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SMART ATTENDANCE MANAGEMENT SYSTEM (SAMS): ATTENDANCE TRACKING PROCESS IN EDUCATIONAL INSTITUTION

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***Abstract*:** *The Smart Attendance Management System (SAMS) is a technologically advanced solution designed to streamline and automate the attendance tracking process in educational institutions and corporate environments. Traditional attendance management methods often suffer from inefficiencies, inaccuracies, and time-consuming manual processes. To overcome these challenges, this paper presents the development of a smart attendance system using Python programming language, Local Binary Patterns Histograms (LBPH) algorithm, MySQL Workbench for storing data, and Microsoft Excel for marking and saving attendance.*

Here faces will be recognized using face recognition algorithms. The processed image will then be compared against the existing stored record and then attendance is marked in the database accordingly. Compared to existing system traditional attendance marking system, this system reduces the workload of people. The system is user-friendly, accurate, and efficient, making it an ideal solution for educational institutions, IT sectors, etc.

***Key Words*: Attendance monitoring, Face recognition, Smart attendance, User friendly, OpenCV.**

1.INTRODUCTION

In today's digital age, technology has become an integral part of our daily lives. The use of technology in education has gained immense popularity in recent years due to its numerous benefits. One such application is the smart attendance system. The traditional method of manual attendance is time-consuming, prone to errors, and requires a lot of resources. To overcome these challenges, this paper presents the development of a smart attendance system using Python programming language, Local Binary Patterns Histograms (LBPH) algorithm, MySQL Workbench for storing data, and Microsoft Excel for marking and saving attendance. The idea for this project came to us in class as we saw the amount of time that has to be skipped for attendance and the nonchalance of students who had already marked their attendance which leads to the method being delayed.

1.1 Research Objectives

The research objective of a smart attendance system is to devise and refine technological solutions that streamline the process of attendance tracking across diverse settings, including educational institutions, workplaces, and events. This involves the development and integration of advanced technologies such as biometric recognition, RFID, Bluetooth, or QR codes to accurately and efficiently record attendance. Emphasis is placed on enhancing accuracy, reliability, and user experience while addressing privacy and security concerns associated with sensitive data. Additionally, research endeavors aim to assess the cost-effectiveness of smart attendance systems in comparison to traditional manual methods, considering factors like initial setup costs, maintenance expenses, and long-term benefits. Through these investigations, the overarching goal is to optimize attendance management practices, fostering improved efficiency, transparency, and accountability within organizations.

1.2 Project Scope and Direction

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. In this project, an application will be developed which is capable of recognizing the identity of each individuals and eventually record down the data into a database system. Apart from that, an excel sheet is created which shows the students attendance and is directly mailed to the respected faculty.

1.3 Impact, Significance and contributions

Many attendance management systems that exist nowadays are lack of efficiency and information sharing. Therefore, in this project, those limitations will be overcome and also further improved and are as follows :

- Students will be more punctual on attending classes. This is due to the attendance of a student can only be taken personally where any absentees will be noticed by the system. This can not only train the student to be punctual as

well as avoids any immoral ethics such as signing the attendance for their friends.

▪ The institution can save a lot of resources as enforcement are now done by means of technology rather than human supervision which will waste a lot of human resource for an insignificant process.

▪ The application can operate on any device at any location as long as there is Wi-Fi coverage or Ethernet connection which makes the attendance system to be portable to be placed at any intended location. For an example, the device can be placed at the entrance of the classroom to take the attendance.

▪ It saves a lot of cost in the sense that it had eliminated the paperwork completely.

▪ The system is also time effective because all calculations are all automated. In short, the project is developed to solve the existing issues in the old attendance system.

2. LITERATURE REVIEW

In recent years, a number of face recognition based attendance management system have introduced in order to improve the performance of students in different organization.

• In Jomon Joseph, K. P. Zacharia[1] proposed a system using image processing, PCA, Eigen faces, Microcontroller, based on Matlab. Their system works only with front face images and there is need of a suitable method which works with the orientation of the system.

• Ajinkya Patil[2] with their fellows in proposed a face recognition approach for attendance marking using Viola jones algorithm, Haar cascades are used to detect faces in images and recognition performs through Eigen face method. Another approach of making 5 attendance system easy and secure, the author proposed a system with the help 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 orientations.

