

Random Interval Tracking System for Virtual Learning

^[1] Aneesa M P, ^[2] Meera K

^[1] Department of Computer Science, MGM College of engineering and Pharmaceutical Sciences, Kerala, India.

^[2] Assistant Professor, Department of Computer Science,

MGM College of Engineering and Pharmaceutical Sciences, Kerala, India.

Corresponding Author Email: ^[1] aneesa.mp.13@gmail.com, ^[2] meera.cs@mgmcet.in

Abstract— With the advent of computer technology, E-Learning has become an increasingly popular learning approach in higher Education institutions. Due to the outbreak of COVID-19 pandemic that demands substantial modification in the teaching-learning process across the globe. However, the student's attendance management in virtual classroom is quite difficult. In this paper I introduce a smart intelligent virtual classroom, which include ML based face recognition system. Further, it can generate dedicated attendance reports, pinpointing students' attention during virtual learning at random time intervals. Moreover, the novel random interval tracking system can also prevent the dropping out of participants from the virtual classroom. The distinctive feature of randomness in Random Interval Tracking System (RITS) ensures that student's attention and engagement in virtual classroom are enhanced.

Index Terms – COVID-19, ML, E-Learning, Virtual Learning.

I. INTRODUCTION

There are many universities and educational institutions that follow virtual learning. Distance education and online education has many facilities that are now essential for higher education that is complete assistance for working place. The universities such as Indira Gandhi national open university, yashwandravo Maharashtra university, etc that follow virtual learning. This is very useful for the people who want higher study along with their job. We all are also familiar with virtual learning due to the outbreak of covid-19 pandemic. Virtual classroom is created by using online learning platform such as google meet, zoom, cisco Webex etc, that help teachers to deliver quality online education to students. Typically, this online platform provides video conferencing, online whiteboard, instance messaging, screen sharing and more to create collaborative environment. Online education can reduce the cost of degree, and can allow you to more easily develop your career along with further education. Social distancing compelled by the covid-19 pandemic demands substantial modification in the teaching learning process. One of the main challenges that followed in virtual learning is it is difficult to find whether the student is attending the class or not. Sometimes the students may seem as online without attending the class. To the best of my knowledge, no such automated system has been proposed so far for tracking students' attendance. Several challenges associated with the widespread use of virtual learning, which is characterized by quite a lot of interrelated features pertaining to students, teachers, and the technologies involved. In this regard, students' attendance management in virtual classes is a major challenge encountered by the

teachers. Student attendance is a measure of their engagement in a course, which has a direct relationship with their active learning. Attendance in a course is a prerequisite as mandated by various universities for the students to take their final examinations in every course. Further, the inclusion of attendance data on students' grade cards is a strategic decision of many universities across the globe to enhance students' attendance and engagement. However, during virtual learning, it is exceptionally challenging to keep track of the attendance of students. Calling students' names in virtual classrooms to take attendance is both trivial and time-consuming. Attendance above 50 percentage is mandatory in many universities and educational institution in order to attend the university exam. Checking your student attendance during online classes is a must to make sure that students are making it to their classes. This also ensures that they are participating in the class. The proposed method is the simplest and the best approach to automatically capture the attendance during virtual learning. The strategies that followed by the teachers in virtual classroom in order to provide attendance is manual attendance calling, self-report attendance system using tools like google form. Manual attendance calling is both trivial and time consuming. Further, it is difficult to find out whether the student is attending the class or just being online. Researchers have identified several challenges associated with the widespread use of virtual learning, which is characterized by quite a lot of interrelated features pertaining to students, teachers, and the technologies involved. In this regard, students' attendance management and assessment in virtual classes is a major challenge encountered by the teachers. In order to overcome these, we have to design an effective learning environment and embedding online technologies

