Online Teaching Learning (OTL) Platforms

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***Abstract* — Online teaching learning platform has become one of the unshakable pillars of education, contributing its fair share to the domain of cyber and education space. The paper talks about the importance of the OTL system including some of the logical components of Online learning system followed by some of the design issues that come along with designing a system for online education and services and how it can be enhanced. Similarly, Online teaching learning system sure does comes with many challenges since it is a distant learning, the paper clearly mentions that challenges that arise in eLearning and Online teaching learning system i.e. Accessibility, Heterogeneity and much more. And how these challenges can be tackled. The paper also categorises the different types of online learning systems based on their nature and mode of services as well as their open source nature and close source nature. Taking the top 3 most popular OTLs to briefly explain their logical component and how they interact with each other. The paper continues to address the comparative chats and analysis of 6 different online teaching learning platforms with 16 different parameters for comparison.**

***Keywords* — OTL , eLearning, Educators, Design system**

I. INTRODUCTION

The term “Learning” is an intellectual process of obtaining new skills and knowledge which can be achieved through sheer experience, or study and education. Similarly, following the above definition, “Education” is the discipline and process of facilitating the process of obtaining new knowledge, also in short term called “Learning”. The way of education has many types including research, discussion, training or even storytelling which usually takes place under the care and guidance of educators. Broadly speaking ‘learning’ in the present context, occurs through different means or systems commonly categorized as informal, formal and non-formal learning systems. Whether the means or systems, the quality and efficiency of learning are of central importance.[1]

In the teaching learning system, students should interact with the world constructed by the educators with their conceptual and practical knowledge. Understanding of the subject matter is passed down to the students via interaction in the classroom. These Teaching learning Systems are embedded in different learning environments and social spaces which impact the educational process [1]. The educator defines that objective, course, evaluation methods and plans on developing the learning curve of the student.

Similarly, the Traditional teaching learning system consists of the educator teaching in front of the classroom and students listening passively or taking lecture notes in the process: the syllabus, the teaching materials and the student assessments are determined by the tutor and transmitted to students in various lectures.

Online learning is the newest and most popular form of distance education today. Within the past decade it has had a major impact on postsecondary education and the trend is only increasing. The education whose teaching and learning takes place on the internet is referred to as online learning [2]. Online learning is frequently interchanged as e-learning or distance learning. Computers and the internet are major components of the online learning system. Online course instructors can have their own teaching contents in multiple formats like presentations and audiovisual in one centralized data center. The main feature of the online learning system is personalized learning path and report analytics of the individual who audits the online course. The advancement in the computer field has led to advancement in the online teaching learning (OTL) system. OTL words seamlessly across multiple devices like laptop, mobile and tablets and it even offers online assessments and quizzes. Instructors can create virtual classrooms and enroll their students using OTL software. Moodle, Google Classroom, Zoom, Discord and Microsoft edx are some examples of leading OTL systems in the global market.

A. Vital Components of Online Teaching Learning

There are several papers and content that have different reasons on why certain components are necessary in Online Teaching Learning Platform. However, Looking over these five major e-Learning Components at the core helps to underline the most fundamental components that covers most of the other sub or extra components of OTL Platform.

There are 5 vital components that will be discussed in this paper that will enable you to create and plan any online course that meets your requirements.

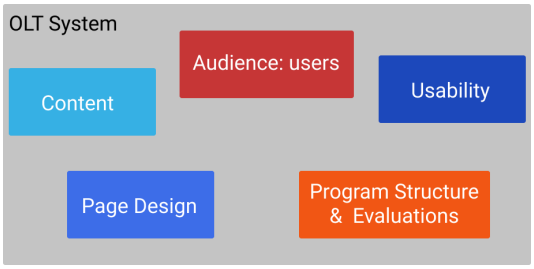

Fig.1 Components Of OTL

The block diagram above shows how these 5 components of the Online Learning Teaching System are related to each other. Each component is vital for the effective running of any OTL Platform. These components can include most of the system's requirement for an Online Learning Teaching Platform to function properly in order.

1) Page Design: The Online Learning Teaching System should support every device and resolution that provides effective and accessible content all over the internet. Which is why it is in the category of one of the vital components of an OTL System. The Page design should be optimal and should look engaging for the users. Additionally, some of the important point that needs to be address when we are talking about design are:

- The navigation between multiple pages should be simple and easy to follow. Using side nav or top nav makes the course engagement easier for students.
- Instructors should avoid using text only or graphics only format. Domination of text only or graphics only distracts the students and they might lose interest in the course. Balance between images and text should be referred to while designing the page.
- Consistent font and layout are pleasing to eyes. Keeping headers and content fonts layout and pop ups of the overall course consistent ensures students are more engaged throughout the learning process.

2) Program Structure and Evaluation: When talking about program structure and evaluation, it gives us the core framework of how the actual education and learning will be based on. It gives an idea of how the course/program will be managed and structured including evaluation of the participants of the program. This is also considered one of the very utmost components of OTL platform and some of the points that need to be addressed before implementing the component are.

- While creating program structure, grouping content into different modules to optimize and modularize topics can help both mentors and learners to access the program easily.
- Media can be a component of active learning strategies such as group discussions or case studies.[3]
- Evaluation system should be based on the program's requirements and participant's capacity to be creative.

3) Content Management: Content management refers to the ability to utilize the content of the system that can be easily accessible, usable & understandable to the participants.There has been several studies that shows that the content of the system can really affect the user's interest to enroll in the course/ program. Some of the points that need to be considered while implementing content management are.

- It is crucial to understand that the content can be stolen and hacked, so maintaining a security & firewall to protect the resource should be the top priority.
- Incorporation of graphics using pictures and animation. Similarly, Adding simulations and animations in the course accelerates the learning process.
- Gamification of contents in management can be a great way to engage users and increase productivity.

4) Audiences: In Simple terms, the audience are those users who use the online teaching learning system. There are three main types of audience that can use the system.

- Students are the audience who get enrolled in courses by their instructors. In some cases, the student can enroll in the course themselves.
- Instructors are the audience that are responsible for teaching and educating students when they get enrolled in the course/program.
- Admin users are those audiences that manage the system and govers the process of the OTL platform.

B. Importance of Online Teaching Learning Platform

In the era of rapid technological advancement, Education also had a significant growth in terms of learning and mentoring. In 2020, More than even people realized the importance of eLearning with the world dominated by COVID19 and had to be quarantined and the era of Online Learning Teaching. With this Online Learning has become an invaluable platform and resource to students and mentors to harness knowledge at their own pace. Some of the importance of OTL Platform are:

1) Personalizing Learning Environment: When it comes to learning and gaining skills, the sense of comfortness it very crucial. eLearning and Online teaching can help students to learn better and feel more comfortable learning in an environment of their choosing.Being able to take a laptop or tablet into your ideal working environment helps children maximise their potential and gain the most from their education. Everyone works differently and some students may prefer the classroom, but for those that don't, this flexibility can have a positive impact on how they absorb information and help them improve their grades. [4]

2) Flexible Environment with Individual Pace: With Online Teaching Learning System, mentors and students can set their own learning pace & a schedule that fits everyone's agenda which in return allows for better balance of work and study of both students and teachers.

