Smart Attendance System

A Minor Project Report

in partial fulfillment of the degree

Bachelor of Technology
in
Computer Science & Engineering

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DEPARTMENT OF COMPUTER SCIENCE & ENGINEERING

CERTIFICATE

This is to certify that the Minor Project Report entitled "Smart Attendance System" is a record of bonafide work carried out by the student(s) B. Sumanth, R. Bhavana, J. Suresh bearing Roll No(s) 19K41A0503, 19K41A0554, 20K45A0504, during the academic year 2021-2022 in partial fulfillment of the award of the degree of ***Bachelor of Technology*** in **Computer Science & Engineering** by the Jawaharlal Nehru Technological University, Hyderabad.

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ABSTRACT

Artificial intelligence is one of the most popular technology that is going to rule the entire world in coming days. As we all know that AI is entrenching into each and every field such as agriculture, healthcare, banking, transportation and education etc. This paper proposes one such idea that implements the AI technology in education sector. The process of taking attendance by roll calls is a hectic task for a teacher in a classroom. There may be a possibility of proxy attendance during the process of taking the attendance by roll calls. In order to avoid the proxy and to minimize the efforts of a teacher while taking attendance, we developed an Conventional Neural Network (CNN) model that takes the attendance using facial recognition of the students. In the process of developing the model we have used the Histogram of Oriented Gradient (HOG) method to detect the faces, Harcascade classifier algorithm to recognize the faces.

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1. INTRODUCTION

The traditional way of taking attendance by roll calls have several drawbacks such as burden for the teacher, time consuming task and there may be a possibility of proxy attendance. In order to overcome these pitfalls we need to computerize the attendance taking process with the aid of advancing technology like AI. Instead of taking attendance by roll calls some of the well established organizations are using various techniques to take the attendance such as ID card scanning system, biometric fingerprint system etc. By using ID card scanning system there may be a possibility of misuse of the card in order to mark fake attendance and even someones ID card may be lost. Biometric fingerprint system also has its own drawback. After Covid situation most of the people are not showing interest to give attendance by physical contact like fingerprint biometric. In order to overcome these issues there is an urge to develop a computerized automated system to take attendance. Smart attendance management system using face recognition will be the best solution for the above mentioned problems. Face recognition based attendance management system avoids the proxy and reduce the time as well as teachers efforts in the process of taking attendance. So as to mark the attendance of a student by using face recognition we need to use a high quality camera to capture the video of the classroom. Frames are generated from the captured video. By using HOG face detection technique the faces of students will be detected. With the help of Harcascade classifier the students faces are recognized from the image frames. By comparing the recognized students faces with the students faces in the database the attendance will be marked.

1.1.1. Existing System

The system is designed for automating the attendance of the different organization and reduces the flaws of existing manual system. The system calculate the attendance subject wise, that is the data of students and subjects are added manually by administrator, and whenever time for corresponding subject arrives the system automatically starts taking snaps and find whether human faces are appear in the given image or not.We have used Histogram of Oriented Gradient for face detection and deep learning techniques to calculate and compare 128-d face features for face recognition. Once faces are detected and recognize with the existing database, system calculate attendance for the recognize students with the respective subject id in real time. And an excel sheet generated and saved by the system automatically.

system splits into two parts, First the front end side which consist of GUI which is based on Electron JS that is JavaScript stack which is serving as a client and the second is the backend side which consist of logic and based on Python which is serving as a server. And we know that both the languages cannot communicate with each other directly so we have used IPC (Inter Personal Communication) techniques with zero library as a bridge to communicate these two languages. The Electron JS call the python functions and interchange data via TCP with help of Zero PC Library.

1.2. Proposed System

The task of the proposed system is to capture the face of each student and to store it in the database for their attendance. The face of the student needs to be captured in such a manner that all the feature of the students' face needs to be detected. There is no need for the teacher to manually take attendance in the class because the system records a video and through further processing steps the face is being recognized and the attendance file is updated.

We've used a machine learning model, and we have used two different type of algorithms ,they are Histogram of Oriented Gradients algorithm and Haarcascade algorithm for face recognition. We have used a HOG algorithm to detect the faces of students and we used Haar cascade classifier algorithm to recognize the students. The colored images are converted into gray scale images and then it will be given to (HOG) Histogram of Oriented Gradient to extract the features and detect the faces in the images. HOG algorith makes the histograms for every feature in the face and it will detect using eyes, nose, mouth, chins etc. After the detected faces are compared with the existing images in the data set with the help of Harcascade Classifier. After comparing the images ,if the student image is recognised ,the attendance will be posted.

