Smart E - Learn Tracer

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Abstract: The COVID-19 pandemic has accelerated the shift towards online education, which presents a range of challenges for educators, including difficulties in monitoring student participation, tracking attendance, generating and evaluating questions, and dealing with external distractions. To address these issues, we propose a comprehensive online video classroom web application that leverages machine learning techniques. The application includes a machine learning approach to monitor and analyze student concentration, an attendance checker based on neural network technology, and natural language processing (NLP) to generate and evaluate questions. Additionally, an outside voice processor using neural network technology will filter out background noise to improve the clarity of both the teacher's voice and the student's responses. Our proposed solution will provide educators with a powerful tool to enhance the learning experience for students, helping them to engage with their students more effectively, streamline question generation and evaluation, and create a more productive learning environment.

Keywords: Machine learning, E-learning, Video processing, Artificial Intelligence, Natural Language Processing.

1. Introduction

Due to the COVID-19 pandemic, many schools have switched to online learning. Online education provides flexibility and convenience, but it also has drawbacks. One of the biggest challenges online teachers have is monitoring student participation, attendance, question creation and analysis, and distractions. Because of this, many schools struggle to provide effective and engaging online learning.

A comprehensive online video classroom web application solves these issues. Machine learning improves student learning and speeds up teacher instruction in our software. Our system will contain machine learning to monitor and assess student focus during lectures, a neural network-based attendance checker, and a neural network-based outside speech processor. We will also utilize NLP to develop questions and evaluate faster.

Our work aims to create a web application for an online video classroom to help instructors create a more productive and engaging learning environment for children. We will employ the latest machine learning and artificial intelligence advances to provide students with a more dynamic, entertaining, and user-friendly platform.

Online lectures make it hard to monitor student participation. This is our first challenge. Online education's biggest problem is students' tendency to become distracted by social media and email during class. Our aim is to employ video processing to monitor student activity and alert the teacher in real time if a student seems distracted or disinterested. This technique will help instructors quickly identify students who need more assistance and provide more tailored feedback to keep them interested.

Attendance recording is our second challenge. In traditional classrooms, teachers take attendance at the start of each session to track attendance. This simplifies standard classroom attendance tracking. In online classrooms, students may sign in but leave without engaging in the instructional activities, making attendance tracking problematic. We will design a neural network attendance checker to solve this issue. This method will efficiently and accurately track student attendance and help teachers identify non-participants.

Our final challenge is creating and grading lecture questions. Traditional schools may quickly develop and disseminate questions for students to answer in class. Online classes make it hard for teachers to track student progress in real time. This makes question creation and grading harder for the teacher. We aim to employ natural language processing (NLP) to design and evaluate queries faster to overcome this issue. The technology will automatically create questions based on lecture material and student performance, saving the teacher time. NLP algorithms will analyze students' responses and provide them with immediate feedback to guide their education.

Our fourth impediment is external distractions that might degrade the learning environment. When they study online, students are more likely to be distracted by noise and other distractions. We need a neural network-based external speech processor to solve this. This will eliminate

background noise and improve the instructor's and students' voices during lectures.

In conclusion, our online video classroom web application gives instructors a vital tool to boost student learning. We employ machine learning to help instructors monitor and engage with students, streamline question generation and evaluation, and create a more focused and productive school environment. Our findings might revolutionize online education and improve student and teacher learning. Our solution uses the latest machine learning and AI technologies to solve some of online learning's biggest problems. Engagement and attendance monitoring, question creation and assessment, and distraction control are these problems.

Our study is crucial to provide effective online learning tools following the COVID-19 pandemic. As online education gains popularity, teachers must have access to the latest technology to provide students with an engaging and effective learning experience. Our online video classroom web application advances this. It will help instructors monitor, engage, and create a more focused and productive learning environment.