3) Scalable: Virtual classrooms are not limited to a few numbers of students like in a real classroom. The course content can be updated as per need and can be accessed by millions by students by scaling up the server.

4) Alternative solution to world pandemic: Not only as in due to COVID19 but a solution to keep the progress of empowerment and education on OTL plays a great importance in keeping the education and learning system alive and running.

C. Types of Online Learning System

There are different categories of online learning systems that have been used by many organizations and individuals. Some of the types of online learning system are discussed below:

1) Synchronous Online Learning System: Synchronous Online learning System enables the audience to engage participants on certain tasks and activities at the same time, from any place in the world. Real-time synchronous online learning often involves online chats and videoconferencing, as these tools allow training participants and instructors to ask and answer questions instantly while being able to communicate with the other participants [5] .Nowadays, synchronous online learning is considered to be highly advantageous as it eliminates many of the common disadvantages of e-learning, such as social isolation and poor teacher-to-student and student-to-student relationships

2) Asynchronous Online Learning System: In case of Asynchronous Online Learning System that enables the audience to participate in activities without real-time communication taking place in between. Asynchronous e-learning methods are often considered to be more student-centered than their synchronous counterparts, as they give students more flexibility. [6]

3) Adaptive Online Learning System: This is one of the new and innovative learning systems that can adapt and redesign learning materials for each student by taking certain variables like their goals, level of knowledge, past performances that enhances personalization.

4) Blended Online Learning System: In a blended learning method face to face instruction between teacher and student is combined together by internet. In simpler words it is a combination of a traditional classroom with the addition of computers to the classroom. These types of systems are also known as hybrid Online Learning Systems.

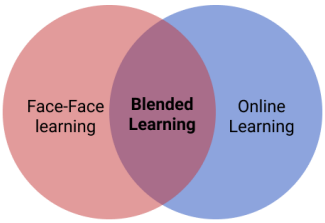

Fig.2 Blended Online Learning

5) Active learning System: In an Active Learning System participants are more immersed into the process of learning by doing creative taks, actions, role playing, group studies, debates & inventions.This method works on the idea that students should work with the activity which has been assigned to them.

6) Engaged learning System: In this system, students are engaged to use classroom skills and knowledge into a

practical environment and scenario. where students are engaged in course materials from the starting day and actively involved in research, projects, discussions, and making discoveries. Engaged Learning provides an arena where students work in a professional capacity with community members, their peers and the instructor of their course. [7]

7) Personalized learning System: Like the term says, Personalized learning system focuses on creating a system that customizes and designs respective to each student's preferences including their needs and abilities. One thing that needs to be taken care of is the fact that while implementing the personalized learning system, the duration and the method of each student may vary. It is a non linear learning system as well. However the core objective of the course doesn't vary with the student. Additionally, Personalized learning system improves the student knowledge significantly and students with weakness are able to learn quickly as teachers are able to focus on them more effectively.

II. DESIGN ISSUE

There is no software system that has no flaws which runs smoothly on every case and scenario. The system flaws or issues are the reason that allows it to grow and progress with experiences.

When dealing on an online teaching learning platform, each system has its own agenda and an objective regarding the audience, designs and policies. One can say that each system has more differences than similarities due with its target. However, it is true that some of the design issues that an online teaching learning platform face have a common category and parameter. These parameters underline the general issue.

A. Heterogeneity

When a certain system has different variables that are related to each other to form a complex interrelated network, the system often can be referred to as an heterogeneous system. Heterogeneity is not an issue in itself, however when the system uses multiple environment variables, the chances of it causing failure is high.

In the context of an online teaching learning platform there can be a lot of variables, such as its ability to work in cross platform and different resolutions of devices, the number of programming languages it has used to create a certain feature/function, the number of servers/ third party applications it uses. While working with cross platform a the system has a high chance of failure rate. The higher the heterogeneity the more sophisticated the system can be. One can find the level of heterogeneity in the system by understanding the different services and platforms the system is used on.

The question that arises is, "How much is too much?". What level of heterogeneity is necessary for it to not be an issue. It is alway recommended to understand the project standards and guidelines to keep a constraint which keeps the level of heterogeneity in check. Some of the thing that can be used are:

- What are the third party software the system uses
- How many different cross platform services it has
- How many language it uses
- What are the features of the system

B. Scalability

The number of users who use the system may fluctuate over time.If the system becomes popular overnight and a large number of people desire to join the program, the server will become overburdened.Scalability should be considered when developing the system.In such instances, even if the number of requests grows, the system should be similarly responsive to all users.

The storage and database requirements should be increased, and the user should have a consistent experience regardless of how many requests the server receives at any given time.The following are some examples of scalability:

- How long will it take to respond if the volume of traffic increases?
- How much bandwidth should be set aside to handle request traffic?

C. Reliability

At the server end of the system, any system is vulnerable to failure or is constantly threatened by hostile attempts by unauthorized users.When malicious efforts are made on the system, the users should not be subjected to any problems or threats.At all costs, user private data should be kept private or not given to an unauthorized third party.In the event of a natural disaster or other unforeseeable event, the service provider should maintain data redundant on many servers to assure on-demand content.If necessary, proper sandboxing should be performed.The system should be up and running at all times and available on demand.The following are some of the points of trustworthiness:

- Is the user's personal information sandboxed by another component?

- Is data duplicated across several servers in various geographic areas?
- What kind of permissions should be granted to various users?
- When transferring data over the internet, what protocol should be used?

D. Quality of Service

The service provided by the online learning platform plays an important role in creating the experience for both teachers and students to be able to adapt to the changing environment and needs. The service should be able to change according to the needs of the users and the constant quality check should be maintained.

Since both teaching and learning is done virtually, the system should be giving a good experience so the users don't lose interest while learning through it. If the quality is compromised then expecting high end results will just remain as expectations. The system designers and developers should highly focus on making the learning experience better.

Some questions that can be asked to ensure the quality of service are:

- Are users satisfied with the features provided?
- Should there be any extra features that need to be implemented?
- Are the end users happy with the experience they are getting?
- Is there any task that users are frustrated about and should be automated?

E. Consistency

In any brand design or system design, consistency plays a vital role in making the system look professional as well as increasing development speed and productivity.

Consistency not only includes in UI design but also in the functional and code structure of the system as well. For example, the logical code structure or template could be used to keep the code base consistent whereas in terms of UI the color palette and proper design system can be implemented to keep the UI pixel perfect. The feature and usability of the system should also be considered while developing for how the user interacts with the system and how consistent the interaction response is.

Inconsistency in a system can create a series of connected issues that are very complex to debug and interpret. In an online teaching learning system, which primary objective is to provide education needs to be consistent in it's interface and interaction design followed by it's code structure that keep the usability and scalability in good level.

