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Online Learning Management System with Video Conferencing

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Abstract: *Education is an important tool to foster progress as an enormous community. In this research paper we discuss implementation of a Learning Management System which can be capable of providing quality education eliminating all sorts of physical confinements and provide incredible quality education to cater needs of students worldwide. This online based LMS will ensure that students will be able to study at their own pace and have a sustainable schedule. Since every one of us is wired differently, the perspective to observe each student should be different and that is precisely what we feel should be the cornerstone in development of any Learning Management System. The most important objectives of a LMS deal with providing cost effective pedagogy schematics and understanding the most efficient ways to deliver education to all sorts of learners worldwide keeping in mind that everyone has different needs and possibly should be handled in a unique way.*

Keywords: Online, Learning, Video-conferencing, Education

I. INTRODUCTION

Learning Management Systems are the backbone of academic institutes and a robust system ensures good delivery of educational content to all the learners. Development of high-quality learning management system is essential in the growth of learners since it has a direct co-relation with the capabilities induced in the learners by the followed academic curriculum. The proposed idea will be an online based learning management system which eliminates all sorts of physical boundaries to cater to learners all around the world since all learners require now will be an internet connection. The advancements in technology in the past few decades have ensured that availability of internet has been quite widespread and this definitely puts online learning management systems as the most lucrative option for all the educational institutes.

Implementation of a Learning Management System has to preceded by thorough examination of all the characteristics of the system and how they affect the learner and his schedule. All the possible outcomes have to considered for establishing an effective system which maximizes the learner's efficiency and enables the institutes to serve learners in the best possible ways. The proposed system will be a framework that all the institutes can incorporate in their pedagogy methodologies and shape up the system according to their needs since the system we are trying to create is fundamentally about rejecting the idea of one size fits all and is all about increasing the existing systems efficiency by introducing a new procedure for catering the learners worldwide. The university remains the same, the instructors/teachers remain the same but the methodologies change to get the learners on a more effective path and make them adapted to a superior system which is metrically more efficient.

The learning management system we discuss relies heavily on the idea of using internet to deliver the lectures/content to the learners. Internet has advertently been among the quickest delivery mechanisms of the 21st century and this is substantially important when it comes to catering a large number of people at once. The internet has been the cornerstone in development of top organizations in this age and hybridizing education with internet seems to be an extremely logical step because it is indeed the most effective way to channel educational facilities to the learners worldwide instantly.

II. LITERATURE REVIEW

The hunt for a perfect Learning Management System never ends because there is always room for more improvement and new systems come up to fill gaps created in the existing ones. The systems existing in the past always aimed at the need of the hour and addressed the real-time issues. The current Learning Management System is adapted to traditional teaching

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methodologies and more improvements are being introduced in terms of session delivery and interactive lectures but the issues of physical barriers and anytime access always remain unsolved when it comes to traditional systems.

The current University methodologies focus on one size fits all method to guide the learners into a well-documented path and this is how the concept of certifications exist as an individual is provided after passing a predetermined set of tests and is queried based upon a predefined syllabus or academia protocols. The existing system's biggest ambiguity lies in the process of inspection because of human tendencies of adding more weight to opinions or perspectives that match their psyche. This renders a system where same opinions can be evaluated in a completely different manner based upon the entity getting evaluated through.

III. PROPOSED SYSTEM

The Learning Management System's core objective is to facilitate a framework for institutes to fit their existing system and make it more efficient. We propose to morph the traditional educational system into an internet-based approach. The traditional system has a lot of drawbacks that can be advertently addressed and the existing system thus ends up becoming way more efficient with the methodologies of the Learning Management System as opposed to the traditional methods.

The learner in traditional system of schooling is present in the institution for a fixed number of hours. The two big problems we can instantly observe are fixed number of hours and physical presence of the learner in an institute. Our proposed system instantly fixes it because it is online internet-based solution which has no boundaries. The learner may never attend the institute in his lifetime yet take the advantages of everything the institute has to offer simply by cutting off the requirement of physical presence in the institution and attending everything online.