II. RELATED WORKS

This section presents a review of various strategies and technologies currently used for attendance management. Since the related literature pertaining to virtual classrooms' attendance monitoring is limited, an extensive review of the same could not be carried out. However, the rationale for adopting the face recognition method in the proposed prototype model is elaborated by discussing the related literature. In [1], aims to design a face recognition attendance system based on realtime video processing. This article mainly focus on actual check in, truancy rate, stability of face recognition system in realtime. The proposed work in [2], introduce the 'Random Interval Attendance Management System' (RIAMS), which is an innovative solution for attendance monitoring issues, students' disengagement, and attendance faking during virtual learning. The work presented in [4] discuss about deep learning based smart attendance monitoring system. It describes the different layers of CNN and Train the CNN model with images of students. It mainly focused on attendance monitoring in physical classroom. In [6],it present fingerprint attendance system. A handheld device used for attendance. The device can be passed and students can mark attendance during the lecture time. In [7],it present face liveness detection using dynamic texturing. It mainly focused to detect whether the image is spoofed with cleared images. In [15] it proposes a smart attendance system that extracts distinguishable phase characteristics of individuals to enable recognition of various targets. The aim of this office attendance system is to correctly distinguish between different people using RFID tag. In [9] Zhang etc propose in order to enhance the discriminative power of the deeply learned features, this paper proposes a new supervision signal, called centre loss, for face recognition task. In [8] Rekha and Kurian propose a design to detect faces in real time using hog descriptor. Taking HOG of the image and calculate the weights which contributes for the facial features. In [12], propose a Raspberry Pi installed with Open CV library and a Raspberry Pi Camera module is connected for facial detection and recognition. In [10], presents a comprehensive survey of various techniques explored for face detection in digital images. Different challenges and applications of face detection are also presented in this paper. At the end, different standard databases for face detection are also given with their features. In [13], focusing on a face recognition-based attendance system with getting a less false- positive rate using a threshold to confidence. Here used Haar cascade for face detection because of their robustness and LBPH algorithm for face recognition. In [11],it present propose a comprehensive framework based on Convolutional Neural Networks (CNN) to overcome challenges in video-based face recognition(VFR).It enhance robustness of CNN

features to pose variations and occlusion, propose a Trunk-Branch Ensemble CNN model (TBE-CNN), which extracts complementary information from holistic face images and patches cropped around facial components. In [17],this paper proposes a student attendance management method named AMMoC (Attendance Management Method based on Crowdsensing).It consists of the initialization phase and the authentication phase.

III. PROPOSED SYSTEM

Random Interval Tracking System (RITS) is an innovation based on Machine learning, specially designed to help the teachers/instructors across the globe for effective management of attendance during virtual learning. RITS facilitates automatic tracking of students' attendance in virtual classrooms. The proposed system is designed in mainly three sections,

- i) Mobile Application
- ii) Desk Top Application
- iii) Website

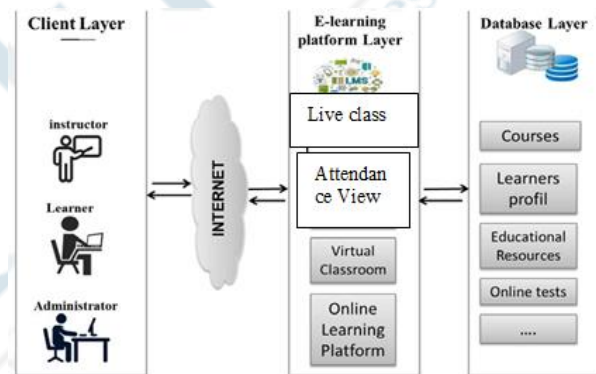


Fig 1: Overview of the system

The whole system design is given in figure 1. The system is designed with mainly three layers such as client layer, E-learning platform Layer and Database Layer. These layers are connected through an internet connection. The system has mainly three user's instructor, learner and administrator. Administrator has all the responsibilities such as train the model with faces of students, add/delete courses, add/delete subjects, add/delete department allocate subjects for teachers, allow permission to teachers by creating username and password and teachers have the desktop application and students has the mobile application. Teachers and students enter in to virtual classroom through internet connection. When students enter in to classroom, they can view live classes and they can attend the live class.

