

Smart Attendance Monitoring System Using Facial Recognition

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Abstract: All Standard institute of learning place high priority on class attendance that if the criterial is not met by the student, the student will not be grant access to sit for his/her examination conducted by the school. This make class attendance an important activity for the student. Over the years, class attendance have been conducted manually and is still taking place currently in almost 80% of Nigerian Universities. Manual monitoring of attendance by the universities lecturer has become a hectic one for most lecturers and students. In the advancement of technology, manual marking of student's attendance have been replaced by biometric concept. Though many researchers have made provisions on some biometric functions like fingerprint scanner, iris recognition, hand and finger geometric. In this paper we will proposed a facial recognition concept as means of verification in marking student's attendance and store it into the database once verified. The system made use of a dlib library OpenCv library in successfully carrying out of the facial recognition. Images are read into directory, and these images are being encoded so as to generate 128 facial measurements like distances between the nose, ear, and eyebrow etc. This encodings will be used in making comparison with images read from camera or from live streaming videos in other to find best matches. For real time attendance system, we created a web application using python flask. Here we used bootstrap framework for frontend design, python as the programming language and Mysql for database design.

Keywords - Facial Recognition, Attendance Management, OpenCv, dlib, Python flask, Mysql database

1. Introduction

All Standard institute of learning place high priority on class attendance that if the criterial is not met by the student, the student will not be grant access to sit for his/her examination conducted by the school. This make class attendance an important one for the student. Over the years, class attendance have been conducted manually and is still taking place currently in almost 80% of Nigerian Universities. Manual monitoring of attendance by the universities lecturer has become a hectic one for most lecturers. Most times students tends to struggle to write attendance in the attendance sheet due to the large numbers of students present in class, most times students tend to help their friends mark attendance who are absent in class. In the advancement of technology, manual marking of student's attendance have been replaced by biometric concept. Though many researchers have made provisions on some biometric functions like fingerprint scanner, iris recognition, hand and finger geometric. In this paper we will proposed a facial recognition concept as means of verification in marking student's attendance and store it into the database once verified.

Facial recognition system is supplanting biometrics viably. It is different of all as it utilizes the facial characteristics of an individual for recognition. It can be ascribed as a procedure with least fault as the facial character of every individual are exceptional. Nobly outperforming in different fields, facial detection can successfully be utilized for security frameworks, however has not been sought after because of apparent defects. Marking of attendance through biometrics had clumsy charge of additional exertion and individual time at the client end. After the flare-up of facial recognition as a valuable strategy, strategies were developed to fuse it in attendance monitoring system. Biometric mode of management of attendance fundamentally utilizes iris identification or fingerprint checking. With entry of time, headways are likewise expected to fasten up with truly developing innovation. As multi tech classrooms are developing [1].

Management of Attendance through biometrics is additionally being improved and executed. As marking procedures are propelling, the desperate need to eliminate barriers, intricacies of devices, delays and a real attendance is the idea under concentration. Though the traditional marking of attendance system is slow and exposed, facial recognition marking of attendance utilizes face characters to distinguish and mark the student present as attendance. Facial Recognition is done through a camera with no component and automatically marks an attendance. The detected face is used to mark are utilized to mark presence. The framework is valuable in marking and monitoring student attendance keeping up record for the lecturer and students. Facial algorithms are utilized to coordinate with faces with the data set appearances of the student. Many have investigated this viewpoint and figured out how to execute the framework effectively [1].

In [2], the procedure of this facial recognition framework is segregated into different steps, but the significant steps are identification of face and detection of face. First and foremost, to mark the student's attendance, the picture of student face will be required. This picture can be snapped from the camera gadget, which will be set in the classroom environment at a reasonable area, so that the of class hall can be covered. This picture will go about as input to the framework. For the compelling face recognition, the picture needs to be upgraded by utilizing some picture preparing strategies like grayscale transformation of picture and histogram leveling [3].