2. LITERATURE SURVEY

2.1 Related Work

The authors of paper Dan Wang, Rong Fu, Zuying Luo published an article on Classroom Attendance Automanagement Based on Deep Learning. They have developed an automatic attendance system by integrating two deep learning algorithm Faster R-CNN face detection algorithm and SeetaFace face recognition algorithm. It addressed the problem of low resolution, they used 4K HD video for face detection and face recognition. This paper used Faster R-CNN and See Face to class attendance, and achieves satisfactory results. It not only gave the four traditional attendance indicators about absence, later arrival, early departure and random access, but also gave the new indicator of carelessness. They have mentioned that it's a promising class attendance technology.

The author of paper Kaneez Laila Bhatti used face recognition approach to reduce the flaws of existing system with the help of machine learning, which requires a good quality camera to capture the images of students, the detection process is done by histogram of oriented gradient and recognizing perform through deep learning. Their system performed satisfactorily in different poses and variations. In future their system require improvements because these systems sometimes fails to recognize students from some distance, also they have some processing limitation, working with a system of high processing may result even better performance of their system.

Ajinkya Patil along with the other authors in paper proposed a face recognition technique for attendance marking with the help of Viola jones algorithm, Haar cascades are used to detect faces in images and recognition performs through Eigen face method.

Another way of taking the attendance of students in an easy and secure manner, the authors of paper proposed a system with the support of artificial neural networks, they used PCA to extract face images and testing and training were achieved by neural networks, their system performs in various orientation.

A 3D face recognition technique for attendance management system was proposed by the author is MuthuKalyani.K, VeeraMuthu.A [6], they marked attendance with monthly progress of each student. There is need for a better algorithm which can enhance the recognition on oriented faces

Efficient Attendance Management system is designed with the help of PCA algorithm, they have achieved accuracy up to 83% but their system performance decreases due to slight changes in light condition.
An Eigen face approach along with PCA algorithm for marking face recognition attendance system have introduced by author in [8], they made a comparison between various face recognition algorithms.

2.2 System Study

In recent advancements in the field of machine learning, neural networks offer a variety of applications for understanding face detection techniques. The machine Learning models showcased prominent results in recognition Systems. So, researchers are focusing more on developing these type of models. We have created our own dataset, that consists images our class students. We have resized the image and the coloured image is transformed to grayscale image in pre-processing phase.

Then the images are subjected to the HOG algorithm which detects the faces. The algorithm consists of several layers and uses different optimizers.

3.DESIGN

3.1 Requirements Specifications

3.1.1 Functional Requirements

The requirements are the descriptions of the system services and constraints.

System functional requirement describes activities and services that must provide.

Taking and tracking student attendance by facial recognition in specific time.

Marking the attendance of the recognised students.

Permitting the lecturer to modify the student absent or late.

Tracking the time and date of a student .

3.1.2 Non Functional Requirements

Nonfunctional Requirements are characteristics or attributes of the system that can judge its operation. The following points clarify them:

The system should perform its process in accuracy and precision to avoid problems.

1. **Modifiability:** the system should be easy to modify, any wrong should be correct.
2. **Security:** the system should be secure and saving student's privacy
3. **Usability:** the system should be easy to deal with and simple to understand.
4. **Maintainability:** the maintenance group should be able to fix any problem occur suddenly
5. **Speed and Responsiveness:** Execution of operations should be fast.

3.1.3 Hardware and Software Requirements

Hardware Requirements

- System: Processor Intel(R) Core (TM) i5-8265U CPU @

1.60GHz, 1800 MHz, 4 Cores, 8 Logical Processors

- RAM: 8 GB
- Hard Disk: 557 GB
- Input: Keyboard, Mouse and Camera
- Output: PC

Software Requirements

- OS: Windows 10
- Platform: Google Colaboratory / Jupyter Notebook / Visual Studio Code
- Deployment software: Heroku
- Program Language: Python

3.2 UML DIAGRAMS

3.2.1 DATAFLOW DIAGRAMS

Data flow diagrams are used to graphically represent the flow of data in a business information system. DFD describes the processes that are involved in a system to transfer data from the input to the file storage and reports generation. Data flow diagrams can be divided into logical and physical. The logical data flow diagram describes flow of data through a system to perform certain functionality of a business. The physical data flow diagram describes the implementation of the logical data flow. The data flow diagram shows data inputs, outputs, storage sites, and paths between each destination using predetermined symbols and shapes like rectangles, circles, and arrows, as well as short text labels. Data flow diagrams can range from simple, even hand-drawn process overviews to multi-level and in depth that go deeper into how data is processed. The main components or symbols in the data flow diagram include:

Components of Data Flow Diagram:

• **Process**: A circle is a process in data flow diagrams and depicts how the data is handled and processed in the system.

