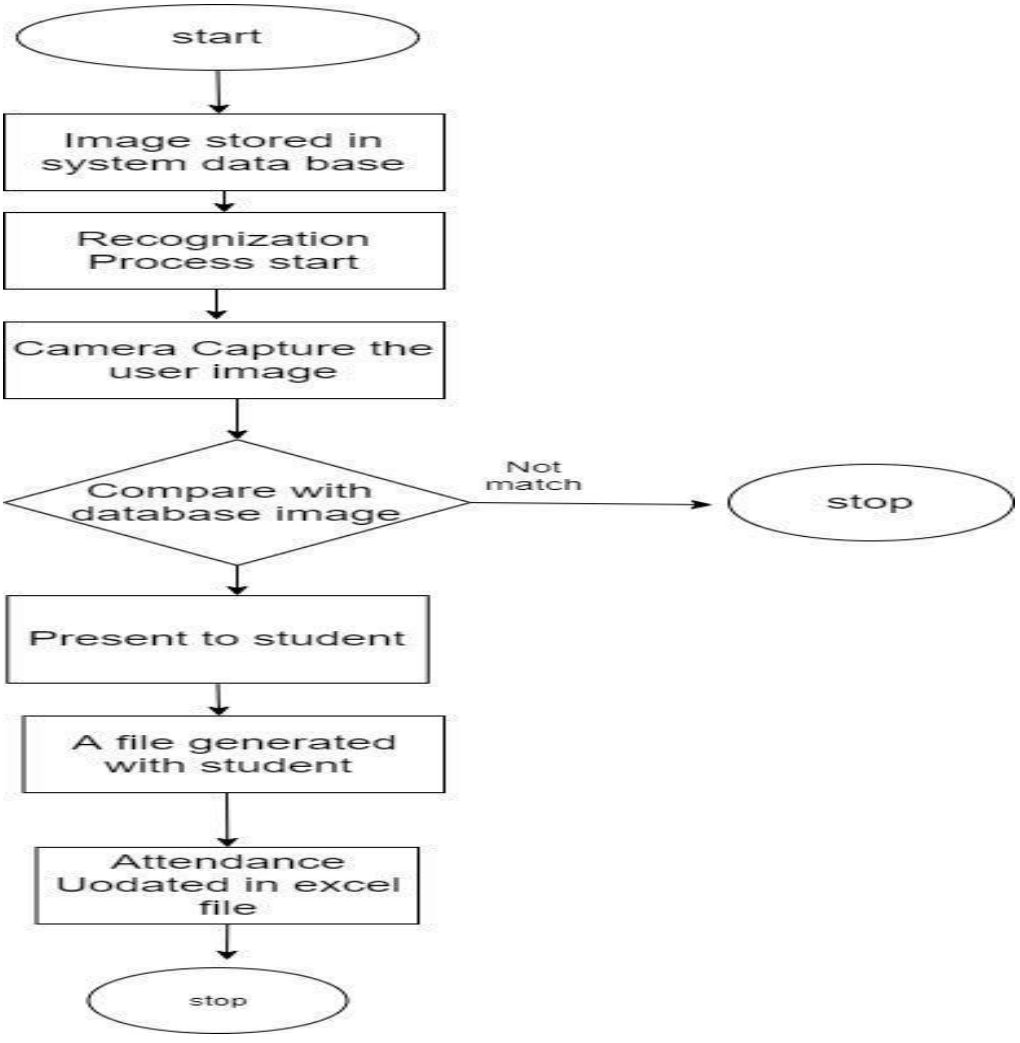


Figure 11: Flow chart for Face recognition-based attendance system

4. WORKS COMPLETED

4.1 Works Completed

1. We can Register the new admin, and we can also reset the password.
2. We can view the home page of the project
3. We have taken the dataset and trained the dataset.
4. We have designed different types of diagrams like Use case Diagram, Class Diagram and Sequence diagram etc. for documentation
5. We can do the database part of the project.
6. Facial detection and recognition work have been completed.
7. Multi face of the student is detected, it recognizes the student and marks attendance.
8. Tabular representation of attendance data is done generating a csv file.
9. Data can be retrieved easily.
10. Validation of the data.
11. Included voice-command.

4.2 Problems Encountered

- The main problems of face recognition is large variability of recorded image due to pose, illumination condition, facial expression, different hairstyles, presence of glasses, beard.
- Difficulties in code writing.
- Difficulty to overcome ambiguity.
- It is often very difficult to maintain and update all the records and retrieve certain data.

5. RESULT ANALYSIS AND CONCLUSION

5.1 Result and Analysis

Over a span of 10 weeks, our team “Pehchan” was successful in completing a proof of concept demonstrating an Attendance System based on Multiple Face Recognition. The following screenshots in Appendices section of the application home page demonstrates the key functionality the application provides.

