International Journal of Computer Sciences and Engineering Open Access
Research Paper Vol. 9, Issue.5, May 2021 E-ISSN: 2347-2693

Face Recognition & AI Based Smart Attendance Monitoring System

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DOI: https://doi.org/10.26438/ijcse/v9i5.1521 | Available online at: www.ijcseonline.org

Received: 15/May/2021, Accepted: 20/May/2021, Published: 31/May/2021

***Abstract*—**In today's generation, authentication is one of the biggest problems in our society. So, one of the most known techniques used for authentication is human face recognition, which is also known as HFR. For example- nowadays we can unlock our phone using the face recognition feature. In the existing system, Our lecturers take attendance manually which is somewhat time-consuming and old school type. So, our Artificial Intelligence-based attendance monitoring system will be capturing the faces of every student in a class during attendance and the result will get stored in the database automatically. There will be no extra Radio frequency Identification card, people need to carry anymore and this system will be the most authentic system of taking attendance. The system stores the faces that are detected and automatically uploads the attendance to the database. Using This process our primary goal is to help lecturers as well as students to track and manage student's attendance and absenteeism.

***Keywords*—**Artificial Intelligence, Face Recognition, Attendance Monitoring System, Database, Smart Attendance Monitoring System, Facial Recognition Based Automated Attendance System, Chatbots.

I. INTRODUCTION

Attendance systems in a traditional way are not quite effective nowadays for keeping track of student's attendance. So, every institution needs a robust, stable, and smart management system which will record the attendance of their students. Every institution manages its attendance in its method. Some are taking attendance manually using registers or attendance sheets or in a file-based approach and some have adopted the methods of various automatic attendance using some biometric techniques like using signatures, fingerprints, RFID Card, Iris recognition[1]. All these methods are time-consuming as students have to wait for a long time in a queue at the time of taking attendance or they have to carry the RFID Card. All students have to carry their assigned cards. But there is a possibility of losing cards or an unapproved person may take advantage of the card for proxy. Most of the biometric systems have their flaws and also not efficient enough [2].

In our system, we use the face recognition approach for automatically taking attendance of the students in a classroom without their involvement. The motive of the article is to give a new idea for an attendance monitoring system that will computerize the traditional methods of attendance management using face recognition. Face recognition [3] is a more exact and faster technique among all other techniques and also decreases the chance of proxy. Our system provides us a portal for tracking the attendance of the students, timetables, details of students, faculties, and classes. There is a feature in which only administrators have the right to modify all the details. So to save time the goal of our system is to give the attendance of the students in a class automatically based on face recognition [4].

The target of this system is to evolve a faced recognition-based automated attendance system for students. To gain better performance, the test images and training images of our system are limited to frontal and upright facial images that contain only a face. And also the test images and training images have to be captured by using the same device to assure no difference in quality.

For the betterment of accessibility and ease of navigation, we have added an AI based human friendly Chatbot which will streamline the interaction between users and our services. We have also focused on easy and simple service experience with our platform. It will improve user engagement by typically reducing the user effort. This Chatbot will be a part of self-learning and human intervention [5].

We have organized the paper as follows, Section I contains the introduction of AI Based Smart Attendance Monitoring System Using Face Recognition, Section II contain the related work of Face Recognition along with Viola-Jones Algorithm, AdaBoost Algorithm, LBP, Haar Cascade Classifier, etc., Section III explain the Face Recognition, Attendance Monitoring System methodology with flow chart, Section IV describes results and discussion of user friendly interface and the process of taking attendance with demo pictures of face recognition, and Section V concludes research work with future directions.

II. RELATED WORK

Authors in [6], proposed a survey paper for Face Recognition Technologies. Mostly, the difference between Face detection and Face recognition is often mistaken. Face detection refers to the process of detecting a face inside an image frame. Whereas Face recognition refers to the identification of the facial image of the owner. The factors of facial recognition contain pose, lighting, image resolution, background, expression, closure, translation, rotation, having spectacles, etc.

