

Random Interim Query and Face Recognition Based Attendance Management System

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Abstract : The COVID-19 pandemic has mandated millions of human to move their communication online. In the case of the educational sector, direct learning in classrooms wanted a substitute in this crisis, leading to the virtual learning concept. Online meeting platforms are an alternative to face-to-face interaction in physical classrooms. In general, attendance is a measure of a student's engagement in a course. However, keeping track of attendance in a virtual classroom is exceptionally challenging. Thus, the online meeting platforms in the COVID-19 pandemic needs a system for looking out the attendance in the classrooms. In this paper, an attendance management system is introduced to handle the attendance and disengagement of the students in the classroom. To ensure the engagement of students in the virtual classroom, the students' face matching module is used along with CAPTCHA and subject-based questions at a random interval of time. This system can be extensively deployed in an online learning platform.

Index Terms –*Virtual learning, Attendance Management, Face Recognition*

INTRODUCTION

The COVID-19 pandemic has given impact in many lives of people [1]. It has exposed many inadequacies in the educational system. The lockdowns in response to the crisis have impacted conventional schooling in many countries. To maintain the learning continuity, the learning community has made several efforts [2]-[5]. The teachers had to change their modes of teaching. The student had to adapt to the virtual learning.

A virtual classroom is a virtual setting where the teachers and students can have live interaction regarding their course materials. The virtual meeting has the advantage of recording the classes which helps students to revisit the class session.

Virtual classrooms and distance learning have become an alternative technologydriven learning methods. Virtual classrooms are used by all educational sectors, including institutional education and corporate learning. The availability of learning on social media platforms like YouTube and also increased usage of online learning courses have raised the popularity of virtual learning. However, due to the spread of the novel coronavirus, the entire world had to face online communication. The pandemic situation paved way for a ground test of virtual classrooms for continuing the education. Universities and organizations like the United Nations Organization (UNO), and World Health Organization (WHO) have to switch to virtual modes of learning and communications during the pandemic. These emergent circumstances stand as an experiment for companies providing virtual learning platforms and services like Blackboard, Desire2Learn, Cisco, Microsoft, etc.

With the development of virtual classrooms, researchers have found several challenges in it. In this regard, a major challenge is maintaining student attendance. In general, student's attention in a class is considered based on the attendance. Attendance is also taken as a prerequisite in many universities. Its record is included

in student mark sheets too. However, at some stages in digital learning, it's far exceedingly hard to maintain the tracking of attendance.

The unavailability of face-to-face communication combines with many of the previously mentioned disadvantages of virtual learning. A lack of any kind of direct interaction with the instructor inhibits student feedback, causes social isolation, and might cause students to feel a lack of pressure on the subject. A lack of pressure is a drawback that might cause students to leave their studies more easily.

One of the difficulties of virtual learning is that there is an expanded liability on the student to deal with their focus and time spent on course material. It's not difficult to get occupied by the student during learning when the web is at the tip of one's finger. Every student is unique; some would prefer visual learning, while others are alright with hear-able learning techniques and self-learning strategies. Presenting the subject in a content material layout that doesn't fit students getting to know patterns can preclude their engagement and expertise retention.

In order to handle this, Random Interim Query and Face Recognition Based Attendance Management System is proposed. It monitors attendance using face recognition module without hindering the learning process. A random attendance tracking approach can prevent students from dropping off in the middle of class. Captcha and subject-based questions at a random time help students stay active throughout the session. Thus, the teaching-learning process will remain as effective as face-to-face learning.

RELATED WORK

Tracking students' attendance has been playing a vital role in the institutions. Several kinds of research were taken to automate attendance. This section presents the related works carried out for attendance management. Student Attendance Monitoring System Using Image Processing [6] has marked student attendance automatically in physical classrooms with the help of student face recognition. The group of students present in the classroom was captured and then the individual faces were recognized using the Haar cascade algorithm and the face images were compared with the training set. Based on the comparison result, the status of the students' presence was sent to the server admin in an excel file. Similarly, Mohammed, et al., [7] has demonstrated the use of image processing technique for facial identification and recognition. This system has created a device that identifies the frontal faces of the students present in the classroom. Haar cascade algorithm was used for face recognition, which identifies the frontal faces from the images and the attendance is marked based on the face match.

Srivastava, et al., [8] have also proposed a system that used the CNN algorithm to train the images and LBPH (Local Binary Pattern Histogram) visual descriptor for image classification. The system detects the human faces where the students enter their ID, and name and then captures their image. The captured face was compared with the database and when it matches, an excel sheet has been updated with the student ID, name, and also with the date and time when the attendance was recorded.