Various design steps of RITS,

1. Teachers and students should log in to the virtual classroom using their smart devices.
2. In the virtual classroom screen captured at Random interval time.
3. Extract all students' faces from the video frames

4. Features extracted from each face
5. Keys generated from each 'genuine faces' are compared with all the keys stored in the database using Kmeans.
6. Attendance Registered based on matching occur.

The interface between RITS and online meeting platforms are facilitated through a web interface that runs on the teachers and students' smart devices in master and slave modes, respectively. The faculty, as well as students, should log in to the online learning platform with their smart devices. The web interface page should remain active during the entire course of the class. Here, the web interface at the teachers' smart device facilitates two things.

1. It provides the teacher to with a timely reminder to click the web-screen for capturing all students' faces of the virtual class for initiating the attendance entry.
2. It performs the extraction of face images from the web screen.

A USER REGISTRATION MODULE

Proposed system has mainly three users Students, Teachers and Admin. Each user has separate interface. In Student Registration Module, Students Log in to the virtual classroom using their smart devices by entering their Admission number and password. If they are new student, they have to register with their details such as Name, Admission number, course, department, semester, password. All the user details are stored in the database. Mobile application created for students. When they enter into classroom, they can view the live class link for corresponding subjects.

In Admin and Teachers Registration module the administrators and teachers can login in to the virtual classroom with their username and password. Administrator has the responsibility to train the faces of students and also, they have the permission to allocate teachers and subject allocation etc. Teachers have permission to add live classes and also, they can view attendance corresponding to each subjects.

B DATA COLLECTION

Data is collected from students who are registered. Data collected from different poses and also based on intensity of light. Each image is stored database with username.

If more data collected accuracy is increased.



Figure 2: Example dataset model

C FACE RECOGNITION MODULE

The core part of the proposed system is face recognition module. Which is implemented using Kmeans. Face identification Using the K-Nearest Neighbor Method consists of two phases namely the training phase and the testing phase. Prior to training, the still photographs of students stored in the database should be authenticated by the respective teacher. Separate folder created for training and testing.

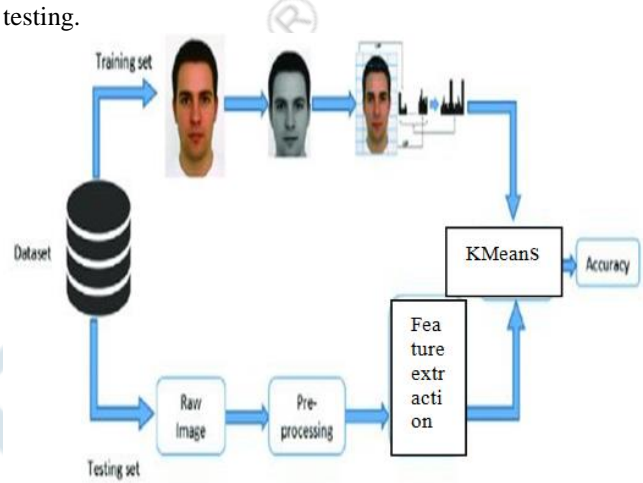


Figure 3: Working of proposed system

Stage 1: Screen Capturing

When students and teachers enter in to virtual classroom using their live class id, screen capturing is performed. Screen capturing performed at random time interval. This random interval generated by system itself. For each random time interval screen capturing is performed and saved in the database.

Stage 2: Random number generation

In java programming, we often required to generate random numbers while we develop applications. In the proposed system we want to generate random number between 1 to video duration and convert this random number in to minutes. Store generated random numbers in array. For each random number screen captured and attendance registered.

