iTeach: A User-Friendly Learning Management System

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1 Introduction

Electronic learning or e-learning [5] refers to gaining knowledge through leveraging the Internet and computer network across the globe. E-learning consists of various forms of learning methodologies that are electronically supported [29]. The process of automation has made the lives of people a lot easier. Therefore, incorporation in education has also contributed to enabling students to learn in different styles altogether by making the process more accessible and empowering educators by developing a set of automation tools to create content and teaching significant [4].

E-learning in the current COVID-19 pandemic situation has proven to be a boon. It provides a learning platform for the students of all the classes. The e-learning offers an instant solution to the COVID-19 outbreak, where the authorities have forced countrywide lockdowns, including educational institutions. In this gloomy scenario, e-learning systems prove to help content makers, educators, and students. Such online software allows people to study from home and get online learning materials and guidance from the teachers online, without their physical presence. The e-learning systems offer many features such as online doubt sessions, online tests and quizzes, assignment submission help in isolation and protection from the virus, and learning in an altogether holistic approach challenging to simulate in a physical schooling environment.

In the twentieth century, the change was from the industrial age to the age of knowledge and technical know-how. E-learning or electronic learning refers to the concept of utilizing the Internet, providing a platform for the students to learn via accessing content available on the Internet such as notes, videos etc., making

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learning more effective and performant. One of the pivotal purposes of e-learning is that every actor should know the technology's core know-how and understand how it can be utilized to reach a specific goal or objective [4].

In today's world, competition among the industries regarding their product efficiency, features, and performance plays an essential role in retaining the customers and tackling their fellow competitor products. The cut-throat competition requires skillful employees who can update themselves with the latest technology at a demanding pace. An efficient learning management system plays a pivotal role in helping learners learn the technologies beyond the time frames and physical boundaries. Also, the e-learning systems can be a great way to document and reference this knowledge for referring to and planning accordingly, which can help automate the learning tasks [4].

In our work, we have developed a platform with an inbuilt scribble pad for simulating the effect of blackboard teaching. This feature consists of a paint-like drawing area where an external device like an electronic pen is used to write on it, draw shapes, and even import pictures and explain them visually. The application also consists of a video editor that enables content creators to create and edit videos on the fly. Cloudinary is used as an online hosting cloud service for hosting their videos. Another application feature is a screen recorder for recording full or a custom part of the screen while teaching via webcam or through a scribble pad.

The content creators can publish playlists of their courses available for purchase at the student marketplace. Each video lecture comprises an online discussion forum where students could discuss what concepts they need clarity on and the teachers' assignment answers as an attachment in the video lectures. One of the platform's significant features is an online one-to-one doubt session with the teacher after the video lecture. Other learning management systems do not offer an online doubt session with the same instructor present in the video. The student can avail this facility by performing well in examinations, lecture revision tests, and assessments that earn them iTeach [17] passes. These iTeach passes would help the students encash live doubt session access and discounts on video content purchases.

Apart from that, the application has an extensible and easy-to-use user interface, making it super easy to access the application. The platform has a rich session and role-right management done at its backend, which normalizes the database.

The paper's outline is as follows: Section 2 briefs the related work by surveying the literature, and Sect. 3 details the formulation of the problem and the proposed model showing all the features of the model. The quantification of various parameters and their comparison is in Sect. 4, and feedback analysis is demonstrated in Sect. 5. Concluding remarks appear in Sect. 6.

2   Literature Review

Various learning management strategies [3, 32, 33] have been implemented, which have significantly contributed to a different approach to learning. But if the users

cannot utilize their full potential or face problems due to lack of accessibility, it defeats the whole purpose. Therefore, an LMS is successful if the students can make the most out of it and fulfill their purpose. However, recent studies [16, 26] have shown that e-learning implementation is a technical solution and have many different factors such as social factors and individuals. There is a process of factors facilitating conditions in addition to organizational, such as behavioral and cultural factors [4].

Absorb [27] is a learning management system that empowers organizations to teach their employees the required skills to stay in this modern and competitive world and change according to the technology demands. The LMS offers content libraries to provide an instant return on investment via thousands of pre-built online courses. An e-commerce is a marketplace for selling their courses and applying monetization and competent administration for the teachers and learners to automate various processes. The LMS consists of 12.9M users across 129 countries with 11,000 customers. One of the disadvantages of this application is its accessibility, a dead-simple user interface, and various modern web optimization approaches. Also, it does not provide automation in the context of content creation. Unacademy [37] is another learning management platform that offers features like an accessible UI, live lecture streaming, course subscriptions, etc. It uses React [11] as its frontend and Nginx and Node [36] as its backend service, along with some management and automation tools like CMake and Google tag manager [10]. But it also does not provide features like an inbuilt text editor and a scribble-pad and software for video creation and content editing on the fly.