Output Screenshots:

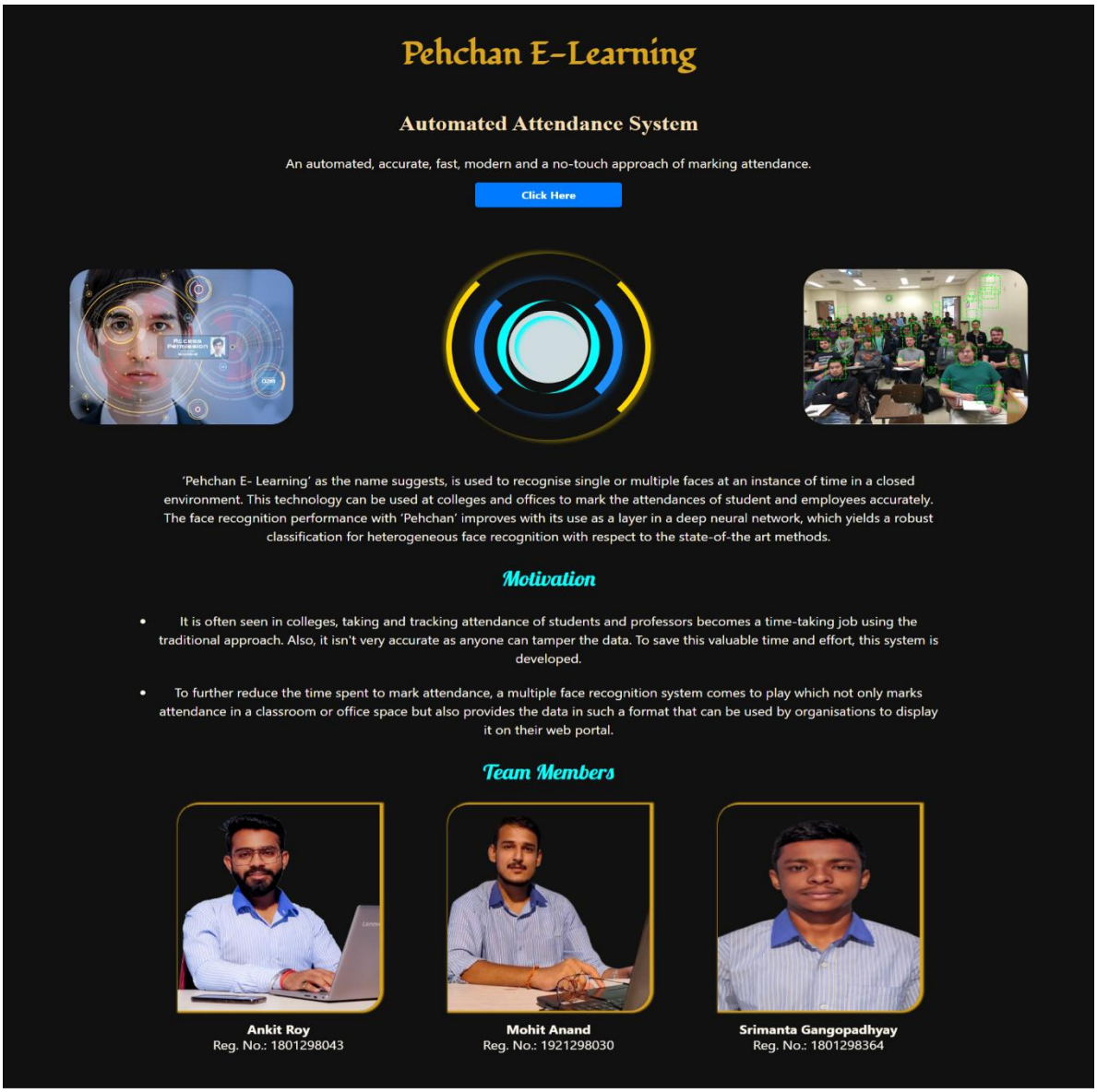


Figure 12: Face Recognition Attendance System Software Interface