Stage 3: Face Detection and Feature Extraction

By using cascade classifier for each screen capturing face detection is performed and features extracted. The haar like feature consider adjacent rectangular region at a specific location in a detection window, sums up the pixel intensities in each region and calculates the difference between these sums. This difference is used to categorize subsection of an image. Therefore, a common Haar feature for face detection is a set of two adjacent rectangles that lie above the eye and the cheek region. The position of these rectangles is defined relative to a detection window that acts like a bounding box to

the target object. Haar wavelets used for feature extraction. A window of the target size is moved over the input image, and for each subsection of the image the haar-like feature is calculated. These features are stored in the database.

Stage 3: Training and Testing

The proposed system uses Kmeans algorithm for training and testing. In the training stage all features are clustered based on kmeans algorithm. KMeans is a clustering algorithm that tries to partition a set of points into K sets (clusters) such that the points in each cluster tend to be near each other. It is unsupervised because the points have no external classification. K-mean clustering technique is used to cluster the face features. Every face has data and by using that data we can recognize it, and the K-means algorithm tries to cluster similar data in K group or cluster, so what we need to do is to gather all data of persons that we want to recognize their faces and cluster them in K cluster and as a result we will have K cluster where each one represents a person. After extracting the features, these features are compared with the features that already stored in the database and forms clustering. In the testing phase, when new face detected, feature extracted and it grouped in to cluster based on its similarity. Each cluster is corresponding to each user. Face recognized based on which group it belongs to.

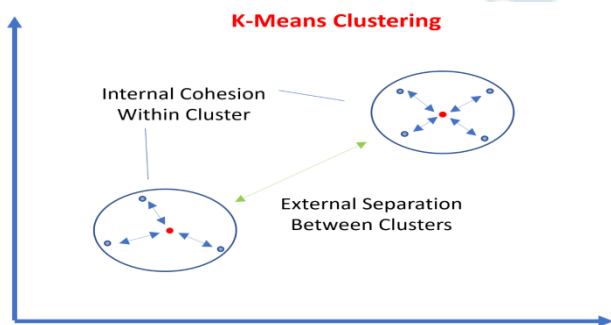


Figure 4: Kmeans clustering

D ATTENDANCE REGISTRATION

Attendance registered after authentication. For each screen capturing attendance registered and attendance finalized if the student attendance registered above the median (based on the count in screen capturing table). Teachers can access the corresponding subject attendance.

IV. RESULT AND DISCUSSION

This section provides the results of the experimental procedures carried out while releasing the RITS model. For implementation it uses hardware requirements such as processor intel core i3, main memory 8GB and android phone with internet connection. Software requirements such as Operating System Windows/Linux used. Front end android studio and NetBeans backend java, android, jsp, GassFishserver and MySQL. The training and testing where

implemented using java programming language. Our software code has been tested in Windows and optimal performance is observed. Download org-netbeans-modules-java-j2seproject to compile the project and download and install Cmake. Download Dlib library and download OpenCV library and build It using Cmake. Download SQLconnectors mysql-connector-java-5.1.23-bin in order to achieve the connection with the Database server. Database contain students' images from different pose and light variations with user name. In database create table for course, department, semester, table faces that contain students faces, user registration table that contain information about the students entered when they are enter in to classroom and login table, attendance registration table. We used the most common Google meet platform to create a virtual classroom and captured video frames from the same during random intervals of time.