• The second research journals "Face Recognition Based Attendance Marking System" (SenthamilSelvi, Chitrakala, Antony Jenitha, 2014) is based on the identification of face recognition to solve the previous attendance system‟s issues. This system uses camera to capture the images of the employee to do face detection and recognition. The captured image is compared one by one with the face database to search for the workers face where attendance will be marked when a result is found in the face database[3].

• "Online Student Attendance System", P. N. Garad[4] et al, in this project, we gave access to three users i.e., Admin, Student, Others. This project is based on client-server. Here, the serve is Tomcat and client is JSP. In this project teachers or the admin will be filling attendance and sending message to the student who is absent. They will have privilege to fill attendance form, update attendance form, send message to the guardian's account whose child is absent, also those attendance is less than 75%, and they also have privilege to send message to the students whose fees are pending.

• Web Based Coaching Institute Management System Mayuri Kamble[5] et al, "Coaching Institute Management System" software developed for an institute has been designed to achieve maximum efficiency and reduce the time taken to handle the storing activity. The system is strong enough to withstand regressive daily operations under conditions where the database is maintained and cleared over a certain time of span. The implementation of the system in the organization will considerably reduce data entry, time and also provide readily calculated reports.

• According to the fourth research journal "RFID based Student Attendance System" (Hussain, Dugar, Deka, Hannan, 2014), the proposed solution is almost similar to the first research journal where RFID technology is used to improve the older attendance system. In this system, a tag and a reader is again used as a method of tracking the attendance of the students. The difference between the first journals with this is where attendances information can be accessed through a web portal. It provides more convenient for information retrieval [6].

3. METHODOLOGY

3.1 Image Acquisition and Pre-processing procedures

After the images are being processed, they are stored into a file in a hierarchy manner. In this project, all the faces will be stored in a hierarchy manner under the „database‟ folder. When expanding through the database folder, there will consist of many sub-folders which each of them will represent an individual where a Facial Recognition Attendance System Using Python And OpenCv Corresponding Author: Dr. V Suresh24 | Page series of face portrait belonging to the same individual will be stored in that particular sub-folder. The subfolders that represent each individual will be named upon the ID no. of that individual which is unique for every single individual in the institution. The whole process of image retrieval, pre-processing, storing mechanism is done by the script named create_database.py

3.2 Face Detection and Extraction

Face detection is important as the image taken through the camera given to the system, face detection algorithm applies to identify the human faces in that image, the number of image processing algorithms are introduce to detect faces in an images and also the location of that detected faces. We

have used HOG method to detect human faces in given image.

3.3 Face Positioning

There are 68 specific points in a human face. In other words we can say 68 face landmarks. The main function of this step is to detect landmarks of faces and to position the image. A python script is used to automatically detect the face landmarks and to position the face as much as possible without distorting the image.

3.4 Face Encoding

Once the faces are detected in the given image, the next step is to extract the unique identifying facial feature for each image. Basically whenever we get localization of face, the 128 key facial point are extracted for each image given input which are highly accurate and these 128-d facial points are stored in data file for face recognition

3.5 Face matching

This is last step of face recognition process. We have used the one of the best learning technique that is deep metric learning which is highly accurate and capable of outputting real value feature vector. Our system ratifies the faces, constructing the 128- d embedding (ratification) for each. Internally compare faces function is used to compute the Euclidean distance between face in image and all faces in the dataset. If the current image is matched with the 60% threshold with the existing dataset, it will move to attendance marking.

4. SYSTEM DESIGN

The design part of the attendance monitoring system is divided into two sections which consist of the hardware and the software part. Before the software The design part can be developed, the hardware part is first completed to provide a platform for the software to work. Before the software part we need to install some libraries for effective working of the application. We install OpenCV and Numpy through Python.