F. Performance

Performance is the terminology used to define how well the system fulfils its certain goal or function under some predefined condition. Performance issue is one the the most common issues in today's software development due high demand of functionality and features.

In terms of online teaching learning platforms, the performance issue can arise due to the high number of traffic from different regions, too many services running parallely and different UI and it's inconsistent responses. Dealing with performance issues can be costly however using the best practices and optimizing code as well as how UI is designed can be the best logical way to eliminate the issue before it causes any catastrophic event.

However, find the right requirements and doing a performance analysis on the system can address the issue that come with performance instability:

- The response time of the system and functionalities.
- The number of visitors and users in the system
- The capacity of the server
- The number of UI components that are interconnected with each other.
- Compatibility of system in cross platform environment.

G. Security

Last but not the least is "Security" which is a very sensitive topic in terms of data protection of one individual that also touches the realm of legalities. It is one of the biggest decisions in making an OTL Platform which keeps the data and information secure.

Using certified services and framework to create OTL systems as well as creating a firewall for databases to secure the data and information can be implemented to enable high security. Similarly there are various hashing models and cryptography that can be used to encrypt the data for security. Some of the point that can be addressed are:

- The model on which the user data is encrypted and passed over the network.
- The networking protocols the system uses.
- How the APIs are authenticated while sending requests from the client side.
- How the client security is implemented

III. CHALLENGES

With every growing online teaching learning platform, now more than ever. Infact, since last year 2020, due to the world plunge into the age of pandemic. The online teaching learning system/platform has seen a sudden rise in demand where most of the people are stuck at home in their quarantine stage. These people are mentors, professors who used to teach and students from different universities and schools.

The rise of OTL platforms is no surprise because of its many advantages of eLearning and ability to continue the course of education even in the midst of a pandemic. However, keep the merits aside. People often find implementing the OTL challenging for which reasons vary from person to person. However , There are certain challenging moments that are in common with most of their answers, which are discussed in detail.

A. Accessibility

The tem "Accessible" means to be able to reach out to everyone who needs it. Now when these systems are accessible to a remote part of the audience it exhibits a trait/characteristic we often can call "Accessibility".

When dealing with online teaching learning platforms there are many content, resources and features that are included in the platform, some of them are even premium packages which require money to get access. Even though the course content is available on demand. But this is not always the case. There are technological and cost barriers in front of accessibility. In the context of Nepal, Even though it has started implementing OTL, the question of how accessible it is to all the people is still questionable. Most of the people can't afford the courses that are of high value.

Accessibility of the OTL also depends on technological barriers like the devices and internet connectivity which not all can get. There are many students as well as teachers who face challenges due to this lack of accessibility.

B. Computer Knowledge Barrier

In an ideal case, when the system is accessible to most of the audience. One challenge that is out of it's control is "lack of computer education" which is concerning. There are many students and teachers who are not knowledgeable to operate technologies and lack the proper training to work in the online teaching learning platform itself. And when there is an issue regarding it, they face difficulty in understanding and solving it.

In the context of Nepali audiences, this challenge is one of the most common problems. But the poor infrastructure like internet and computer access comes as technological barrier. These barriers are greater challenge to the online teaching and learning.

Addressing the challenge can be done by providing access to system support that can help audiences to address their issue through live chat or calls.

C. Course Content & Development

Before the age of online teaching learning, the course contents were designed on the traditional approach and with the increase of online teaching learning practices, the course responsible needs to redesign the course which takes a significant amount of time and energy.

Most of the traditional content and method of education may not be as efficient as how it used to be in physical learning teaching platforms. It is necessary to understand the course content and develop it as per the system. Making sure to modify the task and activities as well as evaluation for online teaching learning would significantly improve this issue.

D. Commitment and Motivation

Even when most of the students may not be present in the physical class during university or school time, finding the real commitment and motivation to stay in the course can be quite challenging for most of the students and for teachers as well. Generally online courses are taken individually and lack of real and physical people around makes the learning process somewhat lousy and it makes it difficult to maintain the motivation to the very end of the course.

To complete the course content, keeping students motivated is the key and can be very challenging. Rather, focusing one creating a daily task of non monotonous activities and addring RnR (Reward & Recognition) system can be beneficial in keeping the participants motivated.

E. Communication

Even the issue may sound somewhat simple, if taken lightly can create a series of events that can collapse the whole system in itself. Communication is one of the most crucial factors that needs to be taken care of. The more detailed the course content is the easier for the students and teachers to communicate.

Lack of communication can create challenges for both students and teachers. Sometimes teachers might not give enough time for students to prepare for the exam/ course or teacher for preparation of course content. And there might be

some students that might avoid teachers during classes, which can create communication gaps.

Certain level of flexibility should be given to both teachers and students if they are not making up for their deadlines. There can be a stand up to understand the problems of both students and teachers for a common understanding of the situation.

F. Course adjustment for underprivileged students

Though the minority, underprivileged students who are physically impaired, with hard to hear or deaf students can have many challenges not only for students but also for the system to be able to educate such a population. Provided that online learning is already a kind of challenge for the students, those deaf or hard of hearing are facing a double problem multiplying the chances of falling behind. [8]

IV. HIERARCHICAL DIAGRAM OF OTL SYSTEM

Online learning system nowaday has grown into a necessity for most of the learners and mentors that provide both audiences with greater flexibility to address different categories and types of learning systems and methodology in different OTL platforms.

Similarly, there are a lot of platforms/systems that fall in more than one category of online teaching learning system. Even if you search on the internet, the results vary from article to article, defined based on their ideals and perspectives. The following Hierarchical Block Diagram is a logical division of different categories of online learning system based on the research done from different articles and from the knowledge gathered from the blogs and definitions.

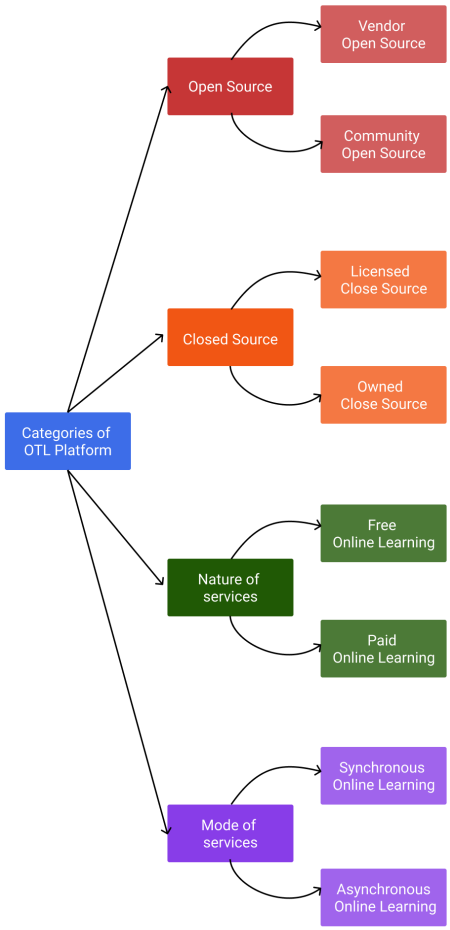

Fig.3 Hierarchical diagram of OTL Types

The following diagram is the proposed hierarchical block diagram that classifies the online teaching learning system into different categories.