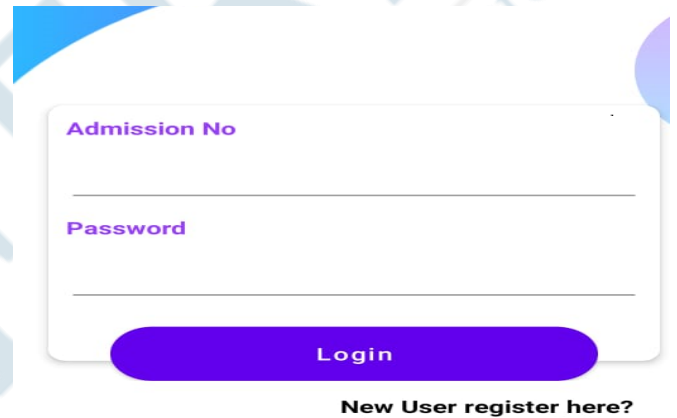


Fig 5: Output of user login and registration module

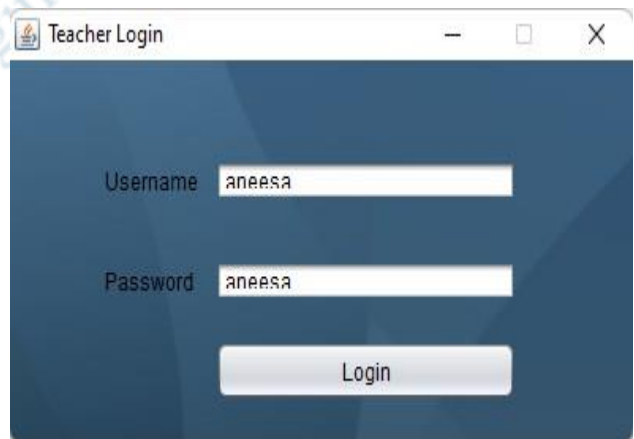


Figure 6: Teachers Login page

Students' login page created in mobile application using android studio as shown in figure 5. Teachers' login in to the virtual classroom by entering username and password. They can add live class by clicking on add live class button. The field such as department, course, semester, subject, google meet link and time have to fill by teacher to add a live class.

When teachers enter in to virtual classroom with their username and password as shown in figure 6, they can start the tracking system by selecting the live class id corresponding to the subject and department and click the button start as shown in figure 7. The tracking system run in the background of virtual classroom without disturbing the teachers learning process.

For each class attendance taken based on the random interval generation. By using random() method in java. if we want to a generate random number between a specified range use mathematical function.

Math.random() * (max - min + 1) + min. Here max is the video duration. For each random interval, screen captured and attendance taken and that marked in the attendance count table in database which contain id, google meet id, attendance count. Attendance finalized based on the attendance count in the table.

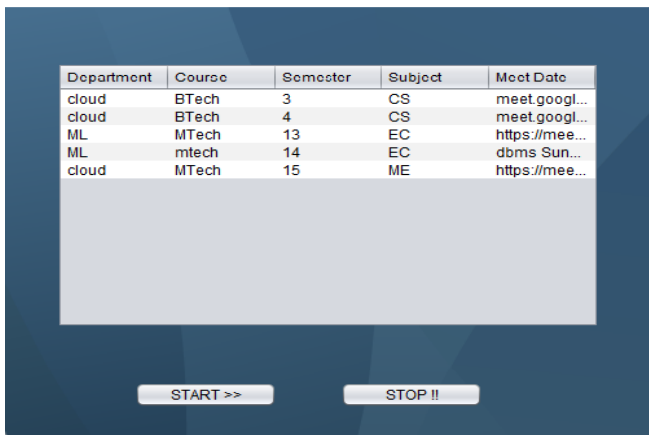


Figure 7: Tracking system

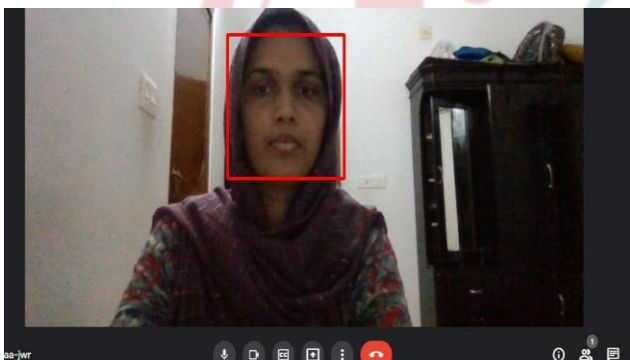


Figure 8: Screen capturing

As shown figure 8, the screen captured and screen shot saved.