4.1 Python libraries used

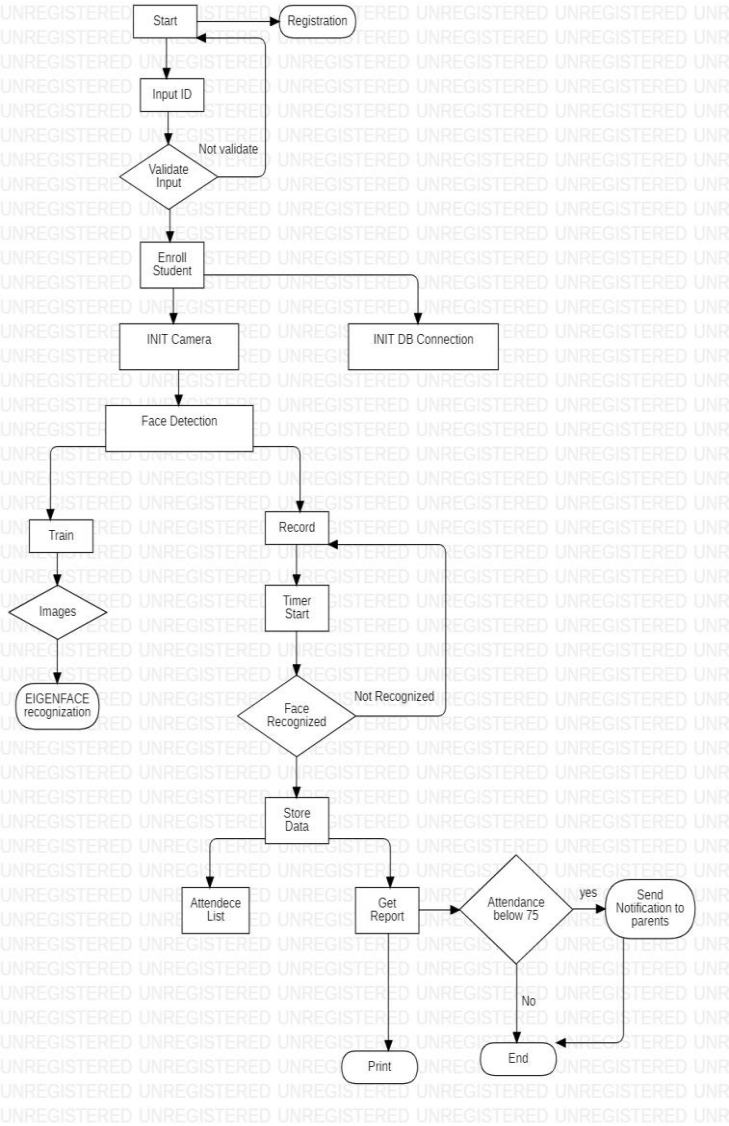
4.1.1 OpenCV (Open Source Computer Vision Library): OpenCV (Open Source Computer Vision Library) is a popular computer vision and machine learning library. It is widely used in various applications such as object detection, face recognition, and image processing. In the context of a face recognition attendance system, OpenCV is used for capturing video input from webcams, reading images, and performing various image processing tasks such as,

a. Face Detection: OpenCV provides various face detection algorithms such as Haar Cascade, LBPH (Local Binary Patterns Histograms), and SVM (Support Vector Machines). These algorithms are used to detect faces in images or video frames.

b. Face Alignment: OpenCV's, dlib library is used for face landmark detection, which is the process of identifying specific facial features such as eyes, nose, and mouth. This information is used for face alignment, which is necessary for accurate face recognition.

c. Face Recognition: OpenCV provides various face recognition algorithms such as Eigen faces, Fisher faces, and Local Binary Patterns Histograms (LBPH). These algorithms are used to compare faces against a database of known faces.

5. FLOWCHART



5.1 Registration process:

- Start: The process begins here.
- Input ID: The user enters their ID number (likely their student or employee ID).

- Validate ID: The system validates the entered ID against a database to check if it's a valid user.
- Valid ID: If the ID is valid, the process proceeds to the next step.
- Not Valid ID: If the ID is not valid, an error message is displayed, and the user likely needs to re-enter their ID.
- Enroll Student (or Staff): The user's information is enrolled into the system, which likely involves capturing their facial image for facial recognition.
- Store Data: The user's information and facial recognition data are stored in the system's database.
- End: The registration process is complete.