• **Data Flow**: The data flow is the curved line that shows the flow of data in or out of the system.

• **Data Store**: A data store denotes the storage of information that can be retrieved later or by other processes in a different order. A single element or a set of elements can be found in the data storage. The group of parallel lines denotes a location to collect the data items.

• **Entity**: An external entity that serves as a source of system inputs or a sink of system outputs is called a source or sink.

DFD – 0 LEVEL:

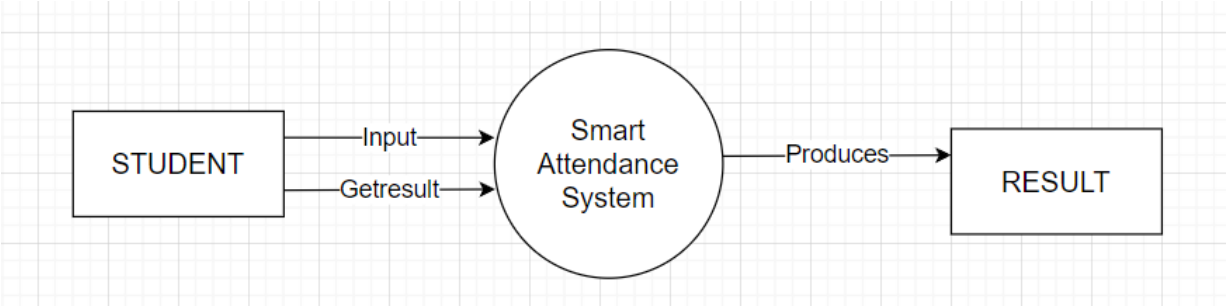

Fig.1. Data Flow diagram for Smart Attendance System

3.2.2 USE CASE DIAGRAM

In the Unified Modeling Language (UML), a use case diagram can summarize the details of your system's users (also known as actors) and their interactions with the system. To build one, you'll use a set of specialized symbols and connectors. Use case diagrams are a way to capture the system's functionality and requirements in UML diagrams. It captures the dynamic behavior of a live system. A use case diagram consists of a use case and an actor. A use case represents a distinct functionality of a system, a component, a package, or a class. An actor is an entity that initiates the use case from outside the scope of a use case. The name of an actor or a use case must be meaningful and relevant to the system.

A purpose of use case diagram is to capture the core functionalities of a system. UML use case diagrams are ideal for:

- Representing goals of system-user interactions
- Defining and organizing functional requirements in a system
- Specifying the context and requirements of a system
- Modelling the basic flow of events in a use case

Components of Use Case Diagram:

• **Actors:** The users that interact with a system. An actor can be a person, an organization, or an outside system that interacts with your application or system. They must be external objects that produce or consume data.

• **System:** A specific sequence of actions and interactions between actors and the system. A system may also be referred to as a scenario.

• **Goals:** The end result of most use cases. A successful diagram should describe the activities and variants used to reach the goal

