Digital Board Marker (Storage Efficient System for Class Lectures)

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Declaration

We declare that the work contained in this thesis is our own, except where explicitly stated otherwise. In addition this work has not been submitted to obtain another degree or professional qualification.

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To out parents and respected members

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LAH   **L**ist **A**bbreviations **H**ere

Abstract

In a new educational concept, the Lecture Recording system is one of the devices that are widely used to provide educational material to students. Lecture recording plays an important role in online learning and distance education. Most of they are recorded by a cameraman or a static camera. But high resolution recorded video require lot of storage space and also the internet bandwidth. In this work, a storage and bandwidth efficient lecture recording system is proposed to minimize the storage and bandwidth issues. This system is 100 times more efficient that the previously developed lecture recording system. This system is also small in size and portable. This lecture recording system allows students to re-experience the lecture session at anytime and anywhere by downloading it with the minimum bandwidth available or viewing it through the portal. It is made public to promote research and further development in this system. The proposed system is combination of hardware module and software modules. Its first step is position detection at each point of board marker through stereo vision cameras to generate a file that will later be easily played offline as well as online on the web portal. . . .

Chapter 1

Introduction

1.1 Overview of the Project

Digital board marker is a size efficient, bandwidth saving lecture recording system. It can record lecture, providing automated google search of handwritten words. Provides on the spot wiki. Lecture text notes can be generated automatically. Lecture can be named and divided into topics and subtopics automatically. According to a survey, 94% students go for online help of recently attended lectures because they can't fully grab the concepts. Recorded lectures as video format require so much internet bandwidth to play. In most cases, large sized videos are difficult to handle or download. Because students mostly don't have huge amount of extra space available especially for the CSE students, as they already use bulky software and also students don't have large amount of bandwidth of internet available.

1.2 Background

The main aim of digital board marker is to provide ease to the students of all the educational institutes. Mostly lecture systems that already exist, of different universities, provide lectures online on youtube but the problem is they need great internet bandwidth and lot of memory to download and watch the lectures which is difficult for students especially in Pakistan. So that we provide bandwidth and storage efficient lecture system.

Universities are places of knowledge production, and the economy and society are the users of this knowledge. So universities can provide ease to student with this system.

1.3   Motivation

The motivation and purpose to do this project is to minimize the use of resources that are used in lecture systems now a days working in all over the world i.e. video lecture recording and streaming through internet.

- The first motivation is to deal with the large amount of storage that normally video lectures take. This system is not based on video recording but on recording the writing on the board with marker. It will record the position of the marker as the coordinates of board where marker touches and store it in the text file (which will later be converted and played like a video). This will take minimum amount of database storage to store this kind of data on a website.

- The second motivation to do this project is to use less internet resources for accessing the lectures. Normally the video lectures of different institutes worldwide are very large and to download those on the system through internet requires large amount of resources which are normally difficult for students to get and to download it in high quality even more resources are required. The lectures for recording are very low in memory as compared to normal video recording and will require very minimum resources to download on the system.

- The third motivation is for example a power failure occurred during the lecture and you cannot clearly see the board but teacher is still writing and erases the board after some time, this may result in not getting proper notes or missing the important point of lecture. Moreover students can get benefit by seeing the lecture again and again if they missed any concept or if they were absent minded or not attending lecture. These few are the reasons which motivated us to do this project.

1.4   Objectives of the Project

1.4.1   Industry Objectives

In industry most of the time it is hard to choose areas for work which have low bandwidth internet and let's suppose you are playing a lagging call of duty runthrough and your stream is buffering and stopping because of low bandwidth it's like you are losing because of this or you are presenting something which is

improved work of someone else and It requires high quality fast internet to present it but it's not guaranteed.

In some places people try to reduce the cost of these things as much as possible but not having proper interface is the main reason of failure so we can cop up with this issue by this new system we are introducing.

- System will reduce internet bandwidth usage which will lead to progress in industry.

- It must minimize the storage issue which can increase working efficiency of industry.

- It will reduce the cost of internet and cost of storage and will help the industry in fast growing world of today.

- Main aim of the project is to provide ease and best performance than most previous ones and will eventually lead to progress in industrial field.

1.4.2   Research Objectives

In the development of digital board marker, computer vision is used and computer vision is most vital in the field of research. Computer vision plays a great role in research work. So by improving the uses of computer vision in future work its vast area for research work. Research objective of the system is to go through all the recent research work done in system's development fields and then on its basis, developing a system which is storage and bandwidth efficient.

- Project research is related to find position and orientation of marker precisely and accurately.

- The high level research part is finding the position and then syncing it with the audio data to play like a video.

- Research must be deep so that researchers must be able to discover new and improved techniques to reduce storage issues.

- Research should be able to help future work in detection of ball in any sort environment without assumptions and with more accuracy.