5.2 Attendance login process:

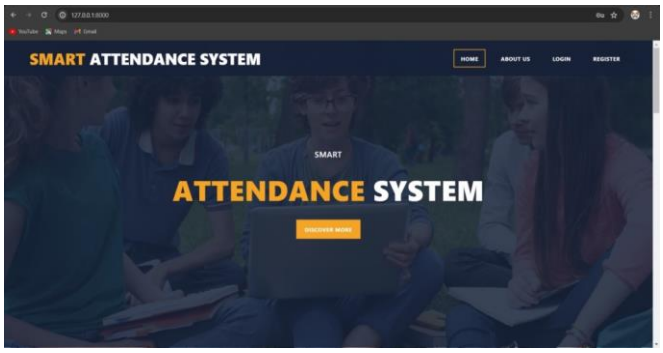
- Start: The process begins here.
- Init Camera: The system initializes the webcam or camera to capture the user's face.
- Init DB Connection: The system establishes a connection to the database where user information and facial recognition data are stored.
- Face Detection: The system detects a face in the camera frame.
- Face Recognition: The system performs facial recognition by comparing the detected face with the facial recognition data stored in the database.
- Recognized: If the face is recognized, the process proceeds to step 8.
- Not Recognized: If the face is not recognized, the user may be prompted to try again, or an error message may be displayed.
- Get Attendance List (Current Date): The system retrieves the attendance list for the current date.
- Store Data: The user's attendance information (likely including the date and time) is stored in the attendance list.
- Print Receipt (Optional): The system may print a receipt verifying the user's attendance
- End: The attendance login process is complete.

6. RESULT

6.1. Home Page: Snapshot 6.1 shows the first page of our application, which consist of two modules:

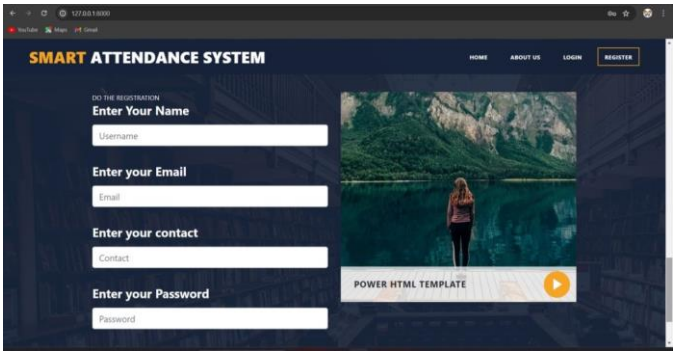
1. User Login

2. New Registration



Snapshot 6.1. Home Page

6.2. New Registration: Snapshot 6.2 shows the second module, which contain registration of new users i.e. New Registration.



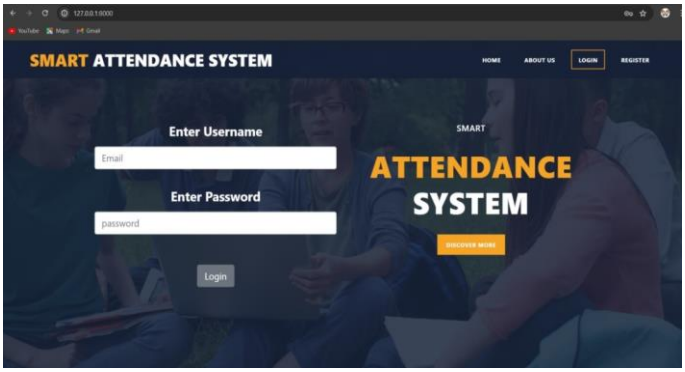
Snapshot 6.2 New Registration

6.3 Login Page: Snapshot 6.3 shows the third page of our application, which consist of two modules:

1. Enter Username

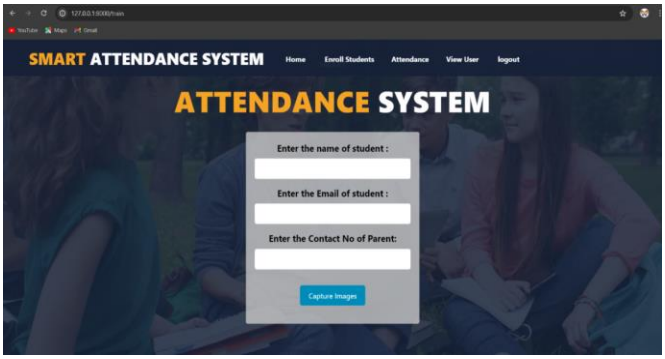
2.Enter Password

Overall, a login page serves as a security checkpoint that verifies a user's identity before granting them access to a secure section of a website or application.