A. Research objectives

The primary objective of our research project is to develop a web application for an online video classroom that makes use of machine learning and artificial intelligence. This application's purpose is to improve the quality of the online learning experience for students and the quality of the teaching process for instructors. The application will solve some of the most major issues connected with online learning, including monitoring student interest and attendance, creating, and assessing questions, and minimizing external distractions. These challenges include:

Students will have access to a more individualized and interactive educational experience thanks to the implementation of the suggested solution, which will make use of several different approaches to machine learning, including video processing, natural language processing, and neural networks. Moreover, the program will have a checker for attendance that is able to reliably detect and record student attendance automatically, saving up significant time for teachers.

In addition, the application will produce and analyze questions depending on the content of the lecture as well as student performance, giving students the option to actively interact with the topic and evaluate how well they grasp it. The external speech processor that has been suggested would also filter out extraneous noises, which will improve the entire learning experience for pupils as well as for their instructors.

Our study is being conducted with the end objective of simplifying the instructional process for teachers while simultaneously enhancing students' engagement, attendance, and overall learning results. We believe that the web application for an online video classroom that we have proposed has the potential to completely change the landscape of online education by delivering a method that is both more effective and more efficient for students and teachers to interact and engage with the subject matter.

B. Specific Objectives

Specific research objectives for our project:

- To design and develop an online video classroom web application that utilizes machine learning and artificial intelligence to monitor and manage student engagement and attendance, generate, and evaluate questions, and process external distractions.
- To develop a machine learning approach for monitoring and analyzing student concentration during class using video processing.
- To develop a neural network-based attendance checker that can accurately identify students and record their attendance automatically.
- To develop a natural language processing (NLP) system for generating and evaluating questions based on the lecture content and student performance.

The tool from unauthorized access the tool will be protected using password and keystroke technology. The five sections that make up this essay are as below. The relevant work is explained in section 2, our system is thoroughly explained in section 3, its performance is reviewed in section 4, and our work is summarized in section 5, which also discusses the scope of future work.

- To develop a neural network-based external voice processor that can identify and filter out external sounds to improve the overall learning experience for students and teachers.
- To evaluate the effectiveness of the proposed online video classroom web application and its various components in enhancing student engagement, attendance, and learning outcomes.
- To identify areas for further improvement and development of the online video classroom web application to enhance its functionality and effectiveness.

By achieving these research objectives, we aim to develop a comprehensive online video classroom web application that can revolutionize online learning and improve the overall learning experience for students and teachers alike.

2. Literature Survey

New technologies are encouraging more individuals to study online. Online education has several drawbacks, including poor student engagement and limited flexibility. Researchers have considered integrating machine learning and artificial intelligence (AI) in online education to answer inquiries and resolve problems. This literature review summarizes and analyzes current works on machine learning and artificial intelligence in online learning.

Predicting Student Achievement using Machine Learning and AI

Machine learning algorithms predict student academic achievement in online education. Lee et al [1]. (2018) created a machine learning system that predicts student performance using a variety of data sources. Demographics, academic performance, and course interactions are examples. The technology accurately predicted student performance, allowing instructors to target pupils who needed extra help.

Chatbots for Student Success
Online educational settings are increasingly using chatbots to instruct pupils. Lu et al (2020).'s chatbot system uses natural language processing to provide students personalized recommendations based on their interactions and inquiries. The chatbot also answers student inquiries [2]. The writers remarked on their experiences after receiving favorable comments from students who found the approach beneficial academically.

Using AI to track student participation.
Wang et al. (2019) created a real-time student engagement and instructor feedback system using AI. The system assesses student participation by analyzing facial expressions and other behavioral cues. Machine learning concludes this. This strategy may help instructors determine which pupils need more support and how to modify their educational tactics to those individuals.

Customized Learning Paths Using several machine learning methods.
Zhang et al. created a successful online learning platform that they shared (2020). This software uses machine learning to customize educational pathways for pupils. The system tailors teaching to students' past knowledge, chosen techniques, and performance. This strategy, which allows educators to customize student learning, boosts student engagement and academic success.