Shamika, et al., has proposed a machine learning model to monitor student attentiveness in virtual classes [9]. This system has used a deep convolutional neural network for identifying the various emotions in the face images for observing the involvement. The emotions like calm, fear, surprise, and happiness have been considered important factors for monitoring students' attentiveness in the class and the engagement level of the students has been noted. The model has produced 90% of accuracy in predicting the concentration level of the student. This has helped the faculties to identify the students with less attentiveness and further, the faculty could advise the student and make their learning in a very better way.

Rohman, et al., has discussed the level of effectiveness and efficiency of virtual learning [10]. The data required for analyzing the efficiency of the learning was taken from a student perspective questionnaire using the Likert scale method for questions. The data also consists of responses from the UNESA electrical engineering department. The examination has come about in 88% of arrangement of understudies with the proficiency of internet learning on time accessibility.

Anzar, et al., [11] has proposed a system that utilized a face recognition module using Dlib open-source software library that recognizes students' faces in the virtual classroom. The system also randomly records the students' replies to ancillary modalities i.e., CAPTCHA and Unique Identification Number based queries. Based on the results obtained from the face recognition module and query based module, attendance has been recorded.

PROPOSED SYSTEM

Random Interim Query and Face Recognition Based Attendance Management System is mainly designed to support the students during online learning. The system introduces the feature of randomness to productively monitor the students' attendance and their involvement in online classrooms without influencing their concentration on learning. It improves the viability of attendance management in online classrooms by integrating real-time responses to CAPTCHAs and subject-based questions.

3.1 Random Interim Query and Face Recognition Based Attendance Management System

Fig.1 depicts the overall architecture of the proposed system. Faculties and students using their smart devices can log in to the online meeting with their credentials. In the virtual meet, when students turn on their cameras, video frames of their faces are captured. Student images are extricated from the captured video frames and face recognition is done. The face image is then categorized as either known or unknown. The students should give their responses to the CAPTCHAs and subject-based questions, induced by pop-ups at random intervals of time. Attendance is calculated according to the results of the face matching, CAPTCHAs, and subject-based query responses.

The details of every student with their video frame are recorded and added to the institutional portal by the admin using their login credential. The admin also handles faculty details and details about the subject handled by the teacher for each class and in the case of universities records the information about every semester subject handling teachers. The development of the portal is executed using the Wamp server and PhpMyAdmin. Students' details will be recorded in the database using MYSQL.

The interface between Random Interim Query and Face Recognition Based Attendance Management System and the virtual meeting platforms is provided via a web-based interface using master and slave modes. The web interface needs to remain functional during the entire session of the meeting.