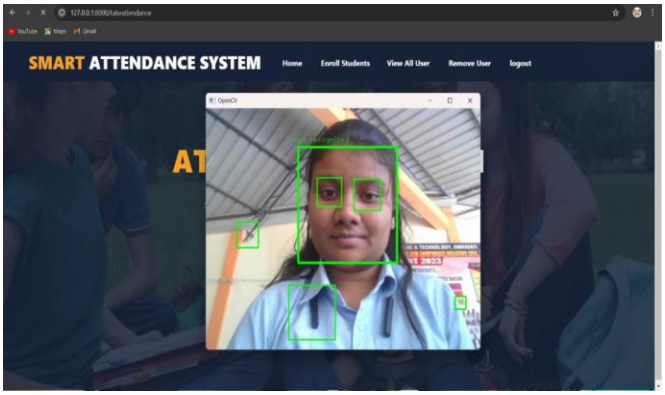
Snapshot 6.3 Login page

6.4 Enrolment page: Snapshot 6.4 shows fields for entering a student's name, email, contact number, and capturing an image. This suggests the system uses facial recognition to Identify students.



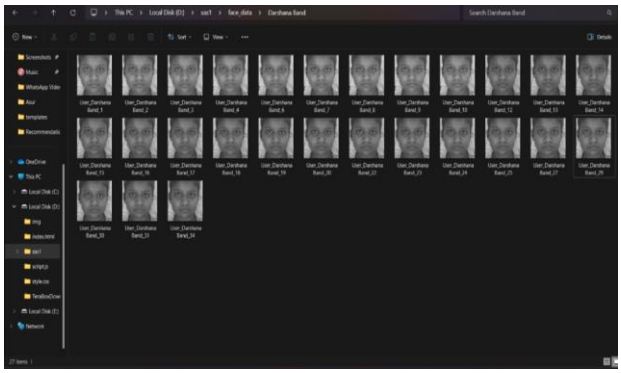
Snapshot 6.4 Enrolment page

6.5. Dataset capture: The system applies a face detection algorithm to the captured image or frame. This algorithm searches for specific facial features like eyes, nose, mouth, and the overall shape of the head.



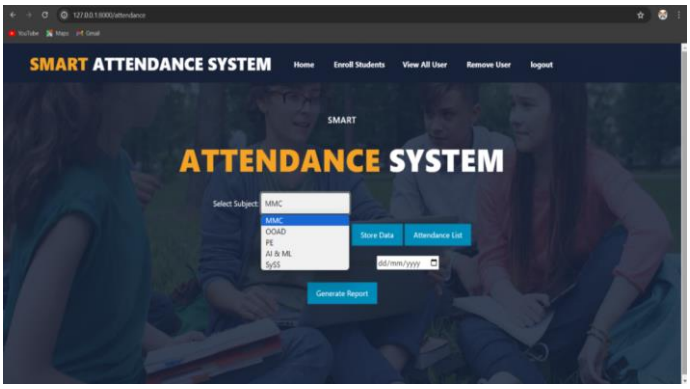
Snapshot 6.5 Dataset capture

6.6 Dataset: The dataset in the **Snapshot 6.6** is a collection of faces from a student attendance system. It uses to match a person's face from a captured image against a database of known faces. In order to train these models, they need a large dataset of labeled images.



Snapshot 6.6 Dataset

6.7 Subject selection: The user interface Snapshot 6.7 described appears to be showing a list of subjects that a student might be enrolled in. The system likely allows the student to select the subject they are attending so that their attendance can be recorded for that specific class.



Snapshot 6.7 Subject selection

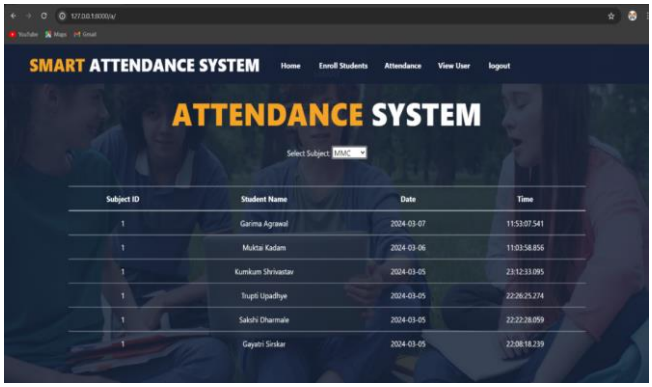
6.8 Attendance List: An attendance list is a record of who attended a particular class or event. It shows the following information for each student:

Subject ID: A unique identifier for the subject or course.