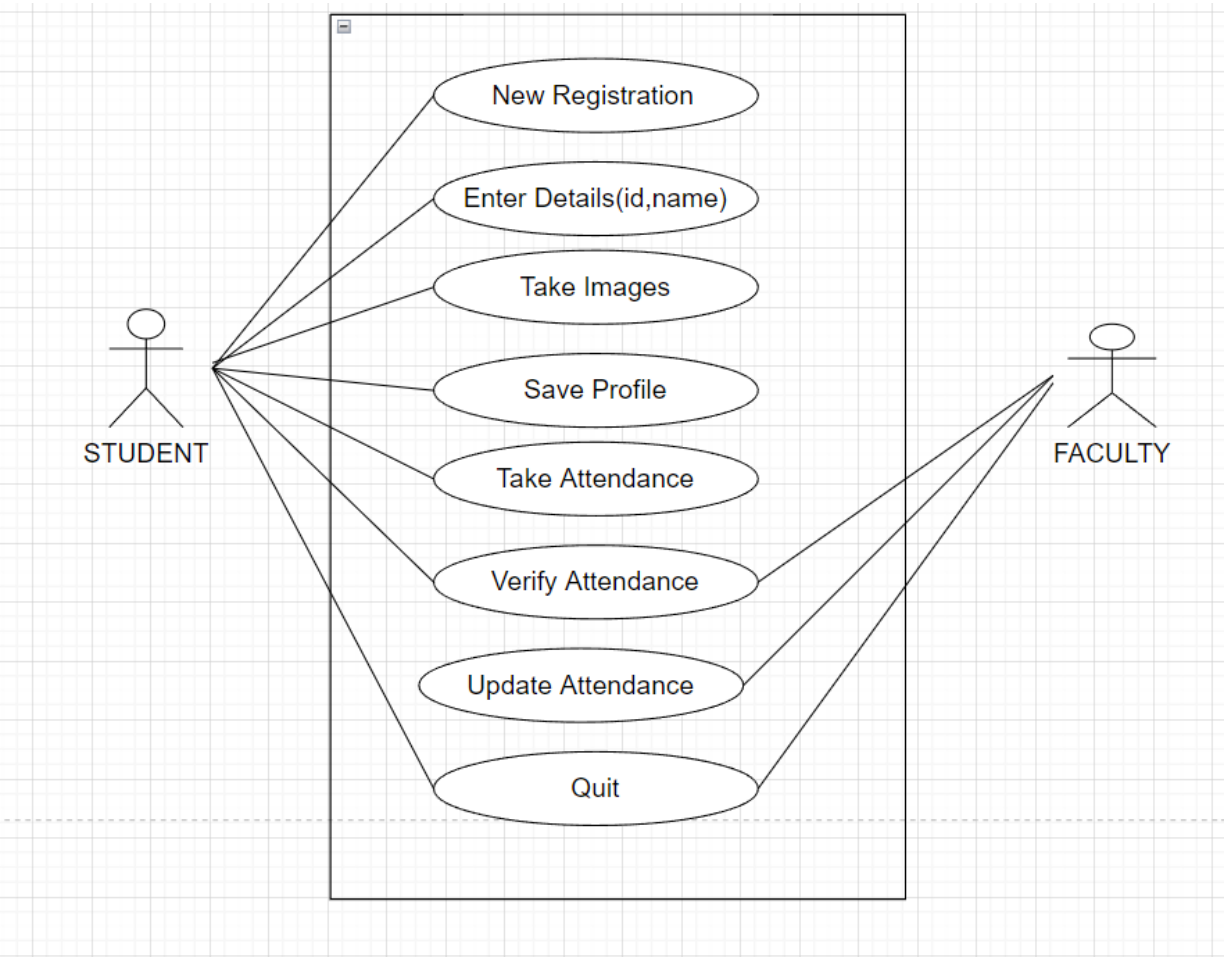

Fig.2. Use Case Diagram For Smart Attendance System

4. IMPLEMENTATION

4.1 MODULES

4.1.1 Data Collection

We have created the real time data set consisting of student name, roll number and face images of 10 students. We have collected 50 images of a student for better accuracy. The images will be stored in a folder called train image. The data set totally consists of 500 images.