Moodle [8] is one of the most famous learning management systems in the market, providing features like learner progress tracker, quick activity, and course setup with ease. It uses Nginx and PHP heavily under its platform layers [18]. Google Classroom [28] is a product backed by one of the learning tech brands called Google, a web platform for creating classrooms to enable the teachers to distribute, collect, and manage classwork. It utilizes Google suite and Kotlin for building the android version of the app, providing features like distribution of resources to platforms like YouTube videos, Google Drive links, and tools like GeoGebra Classic, and Activity learn Hiver under the hood [2]. Easyclass [22] is an LMS that provides a shared digitized environment to content creators and the students for uploading and delivering content to students in videos, digital notes, etc. The students can also submit quizzes and assignments along with tests on the platform. The platform provides a secure environment for teachers and students so that the content is safe from any external or unauthorized access.

Zoom classroom [6] is another such platform that provides the synchronous teaching mode. The platform allows a host and students to connect to a meeting room where teachers connect with them in real time and deliver their content. It also enables platform versatility since a person can connect from a Windows machine or a Mac or even connect via mobile devices. Backed by Office365, Microsoft Teams (MS-Teams) [21] is another learning platform. MS-Teams allows meetings through a virtual meeting room where approximately 10,000 people can connect at the same time. It performs text chats and shares documents and files all in one place and its

accessible user interface, making it a platform to teach many audiences. Hypersay [13] is an online platform that brings presentations with a new perspective. The students can interact with presentations in real time and support features like live subtitle changes. It is not suited to cater to a broad audience since it only allows 20 participants for each classroom session.

Nearpod [30] is another online learning management strategy that provides an interactive learning environment to the audience, where instructors and content creators can deliver interactive lessons. Some of the platform's features are polls, 3-D objects, open-ended questions, and field trips through virtual reality. BrainPOP [9] provides online access to resources to students in interactive class sessions, quizzes, and study materials when access to schools is not feasible. Therefore, it has been one of the favorite tools for such types of closures. Eduflow [25] is an online platform that allows content creators to create online content. It provides a simulation environment for students to submit quizzes and assignments, ask live doubts, track their performance, conduct teamwork activities, and many more. YouTube [7] has been one of the most popular sources to learn online. This platform allows content creators to create education-specific channels and upload a series of videos in the form of playlists. The students have free access to the content and can save a playlist to access it offline.

Many screen recording applications are present, which do not act as a separate learning management system but as tools to create and deliver content online. Applications like Camtasia, screen hunter [38], ice cream screen recorder [34], and windows screen recorder provide the facility to create audio, video, and screen recordings. They further provide an option to edit them, customize the videos through intro and ending screens, add animations, etc.

The main drawbacks of these systems are their inability to provide automation in terms of video creation. Their approaches are not very friendly and encourage educators to create videos with ease rather than restricting them in the barrier of content creation software, discouraging them from creating content and sticking to their straightforward old approaches. Therefore, iTeach [17] offers features like accessible UI, online video recorder, and editor for content creation on the fly, hosting through Cloudinary, and a rich video editor. The application usage is updated to the demands of the modern era. It uses the latest and in-demand technologies like React.js [11] as the frontend, Node [36] for API creation and exposing those endpoints, and Mlab [15] for saving and managing the contents of the users.

3 Proposed Model

One of the critical goals of LMS [23] is to provide learning facilities to students in the best possible manner. They allow the students to connect with the best teachers worldwide, clear their doubts online, and conduct regular exams to track their knowledge and learn better. It also empowers educators to create content without

getting stuck with the cumbersome buying process and video-making software, which block many enthusiastic instructors willing to create content.

Although the most prevalent e-learning models are available, they fail to provide a simple interface and access for students and teachers. For example, a person who wants to teach students at YouTube or Unacademy [37] should spend money on recording and editing software and hardware. A teacher cannot teach students to use images on the screen and make direct edits. He cannot conduct live interactive doubt sessions. One of the pivotal purposes of building an LMS is to make learning accessible to students, connecting them with the best teachers worldwide, clearing their doubts online, and conducting regular tests to track their knowledge and learn better.

Summarizing the following points indicate how the present systems pose to be blocker among the potentials users:

The present systems include a cumbersome and painful process for the instructors to make content for the students, for example, if a person wants to create educational content on platforms like Unacademy [37] YouTube, Scrimba, etc. He has to go through the painful process of buying and setting up video editing software, renderers, and editing videos that require some knowledge and sound technical know-how. The tedious process discourages many such teachers from making content.