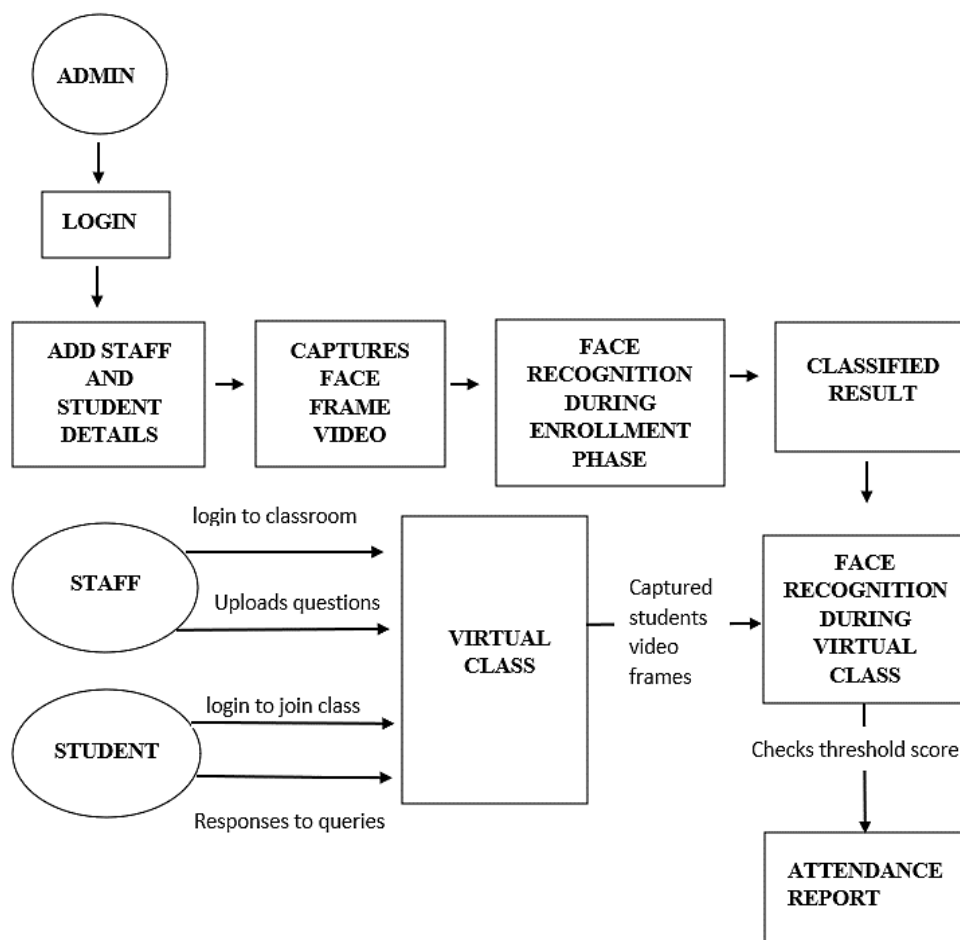


Fig.1 Architecture of Random Interim Query and Face Recognition Based Attendance Management System

3.2 Face Recognition Module

The face recognition module is the main part of the proposed system. Face recognition empowers us to validate an individual from his/her facial highlights extricated from a still photo or a video outline.