Sentiment Analysis to Improve Online Talk Forums
Machine learning may improve online discussion forums. Xie et al. (2021) used sentiment analysis to determine if students' forum posts were favorable or negative and to help teachers enhance student discussion experiences [4]. This strategy may help teachers determine which subjects are most engaging to pupils and adjust their teaching methods to best match their requirements.

Machine-learned feedback
Online education has been studied using machine learning-generated feedback. Mohan et al. (2018) created an automated feedback system that uses machine learning to assess student work and provide improvement suggestions [6]. Mohan built the system. This method allows teachers to tailor comments to each student, which may boost academic performance.

AI-Based Customized Instructional Suggestions
Machine learning allows personalized educational activity suggestions. Cai et al [7]. (2019) created a machine learning-based recommendation system that uses students' academic performance and learning preferences to produce personalized educational suggestions. This strategy may help students identify areas for growth and interact with personalized content.

Liu and colleagues suggested a multi-modal deep learning architecture in research. This methodology might assess online learners' emotions (2020). Speech, facial expressions, and physiological signs help the system estimate student emotions. This research found that tailoring student feedback to their emotional states might enhance online education. This feedback is based on student responses to questions about their experiences.

Li et al. created a machine learning-based system that can identify and diagnose student learning difficulties in real time (2020). The system uses data from students' interactions with learning materials and performance to identify pupils who may be struggling and give them personalized feedback and help.

The literature study discusses how machine learning and AI might improve online education [9]. This shows how machine learning can predict student results, assess student engagement, increase student learning using chatbots, and build personalized learning routes. These findings support our online video classroom web application. The application uses machine learning to increase student engagement, attendance tracking, question generation, and distraction management. These teaching strategies must be tested in various educational settings to guide future research.

A. Research Gap
During the literature analysis, it was obvious that an online video classroom web application using machine learning and artificial intelligence is needed. This would increase student online learning and instructor teaching. Some studies have examined the use of machine learning and artificial intelligence in online education, but few have focused on developing a holistic solution to some of the biggest difficulties.

One of the biggest gaps in online learning research is student participation and attendance tracking. Although machine learning has been used to monitor student activity, a more comprehensive approach that provides real-time feedback to instructors and students is needed. The suggested attendance checker for the online video classroom web application fills this need by providing an accurate and automatic attendance monitoring system that saves teachers time and ensures students attend their scheduled courses.

The current research also neglects online learning question generation and evaluation. Some studies have used machine learning to generate questions, but a system that analyzes student responses and provides feedback to students and instructors is needed. The online video classroom web application's suggested question generating, and evaluation system aims to close this gap by giving students a more personalized and engaging learning experience and helping instructors better evaluate students' understanding.

Finally, the research on online education interruption control has a gap. A more comprehensive approach that handles external distractions like notifications and messages is needed. Machine learning to filter out other sounds has been studied, and there is a need for it. The external speech processor in the online video classroom web application will provide a distraction-free learning environment for students and instructors.

The literature analysis concludes that an online video classroom needs a web application that uses machine learning and artificial intelligence. This tool would enhance students' online learning and instructors' teaching. The suggested method tackles student engagement and attendance monitoring, question production and assessment, and distraction control to solve research gaps.

3. Methodology

The first phase, which will be to gather data for the construction of the online video classroom web application, will be to start with the collection of data. To accomplish this task, appropriate instructional material will need to be gathered, and a database of lectures, assignments, and evaluations will need to be created. The information will be gleaned through websites that are open to the public or via cooperative efforts with various educational establishments.

The second stage, which will take place once the data have been gathered, will be the development of machine learning models for a variety of tasks, including video processing, natural language processing, and neural networks. Python and a variety of machine learning libraries, including Tensorflow, Keras, and OpenCV, will be used in the process of developing the models.