2. Related Literature

Smart Attendance System [4] presents a smart attendance system using Radio Frequency Identification (RFID) technology for class attendance monitoring. The Radio Frequency Identification (RFID) innovation is one of a robotization innovation that is advantageous in improving current traditional method of marking student attendance, as each tag has its own novel ID, it is not difficult to separate each label holder. A Radio Frequency Identification (RFID) innovation RFID tag is an item that can be applied to or embedded into an item, individual, or creature with the end goal of recognition and monitoring utilizing radio waves. A few labels can be read from a few centimeters or meters away and past the view of the reader. Likewise, a Graphical User Interface (GUI) gives more productive approach to survey the student's attendance.

A Conceptual Model for Automated Attendance Marking System Using Facial Recognition [1] propose a model for systematic marking of attendance. They made use of two database in which one is respiratory database and the other use for keeping student's information. The respiratory database contains the generally assembled pictures and the covers determined by the facial fiducial point of the students to such an extent that of nose, eyes and lips principally. The other data set known as student's data set will be utilized to check the attendance of the students. A camera will be fixed in the class in the front, at such a point where the image of the entire class can be taken. When the picture is caught, clamor will be computed and foundation will likewise be limited. Gabor Filters or Jets will be applied after that through which each individual student's 31 facial fiducial focuses will be determined. It will figure the estimations of the facial highlights and afterward they will be coordinated to the picture data put away in the capacity information base.

This all calculation will be going on the worker. When the matches are done, the student's attendance is set apart to address the issue of approval of the student present in the class or not.

Mart Attendance Portal Using Facial Recognition [5] shows the colossal advancement accomplished by the deep learning techniques. The primary piece of the research work is Convolutional Neural Network based facial recognition and identification, and its application over simplifying the everyday life is the illustration on how far these innovations have come. The execution of the facial recognition gives a decent exactness and the limitation in recognition can remove the greatest farce assaults which can be utilized to deceive the system. This present reality execution will have a few key components into play like execution of the facial recognition unit, no of focuses for taking inputting attendance, association speed, and nature of camera.

Smart Attendance System using OPENCV based on Facial Recognition [6] highlights the most profitable Open CV face recognition technique open for the management of attendance. The framework has been executed utilizing the local binary pattern histogram algorithm. The local binary pattern histogram algorithm dominates different techniques by certainty factor of 2-5 and has least sound obstruction. The execution of the Smart Attendance System depicts the presence of a student between the facial recognition measure and the limit esteem. Along these lines, the local binary pattern histogram is the most credible and capable face recognition algorithm found in Open CV for the recognizable proof of the student in an instructive organization and denoting their participation enough by turning away intermediaries.

Smart attendance system via facial recognition using Tensorflow Facenet model [7] adopted a Tensorflow Facenet model for facial recognition of students. Recognizable proof framework is utilized to carefully confirm an individual by contrasting each known face and data comparing to the data set. The Tensorflow Facenet model is the method utilized for the facial recognition where it's called as one shot model where straight learning and planning the face pictures into Euclidean space where distances are utilized to figure the similitude of countenances. With the facial recognition highlight, this framework can undoubtedly oversee and mechanize marking of attendance and securely record it in the data set.

Smart Attendance System using QR Code [8] proposed a model which is partitioned into three modules: the primary module is the module of the administrators, which comprises of 3 kinds: administrator, head of study program and executive of the investigation program. The head of study deals with the exercises of the system like adding courses, altering and erasing courses. The subsequent module is the attendance management, which will be helped out through a gadget in every study hall that will be associated with a camera gadget and the internet. It will empower QR code perusing utilizing the Instascan JS library, the framework will scan the QR code which contains the lone teacher or student ID. At that point, in view of the day and time span, the framework begins the class that the educator ought to go to that day, and it consequently enlists the class as finished and for that date embeds all students attending to that course with 'Absent' status. Another page opens and the camera opens to scan the QR code, but now the students needs to scan his/her code to the gadget. There is the entire rundown of students attending to the course and every student scan their remarkable QR code to change their status to 'Present'. The third module is about the lecturer and student's module, where the lecturer and the student can sign into the framework with their information got from the administrator.