The face detection algorithms has been implemented throughout the workaround, in article [7]. We have used face detection algorithms to make sure whether there is any face in the image present or not. In recent years, many algorithms are proposed for detecting the face, like Viola-Jones Algorithm, AdaBoost Algorithm, Local Binary Pattern, Haar Cascade Classifier.

Sakshi Patel, Prateek Kumar, S. Garg, R. Kumar in [8], discussed a technique for facial recognition based smart attendance system. Viola-Jones algorithm is very much popular among all. It helps to recognize a face in real-time applications. This algorithm was first proposed by Paul Viola and Michael Jones in 2001. Firstly, the face is detected on a grayscale image and after that it finds the exact location on the image colored. In Viola-Jones, a box is outlined where a face is searched in it. Advantages: High accuracy rate, Feature selection, Very Fast. Disadvantages: Not effective in detecting turned and tilted faces. Training time is long.

In paper [9], has worked with algorithms including LBP. Local Binary Pattern operates on texture where the pixels of an image are labeled by thresholding the part of each pixel and appraise the binary number as a result. LBP was first proposed in 1994. Since it is the most powerful feature for the classification of texture. Further, it has been decided that when the Histogram of Oriented Gradients (Also known as HOG) descriptor gets combined with LBP, it enhances better performance mostly on datasets. Advantages: Computation is simple, Tolerance is high against the monotonic lighting changes. Disadvantages: Only used for binary and grey images. Overall performance is less accurate than the Viola-Jones algorithm.

From the paper [10], we get to know about how to make our project more reliable and faster.AdaBoost Algorithm – Short form of Adaptive Boosting and also known as Boosting algorithm. This Boosting algorithm was first proposed in 1996 by Freund and Schapire. This algorithm aims to concentrate on problem classifications and also it is aimed to transform weak classifiers into strong classifiers. Advantages: It is very simple, easily programmable, and fast. Flexible enough to be easily united with any algorithm of machine learning. Can be learned problems beyond binary classification. As it is versatile, it can be used with any text or any numerical data. Disadvantages: The result is highly dependant on images that are trained and can be affected by weak classifiers.

In the article [11], here the implementation of detection along with face level classification has been supervised. Haar Cascade Classifiers technique is developed by Viola-Jones. This technique is based on machine learning where the classifier is used to train a lot of positive and negative images. Positive images- These are the images that contain our images in which we want our classifier to detect. Negative images- These are the images of anything else, in which we do not want to detect the object. Haar Cascade was named after a Hungarian Mathematician " Alfred Haar " who evolved Haar wavelets. Haar refers to Haar–like features which mean " Weak Classifiers " which are used for face recognition. Advantages: High Calculation speed, Low Complexity level, Face capturing is more accurate. Disadvantages: Level of Accuracy is low, Low detection level.

A new methodology of chatbot performance measures [12] the ability to identify the user's intent and extract data and relevant entities contained in the user's request is the first condition and the most relevant step at the core of a chatbot: If you are not able to correctly understand the user's request, you won't be able to provide the correct answer.

III. METHODOLOGY

All the student details, will be uploaded by the administrator or by their own. And that will be stored in the database. When the lecturer will take the attendance, the camera will automatically open and capture the image. After that the image will be compared with the image present in the dataset and the detected faces will be marked as PRESENT and rest will be marked as ABSENT. The final attendance will be shown in the portal. Mainly our paper is focused on two things – Face Recognition, AI Based smart attendance monitoring system which are explained in detailed manner.