Application Development After the creation of the machine learning models, the next stage will be to create web applications for the business. For the front end of the application's development, the React framework will be used, while on the back end, Node.js will be utilized. The machine learning models that were generated in the previous stage will be included into the application in order to offer multiple capabilities. Some examples of these features include monitoring attendance, generating questions, and managing external distractions. The application that was built will be tested so that its efficacy can be evaluated in terms of boosting the overall online learning experience for students and improving the teaching process for teachers. Throughout the testing, there will be user research conducted with a group of students and educators who will be asked to utilize the program and offer feedback on their experiences with it. The input will be used to determine whether the program has any problems or areas that need development.

In general, the approach that will be used for this study will consist of a mix of data collecting, the building of machine learning models, the development, testing, and enhancement of applications, and so on. The end goal of the methodology is to develop a web application for an online video classroom that makes use of machine learning and artificial intelligence. The objective of this application is to improve the quality of the online learning experience for students and to make the teaching process easier for teachers.

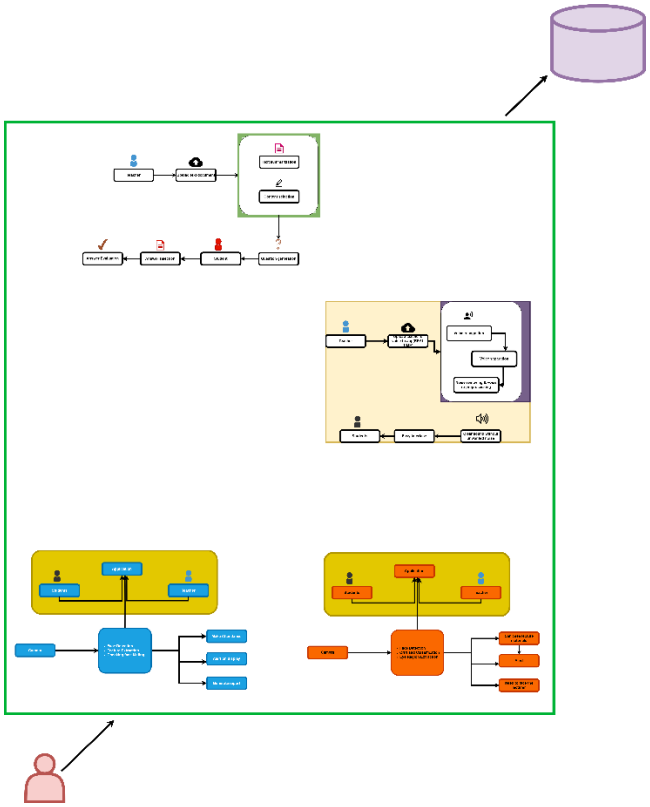

Fig. 1. Overall System Diagram

NLP gives computers the ability to comprehend natural language in the same way that humans do. Natural language processing employs artificial intelligence to take data from the real world, analyze it, and make sense of it in a format that a computer can comprehend. This may be done using spoken language as well as written language. In the same way that people have a variety of sensors, such as eyes to see and ears to hear, computers have programs to read and microphones to gather sounds. And in the same way that a human being has a brain to process the information that is taken in, a computer has software to do the same thing. During the processing, at some point, the information that was supplied is changed into a code that the computer can interpret.

Implementation:

Tracking attendance requires the use of face recognition methods, which can be found in OpenCV. These algorithms allow us to identify specific students and automatically record their attendance. The face recognition algorithm may be trained using a dataset of student images, and it can relate to pandas to store attendance records in a database. Both features are described further below.