Attendance Management System Using Face Recognition [9] proposed an automated attendance system that will be proficient in recognizing the student whose information has been recorded in the database and automatically marks present for the student. Though different algorithms and strategies has been utilized for improving the execution of facial recognition. The idea they utilized is the Open CV. They likewise made use Raspberry Pi and camera module to take picture store them in data set. This way the attendance will be computerized. The concept of two innovations namely: Student Attendance and Feedback framework has been carried out with a Machine-Learning method. This framework naturally distinguishes the performance and keeps up the student's records like attendance and their report regarding the subjects like English and Science, and so forth. In this manner the student's attendance can be made accessible by identifying the face. On identification, the attendance subtleties and insights concerning the marks of the student is acquired as report.

Smart Attendance System Using CNN [10] proposed an intelligent and productive system for marking attendance by utilizing face location and facial recognition. This system can be utilized to mark attendance in learning institutions or workplaces utilizing real time face recognition with the assistance of Convolution Neural Network (CNN). The ordinary strategies like Eigen countenances and Fisher faces are delicate to lighting, clamor, pose, impediment, enlightenment and so on Henceforth, they have utilized Convolutional Neural Network to identify the face and outperform such challenges. The attendance database will be refreshed consequently and put away in excel sheet just as in information base. They made utilize the MongoDB as backend information base for recording of attendance.

Location Based Smart Attendance System Using GPS [11] proposed location-based system for tracking of student's attendance which is carried out on the android versatile application utilizing smart phone decreasing the prerequisite for added biometric scanner gadgets. Things of the association enclose a chosen area, which could be controlled by GPS. The student ought to be inside the predefined territory of the GPS to be tracked. They carried out this with the fundamental point of final year students to make the actual presence in the task hour to be inside the campus. The location of every student will be chosen by the GPS utilizing cell phones. This area is characterized as a key of some time and attendance tracking in their paper.

3. Methodology

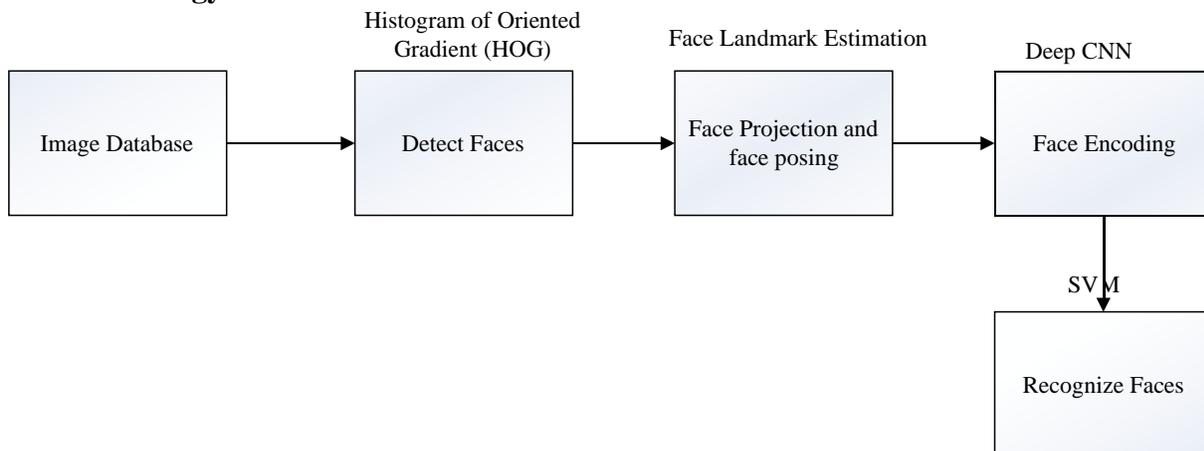


Figure 1: Architecture of the Proposed System

The following are the detailed explanation of the steps involved in our proposed smart attendance monitoring system using facial recognition

Image Database: This contains the list of images that we will be using for training of our proposed system model for comparing various images with that of our trained images. The compared images can be that from camera and it also images from a live streaming video.