The idea behind the division was to divide the OTL system into depth of level 2 that classifies the system based on open source, close source, mode of service & nature of service.

A. Open Source

Open source are those systems that are made freely available for any possible modification and redistribution including permission to use the source code to customize the system and redistribute the system with new features and versions.

Online learning teaching system domain also has an open source category where the system is available in community to modify and implement in their own university or school. Some examples of open source learning systems

are: Moodle, Chamilo Edu-Sharing etc. These systems have made their source code available.

Similarly, The open source is also sub divided into two categories based on the range of it's availability.

1) Vendor Open Source: A vendor open source is the one where certain licensed individuals can only develop, contribute and distribute.

2) Community Open Source: In this category, the system has a group of contributors from different places around the world who share an interest in fulfilling common goals and contribute to the system.

B. Closed Source

Closed source refers to those categories of system/platform whose source code or any modification services are not freely available. In simple terms, these kinds of systems are closed and protected from unauthorized users. Based on that, those organizations or individuals who are the sole proprietor to the system are able to access the source code. The closed source can more be subdivided into 2 sub categories. Some examples are like, Google classroom, coursera, zoom etc.

1) Licensed Closed Source: This is the type of system that is managed and administered by licensed users or organizations rather than the original owner of the product. It can be simply defined as a proprietary system distributed under a licensing agreement to authorized users with private modification, copying, and republishing restrictions.

2) Owned Closed Source: Unlike licensed closed source type, owned it is managed and administered by the very original owner of the product.

C. Nature of Service

Every online teaching learning system has certain kinds of features or traits that distinguish them from others. These qualities sets that define their nature fall in the categories.

However, There is a very thin line between the nature of service that an online learning system provides and the mode of service that it has. When talking about nature, you can mainly distinguish them based on how premium the service is. For example, there are a lot of online teaching learning systems that only have paid content and provide exceptional nature of service to the users and teacher in the same order. However, there are some online teaching learning systems that provide free content which is relatively less than premium and common in most of the systems.

Based on that perspective, the nature of service was sub-divided into 2 level 2 categories. 1. Free online learning & 2. Paid online learning. These two sub categories perfectly fit the place to justify the nature of service given by any OTL system.

1) Free Online Learning: As the headline says, any system that offers free service to their users and available to most of the users falls in the category of free online learning system. This system primarily focuses on creating free content for a cause and provides it as a free online course for the learners. The services of these systems are less managed with many things happening at once.

2) Paid Online Learning: Paid / Premium online teaching learning systems are those platforms where most of the content and courses are pay-to-get. The content is developed by professionals specializing on certain objectives to reach the standards of paid content. The services of these platforms are well managed and very precise that follows their guidelines.

D. Mode of Service

The mode of services defined the way of how the nature of service is provided. There are a lot of services that OTL can provide but the manner of executing those services may also vary from platform to platform. For example , a paid online teaching learning system can provide both asynchronous and synchronous modes of service and so can free OTL system service.

Based on that foundation, the mode or rather the way of providing the service is further divided into 2 sub level categories called 1. Asynchronous mode of learning & 2. Synchronous mode of learning.

1) Asynchronous mode: Asynchronous mode of service allows you to get the content service with your own desired time and schedule. This type of system can be accessed any time to read the content, completing the assignment or other activities within the set timespan of the course content.One of the biggest benefits of this mode is how flexible it is.

2) Synchronous mode: Synchronous mode refers to any kind of OTL system in which students & mentors are in the same place and time that allows the learning to take place. Examples of these services are educational seminars &

conferences. One of the biggest benefits of this mode is that students can ask questions and feel a sense of community in real time.

V. POPULAR ONLINE LEARNING SYSTEMS

There are many online platforms that serve the purpose of online teaching and learning. With institutions adapting to virtual environments for teaching and learning , the platforms are rising serving the same purpose with their own uniqueness. There are some popular online learning systems which are described below with their components and explaining how they are serving the purpose.

A. Google Classroom:

Google Classroom is a free web tool built by Google for schools with the goal of making it easier to create, distribute, and grade assignments without using paper.The major goal of Google Classroom is to make file sharing between professors and students more efficient.

Google Classroom includes Google Drive for creating and distributing assignments, Google Docs, Sheets, and Slides for writing, Gmail for communication, and Google Calendar for scheduling.Students may be invited to add a category using a personal code, or categories may be automatically imported from a college domain.

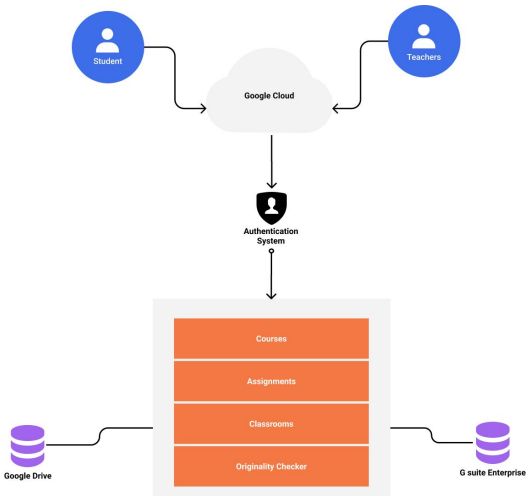

Fig 4 Google Classroom Block Diagram

Some of the features that make google classroom unique are mentioned below:

1) Assignments: Google's suite of productivity applications, which allow communication between the teacher and the student or student to student, are used to store and grade assignments.Rather than sharing papers with the teacher that reside on the student's Google Drive, files are hosted on the student's Drive and then submitted for grading.Rather than allowing all students to look at, copy, or edit the same document, teachers can choose a file that can then be used as a template so that each student can edit their own copy and turn in a grade, teachers can choose a file that can then be used as a template so that each student can edit their own copy and turn in a grade.Students may choose to attach additional materials to the assignment from their Google Drive.

2) Originality Report: The originality report enables educators and students to identify the parts and sections of a submitted work that use the same or similar words as another source.It highlights sources and flags missing citations for college students to assist them in improving their writing.
Teachers have access to the originality report, which allows them to check the educational integrity of the student's work.
Teachers can turn on the originality report for three assignments in G Suite for Education (which is free).

3) Active Courses: Instructors can archive courses at the end of a term or year using Classroom. When a course is archived, it is removed from the site and placed in the Archived Classes section to help teachers arrange their current classes. Teachers and students can see a course that has been archived, but they won't be able to make any modifications until it is restored.