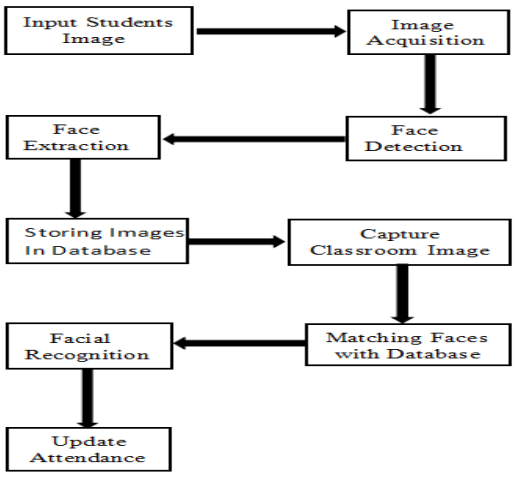


Figure 1. Stages for Face Recognition & AI Based Smart Attendance Monitoring System

Face recognition is a process of matching a human face from a digital picture or a video frame in opposition to a database of faces for checking valid authentication.

In the Image Acquisition stage, the image is captured from any source like camera or images working with definitive databases. The taken image is transformed to grayscale image. In the images, the pre processing is done by resizing, cropping and grayscale conversion.

For face recognition, Face Detection is an AI Based computer technology that can identify and allocate the appearances of human faces in photos. We have used this technology as it detect faces in a photo or video, which is independent of head pose, lighting conditions, & skin color.

Feature Extraction is a method of dimensionality reduction by which the raw data is compressed to more manageable groups of processing. Facial feature extraction is a process of extracting face components of humans like the mouth, nose, eyes, etc, from an image. it is very important for initializing the process of techniques like face tracking, facial expression recognition, or face detection. Among all Eye localization and detection is essential since from this all other facial features are identified.

Facial recognition is a way of recognizing confirming and identifying an individual's identity using their face. This system can be used to identify people in real-time, live videos as well as in photos. It falls under the category of biometric security in which other forms like voice recognition, fingerprint recognition, and eye retina falls. The technology is used mostly for security purposes and law enforcement.

The system works on face recognition where each student in the class is photographed and their details are stored in a server. The teacher can then record the attendance by just clicking some pictures of the classroom. The system will recognize the faces and verify the presence or absence of each student.

Matching Faces with Database :- The purpose is to make a AI based facial recognition system which needs as less training data as possible. The main reason behind this constraint is the fact that it is more useful for a supervisor/Admin to have train the model with one or few pictures for each student rather than having to make a large Dataset with many images for the same person.

Live Facial Recognition :- In this project, we are using the OpenFace pre-trained model for face embedding. OpenFace used FaceNet(Google's model used on 3D images) architecture on isolated faces by dlib library.

OpenFace uses a simple 2D affine transformation to make the eyes and nose appear in similar locations for the neural network input. The 68 landmarks are detected with dlib's face landmark detector. Given an input face, the affine transformation makes the eye corners and nose close to the mean locations. The affine transformation also resizes and crops the image to the edges of the landmarks so the input image to the neural network is 96 × 96 pixels.

To understand sentences structure, A.I. Chatbot use Artificial Intelligence and neural language processing technology, then process that information & progressively get better at answering the question instantly. AI-powered chatbots understand free language, with a predefined flow to make sure they solve user's issues. They can remember the concept of the queries and the user's choices. These chatbots can jump from one point of conversation scenario to another when needed and address random user request at any moment. Our chatbot use Machine Learning, AI and Natural Language Processing (NLP) to understand people.