Detect Faces: We will be making use of Histogram of Oriented Gradient (HOG) method in detecting images from cameras or live streaming videos. Histogram of Oriented Gradient (HOG) is an element descriptor habitually utilized for object recognition. HOGs are broadly known for their utilization in common recognition. Histogram of Oriented Gradient (HOG) depends on the property of items inside a picture to have the appropriation of power angles or edge headings. Angles are determined inside a picture for every square. A square is considered as a pixel lattice wherein angles are comprised from the extent and course of progress in the powers of the pixel inside the square.

Face Project and Posing: Most times, various images are taking on a different projection, some can be taken from the side while some can be taken from the front and also most images taken by a person tends to have different posture. So in other to solve the problem of face projection and posing on images and live streaming videos, we will be making use of Face Landmark Estimation. This works by using 68 unequivocal points called landmark. This landmarks is present on every face starting from the apex chin, the outside brink of each eye, and the inner brink of each eyebrow, e.t.c.

Face Encoding: To solve the problem of comparing different faces on an image or a live streaming video, we need to encode this image so that we can compare directly unknown image from a camera or a video with the image in our database. For comparison, we can make measurement with the ear size, distance between the eyes, nose length e.t.c. To achieve this we will be employing a deep convolutional neural network to encode this images and carry out this measurements. The images will be trained to make 128 measurement.

Recognize Faces: Here, we will be making use of a basic machine learning algorithm to the measured encoded images, and tell which person will have the closet facial match.

4. Result and Discussion

This system proposes a smart attendance monitoring system using facial recognition as concept of verification. The system starts by acquiring images that will be used for training. Each of this image will be saved with the name of the individual. The acquired images was saved into a folder called training_images. This images was read into directory as a list by using the os.listdir() function. For face recognition, we used a face_recognition library in python which was built using dlib's state-of-of-the facial recognition with deep learning, which have about 99.38% of accuracy. We created two arrays namely img and classNames. The img holds the training images and the classNames hold the name of the individuals whose images are stored in our training folder. After the processes, we encoded our training images in other to generate some measurements in which we will be using in comparing other images read from camera and live streaming videos.

Comparison will be done using face location which have to do with distances between the nose, the ear, eyebrow etc. Figure 2 shows the encoded measurements of our training images which is being stored in training folder. After successfully completion of our encoded trained images, we used cv2 which OpenCV in streaming a live video (cv2.VideoCapture (0) in loading a live video from our local web camera. The images were read from camera by using cv2.imread(), which holds the variable assigned to the live streaming camera. We also resize the read images to 250 x 250 pixels. We used the Histogram of Oriented Gradient (HOG) method in detecting images from the live streaming video. We converted the read images to white and black by using cv2.cvtColor() function which holds the images and assign an RBG color to it. We used land mark in assigning a location to the images, and finally we encoded the read images by using the deep convolutional neural network. For facial comparison we assigned a variable called faceDis which holds the compared distance results from the compared images. We draw a rectangle using cv2.rectangle function(), and we inputted the names of every person found on the database on the outputted images and we inputted no record found on the unknown images. This can be seen in figure 3, For real time attendance system, we created a web application using python flask. Here we used bootstrap framework for frontend design, python as the programming language and Mysql for database design. The web application is made of a login page which can be seen in figure 5, here the lecturer have to login, select course on which he/she wants to mark attendance on, and click on mark attendance button, automatically a live video is being popped up and attendance is being marked and stored on Mysql database once the student face is being recognize in the database. Figure 6 shows the viewed attendance.

```
encodeListKnown = findEncodings(images)
print('Encodig Complete')
print(encodeListKnown)

Encodig Complete
[array([-0.17195195,  0.07661455,  0.10910164,  0.00160526,  0.00408013,
-0.08999063,  0.08654487, -0.03165666,  0.09216088, -0.01006828,
 0.25912562, -0.03454798, -0.19521207, -0.16430478,  0.11553299,
 0.15092781, -0.10738441, -0.08215977, -0.12155474, -0.08538298,
 0.04001962,  0.00674159, -0.00944867,  0.12250186, -0.06659934,
-0.30800703, -0.09492626, -0.16491742, -0.01409615, -0.10783171,
 0.0116392 ,  0.06733897, -0.1216422 , -0.06128506, -0.05719358,
 0.03565004,  0.03321711, -0.00277488,  0.16498554, -0.02709239,
-0.14417326,  0.01880567,  0.00526961,  0.28808397,  0.16756344,
-0.07133182,  0.04902788,  0.08744337,  0.05114863, -0.22923896,
-0.05422597,  0.07327207,  0.16334936,  0.03672477,  0.05002705,
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-0.25807521, -0.04957012,  0.06704608,  0.31770483,  0.16930355,
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-0.02661611, -0.10711194,  0.14683986, -0.18535526,  0.17493503,
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-0.05106678, -0.05833841, -0.08266178, -0.00063324,  0.11268426,
-0.14797434,  0.01454525,  0.05905674]])]
```