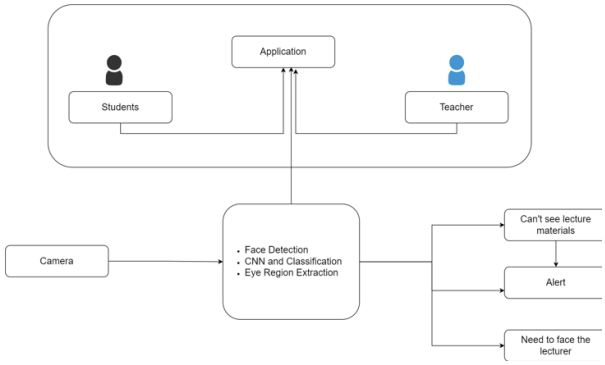

Fig. 2. Attendance checker

Generation of questions and evaluation of student responses We can generate questions based on the content of the lecture by utilizing natural language processing techniques with the assistance of Python libraries such as NLTK and spaCy. We can then evaluate the student responses utilizing a variety of metrics such as precision and recall. NumPy is available to us for use in carrying out the necessary mathematical operations for the assessment.

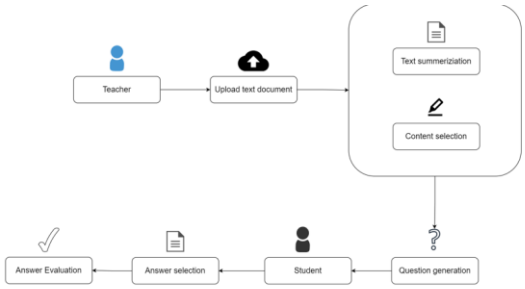

Fig. 3. Automatic question generator

Handling of External Distractions: With the help of OpenCV and NumPy, we can develop an external voice processor that is able to remove distracting background noises and other sounds from the environment. The speech processor is equipped with the ability to distinguish various noises that are typically linked with external distractions such as typing, shuffling papers, or conversations by using algorithms that are designed for machine learning. If the algorithm has successfully identified these noises, it will be able to use the signal processing facilities provided by NumPy to remove them from the audio stream.

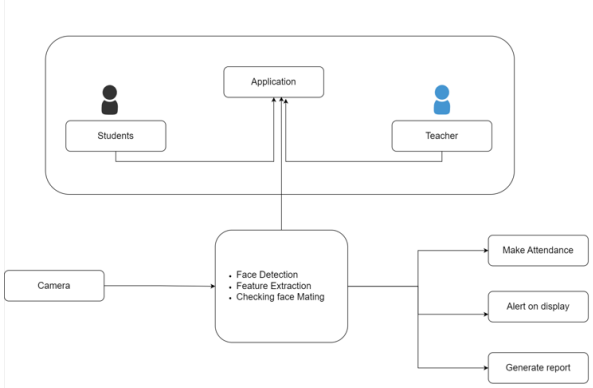

Fig. 4. Concentration checker

Monitoring of student involvement We can monitor student participation by using machine learning algorithms to analyze different indicators such as facial expressions and interaction with the lecture content. Python frameworks like Keras and TensorFlow may be used to develop and train machine learning models that can reliably predict the levels of student engagement. Pandas are a tool that we may use to store and analyze data on interaction across time.

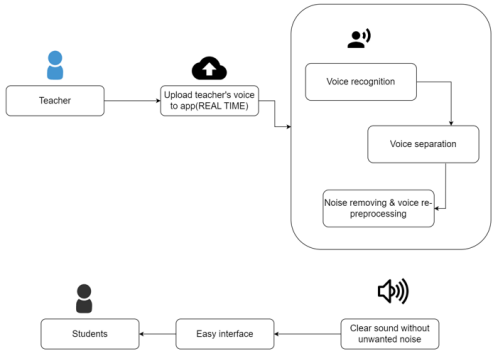

Fig. 5. Noise reduction

Overall, the implementation of the suggested features in our online video classroom web application will need a mix of multiple Python libraries such as pandas, OpenCV, NumPy, NLTK, spaCy, Keras, and TensorFlow. These libraries may be found in our online video classroom web application. These libraries contain the tools and methods that are essential to develop a strong and scalable online learning platform. Such a platform has the potential to improve the overall learning experience for students and to ease the teaching process for instructors.