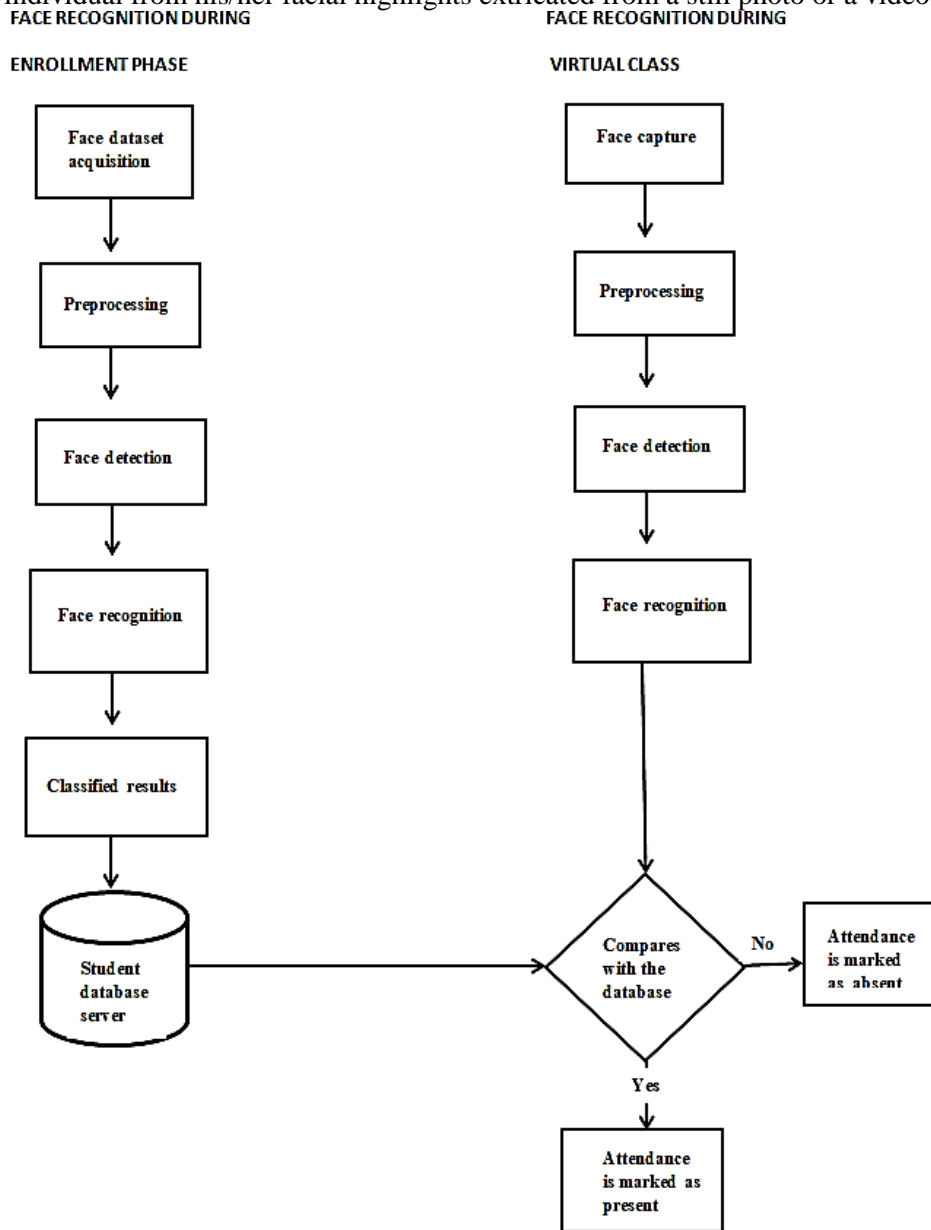


Fig.2 Comparison between face recognition during enrollment phase and virtual class

Face image acquisition is the initial part of the face recognition module. The student video frames are recorded during the enrollment of the student in the school or college. Student face images are extricated from the captured video frames. The acquired images are then converted to grayscale images and resized. After the removal of noise using mean and Gaussian filters, further operations are performed on this image. The face detection module recognizes image regions that are probably going to be human. For face detection purposes, Region Proposal Network (RPN) is used for drawing anchors and outputs which seems like objects. The detected face regions are cropped and scaled to 200x200 resolution and then used for the following recognition task. After face detection, the feature extraction module takes the face image as input to find the key feature that will be used for classification. The module composes a short feature vector that is sufficient to represent the face image. Here, classification is done with the DCNN method with the help of a pattern classifier. Then the classified result is stored in the database.

During the virtual class, individual students' video frames are captured. The face images are then extracted and face recognition is done. The extracted features of the face images are contrasted with the images in the database. The face image is further categorized as either known or unknown based on the comparison **Fig.2**. The corresponding student is identified if the face is known and the duration of the student available in the video is recorded.

3.3 Query Based Modules

To improve the efficiency of classroom learning, the query based modules which consist of CAPTCHA and subject-based queries are used. The queries are prompted by pop-ups at random interval of time. The random interval of time is designed so that the student is active enough in the classroom to respond to these QA. The responses of students to the queries like CAPTCHA and subject-based QA at a random time are taken for attendance calculation accompanied with the results of the face recognition module. The responses will be saved in the database for future requirements. The teacher automatically receives the responses of the students to the queries from the details stored in the server through the application.

RESULT

The result part provides the experimentation results acquired by executing the query based module and face recognition modules. As mentioned, the face recognition module is implemented using DCNN. Face recognition using deep CNN has comparatively better accuracy than other algorithms. **Fig.3** represent the recognition accuracy graph obtained for the DCNN model.

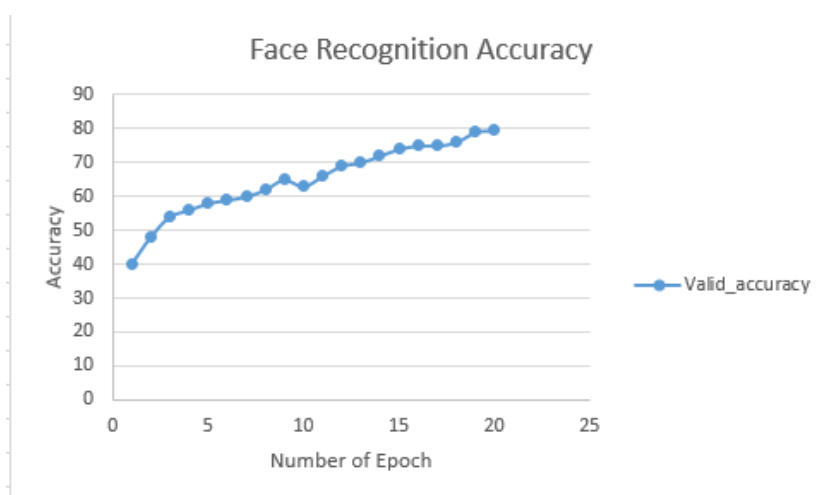


Fig.3 Face Recognition accuracy graph obtained for DCNN



Fig.4 Face recognized during enrollment phase

A database containing students' and faculty details were created. The extracted face images saved in the database are recorded during the enrollment phase **Fig.4** i.e. when the student enrolls themselves in the institution. The stored face images are used for comparison. **Fig.5** represents the virtual meeting where the faculty and the students can log in with their credentials.