Figure 2: The encoded images of our training images.

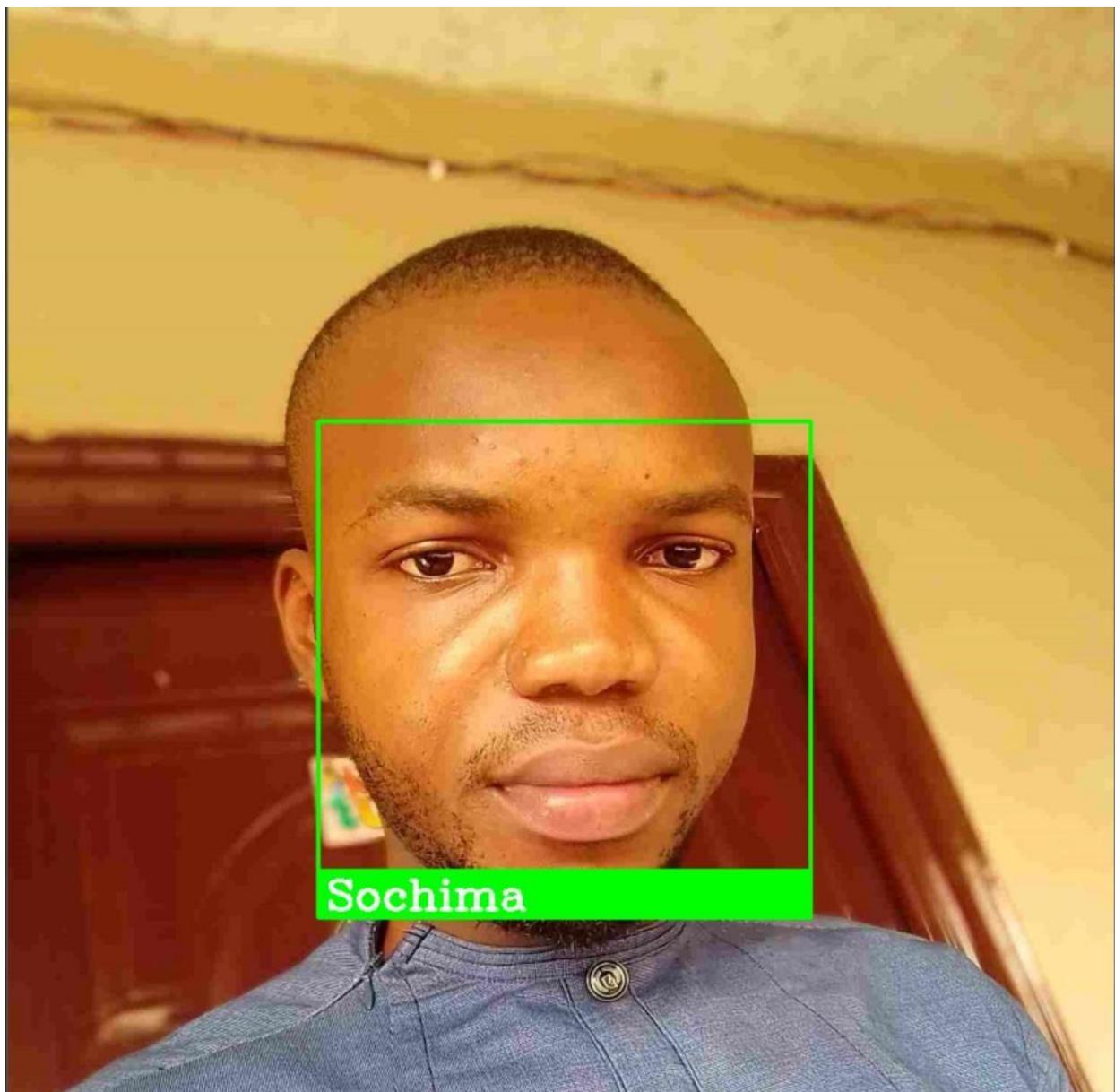


Figure 3: Showing the