Here the captured frame contains one face that detected. Then search for image and finding highest similarity. Here the highest similarity is 0.8088 and username Aneesa. Based on the similarity attendance registered. Then Screen captured at random time interval which automatically generated by system itself. From this captured video frame face detected

and authentication performed and attendance registered in the table as shown in figure 11. Attendance registered with admission number along with date.

```
image #processed
Screenshot saved
Detected 1 faces
#####
Searching Image :D:/face image/facedetect_output0.jp#
SearchImage =D:/face image/facedetect_output0.jpg

Root Directory :C:\Users\anees\Documents\NetBeansProjects\VirtualLearningApplication
hi
path :::C:\Users\anees\Documents\NetBeansProjects\VirtualLearningApplication
Indexer in get index
rootpath in Cluser Reader ==C:\Users\anees\Documents\NetBeansProjects\VirtualLearningApplication\ind
Image :C:\Users\anees\Documents\NetBeansProjects\VirtualLearningApplication\src\trainingimage\umer9.j
username :umer
index.similarity() : in search0.7756652677039405
age :C:\Users\anees\Documents\NetBeansProjects\VirtualLearningApplication\src\trainingimage\aneesa1.jpg
Highest Similarity :0.808849025858659
Highest Similarity Username :aneesa
```

Figure 9: User authentication based on similarity

Department	Course	Subject	Google Meet link	Link	Time	Action
CE	BTech	cloud	2022-06-24	https://meet.google.com/mad-amzs-gza	5.05	Attendance Report
CS	BTech	cloud	2022-06-24	https://meet.google.com/saw-vmsc-fcy	13.26	Attendance Report
CS	MTech	ML	2022-06-15	https://meet.google.com/nsw-ztda-cfj	10:00	Attendance Report
CS	MTech	ML	2022-06-15	https://meet.google.com/bym-cvea-toc	10:00	Attendance Report
CS	MTech	DBMS	2022-06-18	https://meet.google.com/kmx-cyhg-buo	10:00	Attendance Report
CS	MTech	OS	2022-06-18	abcd.com	10:00	Attendance Report
EC	BTech	OS	2022-06-18	https://meet.google.com/dww-bhsm-ect	13.47	Attendance Report
IT	BTech	OS	2022-06-22	https://meet.google.com/zck-tfaq-buk	10.17	Attendance Report

Figure 10: Attendance report

User	Date
1000	2022-06-15
ccv20cs01	2022-06-18
ccv20cs01	2022-06-24
ccv20csce03	2022-06-27

Figure 11: Attendance registration

V. CONCLUSION

Online teaching and online learning has been an invaluable component of education in the past decade. Demand for fully online or hybrid courses has been steadily increasing. Random Interval Tracking System is an innovation based on Machine learning, specially designed to help the teachers/instructors across the globe for effective management of attendance during virtual learning. It facilitates precise and automatic tracking of students' attendance in virtual classrooms. It incorporates a customized face recognition module. Due to the feature of randomness, it ensures the active engagement of students since students does not know the time interval at which attendance will take.

The experimental results show that the proposed system is highly efficient and scalable. Its modest design allows teachers to precisely monitor and manage students' attendance and generate reports as per the administrative requirements. The automated system reduces wastage of time and manual labor involved in tracking and managing attendance in virtual classrooms. It offers the feature such as, very user-friendly and robust and can be easily integrated with any existing virtual meeting platform, Generate attendance report . Attendance will take at random interval. All users who have internet facility can access the system wherever and whenever they wish. It will reduce dropping out of Students and also reduces wastage of time.

The proposed design can be integrated by adding a module that automatically assess the students in the absents of teacher using NLP.Effective attendance management in virtual learning could enhance the quality of the teaching-learning process, which will be benefited by millions of teachers, students, and other stakeholders across the globe.

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