The Learning Management System aims in inducing ultimate levels of flexibility in the learners' schedules since every day is a different chapter in everyone's life and it just cannot be picture perfect. The learner may encounter a day where things are not as balanced as they should be and the domino effect just trickles down the entire day causing the entire schedule to be disrupted. In the traditional system the learner may miss the lectures and be deprived of what he could have learned on the particular day. This problem is resolved in our Learning Management System since we propose to provide pre-recorded lectures which can be accessed anytime and anywhere with requirement of an internet connection. The facility of live lectures has been incorporated to give the best representation of what the traditional schooling system would seem like but here we have added advantages of elimination of the cons of traditional schooling by inducing internet-based pedagogy methodologies.

IV. TECHNICAL METHODOLOGY

4.1 Backend

A. NodeJS

Node is a JavaScript programming language-based server-side environment. It is open-sourced and community driven to a large extent. Node is asynchronous i.e.; it can handle a lot of requests without waiting for threads to get completed and this makes the entire process very efficient. Node.js here will be used to manipulate database content and serve dynamic web pages to the learners.

B. ExpressJS

Express is a node-based framework that facilitates creation of incredibly robust web applications and makes the process of handling requests and serving users very simple and efficient. Express is conducive in passing arguments and rendering dynamic web pages. Express contains well-built libraries for distributing cookies and maintaining sessions and this minimalistic framework forms the backbone for request handling in the Learning Management System.

4.2 Database

A. MongoDB

Mongo Database is one of the most popular NoSQL category databases used for storing data in document format without tabular relations being established among them. MongoDB is programmed in C++ programming language and it works very efficiently with Node and Express to seamlessly serve lot of users concurrently. MongoDB is performance oriented because of very rapid searching techniques and is extremely good at scaling up to put up with a lot of data at once.

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B. Amazon S3

Amazon S3 is data storage facility provided by Amazon which is robust, scalable and high-performance oriented. A suite of features are provided to make management of data for enterprise level applications very smooth and operations always remain stable. Amazon S3 is container-based storage service that treats every data piece as an object and places them in buckets.

4.3 Frontend

A. ReactJS

React is a free and open-source front-end JavaScript library for building user interfaces based on UI components. It is maintained by Meta and a community of individual developers and companies.

B. NextJS

Next.js is a react based framework for building incredibly fluid user interfaces. We will use Next.js to build a great UI with simple yet powerful features which can be accessed in quite an intuitive manner.

4.4 Other Services and Technologies on the Backend

A. Amazon SES

Amazon Simple Email Service is a very important utility for our Learning Management System to incorporate email-based messaging techniques between institutes and the learners. Amazon SES is very cost effective for regular usage and extremely flexible to incorporate for the institutes to send out updates regarding anything that learners should be aware of. Amazon SES service is extremely secure and is backed up by Amazon Inc which is the market leader when it comes to provision of web services

B. WebRTC

Web Real Time Communication is a technology to exchange arbitrary data between web users without requirements of a middleman or an intermediary. Peer to peer data sharing is incredibly well managed and the operations are very robust with the WebRTC. We will be using WebRTC for peer-to-peer based teleconferencing i.e. delivery of online lectures in our Learning Management System.

4.6 Video conferencing

The system uses an SFU approach for video conferencing. An SFU (Selective Forwarding Unit) receives audio and video streams from endpoints and relays them to everyone else (endpoints send one and receive many). Each receiver endpoint can select which streams and spatial/temporal layers it receives. Compared to a mixer or MCU (Multipoint Control Unit) this design leads to a better performance, higher throughput and less latency. It's highly scalable and requires much less resources given that it does not transcode or mix media. Since endpoints get the other endpoints' media separately, they can have a personalized layout and choose which streams to render and how to display them.

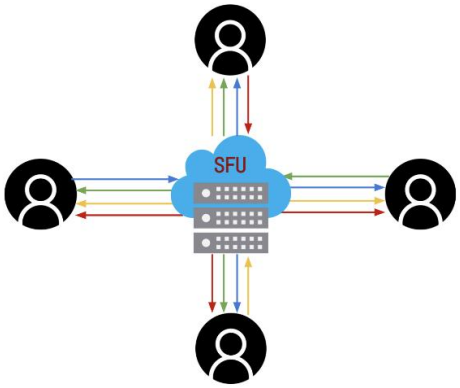

Figure: Architecture of an SFU system

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A. Mediasoup

Mediasoup is a popular WebRTC SFU (Selective Forwarding Unit) for Node.js that allows applications to run multiparty video conferencing with browser and mobile devices in a multi-stream fashion. Rather than being yet another standalone media server, mediasoup is a Node.