recognize face found on the database

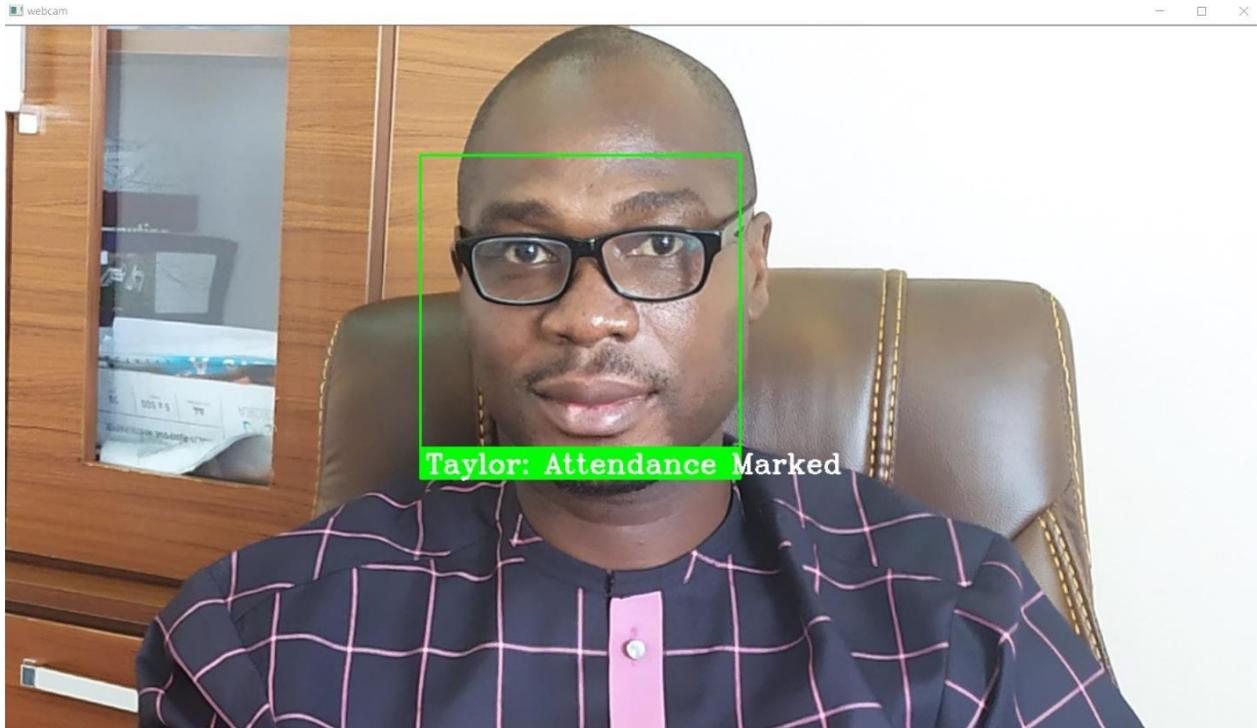


Figure 4. Showing marked attendance.