4) Communication: Teachers submit announcements to the category stream, which students can remark on, allowing for two-way contact between the teacher and students.Students may post to the category stream, but they will not have the same priority as a tutor's announcement and may be moderated.To distribute material, announcements and postings are accompanied by a variety of media from Google products, such as YouTube videos and Google Drive files.Within the Google Classroom interface, teachers can use Gmail to send emails to at least one or more students.

5) Grading: Many different grading schemes are supported by Google Classroom.Teachers can attach files to an assignment that students can see, edit, or receive a private copy.If the teacher did not generate a duplicate of a file, students can create their own and attach them to the assignment.Teachers can choose to monitor each student's progress on the assignment and offer comments and edits as needed.Turned-in assignments will be graded by the teacher and returned to the student with comments so that they can amend the work and resubmit it.Assignments can only be

modified by the teacher after they have been graded, unless the teacher sends the work back in.

6) Privacy: Google Classroom, as part of G Suite for Education, does not display advertisements in its interface for college students, instructors, or teachers, and user data is not scanned or utilized for advertising reasons, unlike Google's consumer services.

7) Mobile Application: Apps for iOS and Android smartphones are available for Google Classroom.Users can snap images and attach them to their assignments, share data from other applications, and use the apps offline.

B. Zoom:

Zoom is a cloud-based video communication technology that is both modern and enterprise-ready.
It's commonly used for audio and video conferencing as well as webinars on various devices.Zoom connects its users using a mechanism called Zoom Room.Zoom meeting is the official term for bringing people together from all throughout the Zoom ecosystem.This is a paid application in which the user must pay for various subscription schemes.

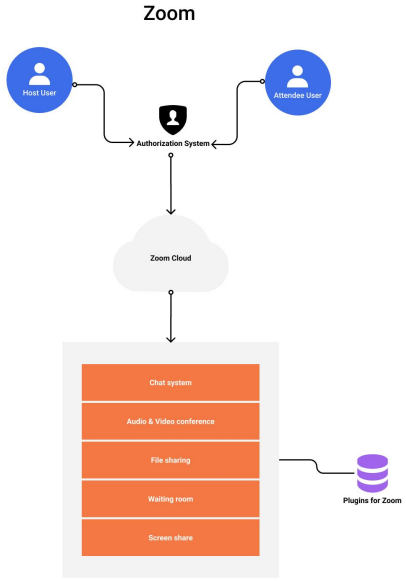

Fig 5. Zoom Block Diagram

Zoom has unique features which makes it one of the most popular apps among the users around the world. The features are mentioned below:

1) Scheduling: Zoom has a feature where one can schedule a call. It allows to schedule meetings and the meetings can have multiple occurrences, so its easy to use the same meeting ID and settings.

2) Delegations: Zoom has a feature where the delegation of people can be done like, host, co-host with settings where the host , co-host can mute the participants, give them rights to speak/unmute, share the screen.

3) Calendar Integration: For a faster and easier way to book Zoom meetings, a plug-in for Outlook and a zoom scheduler extension can be implemented.Zoom's calendar management software is available on both the desktop and mobile platforms.The calendar data is available in ica format for use with other calendar applications.

4) Touch-up my appearance: For the users who are self -conscious, this feature called touch-up my appearance comes handy as it promises to smooth the skin tone, present a more polished appearance. It also eliminates rough and bad lighting which makes video clearer.

5)Multiple Sharing: At the same moment, multiple people can share their screen.This facilitates real-time cooperation with other users.Users can also use Zoom's multi sharing feature to show a presentation slide.

6)Virtual Background: The Zoom virtual background allows the user to create a new background to hide clutter, remove distractions, or emphasize branding. One may create a green screen effect and make your zoom meeting even more lively and clear for your audience by using this zoom background.

7)Waiting and Breakout Rooms: If a person doesn't want everyone to arrive at the Zoom meeting one after the other, Zoom is a better option. Zoom provides a waiting room, or simply a lobby, where one can see who has arrived for the conference.This gives the Zoom conference an extra layer of protection. The host of the meeting can also create rooms for discussions giving the vibe of the private rooms for different discussions in each room.

8)Personal Meeting Rooms: Zoom has developed a bespoke meeting room that allows you to create a private and virtual conference space for you and your coworker.

C. Cisco Webex

Cisco Webex is a cloud-based collaboration package that includes Webex Meetings, Webex Teams, and Webex Computers.Video meetings, team communications, and file sharing are just a few of the collaboration tools available in Cisco Webex apps.Regardless of whether meetings are joined from Webex Meetings or Webex Teams devices, the Webex backbone network manages them all.Cisco Webex's Webex Hybrid Services, which connects Webex Teams' cloud-based capabilities to on-site Cisco communication systems, offers both on-site and hybrid solutions.

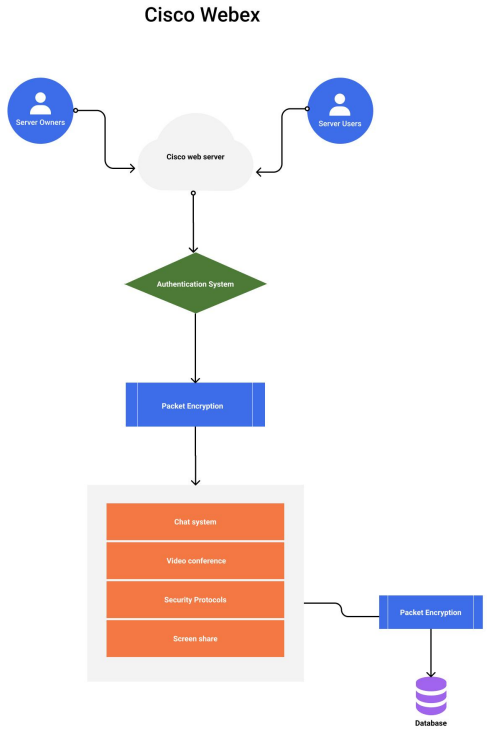

Fig 6 Cisco Block Diagram

Some important features of Cisco Webex are as follows:

1)Localization of video bridge user experience: Participants connecting through video devices can now have audio and visual instructions translated into the meeting host's preferred language.Previously, that option was only available in English.

2)Customizable video address: As part of the Webex Personal Rooms improvements, customers of the Cisco Webex Video Platform can now create their personal room video address for a more personalized experience.

3) Superior scale: Webex users are allowed up to 200 video endpoints & 500 video endpoints in a single meeting, which may need joining Webex Teams / Jabber and is limited based on your unique account / subscriber's participation cap.With a screen quality of up to 720p, two-way video communication between the Webex application and the Telepresence apps is possible.

4) Security: Personal Meetings are only open to users who have been granted access.Communication and call control are both encrypted.

5) Integrated presentation sharing: As one of the remote link functions, audio and video presentations with a mobile content sharing interface can be shared.