Student Name: The full name of the student.

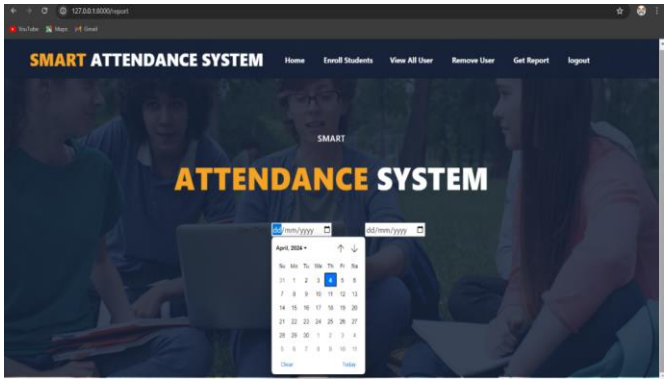
Date: The date the attendance was recorded.

Time: The time the attendance was recorded.



Snapshot 6.8 Attendance List

6.9 Get Report: "Get Report" feature allows users to generate reports on student attendance data between a specified start date and end date.



Snapshot 6.9 Get Report

5.10 Report generating page: The report is a list of students and their attendance information for a particular subject, the headers include:

Student Name: The full name of the student.

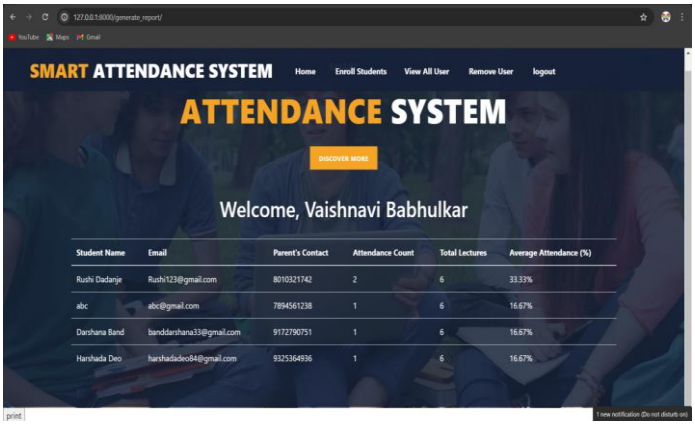
Email: The student's email address.

Parent's Contact: The student's parent's contact number.

Attendance Count: The total number of times the student was marked present during the reporting period.

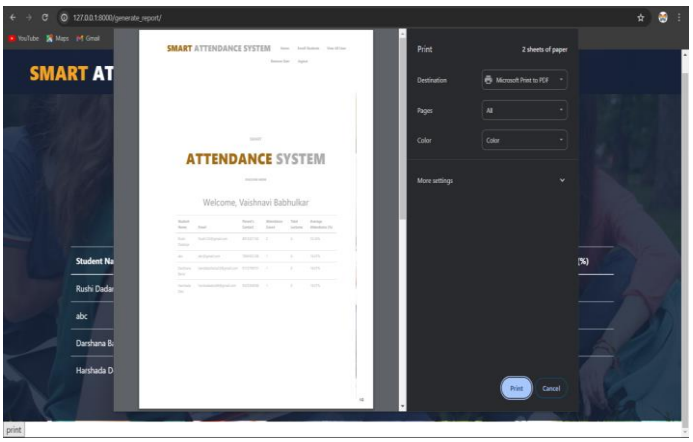
Total Lectures: The total number of lectures held during the reporting period for this subject.

Average Attendance (%): The percentage of lectures the student attended, calculated by dividing Attendance Count by Total Lectures and multiplying by 100.