Figures 3 and 4, shows how the model have successfully compared the image to that of the database and it matches the image Taylor.jpg. Automatically it system marks attendance for him and the attendance is being saved into Mysql database.

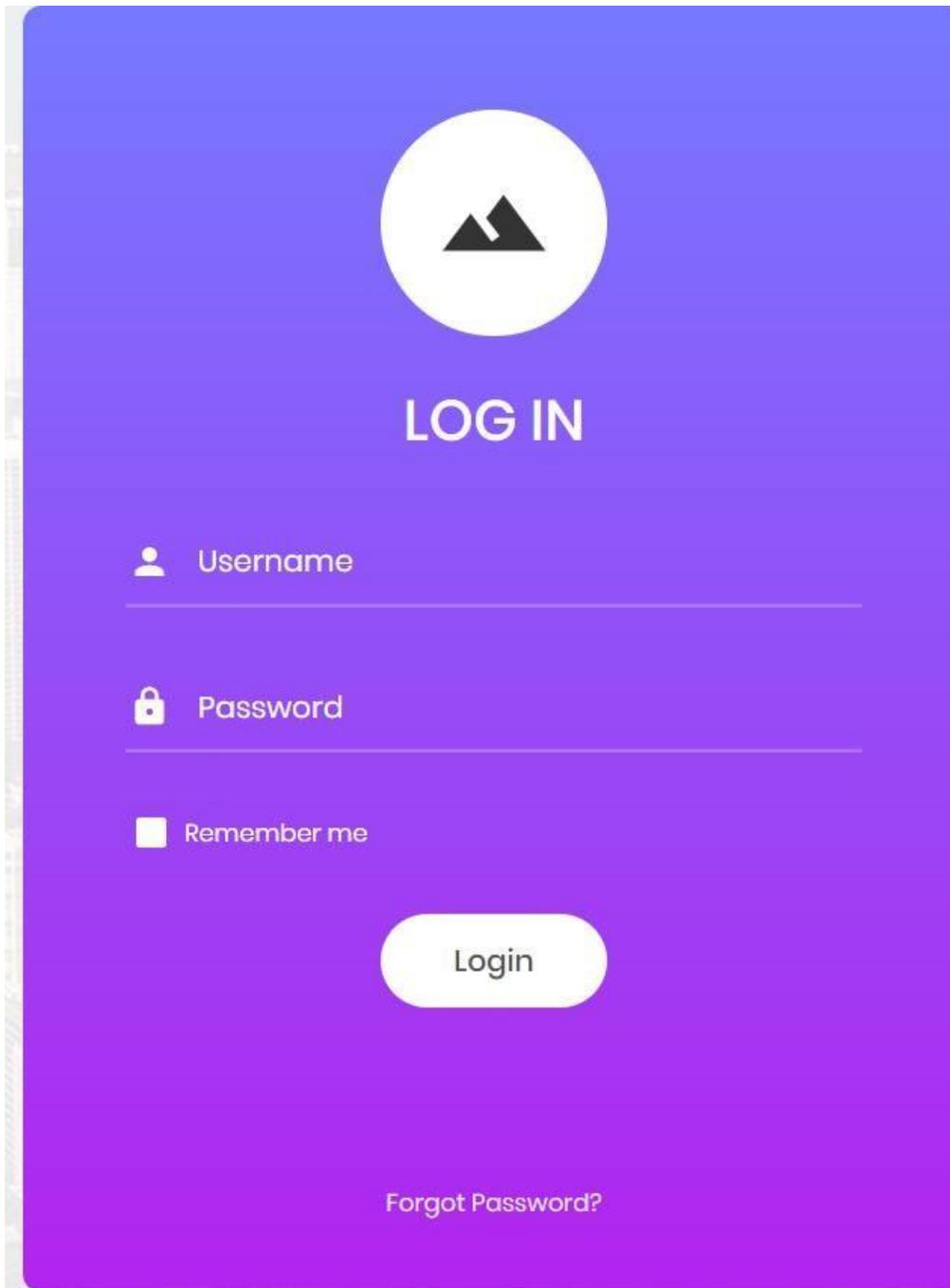


Figure 5 Login details

This is the login form of the proposed system, here the lecture will have to login into the system in order to mark student's attendance.