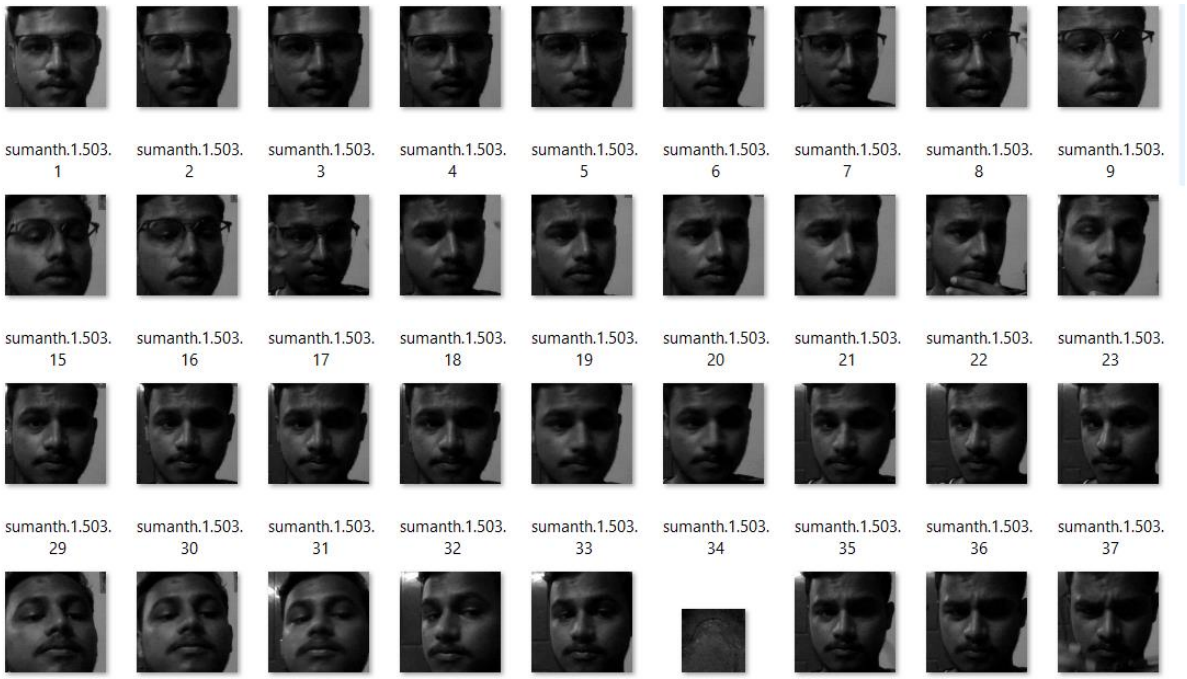

Fig.3. Images in the Data set

4.2 OVERVIEW TECHNOLOGY

MODEL ARCHITECTURE

In this project we have developed a CNN model that is used to mark the attendance of students based on face recognition. We have used HOG algorithm to detect the faces of students and we used Harcascade classifier algorithm to recognize the students.

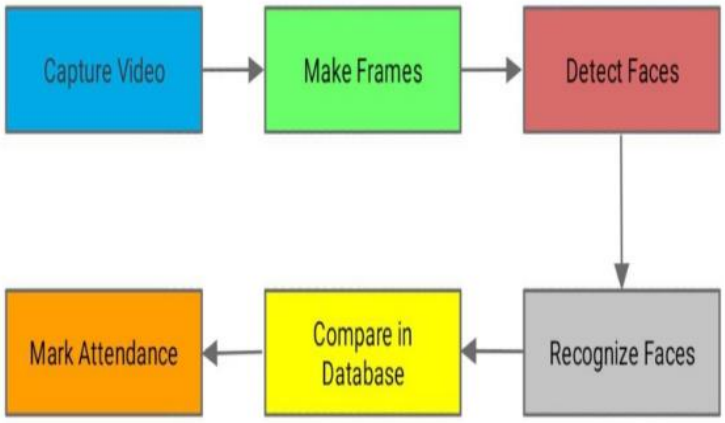

Fig.4. Architecture Model

This project mainly focuses on the attendance taking process, to reduce the time consumption and the efforts of the faculty to take attendance by traditional roll call methods. Firstly we have created a dataset of the students by collecting there images. We have collected the details of the students interms of name of the student, roll number and their images. For better accuracy we have collected 50 images of each student to train the model. In order to implement this project we require a high quality camera to capture the video of a classroom. The camera is placed in the classroom so as to capture the video of entire classroom. The camera must be of good quality, for a small classroom of length 6 meters the camera quality of 1080P is sufficient but for a large classroom like seminar halls the camera quality should be of minimum 4k. In a particular period the captuted video will be made into frames at a regular interval of time, and those frames are converted into gray scale images. In this project we have developed a CNN model that is used to mark the attendance of students based on face recognition. We have used a HOG algorithm to detect the faces of students and we used Haar cascade classifier algorithm to recognize the students. The colored images are converted into gray scale images and then it will be given to (HOG) Histogram of Oriented Gradient to extract the features and detect the faces in the images. HOG algorith makes the histograms for every feature in the face and it will detect using eyes, nose, mouth, chins etc. After the detected faces are compared with the existing images in the data set with the help of Harcascade Classifier. If the recognized students faces is available in the dataset then the attendance will be marked for that student on that date and for that particular period. While taking the attendance the date and time stamps will also be recorded. Finally the faculty can view or download the attendance report at the end. The student enrollment process consists of entering some of the basic details of the students in terms

of name of the student, roll number of the student, then after we should click capture images option so that the camera will be turned on and the required number of images in different angles will be taken to train the model. After successful capturing of images of the student it will be asking to save the profile of the student. After saving the profile the enrollment is successful and the enrollment count will be incremented in the application.

