

Attendance Tracking with Perception Detection using Recurrent Neural Network

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Abstract: The online class environment has become prevalent in education since the Covid-19 pandemic. It offers students and educators the flexibility to access online education from various locations. Despite its challenges, the online class environment has become essential for providing accessible education, especially during the times of disruptions. There are still educators that conduct attendance checking manually so the student's attendance and attentiveness during online classes is a big challenge for teachers. The researcher developed a system that can detect body motion and face expression in an online class setup. Attendance tracking with perception detection with the use of Recurrent Neural Network is suggested to detect body motion and face expression, capture and then, store the students' attendance in the system. The system will use real-time detecting the body motion and face expression whether the students is attentive or not are being captured to store the student attendance during online classes. The body motion will detect the body and the facial expression to capture and track when the camera is on. The system incorporates a notification within the system for faculty regarding inattentive students. Also, the system developed as a separate web application that is compatible or complementary with the existing setup of online classes.

Keywords: Online class, (RNN)Recurrent Neural Network, Attendance, body motion, face expression, (LSTM) Long-Short Term Memory

1. Introduction

The Commission on Higher Education (CHED) is the government agency promoting quality higher education that is accessible to all. Education has evolved throughout the past years taking advantage of the advances in technology. Now, education has taken many forms with different learning pedagogies. However, when the coronavirus or COVID 19 became widespread throughout the world, the education system was affected tremendously, precluding the conduct of face-to-face classes. For education to continue on, online learning was implemented and became standard in the whole country so the Commission on Higher Education (CHED) released a memorandum order no.4 series of 2020 that encouraged every school to maximize the use of technology to support learning and teaching, using the availability of devices and internet connectivity to ensure uninterrupted learning of the students.

In traditional classrooms, educators use the manual attendance tracking and it is recorded in the class record before classes start. Regular attendance will help the students maximize their learnings. Therefore, mandatory class attendance policy is important and recommendable. The COVID-19 pandemic has changed education in all levels, shifting to online classes. Adapting to online classes has been difficult for many since not all are tech-savvy and those who are may not have reliable internet connections. Little by little, through the help of IT

professionals who teach the educators thru online trainings/seminars and with increasingly reliable internet connections, at least in some areas, studying anytime and anywhere through online classes has come to the fore all the more.

[21] Attendance checking of student's attendance and attentiveness during online classes is a big challenge for teachers. The significant challenge in online classes to all teachers is continuous monitoring of attendance and participation of students during the COVID-19 pandemic lockdown. It is essential to focus on the attention and attendance problems faced during online classes. In an online class there are no direct contact with students and at times it will be difficult to engage because students are easily distracted and lose concentration. [21] Studies have shown that almost 62% of students lose interest in an online class setup. Majority of the students were greatly challenged in learning due to their learning environment at home [23] and other recognized challenges by students during online classes such as technological difficulties, instructional struggles, individual readiness, domestic barriers, and infrastructural difficulties [22]. On the other hand, faculty members also have their own problems and concerns regarding online education such as students possibly being dishonest academically, impersonal, and lacking emotional connections when classes were conducted online.

2. Related Literature

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[9] Motion is a changing of position or location with respect to some reference object. The body is at rest or in motion which depends on different position or location and emphasize in tracking the motion of an object and detecting the specific object by using a camera to know its behavior.

A variant of the Recurrent Neural Network (RNN) is Long-Short-Term Memory (LSTM) that is used in the field of deep learning learns from training the [24] and sequential neural networks as indicated [25] highlight the use of (LSTM) that regulates the passage of information in and out of the memory cell.

[20] It shows the STMP-Net video framework because of the limitations of Recurrent Neural Networks (RNNs) capturing spatiotemporal insights and dynamic motion during the video prediction tasks. The integration of spatiotemporal memory and motion prediction improves predictive precision.

As mentioned [4] emphasize the importance of temporal contextual data in video-based object detection, utilizing recurrent neural networks (RNNs) that includes LSTM and ConvLSTM. These contributions innovate the detection model that trained from the ImageNet VID dataset that shows the remarkable 81% map within the realm of video object detection.

There have also been local studies on these. [14] study focuses on real-time facial feature detection and tracking in a video. [15] The study utilizes the trained R-CNN model inception v2 for immediate detection and classification of common public security threats in videos from CCTVs. [17] proposes a real-time detection of student performance if not attentive or attentive based on facial recognition during online class sessions. [18] The research presents a real-time gender identification system using Raspberry Pi and the Raspberry Pi Camera Module V2.

These studies all focus on various aspects of human motion recognition, facial feature detection, and gender identification using deep learning and other advanced techniques. All of them demonstrate significant advancements in accuracy, efficiency, and real-time capabilities.