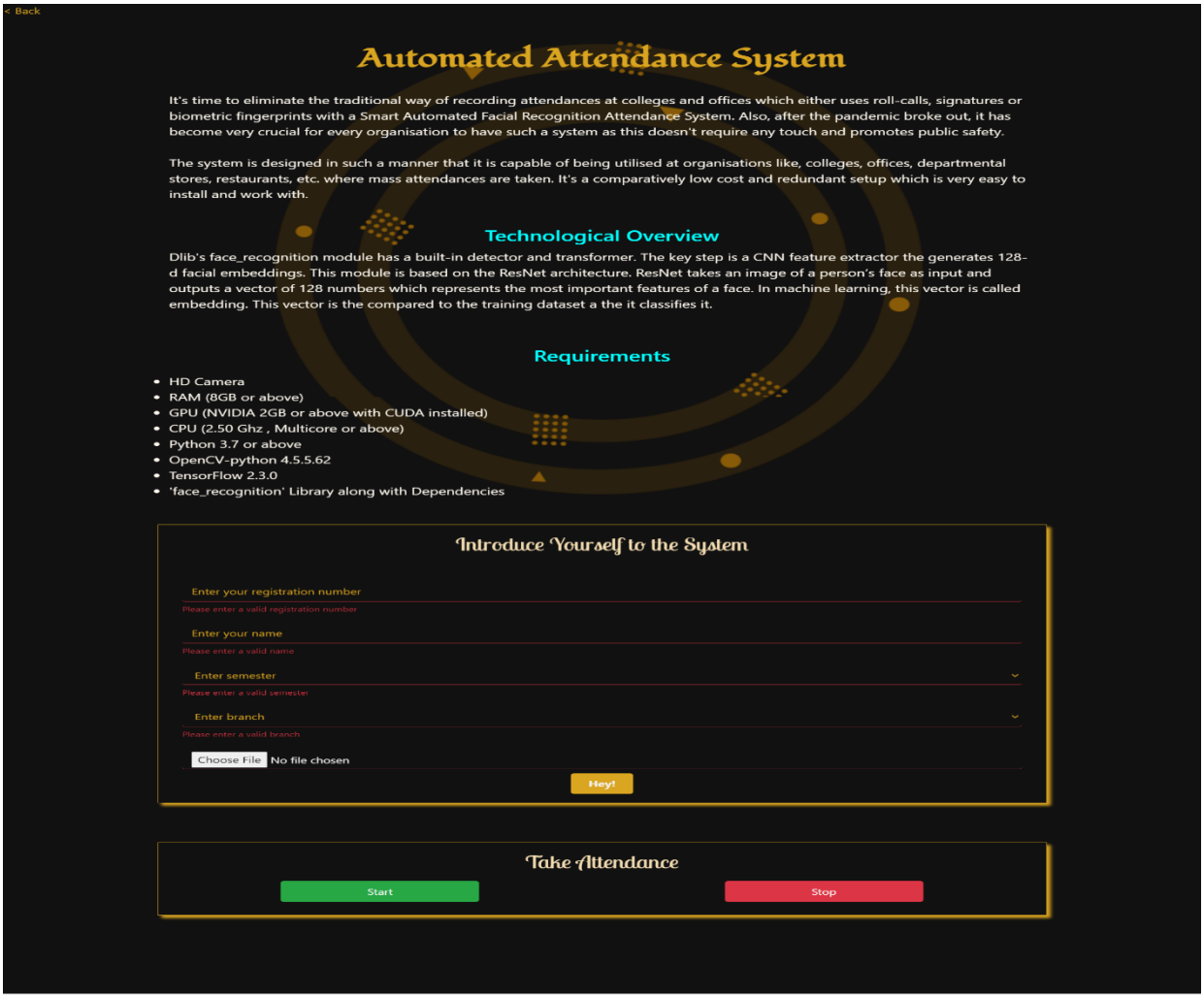
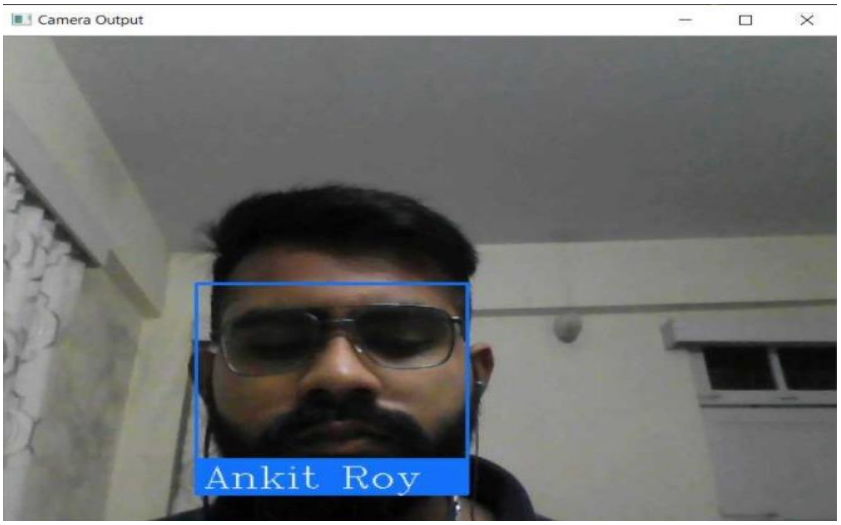
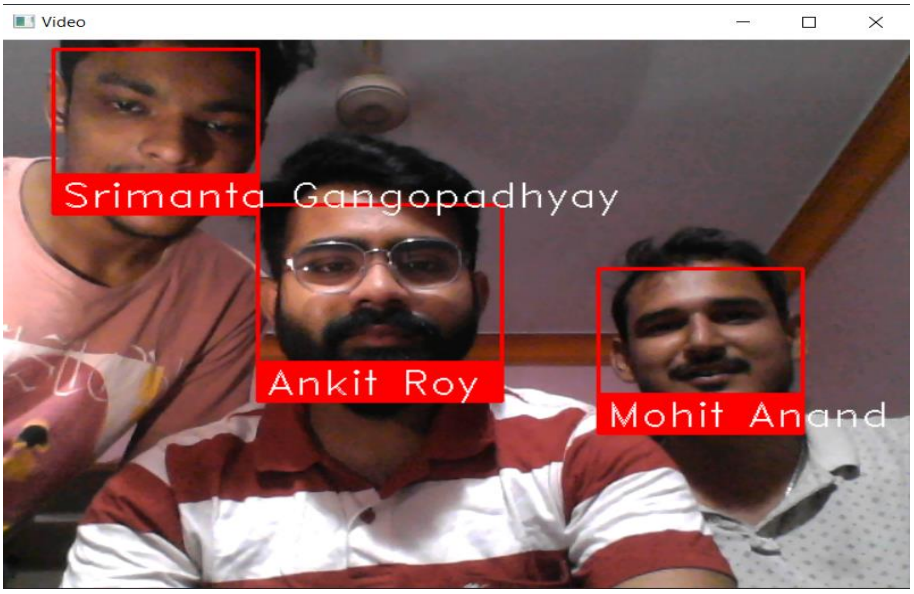