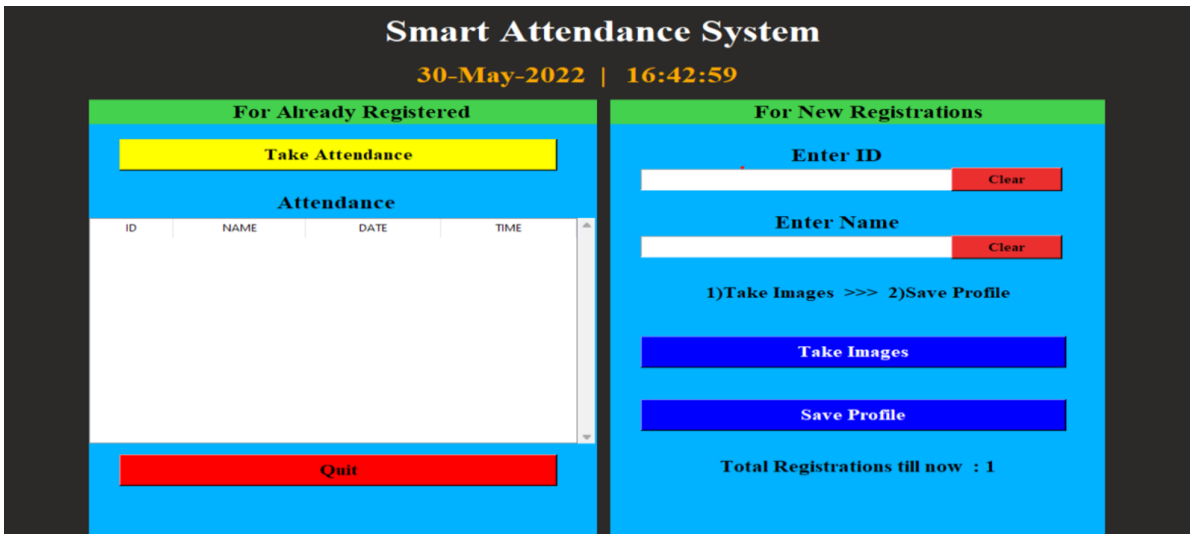

Fig.5. Student Registration

After clicking on take images ,a window will be opened with the camera access and then the images will be taken .The following figure shows the capturing of images through the camera.

Fig.6. Image Capturing

The following image shows how the faces are detected through face camera.

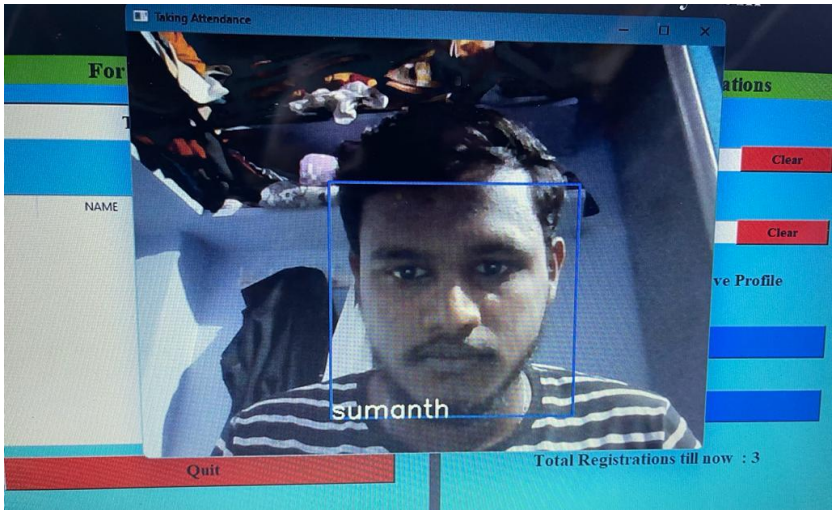

Fig.7. Image Detection

After taking the attendance, the student id , name, date and time will be recorded in the excel sheet and also it will visible on the aplication.