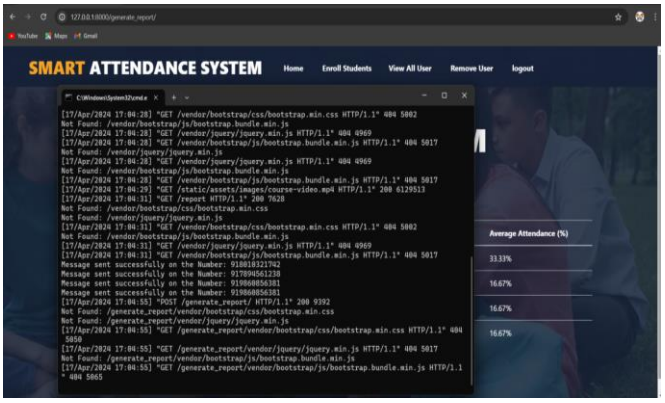
Snapshot 6.10 Report generating page

5.11 Report: It appears you can generate a report in a page format suitable for printing.



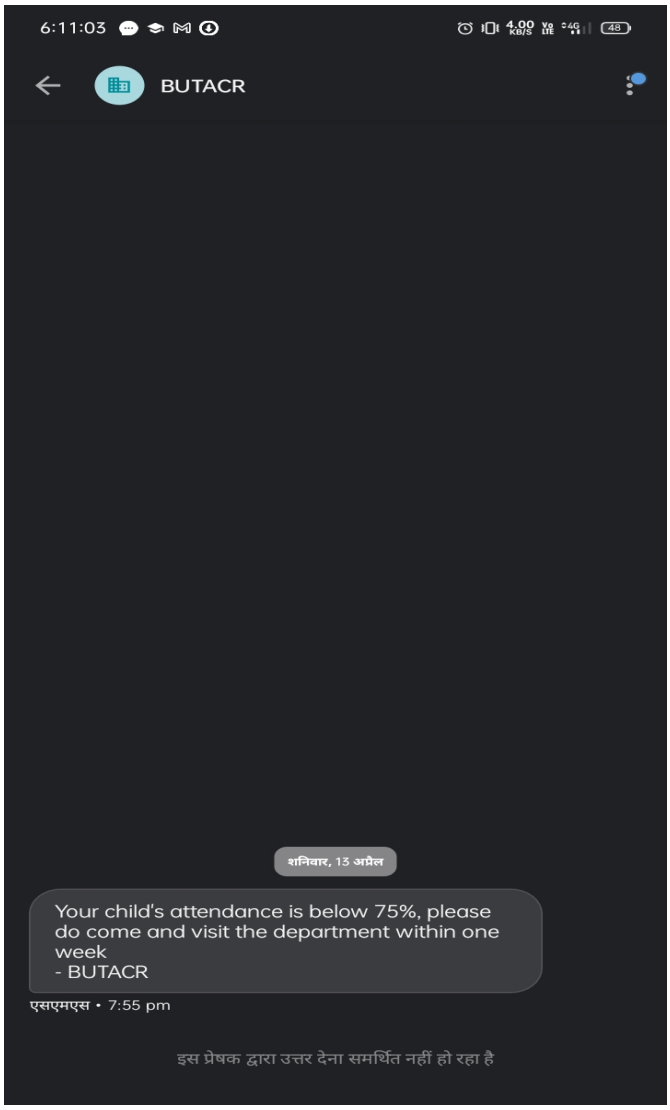
Snapshot 5.11 Report

5.12 Sending message: It appears the "Image sent" message likely indicates a successful notification process triggered by the smart attendance management system.



Snapshot 5.12 Sending message

5.13 Getting SMS: Pop-up message getting on Parent's number if student's attendance is below 75%.



Snapshot 5.13 Getting SMS

7. CONCLUSION

In conclusion, we have presented a smart attendance system that automates the process of marking attendance in educational institutions and workplaces while ensuring data security and accuracy through its use of facial recognition technology and secure database management methods. The system's flexibility, cost-effectiveness, ease of use, and accuracy makes it an attractive alternative to traditional methods of marking attendance such as manual registers or biometric systems that require specialized hardware or software solutions at high costs.

We believe that our proposed solution will significantly contribute to enhancing efficiency in various settings where accurate record-keeping is essential while reducing errors associated with traditional methods of marking attendance manually or through biometric systems requiring specialized hardware solutions at high costs.

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