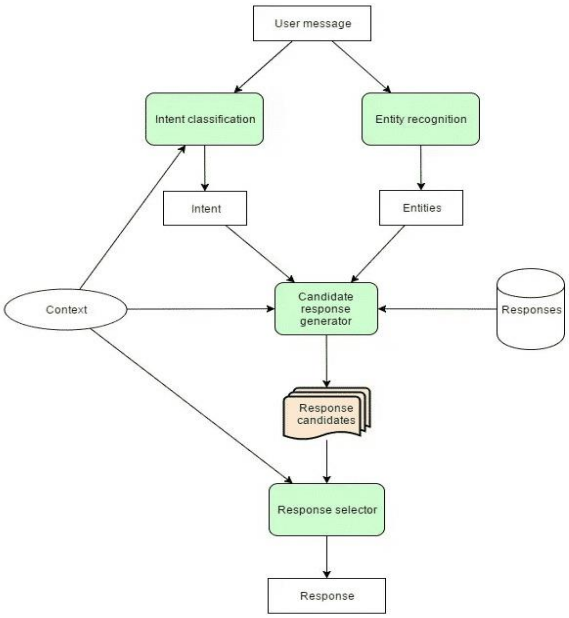


Figure2. Flow Chart of Chatbot

IV. RESULTS AND DISCUSSION

The smart attendance monitoring system is a simple and work efficient system that provides an interactive, user-friendly portal. The Login page of the portal allows administrator and faculties to access the portal using their login credentials.

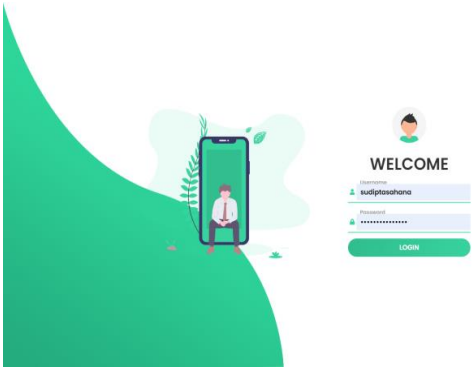


Figure 3: Login Page

The user can operate the system using a GUI. Students have to register themselves in our system. The administrator has the right to operate all the features. E.g., ADD Student, ADD Classes, Modify Marked attendance, Assigning a class to a teacher, etc. they have to register their students along with their name, roll no. department and profile pictures.

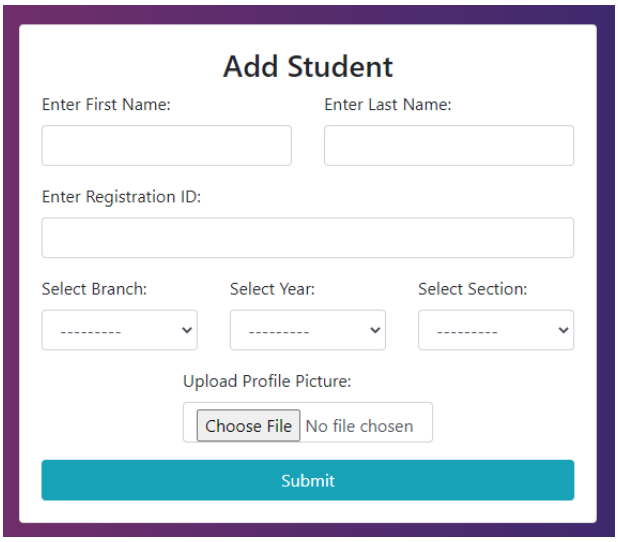


Figure 4: Student Registration

Our system consists of some modules, such as – Student Registration, Face Recognition, Addition of classes with their corresponding time and teachers, taking attendance, and storing them in a database.

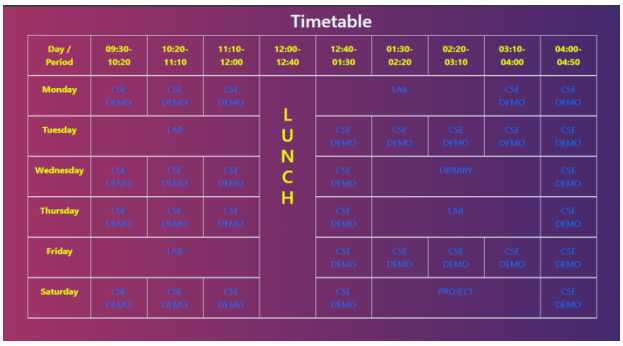


Figure 5: Time Table

Faculties will be assigned classes and corresponding students by the administrator. Different sections of a department in a particular batch have a different portal.