In many platforms like Unacademy [37], Moodle [8], and Absorb [27], the feature of a live scribbler, live video editor on the fly, and live doubt sessions with the teachers is not present.

Our model has incorporated new features with pre-existing e-learning systems and pre-existing infrastructure, which makes learning easier. Our learning management systems have provided various following features shown in Fig. 1 to make learning easier and help automate the learning tasks.

1. *Webcam teaching* [24] – This utility allows teachers to teach from anywhere worldwide through video live video sharing. A webcam enables a teacher to simulate the behavior of live teaching. This feature utilizes the browser APIs to record videos using a webcam and host the video sessions on a cloud service (Fig. 2).
2. *Screen recorder* – It allows teachers to teach via broadcasting their screen to the students. It serves many applications like teaching through code, explaining through pictorial representations, etc. The instructor can start the screen recorder with just a click. He would be given a set of options to load the whole desktop or a custom screen. Saving the recording makes an API call where a storage management utility called Cloudinary stores and hosts it to its server (Fig. 3).
3. *Scribble pad* [20] – Another application feature includes an inbuilt scribble pad. The pad is provided to simulate a blackboard's behavior more interactively and handily, which would enable educators to teach on a virtual board with a hardware pen attached to their computing device. The device would talk to the OS and would trigger drawing strokes on the provided area. Usually, the existing
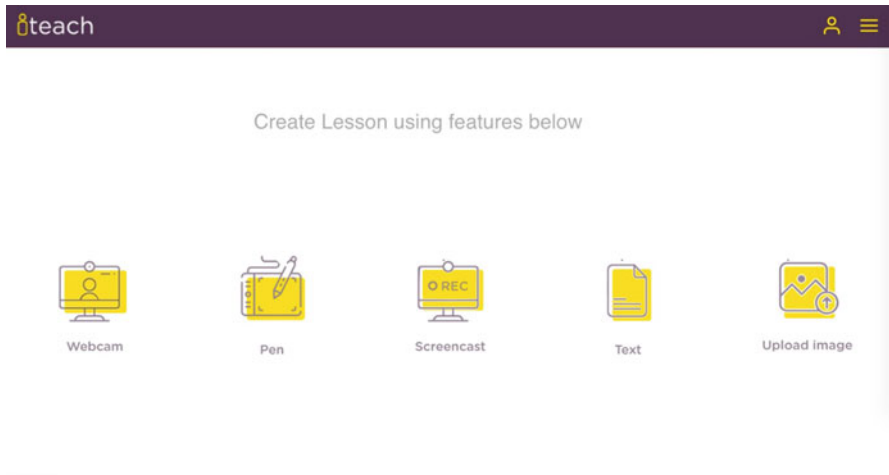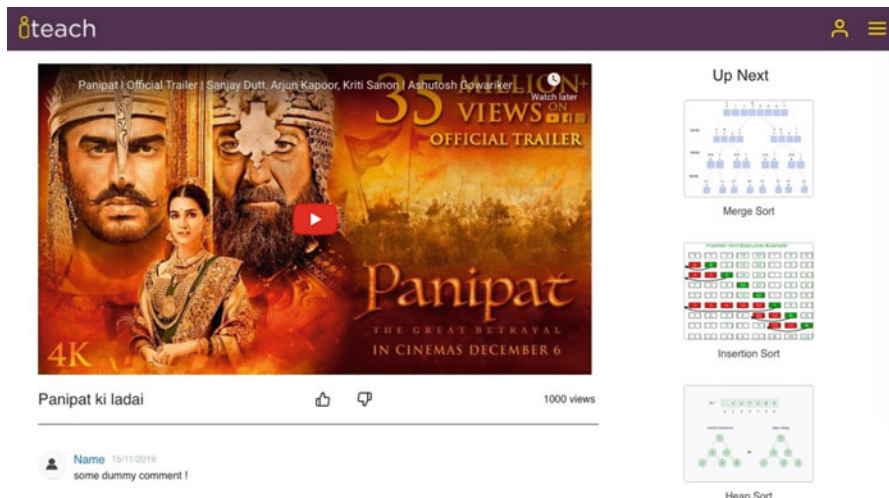
Fig. 1 Lecture creation

Fig. 2 Embedded video

mechanisms only handle and upload the instructors' videos but don't offer the tools. An online scribble pad would prove to be a great boon for the teachers, which would allow the following features.