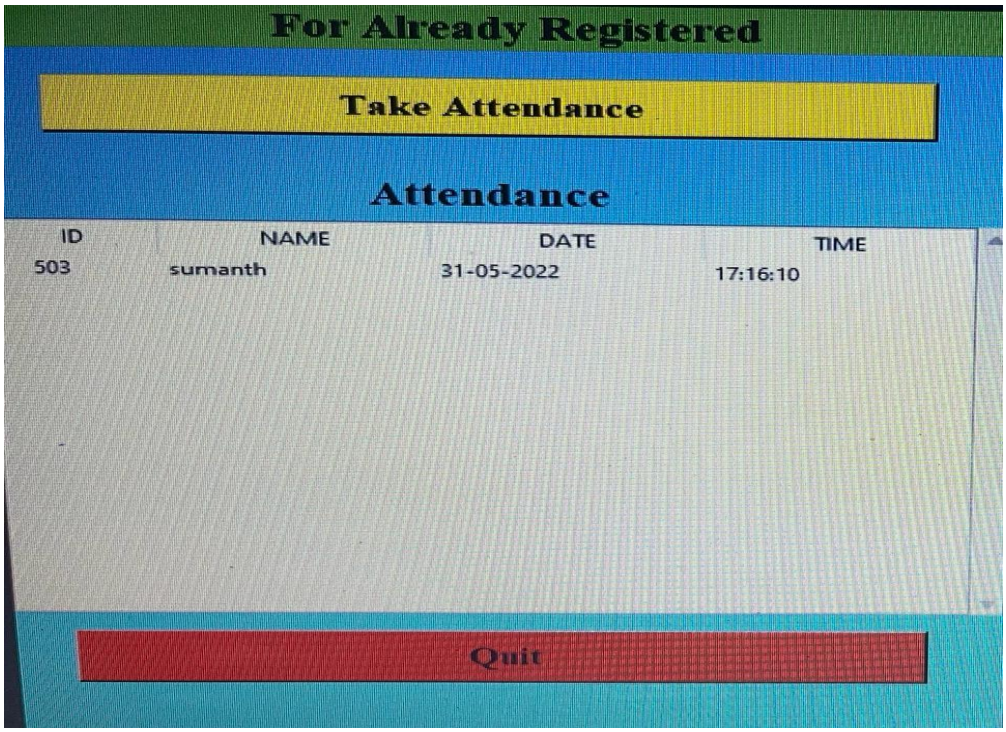

Fig.8. Attendance report on applicatiion

5. TESTING

Test Cases and Test Results:

Testing the model based on different image features

MODEL PERFORMANCE

The model will detect the image of a person and compares it with the data set and then it marks attendance.

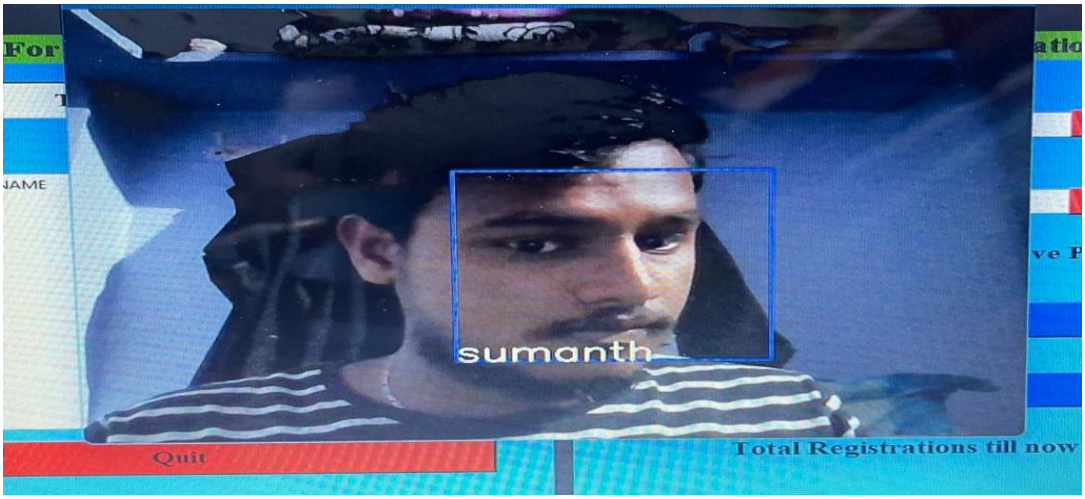

Fig.9. Model Recognised the Registered Student

The developed model will recognize only the registered students and mark the attendance for them only.