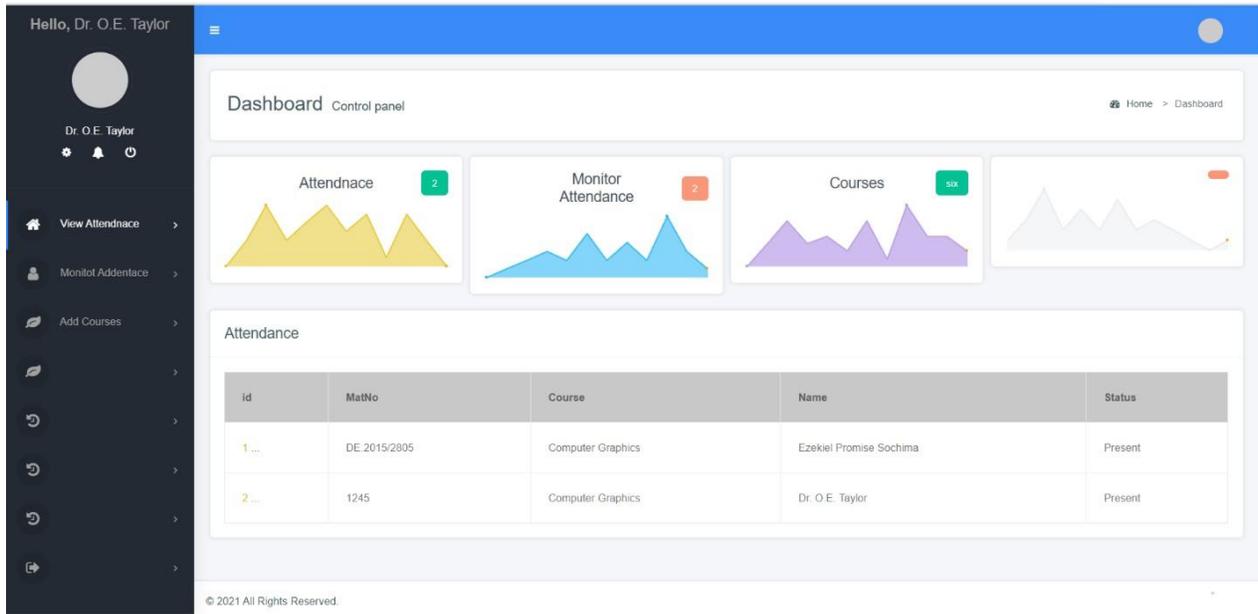


Figure 6: Lecturers Dashboard

Here, the lecturer can view attendance taken by the student

5. Conclusion and Future Work

All Standard institute of learning place high priority on class attendance that if the criterial is not met by the student, the student will not be grant access to sit for his/her examination conducted by the school. This make class attendance an important one for the student. Over the years, class attendance have been conducted manually and is still taking place currently in almost 80% of Nigerian Universities. This paper proposed a smart attendance monitoring system using facial recognition as a concept of verification. The system made use of a dlib library OpenCv library in successfully carrying out of the facial recognition. Images are read into directory, and this images are being encoded so as to generate 128 facial measurements like distances between the nose, ear, and eyebrow e.t.c. This encodings will be used in making comparison with images read from camera or from live streaming videos in other to find best matches. This system was further deployed for real time attendance management system using python flask. This work can further be extended by using Raspberry Pi with a CCTV camera to capture images of students in class and mark them present as attendance.

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