D. MOOC

A massive open online course (MOOC) is a type of online course that allows for unlimited participation and open access. Many MOOCs offer interactive courses with user forums or social media discussions in addition to traditional course materials like filmed lectures, readings, and problem sets to support community interactions among students, professors, and teaching assistants (TAs), as well as immediate feedback to quick quizzes and assignments.

There are very popular MOOC systems that are famous and are used by millions of users. Some of the famous MOOC systems are mentioned below:

- Udemy : Udemy is one of the largest and biggest online platforms which has millions of users. They have a broad range of courses and classrooms with a very large number of videos. The certification that they provide while completing the course has been recognized around the world.

- Udacity: Stanford and other companies have invested in Udacity. Stanford academics and teachers use them widely, and the instructors come from renowned colleges all around the world.

- Coursera: Coursera is powered by google and also has wide varieties of courses to study from. It offers a wide range of classrooms from teachers from around the world.

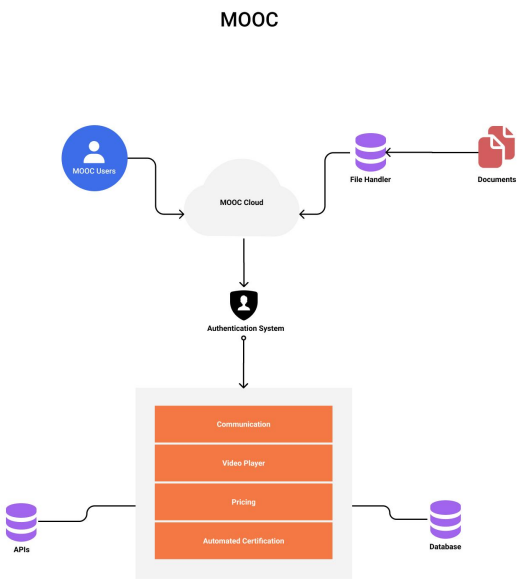

Fig 7 MOOC Block Diagram

Some features that made MOOC extensively used are:

1) Advance course selection : Most MOOC providers, such as Udacity, Udemy, EdX, and Coursera, allow users to choose courses based on their knowledge or preferences.The duration of the course, the course grade, and the course fee all influence the course selection.In general, MOOCs provide courses with a high user rating.

2) Video and audio lectures: The majority of the MOOCs teaching materials are in audio and video format. Students, on the other hand, have access to their professors' presentation slides and summary notes.

3) 30 day money back guarantee: If students confirm that they do not want to pursue a course for whatever reason during the first thirty days after enrolment, the tutoring fees are refunded in full.

3) Certificate: Students will receive certification at the end of the course after they have completed quizzes, assignments, and projects. MOOC grants certification on successful completion of any course conducted by an instructor.

4) Lifetime access: Courses, or any element of a course, can be retaken or reviewed an unlimited number of times at no extra charge.This access assures that students, regardless of their personal schedules or interruptions, have every opportunity to grasp the topic.

5) Get enrolled in multiple courses: MOOC system allows the users to get enrolled in multiple courses parallely and doesn't restrict in the number of courses a user can take at once.

E. Moodle

Moodle is a free and open-source learning management system (LMS) written in PHP and distributed under the GNU General Public License [9]. Moodle contains a number of common and creative features, like a calendar and a Gradebook. Moodle is a popular virtual learning environment that may be used in a variety of situations, including education, training and development, and business.

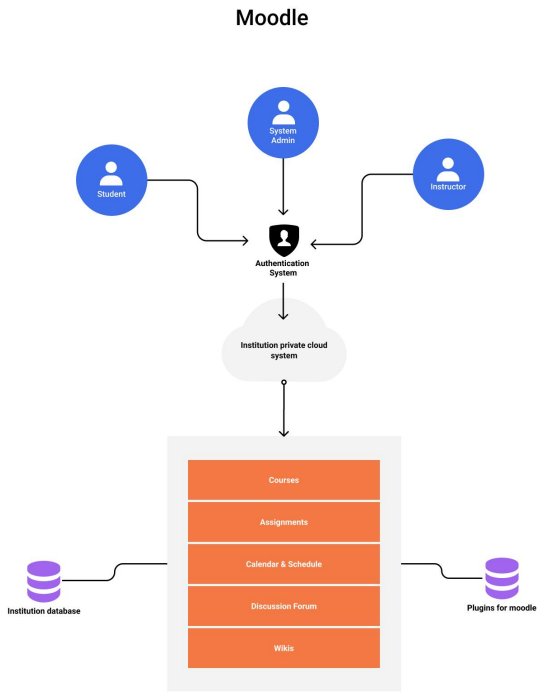

Fig 8 Moodle Block Diagram

Some of the key features of Moodle system are as follows:

1) User roles and permissions management: The application can have different levels of authorisation to control which users have access to which data.The system administrator and the course instructor can allocate roles.

2) Secure authentication and mass enrolment: To enroll in a course on your Moodle site, a user must first log in or be logged in, and then be granted access to the course they wish to enroll in.Authentication is the process of creating an account and logging into the Moodle site, and it can be done in a variety of ways.You could, for example, allow users to establish their own accounts on the site (this is known as Email-based self-registration) or create their accounts for them (this is known as Manual accounts).Once on the site, visitors must enroll in the course of their choice, which is called Enrolment.Again, there are a variety of enrolment options, one of which is self-enrolment, which involves students clicking a button to add themselves to the system.It uses over 50 authentication options to enroll and authenticate users in the Moodle system, keeping user data safe.Instructors also have the option of quickly adding a large number of students to a single course with a few mouse clicks.

3) Personalized dashboard: Moodle's dashboard is contemporary, responsive, and simple to use.The customizable dashboard displays current, previous, and upcoming courses.The dashboard also displays the tasks that are due.Admins can choose whether to require users to see the dashboard or the front page after they log in, or give them the option.

4) Customizable design and layout: If students or instructors do not like Moodle's default layout, they can change it to suit their needs.The theme layout can also be altered according to the user's preferences.

5) Collaborative tools: Moodle comes with forums and wikis where students can talk about the subject.Students can access a database of course records and collaborate with their peers to learn.Moodle also includes a comprehensive dictionary and index.

6) Convenience of file management: Along with Moodle, Microsoft OneDrive, Google Drive, and Dropbox are all integrated.Students may effortlessly drag and drop files onto the cloud using drag and drop.The file manager offers a feature that allows you to sort files by type, such as photographs, documents, and codes.

7) Simple and intuitive text editor: Moodle provides a simple and powerful text editor that works across all web browsers and devices in the situation of submitting online assignments where students must type everything up.

8) Progress tracking: Educators and students can keep track of their progress and completion using a variety of methods for tracking specific activities or resources, as well as at the course level.

9) Notifications: Notification is another important component of Moodle's online teaching and learning system. Users can receive automatic alerts for new assignments and deadlines, forum posts, and send private messages to one another when this option is activated.