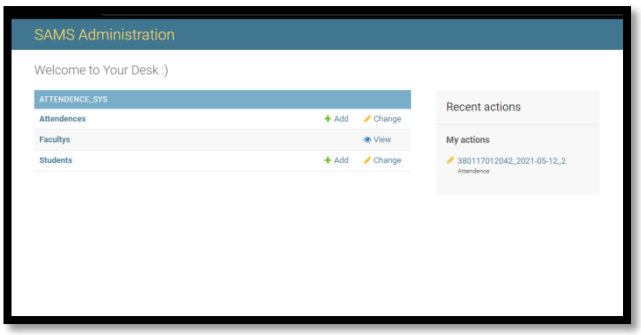


Figure 6: Admin Panel

The lecturers have to log in to that portal with a particular username and password which will be assigned by the administrator.

For ex- There will be a particular ID and password for section A of a fourth-year student. Whenever the teacher login to the system, they will be able to take attendance using the timetable. After they click on the take attendance option, the webcam/ camera/ CCTV Camera will automatically capture the photos of the entire classroom.

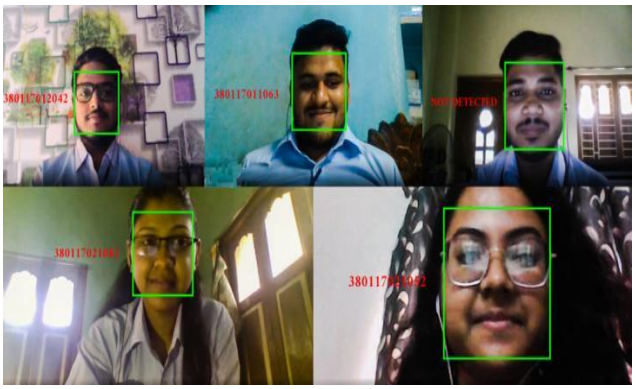


Figure 7: Facial Images for Face Recognition

Our AI-Based smart attendance monitoring system will recognize the faces and automatically give the attendance of the present students of that class and store them in database.

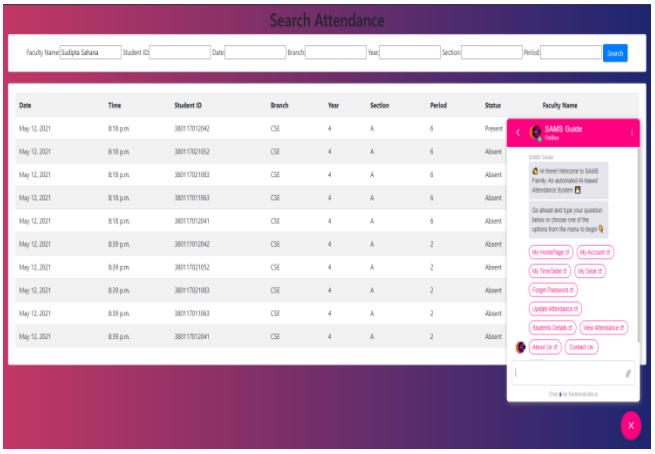


Figure 8. Student Attendance Record

Also, along the way of navigation throughout the portal we have introduced the Chat Bot which will guide the user to move forward with the commands listed on the Bot or User defined command so that it can automate the User's experience along the navigation process. Starting from My Home page, My Account, to Update attendance and extending our functionalities to Student Details, View Attendance and ending with About Us. Also, if the AI bot was unable to answer any User's query it will redirect the chat to the Available Admin and wait for the confirmation. Let's see how our chatbot looks like: -

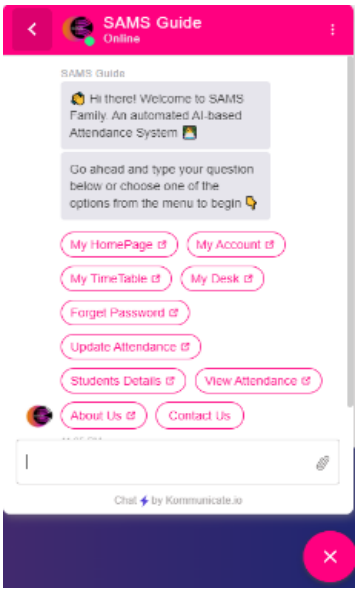


Figure 9. SAMS GUIDE (CHAT BOT)

In a nutshell, this is the login page, we are logging in the portal using login credentials, i.e., user id and password, after logging in, faculties can see the timetable assigned to them. Refer to Fig- 4,5.