3. Methodology

The Agile Software Development Life Cycle as reference for the development of the project. This development model is utilized because of quickly changing demands and continuous improvement in emerging technologies. The agile methodology helps to easily adapt in the creation of applications that are seamless, quick and easy

to use. The agile model is more stable and has shorter iterations and it works divided into shorter phases.

4. Results and Discussions

A video conferencing platform named KNIGHTMEET was developed by the researcher and has features that tracks body motion and detects face expression to check the attendance of students in an online class setup utilizing the Recurrent Neural Network (RNN) algorithm.

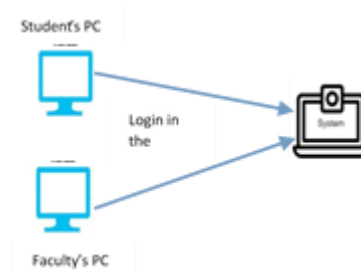


Fig 1. Process of checking the attendance

1. The faculty will send the link to the students through email so they can join the online class.
2. The students should click the link then write their name on the space provided then click join button.
3. When everyone is in the “KNIGHTMEET”, the faculty as a host will now click the Attendance button on a selected time; 5 minutes, 10 minutes or 15 minutes.
4. Once the attendance checking is started the system will notify the students instructing them to open their camera.
5. Then it will start detecting the body motion and face expression using RNN until the time ends.
6. It will automatically pop up on the screen of the faculty for those students’ checked attendance by the system.
7. Then it will also pop-up the download excel file and the faculty should click the file to have a copy of student’s attendance during their online class.
8. The faculty can start the class discussion while the system automatically checks the student’s attendance. The faculty and students can end the online class whenever class discussion is done.

Attendance Tracking with Perception and Detection using RNN Screenshots

The following figures show the screenshots of the functionalities of the Attendance Tracking with Perception and Detection using RNN:

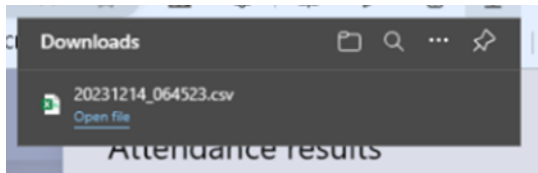


Fig 2: Main Screen on the Web

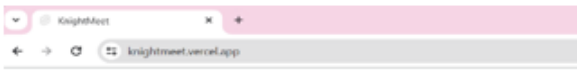


Fig 3. Picture using the KNIGHTMEET for checking the attendance of students while their camera is open.



Fig 4. Attendance Checked Result display the presence percentage of students in an online class setup

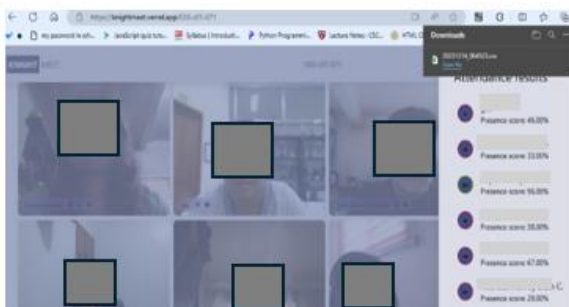


Fig 5. Picture detected presence of students while checking the attendance.

The dots that appear on the body or face are called “keypoints” while detecting the body motion and facial expressions.

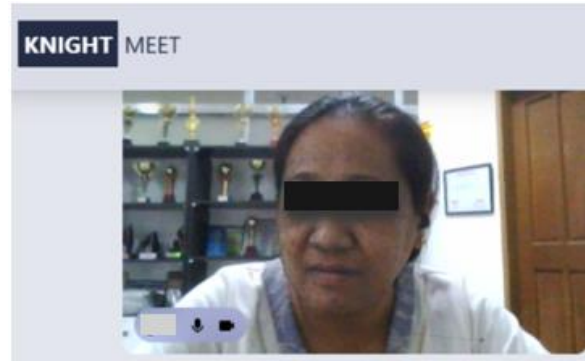


Fig 6. Picture shows the download file displayed and can be open after detecting and checking the attendance of students in an online class setup.

Body motion and face expression detected using Recurrent Neural Network (RNN)

Recurrent Neural Network is a machine learning type of neural network that is commonly used for sequential data such as time-series and video data. RNN is suitable in temporal dependencies such as predicting future frames in a sequence. The Long-Short Term memory (LSTM) is an architecture of RNN that is used to predict future frames in a sequential video. The researcher used frames per second (FPS) in the system to be able to predict frames in a sequential video in an online class setup. The frames per second (FPS) are essential in measuring the number of frames that appear within a second in a video. The researcher assumed a 30 standard frames rate of frames per second (FPS) because it is commonly used in online video platforms. But the expected frames for the time frame set by the researcher is 20 frames per second (FPS) and the expected count of frames time frame is 60 seconds so the expected frames are 1200 total expected frames per second. The RNN measures it per frame, so to get the presence percentage is to divide present frames divided by expected frames multiplied by 100.