(a) *Pen* – The feature offers the teachers to write using a hardware device to construct strokes on the screen to simulate a blackboard's behavior. Apart from a pen, other handy features like drawing squares, circles, or even panels are also provided, aiding in geometrical learning.
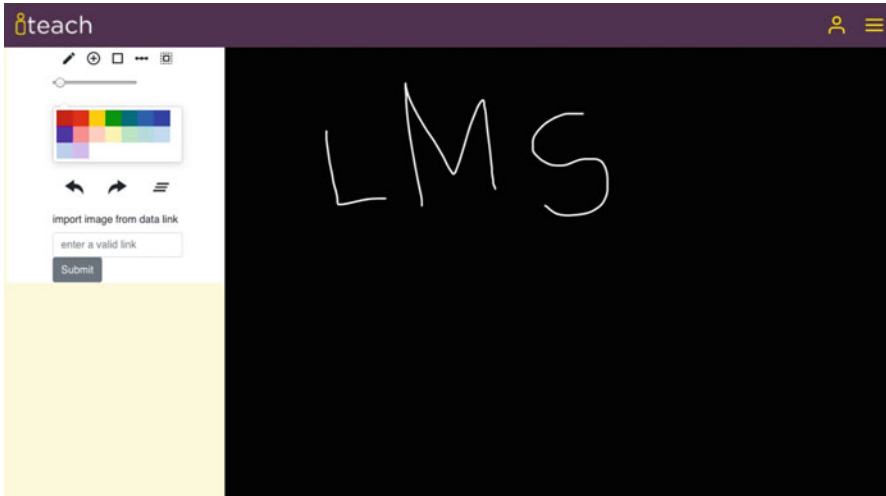
Fig. 3 Live screen

(b) *Image upload* – The image upload feature allows the user to upload an image and explain it using scribbles, which would enforce a better learning experience. The teachers would be free from old school methods of writing everything on the board and explaining afterwards or building the whole diagram first and then explaining. The image upload feature works by inserting an image link either from Google or any other jpeg link or importing from the computer and clicking the upload button. The corresponding image will be on the display screen through which the instructor can teach seamlessly.

(c) *Undo/redo* – The scribble pad also opens the options for undoing and redoing strokes and other actions like adding images or changing the stroke colors, which proves to be useful for effortless teaching and a smooth experience (Fig. 4).

(d) *Color palette* – The pad also has a rich set of color palettes for colorful teaching and highlighting the essential parts or indicating proper texts.

4. *Lecture live streaming* – This feature allows teaching to live stream their lectures, directly interact with the students, and improve their doubts (Fig. 3). The live sessions help enhance mutual communication between the two parties [1].

5. *Student marketplace* – This section of the application offers a complete marketplace where students can select a set of different courses or teachers worldwide.

6. *One-to-one doubt sessions* – This feature offers live one-to-one doubt sessions with the teachers who undertook the lectures. Teachers would be able to come live and interact with students launching their doubts and questions. This feature allows instructors to directly interact with the students after discussing the students' queries. This feature is missing from many prevalent systems and would improve accessibility and user experience significantly.
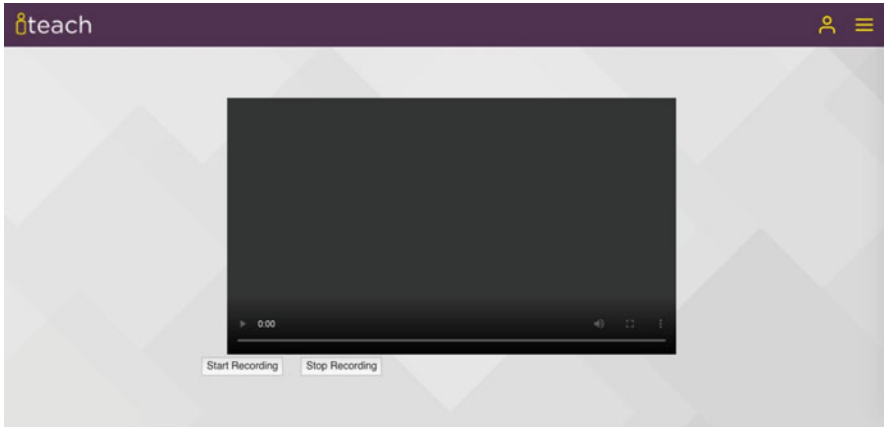
Fig. 4 Playback class

7. *A blazing fast video editor* – The teachers would be saved from the hassle of extensive manual video editing. The features include providing video presets to automatically enhance sound quality and an easy-to-use GUI for video editing on the fly.
8. *Teacher ratings* – According to student feedback, it offers an anonymous user feedback forum by which a teacher could understand the students' learning strategies and mold their teaching methodologies [19] (Fig. 5).