4. Results

The proposed system aims to boost online student involvement and attendance tracking. Face recognition and video processing, machine learning technologies, allow the tool to track student attendance accurately and automatically. Rather than manually tracking attendance, this would aid educators. The application's external speech processor eliminates extraneous sounds, improving learning for students and teachers. The solution also requires a question generating and evaluation mechanism. This system will employ natural language processing and machine learning to create and evaluate questions based on lecture topic and student performance. This exercise lets students engage with the topic and measure their understanding. The system's capacity to analyze student responses allows instructors to adapt their education to student performance and understanding, improving learning outcomes.

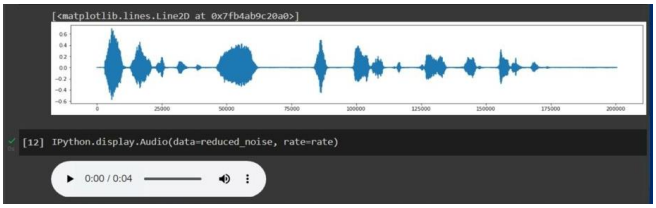

Fig. 6. Noise Remove

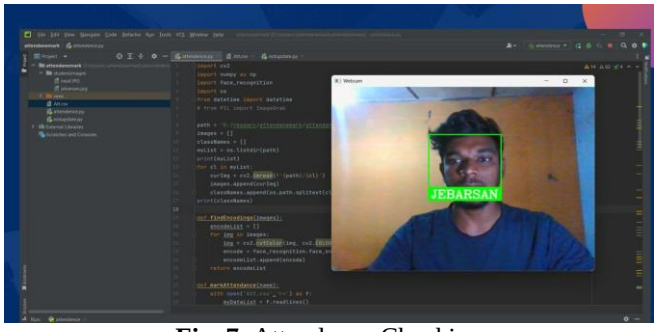

Fig. 7. Attendance Checking

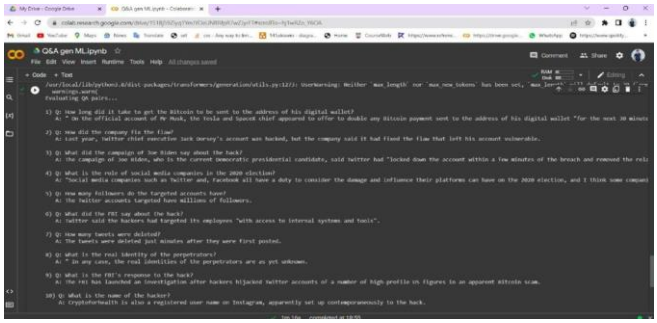

Fig. 8. Auto Questions Generate

In conclusion, using machine learning to manage outside interruptions during online meetings is advised. Reducing noise and other outside interruptions will improve education for students and teachers. The approach addresses some of the biggest online learning concerns. Distractions and student attendance are among these problems. The recommended methodology uses machine learning and artificial intelligence to improve student and teacher engagement with the subject matter. The program's capacity to generate and evaluate questions based on student performance and knowledge will allow instructors to tailor their training to their students' needs, improving academic success. The automatic attendance tracking, and external voice processing technologies will save instructors time and improve the learning experience for students and teachers.

5. Conclusion

Ultimately, the goal of our study was to create a web application for virtual classroom instruction that makes use of machine learning and AI to better serve both students and teachers in the realm of online education. The program assisted with issues such as monitoring student participation and attendance, creating, and assessing questions, and preventing students from being distracted by other sources.

Our research approach integrated many machine learning methods, including video processing, NLP, and neural networks, to provide students with a more tailored and engaging education. Using the application's built-in attendance tracker, teachers' time is saved since students are easily identified and their attendance is recorded automatically.

In conclusion, our study makes an important contribution to the area of e-learning by addressing a pressing issue plaguing the virtual classroom. The promise of machine learning and artificial intelligence to improve online education and the lives of teachers is on full display in the online video classroom web application we propose. We think our suggested method may be expanded upon to solve other issues in the area of online education and has important implications for its long-term viability.

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