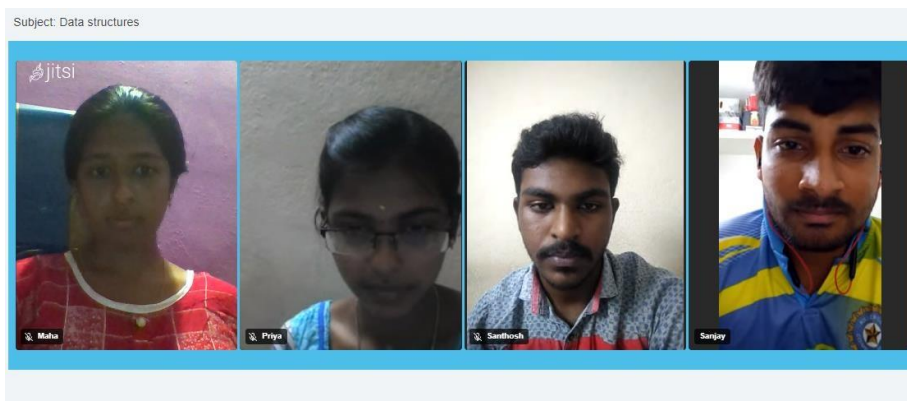


Fig.5 Virtual meet

During the virtual meet, every student needs to respond to CAPTCHA and subject-based questions that pop-ups at a random interval of time. **Fig.6** represents the captcha that popped up during the meet.

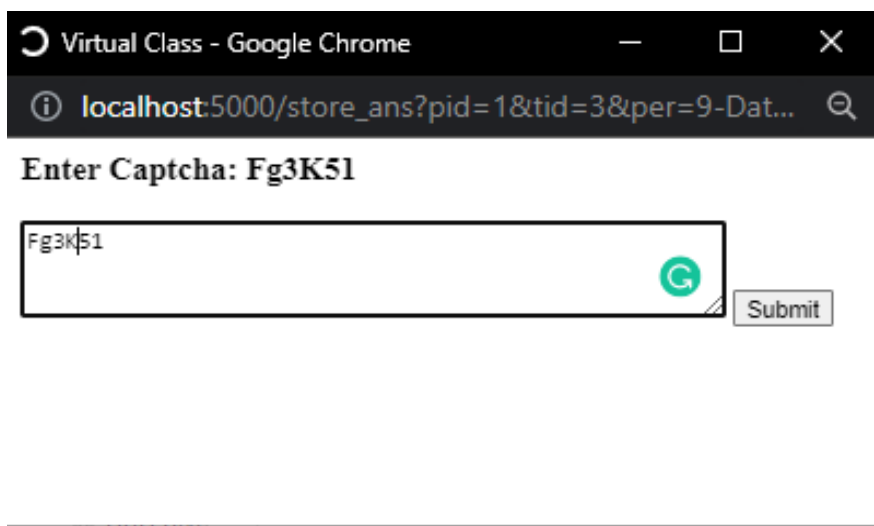


Fig.6 CAPTCHA popped-up at random time

Along with the face recognition of every student's face, the duration of every student present in the class with the video mode turned on is recorded. Additionally, the responses to CAPTCHA and subject-based questions are evaluated. Attendance of the student is marked accordingly based on the threshold score. **Fig.7** represents the attendance of the students on the corresponding dates based on the queries and the duration of time attended.

S.No	Date	Attend(Minutes)	Questions	Correct	Status
1	06-04-2022	6 / 22	3	1	Half day present
2	14-04-2022	2 / 16	0	0	Absent
3	22-04-2022	6 / 24	2	1	Half day present
4	23-04-2022	0 / 2	0	0	Absent

Total Days: 4
Total Present: 1.0
Attendance: 25.0 %

Fig.7 Attendance of the student based on the threshold score

CONCLUSION

Random Interim Query and Face Recognition Based Attendance Management System is mainly designed to support the teachers or other lecturers with the effective management of attendance during online learning. The proposed system allows teachers to effectively monitor and manage the student's attendance. The developed system is time saving and involves less human intervention for managing attendance in virtual classrooms. The system has combined a face recognition module along with the query based modules. It checks the student's responses to CAPTCHA and subject-related questions. Once the student answers the questions, the system collects the responses of the student to subject-related questions at a random interval of time. Both the face recognition module and query based modules function at a random interval of time so that the student cannot predict at what time attendance is going to be monitored. This makes students to actively listen to the class and also reduces dropping out of students from the classroom. The proposed system is efficient and can be deployed in an online learning platform.

The future work of this paper is to enhance the proposed system by incorporating various query based modules like speech recognition. So that the efficiency and accuracy of the system can be enhanced.

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