10) All in one calendar: The Moodle calendar maintains track of academic and course deadlines as well as other personal activities.All of these qualities are summed together in one calendar.Furthermore, the all-in-one calendar can be downloaded and shared with others.

11) Themes: Themes are a type of “skin” that allows you to fully modify the look and feel of your website (or even an individual course). There's no excuse for a plain-looking Moodle site anymore, with the standard More theme being fully configurable and the community supplying well over a hundred donated themes.

VI. COMPARATIVE ANALYSIS OF ONLINE TEACHING LEARNING SYSTEMS

All of the online teaching learning systems have their own goals and objectives that they are striving to fulfill based on their principles, values and beliefs forming a set of standards they abide by. Some focus on performance and some might focus on content development with their own agenda. These small features and traits as well as services are what makes them different from one another.

In this section, a detailed comparative analysis will be done to analyse the different online teaching learning systems that the current world has and compare them with one another with constructive information and feedback.

A. Usability

Usability is simply the measure of how well the system performs its functionalities for a specific user to achieve their task or goal. To analyze usability, the online teaching learning system’s functions, UI intuitiveness and features they provide will be tested followed by its effectiveness and level of satisfaction.

For an example, While checking for Moodle system usability functions like uploading files and sharing files will be tested.

B. Performance

Performance is the measure of how fast and accurately the system responds to the action of users. The output variable is used to measure how the device works when pressing different buttons, and its response time is evaluated to see how quickly it reacts. The performance attribute is used for the performance checking in OTL systems.

C. Interoperability

Interoperability is an ability of a system to exchange information and communicate with external systems for its operation. For example, to communicate with backend, using web services and API's functionalities. Interoperability is tested in our OTL framework for each OTL framework by understanding how they communicate using web services and their effectiveness.

D. Reliability

Reliability is the measure of how a system performs accurately during certain time under specific conditions. The product is reliable as it can give accurate expected response to the action at any given time and circumstances.

It is often that those systems which have a very large amount of features with high complexity are less reliable. In the analysis reliability of the OTL, the system's response to low network connection and memories would be tested by doing multiple tasks at once.

E. Availability

Availability is the system feature to be able to use and function effectively for all ranges. The Availability of the Online Teaching Learning device is checked by sending HTTPs requests to the server at intervals of every 5 minutes each day, and recording response time and response data.

F. Security

As most familiar with, Security is the feature of OTL systems to secure and protect the system information with any malware or threats such as, social engineering, hacking, phishing, identity fraud and much more. These OTL systems can be targeted to steal users critical information and credentials. .

Security for the OTL system was checked by trying to access the API using postman and trying to scan the IP for some information gathering.

G. Scalability

Scalability of a system is its ability to scale the capacity as per the demand of the network. A good scalable OTL system can handle a significant amount of load without reducing its performance . Testing scalability for a system is a tricky task, since we are unaware of its threshold capacity. However, we can test a portion of how scalable the OTL system is by pushing a few hundred data to its server.

H. Maintainability

In the real world, Online teaching learning systems constantly get maintenance, THe Maintainability of OTL systems is its ability to adjust or in case of system crash, its ability to restore to its original previous state. Corrective, adaptive, perfective, and preventive maintainability attributes could be tested in our OTL System.

I. Modifiability

Modifiability is the degree at which the changes can be made for a certain function to run the whole system optimally. Any modifiability of an OTL system may be tested by analyzing how the system performs when one updated feature increases or decreases the response time.The more modifiable the OTL system is the easier for developers/users to update and modify for improvement or other goals.

J. Heterogeneity

As discussed in chapter II, heterogeneity refers to its nature of having diversified external agents. A heterogeneous OTL system has different external services as well as languages that it uses under different protocols.Making cross-platform apps that reduce the complexity that a software might possess and may not implement many features.

K. Affordability

The ability of OTL systems to be affordable for all ranges of audience. The test would be done by analyzing the price for all paid content and if the pricing strategies are justifiable and affordable or not. Many OTL systems are open source, while others are free to join but need payment for specific apps.

If the course price is too expensive and doesn't provide the value of its worth then it loses its effectiveness.

The test would be conducted by comparing the course value and price with similarly OTL systems.

L. Quality of Service

QoS aka Quality of service refers to the measure of the entire performance of the OTL system from every platform.QOS can be assessed on the OTL framework by reviewing their ratings, number of website user's participation, pattern, comments etc. There are a lot of criteria like latency, user satisfaction, content management and performance that falls into QoS.

M. Privacy

There is a difference between privacy and security. Security is about protecting data from malicious threats, whereas privacy is about using data responsibly. While playing with data, it should be secure, especially on the client side of the network which can be done using some cryptography methods. It also concerns how security-related attacks or violations can be tolerated by limiting damage, continuing operation, speeding up repair and recovery, and failing and recovering securely.

Privacy of the user can be checked from developer tools or using APIs to test if they are authenticated or not. Similarly, Analyzing privacy policies on their OTL website can give a great insight of how they handle data and information.

N. Supportability

Supportability in simple terms can be defined as its ability to support the whole system with necessary logistics and requirements for its entire life cycle.Taking into account the process, logistics management, adjustment, each OTL system was tested for support. Support for cross-platform enty.

O. Testability

Testability of a system refers to its ability to allow testing of various cases in the system.If the software's testability is high then it is easier to find faults in the system through testing.

Similarly, we can test the testability of a system with different parameters and variables. For any given parameter, the system responds good or not and analyzes accordingly.

P. Multimedia Supports

The criteria refers to the ability of software that is capable of playing, recording, sharing files, music, sound effects and video tutorials.

The multimedia support was tested by checking how it functions and what are the type of multimedia files it supports and tools. The testing of multimedia support is important for all systems since it should be able to deliver content in all forms of way including videos, text, graphic , audio or animation.

Q. Comparative Chart & Discussion

Parameters	**Google Classroom**	**Zoom**	**MOOC**	**Moodle**	**Cisco Webex**
Usability	High	Med.	Med.	Med.	Med.
Performance	High	Med.	Med.	High	Med.
Interoperability	High	Low	Med.	Med.	Med.
Reliability	High	Med.	High	Low	Med.
Availability	Med.	High	High	Med.	High
Security	High	Low	High	High	High
Scalability	High	Med.	Med.	Med.	High
Maintainability	Med.	Mid.	Med.	Med.	Med.
Modifiability	Low	Mid.	Low	Med.	Low
Heterogeneity	Low	Low	Med.	Low	Med.
Affordability	High	Med.	Med.	Med,	Low
QoS	Med.	Med.	Med.	Med.	Med.
Privacy	High	Mid.	High	High	Low
Supportability	Med.	Med.	High	Low	Med.
Testability	Med.	Low	Med.	Low	Med
Multimedia Supports	Med.	Low.	High.	High	Med.