Fig.10. Model Detected An Unknown Student

The model is capable of detecting the unauthorized students entering the class and display them as unknown persons. By this we can avoid the unauthorized persons entry to the classroom.

6. RESULTS

The Following figure shows the face recognition window where the registered students are recognized by showing their Roll No. and Name in case they were not registered it would have shown 'unknown'**.**
The date and time of the student attended to the class also will be recorded accordingly in the excel sheet and also in the application.

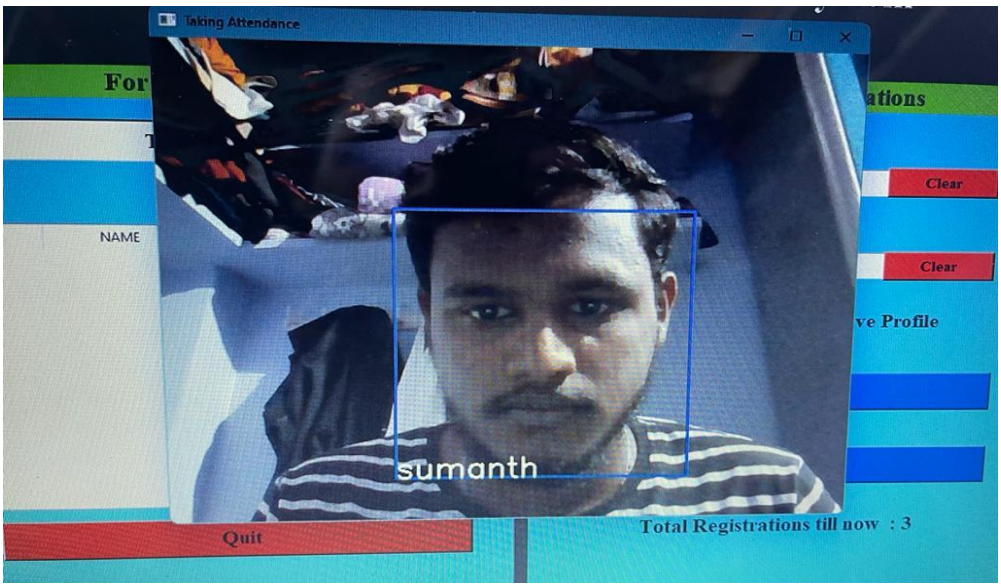

Fig.11. Image Detection for Marking Attendance

By pressing Q(quit), the window will be closed and attendance will be updated in the excel sheet.
The following image shows attendance of the registered students .

	A	B	C	D	E
1	SERIAL NO	ID	Name	Date	Time
2					
3	1	503	sumanth	31-05-2022	17:16:10
4					
5					
6					
7					
8					
9					
10					
11					
12					
13					

Fig.12. Attendance Record

7. CONCLUSION

Attendance is an important part of daily classroom evaluation. The conventional method of calling name of each student is time consuming and there is always a chance of proxy attendance. The project is based on face recognition to maintain the attendance record of students. This project develops an automatic attendance system by integrating a model that is used to mark the attendance of students based on face recognition.

We have used HOG algorithm to detect the faces of students and we used Harcascade classifier algorithm to recognize the students. The system performs is satisfactory in different poses and variations. The accuracy of the system is 91%. Taking attendance using face recognition is the best options among all of the solutions. The project aims on marking students attendance using face recognition, thus eliminating the manual process of taking attendance. This provides the university with an efficient automated and easy way for confirming the student attendance.

8. FUTURE SCOPE

A more detailed research is needed on a project as such. The methods used could be combined with others to achieve great results. According to the literature research, various strategies have been used in the past. For security reasons, a login feature would be implemented on the system. The system will be deployed as a stand-alone system that other schools can use. Data confidentiality is very important. At the start of each school year, the images of new students are taken and stored in the university database. Every student will have the right to know if their faces will be used in a face recognition attendance system. This must adhere to government regulations on ethical issues as well as data protection laws and rights. Students must provide their permission for their photographs to be used for attendance purposes. There are some other tasks to be completed on this project in order to alert the student by sending an SMS regarding his or her attendance. This is accomplished through the usage of a GSM module. This SMS alert is sent to the student's parent. Because it is not totally reliable, the system that has been given should only be used for testing purposes.

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