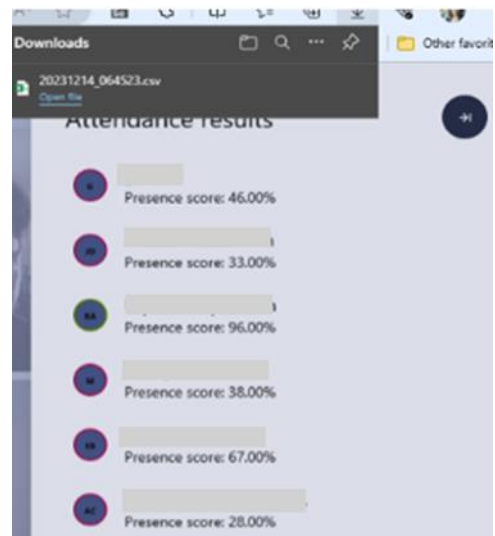


Fig 7. The measurement result was detected using the RNN.

The attendance results appear right after the time set in checking the attendance of students and the presence percentage is shown below.

System Testing and Evaluation Results

In this section, results are shown based on the testing and evaluation of the respondents of some students and some IT professionals. The evaluation of the respondents that the researcher used was ISO 25010 based on the five (5) categories of functionality, performance efficiency, compatibility, usability, and reliability. Also, the Likert scale table interpretation below is included to show the comprehensive understanding of the system's effectiveness and guide potential enhancement for future development.

Likert Scale Table Interpretation

Likert Scale	Mean Score	Interpretation
5	4.5 - 5.00	Strongly Agree
4	3.5 - 4.49	Agree
3	2.5 - 3.49	Neutral
2	1.5 - 2.49	Disagree
1	1.00 - 1.49	Strongly Disagree

Fig 8. Likert Scale Table Interpretation Used in testing and evaluation of the system.

Evaluation in Terms of:	Students	Interpretation	IT Professionals	Interpretation	Overall Rating	Interpretation
Functionality	3.88	A	4.37	SA	4.13	A
Performance Efficiency	3.97	A	4.47	SA	4.22	SA
Compatibility	4.02	A	4.55	SA	4.28	SA
Usability	4.25	SA	4.58	SA	4.42	SA
Reliability	4.15	A	4.57	SA	4.36	SA
Overall Weighted Mean					4.28	SA

Fig 9. Summary of Evaluation of the Respondents Based on ISO-2510

Based on the evaluation, it can be seen that the respondents view the System as highly acceptable and suitable for the purpose and tasks it was designed for, giving it an Overall Weighted Mean Rating of 4.28 (Strongly Agree). The respondents view the System's Usability as its strongest suit, giving it the highest rating among the five (5) Categories of 4.42 (Strongly Agree) while assessing its Functionality as probably having some room for improvement, giving it the lowest rating, among the five (5) Categories of 4.13 (Agree).

Overall, based on the assessment of the potential users and stakeholders of the System, there is a high degree of confidence that the system can attain its intended purpose of being a precise and effective student's attendance tracking system for online classes.

5. Conclusion

Concluding the study, the attendance tracking that detects body motion and face expressions is an advantage of use for educational institutions. This system gives accurate

results of attendance for those students that activate their cameras. The development of the system shows the advantage of using the cameras when checking the attendance instead of manually and individually checking with the faculty. It further enhances the accuracy and speed of tracking and detecting the student's body motion and facial expressions. Precious time is saved that would otherwise be used for individual checking of attendances. This equates to more time for actual teaching by the teachers.

The study in developing a system using recurrent neural network algorithm has proven to be not only feasible but also highly promising for enhancing the online learning environment. There is the achievement of the researcher's objectives, including the developing of the system capable of tracking the student's attendance that detects body motion and face expressions during online classes and popping up of notification when checking the attendance and notifying the students who are not opening their cameras. This also provides educators or faculty with excel file results of attendance aside from pop-up attendance once attendance-checking is over. This is a significant step in a more interactive and productive online class among students and faculty.

Adopting this system would be a step forward in improving the learning opportunities for students. Lesser interruptions, which is what individual attendance checking really are, would also mean more lessons and examples to be shared by the teachers and more practical learnings for the students.

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