Fig 9. Table of Comparative Analysis

The above table is the comparative chart of 6 different online teaching learning systems/platforms against 17 different parameters with the scale rate of high to low. Low score on any parameter is not satisfactory to the audience, For

Medium score the OTL system performs well and is satisfactory with the users. Similarly, For High score, The online teaching learning system provides great flexibility and satisfaction to the user.

The rating and analysis is based on personal opinion, research and testing, which is subjective and may vary from person to person. The following 6 OTL Platform were taken from chapter V.

The usability testing conducted on all 6 of the OTL system, Google classroom has a significantly higher usability relative to other testing. The UI plays a vital responsibility in enhancing the usability , MOOC and Moodle systems are something that has many rooms for improvement in their UI and Usability. Zoom was something that was confusing for the beginners.

From the listed online learning system platforms zoom and MOOC have the lowest performance measure. With good UI and the basic functionality provided by the system, all the functions were acceptable to the all user base. Where google classroom and moodle is good with their consistent responses.

Most of the tested system works quite well in cross devices. However, Zoom lacks web application support, Making the Zoom with lowest Interoperability.Whereas Google classroom communicates with its drive and calendar seamlessly.

Cisco WebEx appears to have a reliability issue. A major WebEx issue may be found in the video conference service, where there is no real-time video frame rate adjustment, which can lead to disconnections. There is also a recurrence of audio and video cutting.

Almost most of the OTL systems are pretty good with the parameter of availability, however Moodle & MOOC systems sometimes give an error for some service. Google classroom, Zoom and Cisco have some of the great test results.

In terms of security, Google has the highest secured platform ranging from cross devices to cross OS. It monitors the Public IP to authenticate multiple account users.Zoom, on the other hand, provides a poor level of security. There have been recent publications detailing how hackers gained access to the personal information of various Zoom users.

. On the basis of scalability all the systems mentioned above are capable of scaling according to user traffic. However, Google Classroom and Cisco can be highlighted as two most scalable. Moodle and MOOC systems depend on the vendor’s or license user’s server DB capacity which may vary from place to place. It's vital to push system updates once new modifications and problem fixes are made, but shutting down the server isn't an option. Moodle is based on PHP, and users will be unable to use Moodle systems such as Google Classroom, and others while the new system is being updated. Moodle has the lowest maintainability score of all the platforms.

Most of the OTL’s systems are not modifiable, Which is why the modifiability of most of the OTL systems are low or in medium. Creating roles and implementing new modifications is quite smooth. All other services and systems provide little or no assistance for changing system objects. Followed by heterogeneity, Almost system users use the same service within their brand or organization.

Moodle and Google classroom provides a significantly relatively higher affordability than other tested OTL systems.Zoom and Cisco Learn are all free to use, but to access the system's primary features, users must purchase a subscription, which may cost anywhere from $50 to $1,000 between the range.

Most of the systems have a high level of user involvement and positive feedback. In a shorter length of time, all systems give change with a change in trend. Reviews, comments, and bandwidth given may all be used to determine the level of service provided to the user base. Privacy is something all of the online teaching learning systems take very care of. They have good policies and terms for keeping their user information secured. Where google classroom and moodle has relatively good privacy implementation on how users want to show their information or put their post/comments.

Testability for zoom and moodle compared to cisco and google classroom is relatively low. SInce most of the features are defined and if any error occurs, the system gives a reasonable and understandable message to find the cause. I.E Low network connection.

Multimedia Support is something that most of the system should have. In google classroom, you can post images and links however you can’t upload video, zoom support real

time video & audio. MOOC & Moodle have great diversity of multimedia support.

VII. DISCUSSION AND WAY FORWARD

As discussed detailly about the rise of online teaching learning systems, how they are important in the current age of information and how they have been contributing in the field of education from different platforms and backgrounds. It is not realized that not all systems can provide all the services among all the platforms. In an Ideal system, all the parameters are highly satisfactory for all the audience which is only imaginable due to many conditions including technology, cost and capacity.

However, Most of the online teaching learning systems do their best to fulfil the requirements of their customer. The satisfaction level of any user depends on how the system can achieve the expectation and requirement of their customer/user using their features. If we talk about an ideal online learning system, it should have all the requirements that the user wants. But the question remains, that What do these requirements be based on?. Any features of the OTL system have to do with the problem that it is trying to solve and eventually become the requirements. Some requirements like Support and creation of learning content, Learning models & User and course management are the generalization of the requirements. The ideal OTL framework should be able to maintain privacy and a sufficient level of security so that users' data does not fall into the hands of hackers. The needs of users depend on the problem that they face. Privacy & security are the two top needs that should be addressed in all of the online teaching learning systems. The requirement of ePayment and service like a practical learning environment can also be implemented to create a sense of relevance in the OTL community. Additionally, For those students who can't hear or see properly, specialized course content and audio course contents can be created to include the disabled minority students as well to the system.

Moving on to legalities of OTL, Cyberspace refers to the boundless space known as the Internet and every online teaching learning system must abide with the cyber laws of their nation and international cyber laws.Cyber law poses particular problems of computer and electronic intellectual property, contract law, anonymity, freedom of speech and jurisdiction [10] . Most of the OTL system follows cyber laws under international guidance. However, In most cases, collaborative learning experiences are developed and conducted with pedagogical concepts in mind, but security considerations are generally neglected. Students falsifying course grades, providing others with a compelling false identity, interfering with monitored or private interactions, changing the date stamps on submitted work, and a teacher gaining access to student personal data are all examples of unintended consequences that have a negative impact on the learning process and its administration. Every user including mentors must abide by the cyber rule with integrity and discipline.

In the context of Nepal, one of the developing countries. The era of information technology just began years ago where most of the eBased services are just in the initial stage of online cyber space. An idle OTL initiative will seek to remove the IT limitations imposed on students and maybe professors. The government should make the OTL system and flexible legislation available to both parties for unhindered growth and progress.The socio-economy of the people in the context of Nepal is fragile, which means most of the people can't afford to buy high end electronic devices for learning online or using internet service. The government should form an OTL system that also focuses on the socio-economy of the people and implement a cost and people friendly system. Proper discussion forums and customer support should be set up so that with minimal effort the users can easily solve their problems [11]. Automated problem solving and updated discussion forums can help people solve this problem.Using the technologies of cloud computing to ensure the OTL system is available to most of the students .

VIII. CONCLUSION

To conclude, Online teaching learning platform has become one of the unshakable pillars of education, contributing its fair share to the domain of cyber and education space. The paper was possible only after intense research and analysis of multiple online teaching systems including Software development & design articles and blogs.

The paper contribute to the uses of OTL system by Exploring the essence of online teaching learning platforms, addressing some of the issues caused with OTL and deep comparative analysis of some of the most famous online learning platforms in today's era.

Additionally, Some of the future works that will follow the paper in the domain of OTL platforms are:

- Exploration of augmented reality classroom
- Analyzation of cyber laws & how it can be modified
- Proposing an open source online teaching platform for all including physically disabled audiences.
- Detailed discussion of some of the real life cases related to privacy and security with OTL systems.

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