Following are some of the screenshots of the applications:

4 Comparison

There are various LMS available in the market based on different technological stacks and platforms. These available LMSs offer multiple features ranging from tracking learner progress and setting up the course, offers live classes, doubt sessions, assignment management, distribution of resources, planner for teachers, and other feature like in-line scribble pad, video editor, student discussion forum, etc. Table 1 indicates the comparison between various learning management platforms on the parameters like the technology used, features and platforms, etc. [28].

From the literature, we have identified various LMSs offering different feature sets. The following table demonstrates the feature comparison of the applications based on factors like SCORM, course content creation, LTI support, etc. (Table 2).
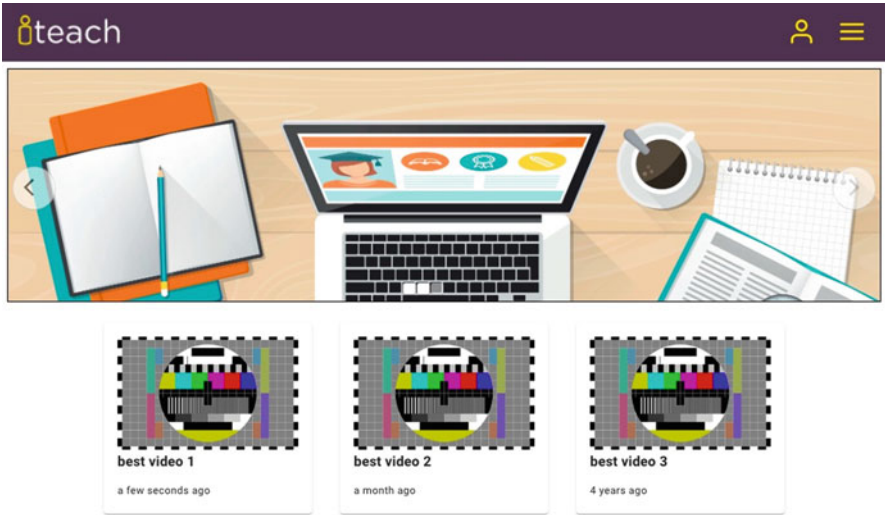
Fig. 5 User interface

5 Users Feedback Analysis

We have tested our application during the COVID-19 pandemic. This section describes the questionnaire distributed among 104 teachers and 600 students to test the application and provide their valuable feedback by answering the questionnaire. Two questionnaires (for teachers and students) were prepared according to their respective application usage sections.

Table 3 specifies a set of generic questions for both teachers and students.

In our feedback evaluation, we have used the Likert scale, which ranges from strongly disagree (1), disagree (2) and neutral (3) to agree (4) and strongly agree (5). For the feedback analysis, we have used the divergent stacked bar chart. These graphs consider the dual-axis charts that measure positive and negative sentiments and visually help us understand the feedback's polarity.

From Fig. 6, it is very evident that there is positive feedback on the feature set. The evaluation of the questionnaire set provides the following insight about the application: it offers a smooth user experience without lagging on its interface (Fig. 5). Further, it is working fine even with a low bandwidth network.

The student's feedback, shown in Table 4, on the application usage provides the effectiveness on various parameters. From Fig. 7, we can identify that the application proves to be effective, where nearly 40% of students agree that the

Table 1 Comparison of the various learning management platforms

LMS name	Technology used	Features	Platform and tools
Moodle [18]	PHP, Nginx	Learner progress tracker, quick activity and course setup	Mandrill, GSuite, RequireJS for DevOps
Unacademy [37]	JavaScript, React [11], Ruby, C#, Typescript	Live classes, doubt sessions, student subscriptions	CMake, Google Tag Manager [10]
Absorb LMS [27]	PHP, Amazon Web Services, JavaScript, TypeScript, React	E-commerce, content libraries, analytic reports, AICC/SCORM support	Google Analytics
Google Classroom [12]	Google Suite, Kotlin	Assignment management, distribution of resources	GeoGebra Classic, Activity learn, Hiver
Edmodo [31]	jQuery, NGinx, Handlebars, Node.js	Planner for teachers, Edmodo badges, publisher communities	Optimizely, Google Analytics, Google Tag Manager [10], Bugsnag, New Relic
iTeach [17]	React, JavaScript, Node.js, MongoDB, Mongoose	In-line scribble pad, video editor, student discussion forum	Mlab [15], Cloudinary

Table 2 Feature comparison

SCORM import	Yes	Yes	Yes	No	No
Bundled course content	No	No	Yes	Yes	Yes
Google app integration	Yes	Yes	Yes	Yes	No
Single sign-on	Yes	yes	Yes	Yes	Yes
E- commerce	Yes	Yes	No	No	No
Developer API available	Yes	Yes	Yes	Yes	No
LTI support	No	Yes	Yes	Yes	No
Native web hosting	No	No	Yes	Yes	Yes
Scribble pad	No	No	No	No	Yes
Screen recording	No	No	No	No	Yes
LMS Name	Absorb LMS [27]	Moodle LMS [18]	Infrastructure Canvas LMS [35]	Schoology LMS [14]	iTeach [17]