V. KEY CHARACTERISTICS

The Learning Management System has to be developed from a perspective of improving efficiency of the learner and maximizing throughput from the institutes providing education. We will incorporate fundamentally strong learning methodologies and techniques to help learners improvise their schedules and incorporate academia with utmost flexibility to ensure optimum results for learners and the institutes. Following are the key characteristics which signify the working of the Learning Management System.

- The Learning Management System will be a framework to be moulded in the way institutes would require it to be. This ensures the fundamental working of institutes is never compromised but modern well-researched and proven methodologies are adapted to increase the throughput.
- The learners will be provided immense flexibility of attending lectures anytime through the facility of pre-recorded lectures and this ensures no gap will be present when it comes to delivery of content and the overhead of recording the lectures will be a one-time investment in case the institute desires to put up professional level courses on the platform.
- The learners have the facility of attending the live lectures with the instructors in real-time classroom like environment and this ensures that the traditional educational methodology is followed with the modifications to limit certain shortcomings through technological advancements.
- The institute can view valuable information and insights with regards to course enrolment and important metrics can be obtained from the built-in dashboard in the Learning Management System.

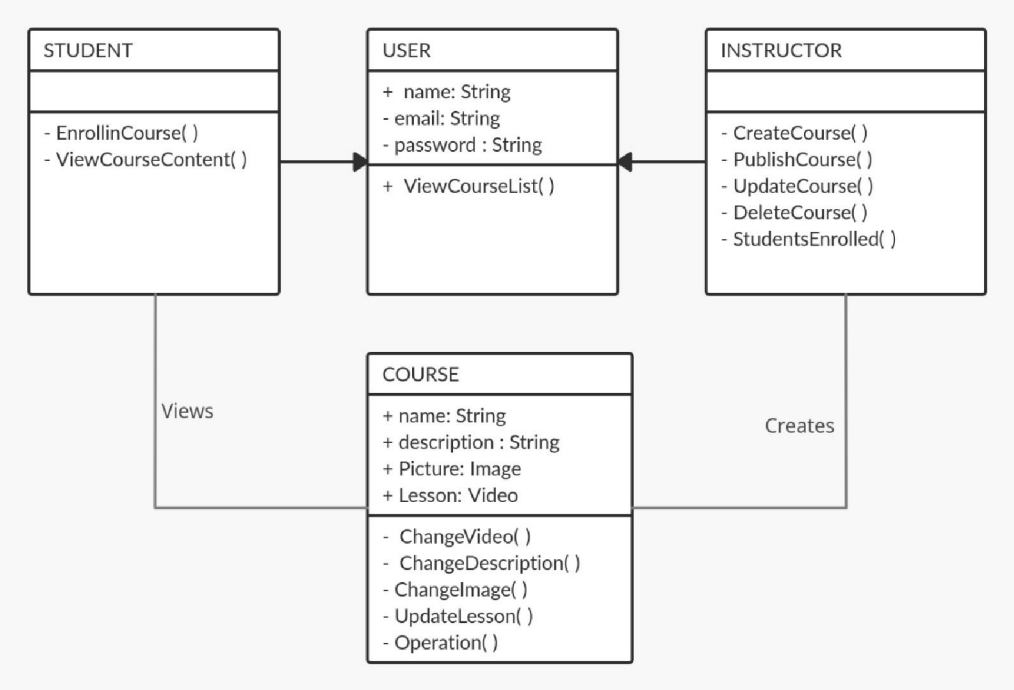

Figure: UML Class diagram of the system

VI. CONCLUSION

A Learning Management System is crucial in imparting quality education and our approach to bridge the gap between the traditional methods and incorporating modern techniques to improvise the pedagogical landscape is pretty obvious to be

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adopted in the next decade. We have witnessed the times like Covid-19 crisis where we realise how important it was to have an internet based academic service and our approach seems to be the all-rounded package that preserves the traditional methods which have been proven to be very efficient and yet amplify the good effects by addition of internet-based techniques.

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