A home option is present in the right top right corner of the timetable page, after clicking on that option, faculties can access their home page. In homepage, there are four features, "Take Attendance, add student, Update Student Details, Search Attendance, Go back to Timetable.

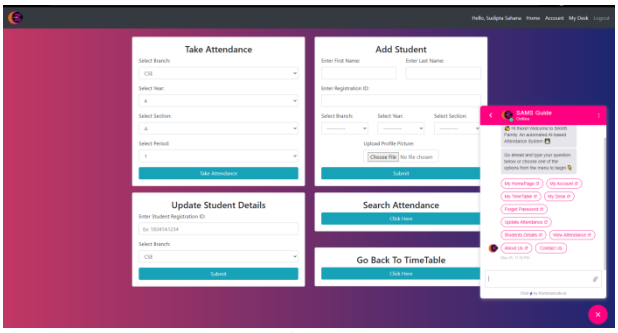
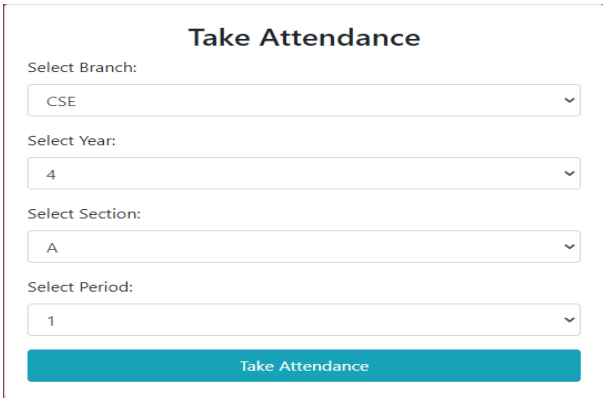


Figure 10. Homepage



Take Attendance – This is the option where Faculty can take the attendance of students.

Add Student – In this option, Faculty or Admin can add students.

Update Student Details – Student details can be updated using this option.

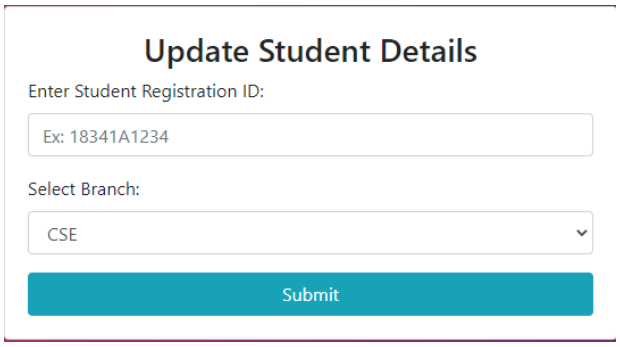


Figure 11. Update Student Details

Search Attendance – Attendance of a particular student can be searched by giving the details asked in the search bar.

In the search bar for attendance, it is asked to give Student ID, date, Year, Period. Just by putting these details, user can get search results of a particular student.

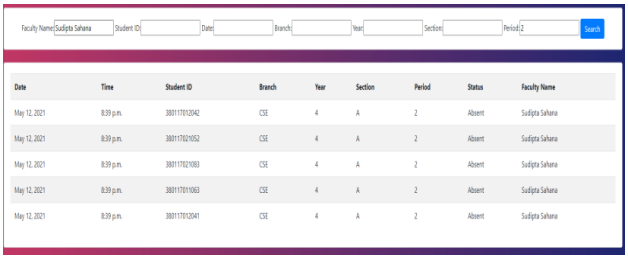


Figure 12. Search Students Attendance

Go Back to Timetable – By clicking on this option, user can go back to its timetable page.