Table 3 General feedback ratings

| S. no.	Questions	1 (Strongly disagree)	2 (Disagree)	3 (Neutral)	4 (Agree)	5 (Strongly agree)
1.	The application has a smooth user experience	66(10%)	47(7%)	82(12%)	262(40%)	203(31%)
2.	The application is easy to operate and find on the Internet	22(3%)	19(3%)	100(15%)	200(30%)	319(48%)
3.	No personal data leaked from the application	20(3%)	47(8%)	419(70%)	95(16%)	20(3%)
4.	The application works even on slow connections	23(3%)	45(7%)	111(17%)	336(51%)	145(22%)
5.	The interface does not get stuck and responds effectively	50(8%)	62(9%)	61(9%)	76(12%)	411(62%)
6.	The application replies to bugs and patch update issues on time	73(11%)	79(12%)	97(15%)	281(43%)	130(20%)
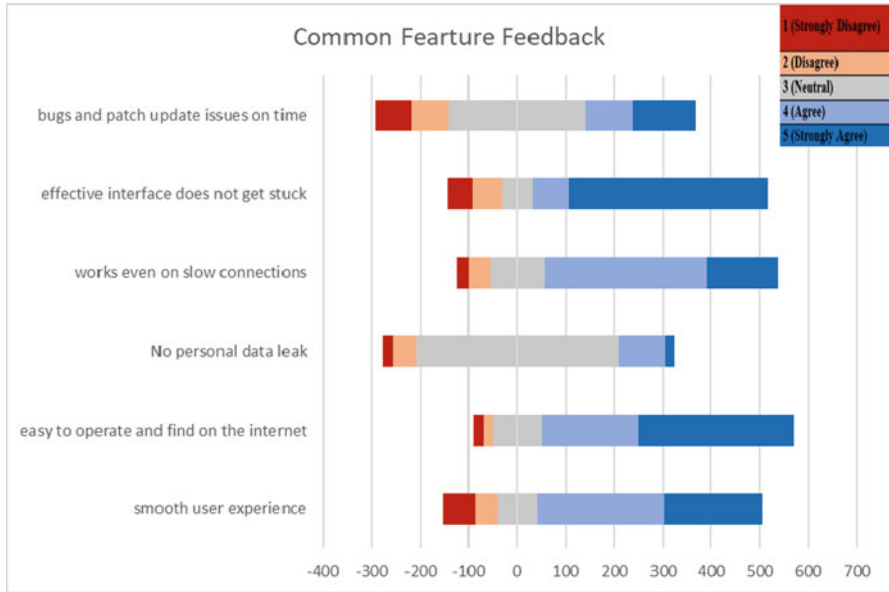
Fig. 6 General feedback stacked bar chart

application provides a good learning platform. Almost 70% of students settled upon the smooth test experience, with more than 90% appreciating the result evaluation and representation for pinpointing the scope of improvement and learning gap. The application offers better adaptability and understanding of the topic as the same teacher takes the doubt session. The students also approved that the application was not bulky, and they didn't observe any connectivity issues. The application doesn't take too much RAM for mobile/desktop devices, and the scratchpad feature is handy for visual learning. Over 80% of students are willing to recommend the application platform to other students.

From Fig. 8, the teacher's feedback (Table 5) on various usability parameters also suggests that the application serves a good purpose and easy to use interface. The platform is user-friendly in creating content as approved by over 80% of faculty. Also, nearly 70% found that the application doesn't take too much video rendering time, which is otherwise an issue with any LMS system. The platforms allow bulk entry to questions through excel sheets, which is a good help for the evaluators to save their time. The platform is time-saving to effectively evaluate tests and assignments, provide correct visualization data, and correctly depict students' weak points. More than 75% of teachers agree with the effectiveness of the application and are ready to recommend the application to other teachers.