Figure 13: Admin/User Home Page



	A	B	C	D	E	F	G
1	Registration No.	Name	Branch	Semester	Time	Last Seen	
2							
3	1801298043	Ankit Roy	CSE	5th	20:12:24	20:12:24	

Figure 14: Single Face Recognition System



1	Registration No.	Name	Branch	Semester	Time	Last Seen
2						
3	1801298364	Srimanta Gangopadhyay	CSE	8th	19:15:57	19:15:57
4	1801298043	Ankit Roy	CSE	8th	19:15:58	19:15:58
5	1921298030	Mohit Anand	CSE	8th	19:16:01	19:16:01
6						
7						

Figure 15: Multi-Face Recognition System

5.2 Conclusion

This model is based on recorded existing videos and found to be working effectively. The camera, face detection & recognition model, and liveness detectors were integrated successfully. The model was tested and evaluated using existing and recorded videos. The Concept of face recognition plays important role in the advanced human authentication system. Since most of the organization and offices rely on CCTV footages for monitoring purposes, the combination face recognition system with the live feed, play a crucial role for an automated monitoring system. Thus, the applications of the **Pehchan E-Learning** Systems are not limited.

6. LIMITATIONS AND FUTURE SCOPE

We, the team "**Pehchan E-Learning**", identified some limitations which opens the door to opportunity forimprovement and further enhancement in this project.

6.1 Limitations

1. The major limitation of the face recognition model is the recognition of a person's 2D image. This leads to the attendance of being marked if the picture of a student is shown. Some face recognizers are made to detect the depth of faces and hence cannot be incorporated in this project.
2. Another constraint is that in this project 100 images of each student are taken for better accuracy. 100 images per student in a larger university/college would consume a massive volume to store the images.
3. Sometimes there may occur illumination and pose problems. And also the system can't detect face with masks.
4. The training time for our classifier takes about 20 seconds for each person. Hence for a large number of students, it would be time consuming to train. Though training the classifier isn't something that needs to be frequently done, but it would be better if a classifier taking lesser time while maintaining the accuracy can be built.
5. Small image sizes make facial recognition more difficult.
6. The current face recognition model is 96.78%.

6.2 Future Scope and Recommendation

1. A feature which can give intruder alert can be included in the system. Furthermore, the images of unknown people can be saved in an efficient manner and displayed in the system for better security.
2. Automatic mail alert/response to the parents regarding the presence and absence of the students can be added.
3. The number of training images can be reduced by removing duplicate images of the same person, or images with similar embeddings.
4. The training time can be reduced by retraining the classifier only for the newly added images.
5. Wrongly classified images can be added to the training dataset with the correct label so as to increase the accuracy of the recognition model.

7. REFERENCES

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