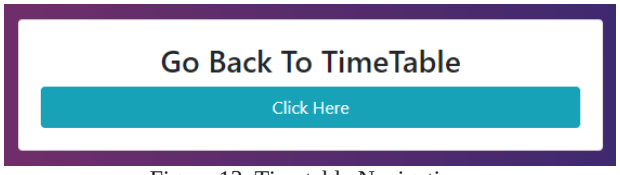


Figure 13. Timetable Navigation.

My Profile Page – This is the page where faculty can update its profile picture, Name, phone no. and Email Id.

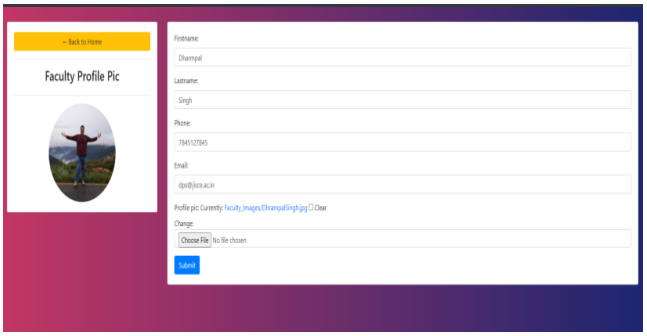


Figure 14. Faculty Profile.

Here are some Administrative desk: -

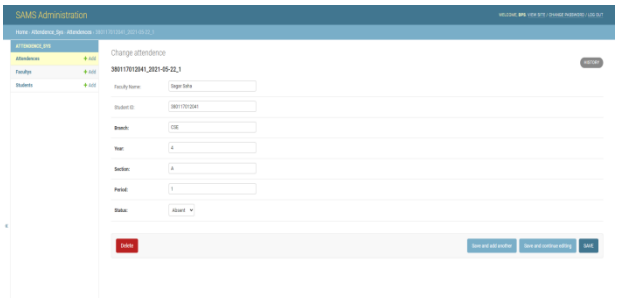


Figure 15. Update Attendance.

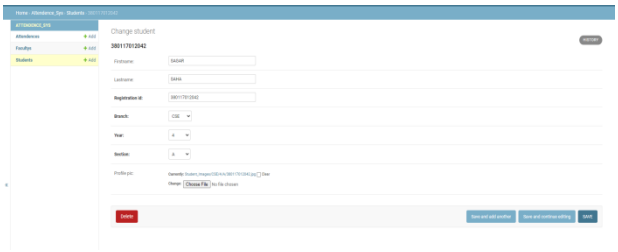


Figure 16. Update Student Details.

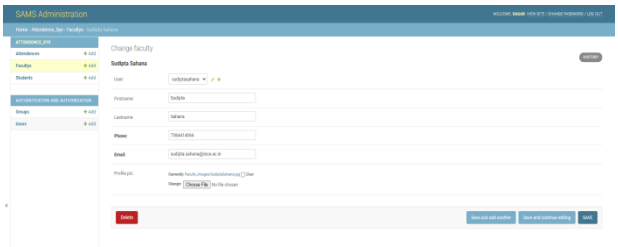


Figure 17. Update Teacher Details.

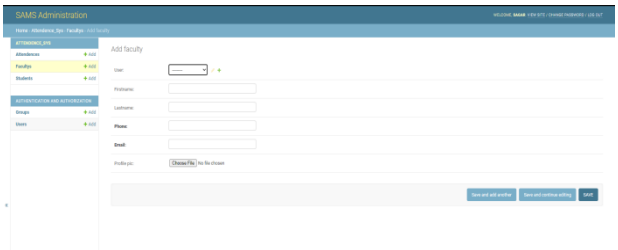


Figure 18. Add new Teacher.