Table 4 Students feedback ratings

| S. no.	Questions	Student feedback rating				
		1 (Strongly disagree)	2 (Disagree)	3 (Neutral)	4 (Agree)	5 (Strongly agree)
1	The application helps me learn efficiently	32(5%)	112(19%)	221(37%)	145(24%)	90(15%)
2	The course material is useful and covers all concepts	67(11%)	124(21%)	172(29%)	203(34%)	34(6%)
3	The application has a smooth experience for taking tests	15(3%)	46(8%)	58(10%)	339(57%)	142(24%)
4	The application is sound with no security vulnerabilities (like hacking the test timer, etc.)	31(5%)	70(12%)	363(61%)	96(16%)	40(7%)
5	The application shows the correct test result data after the test	15(3%)	12(2%)	20(3%)	27(5%)	526(88%)
6	The application shows the graphical representation of tests results taken over time	5(1%)	7(1%)	14(2%)	56(9%)	518(86%)
7	The doubt sessions involve the same teacher taking your classes, with no connectivity issues	77(13%)	93(16%)	70(12%)	200(33%)	160(27%)
8	The application doesn't take too much RAM for mobile/desktop devices	68(11%)	88(15%)	115(19%)	267(45%)	62(10%)
9	The scratchpad feature is handy for visual learning	32(5%)	24(4%)	69(12%)	163(27%)	312(52%)
10	You wish to recommend the platform to other students	2(0%)	43(7%)	36(6%)	300(50%)	219(37%)
11	The courses provide a sufficient number of assignments to cover the topic	70(12%)	83(14%)	196(33%)	155(26%)	96(16%)
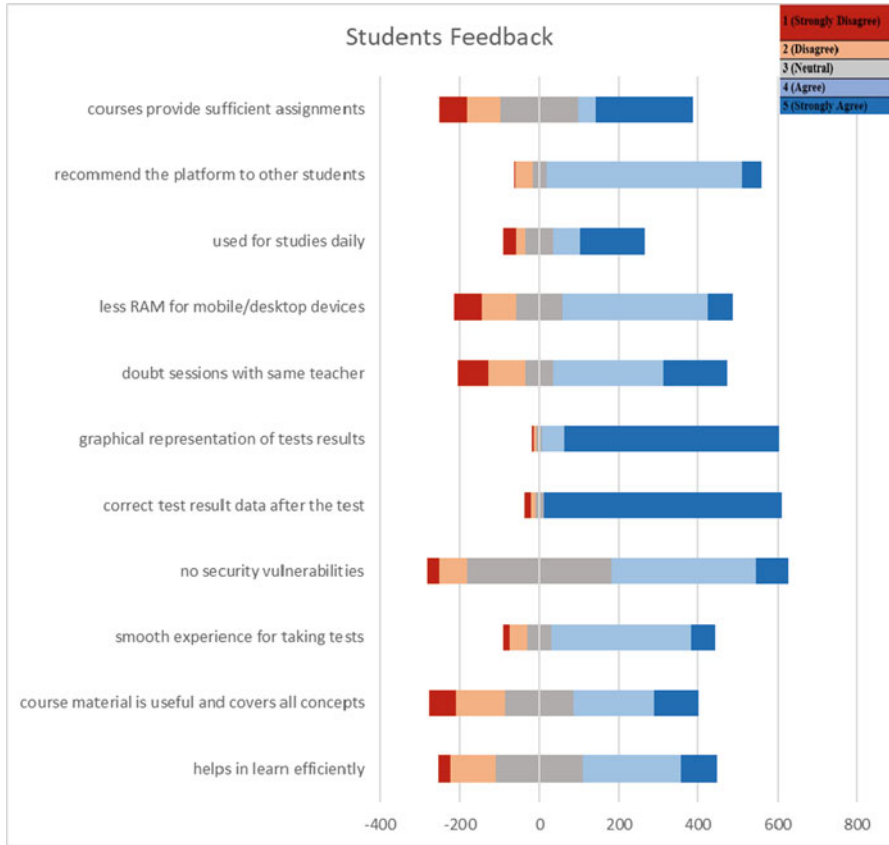
Fig. 7 Students feedback stacked bar chart

6   Conclusion and Future Scope

The learning management system has been successfully built with easy-to-use features. The model has implemented new features with pre-existing e-learning systems and pre-existing infrastructure, which makes learning easier. The model provides a better teaching–learning environment suited well to students and teachers. Students can appealingly visualize the content, and teachers can create the content with great ease. A few of the critical components that make the application smooth and easy to use are as follows:

- Fast video editor allows teachers to create and edit their videos without using external resources easily.
- There is a new feature called a Feedback system, in which the student can complete a short survey of what they understand, which requires more clarity.
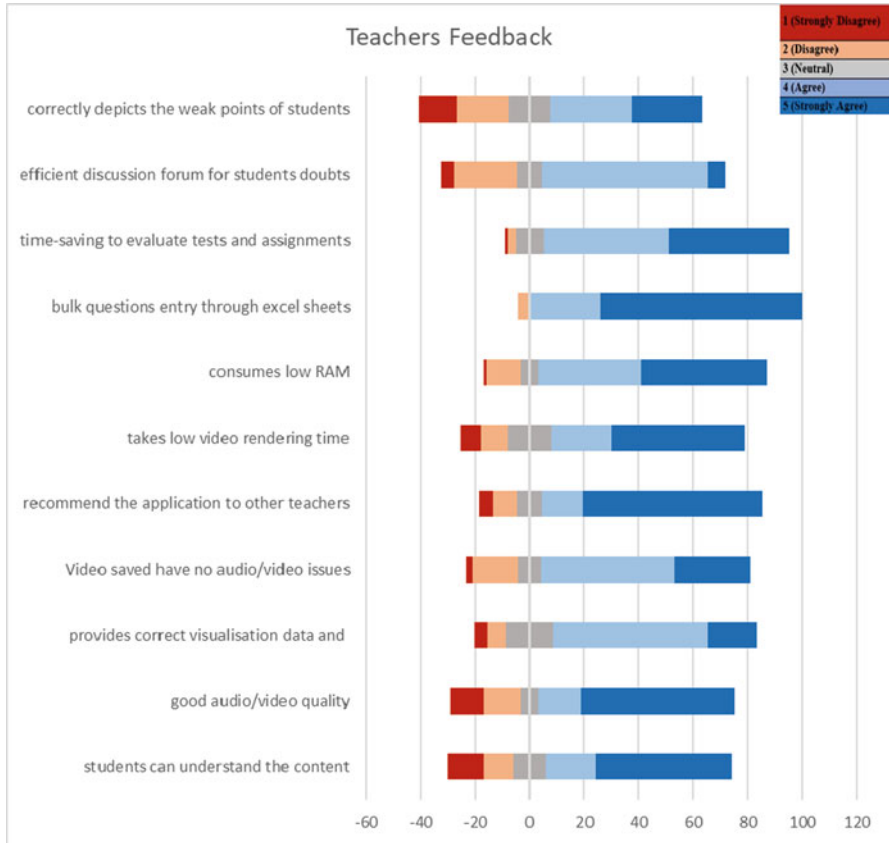
Fig. 8 Teachers' feedback stacked bar chart

It allows online quiz sessions with the teacher, not just those students, to write questions in forums that are never fun.

- It offers a built-in, powerful Scratchpad that mimics the board experience with the added feature of importing images and videos and interpreting concepts with visual learning.
- Teachers can periodically conduct tests that show what concepts the children have understood and what elements need repetition.
- The product enables the instructors to create content without requiring any prior knowledge of video editing, content rendering, etc. They now need to focus on what they are going to teach with the utmost focus.

In the application's future scope, we need to provide more advanced software for e-learning management systems. The teletyping features, where the teacher's words could be written when they are speaking, give the students notes for greater accessibility and a better provision for storing, saving videos, and removing noise.

Table 5 Teachers feedback ratings

S. no.	Question	Teacher feedback rating				
		1 (Strongly disagree)	2 (Disagree)	3 (Neutral)	4 (Agree)	5 (Strongly agree)
1	Students can understand the content delivered	13(13%)	11(11%)	12(12%)	18(17%)	50(48%)
2	Students happy with audio/video quality	12(12%)	14(13%)	6(6%)	16(15%)	56(54%)
3	The application provides correct visualization data and correctly depicts the weak points of students	5(5%)	7(7%)	17(16%)	57(55%)	18(17%)
4	Video saved have no audio/video issues	2(2%)	17(16%)	8(8%)	49(47%)	28(27%)
5	You would recommend the application to other teachers	5(5%)	9(9%)	9(9%)	15(14%)	66(63%)
6	The application doesn't take too much video rendering time	7(7%)	10(10%)	16(15%)	22(21%)	49(47%)
7	The platform is user-friendly in creating contents	1(1%)	13(13%)	6(6%)	38(37%)	46(44%)
8	The platforms allow bulk entry to questions through excel sheets	0(0%)	4(4%)	0(0%)	26(25%)	74(71%)
9	The platform is time-saving to evaluate tests and assignments	1(1%)	3(3%)	10(10%)	46(44%)	44(42%)
10	The discussion forum helps understand the doubts of the students	5(5%)	23(22%)	9(9%)	61(59%)	6(6%)
11	The application correctly depicts the weak points of students	14(13%)	19(18%)	15(14%)	30(29%)	26(25%)

The above items are improvements that can be made to increase the applicability and utilization of this model. Hence, effective management of student and assignment records and a strategy to utilize the cloud space to get better space at a low cost. Also, the players are as versatile as they can see now. It is possible to introduce a method to manage e-learning management systems with student, administrator, and teacher improvements like quizzes and assignments. A significant role-right management system is necessary to provide a normalized implementation so that the real data can be handled without any security leaks and the users' reliability can be retained.

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