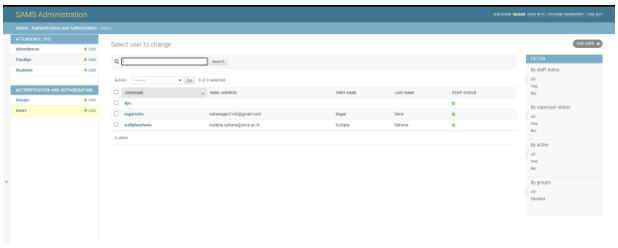


Figure 19. Admin Management.

There is a very user-friendly communicative option we have added in our portal that is Chatbot. We have designed Chatbot system in order to handle queries of the user. In our project, users can get a solution of their queries, Like if the user has forgotten password, then our AI Based chatbot will provide to options – Reset Link & Login Link. Its user's choice which option to be chosen. If user is unable to logout then our AI Chatbot will give a solution on the asked query by user. Also, there are many more solutions we have added in our Chatbot system for the queries to be asked by the user.

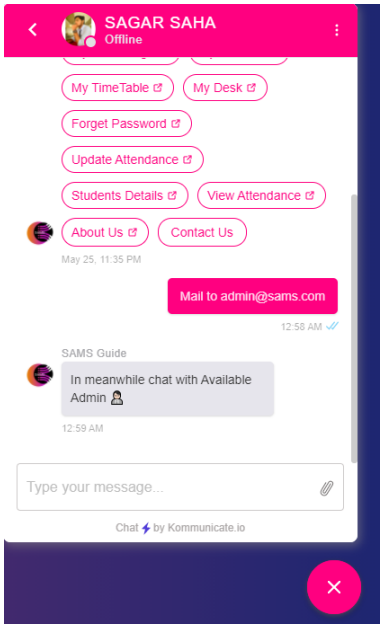


Figure 20. Admin Response Service.

V. CONCLUSION AND FUTURE SCOPE

An automated attendance system has been proposed for reducing the error that appeared in the traditional attendance-taking system. The goal is to automate and propose a system that is advantageous to the institutions. We have used the face recognition approach to take students' attendance and to make a better system. Automated attendance system has been visualized for the aim of reducing the mistakes that happened in the existing attendance management system. The goal is to automate and make a system that is useful to the institute. The exact and proper method of attendance in the office surroundings that can replace the existing methods. In this proposal, the face recognition based automated student attendance system is described thoroughly. The given approach provides a process to recognize the individuals by the input image compared obtained from recording video frame with respect to image trained. Chatbots or Virtual assistants with AI are changing the pattern of navigation. It can reach out to a large number of users on messaging, social media apps and also it can be more effective than humans. They are developing into a capable of information- tool gathering.

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Sudipta Sahana is an assistant professor of a renowned engineering college of west Bengal. More than 9 years he has worked in this region. He has passed his M.tech degree in Software Engineering and B.Tech Degree in Information Technology from west Bengal university of technology with a great CGPA/DGPA on 2010 and 2012 respectively. He has completed his Ph.D. from University of Kalyani in 2020. He has published more than 60 papers in referred journal and conferences index by Scopus, DBLP and Google Scholar and working as editorial team member of many reputed journals. He is a member of the Computer Society of India (CSI), Computer Science Teachers Association (CSTA), and also a member of International Association of Computer Science and Information Technology (IACSIT).

Dharmpal Singh received his Bachelor of Computer Science and Engineering and Master of Computer Science and Engineering from West Bengal University of Technology. He has done his Ph.D in year 2015. He has about 12 years of experience in teaching and research. At present, he is with JIS College of Engineering, Kalyani, and West Bengal, India as an Associate Professor and Head of the department. He has published 50 papers in referred journal and conferences index by Scopus, DBLP and Google Scholar and editorial team and senior member of many reputed journal index by SCI, Scopus, DBLP and Google Scholar. He has organized many national levels Seminar/Workshop and published many patent also.