1.4.3   Academic Objectives

Digital board marker mainly cover academic area the main purpose is to provide each and every student all the lectures with better quality and less bandwidth because in Pakistan we students face this issue the most, as we know it cannot be resolved in near future we have to work something out for this issue and that's where this system will work it will provide an interface to all the students which have all the lectures of their respective subjects from their respective teachers which can be streamed online and downloaded for offline to play later on at very low bandwidth. It will provide all the assignment related material and lectures at same platform to students. It is the new revolution in the academic field.

- The main academic objective of the developers is to learn major computer science field i.e. computer vision.

- On basis of computer fields used in project developers must be able to use this knowledge to improve in this field.

- Developers must complete all the work before respective deadlines. so by working in a professional way project will be at its best.

- Developers must be able to risk the change management in their projects, as while doing the projects, developers might face different kinds of situation and their decision making plays and important role in leading them to success.

1.5   Problem Statement

To make a storage and bandwidth efficient system with a lecture player and learning management system for the students and the educational institutes.

1.6   Scope of the Project

Digital board marker mainly cover academic area the main purpose is to provide each and every student all the lectures with better quality and less bandwidth because in Pakistan we students face this issue the most, as we know it cannot be resolved in near future we have to work something out for this issue and that's where this system will work it will provide an interface to all the students which have all the lectures of their respective subjects from their respective teachers which can be streamed online and downloaded for offline to play later on at very

low bandwidth. It will provide all the assignment related material and lectures at same platform to students. It is the new revolution in the academic field. Although it covers industry and researches as well.

1.7 Challenges

1.7.1 Technology Selection

The technology used is:

- Angular 8 and C# for web application

- C# windows application for desktop application

- Embedded C for marker hardware

The selection of technology was one of the first major issue at the start of project. The first technology we thought of using was **django** (a python related framework) but we could not get comfortable with that so we switched to C# and angular 8. These were quiet familiar to us and also angular 8 was newly stable released latest technology so we opted these.

1.7.2 Camera Selection

To record the position and orientation of the camera the main issue was to use good quality cameras with low cost. High FPS cameras with low cost were very difficult to find. So this was also one of major challenges of hardware.

1.7.3 Stereo Vision Camera Input

Recording a stereo vision using two cameras and taking correct input, setting them at correct angle came up as a challenge.

1.7.4 Marker Hardware

Marker hardware was also a challenge. To make a marker which is almost same as light weight as the normal marker and make it easy to pick. Also to make it in less cost with all the hardware parts and wires attached.

1.7.5   Ball detection

The ball attached on the top of marker is used to detect the position of marker but sometimes the color of ball can match with dress of user and cameras can confuse with the color, which came up as a challenge.

1.7.6   Marker Orientation Calibration

There should be precise and accurate orientation data of marker so that proper position data can be recorded and later used which became a big challenge.

1.7.7   Pressure Sensor handling

There was a lot of noise in the data that is recording which was handled using pressure sensor, it was also one of the major challenges.

1.7.8   Transmission Speed

The transmission speed lag between **NRF24L01** came up as a challenge with and without antenna.

1.7.9   Audio Hardware

Audio hardware itself was bit of a challenge which is to be attached so that synchronized audio data can be recorded.

1.7.10   Noise Reduction

The noise from audio should be removed to get clear audio which was also one of the challenge.

1.7.11   Marker and duster thickness configuration

Selecting the dimensions, size and configuration of marker and duster so that it can sync with stereo vision of cameras and input to camera.

1.7.12   Erasing board

When erasing the board or a part of board there should be removal from the video that is played in the video player. So it was a difficult challenge to keep record of that.

1.7.13 Seek bar control

Controlling the seek bar in audio player for forward and rewind of video came up as a challenge.

1.7.14 Getting familiar with new framework

Angular 8 came up as a new framework for the developers so it was a bit challenge for getting familiar with this. Moreover we started using simple HTML and then converting to angular material was bit of a challenge.

1.7.15 Cross Platform Linking

Connecting front end to API came up as a challenge as developers have never worked with API before. Also there were many development related issue to work with .NET core framework since it is updated version of what developers were already using (.NET classic). So it was a bit of challenge to combine API and front end.

1.8 Assumptions and Constraints

Following are assumptions which were kept in mind during the implementation of the project:

- The position is detected via ball using the computer vision so ball color should not interfere with color of surroundings.

- Teacher should erase complete board and not some words or some parts and also there should be an indication of that so that screen can be removed accordingly.

- Teacher or writer should not block the vision of camera by coming in the way.

- Teacher should start recording using a button on the controller app and similarly stop in the same way.

1.9 Possible Applications of Work

Following are the possible applications where DBM can be used:

1.9.1 Educational Institutes

There can be different types of users in educational institutes so DBM will be helpful to all these users:

FIGURE 1.1: Digital Board Marker Application: Educational Institute

1.9.1.1 Admin

Admin can interact with system in form of following tasks.

- Admin can directly login into the system.

- Admin can create different groups/roles.

- Admin can assign different permissions to each group/role.

- Admin can approve or disapprove the login access requests of the users.

- Admin can add courses.

- Admin can assign courses to teachers.

- Admin can update and delete the courses.

1.9.1.2 Teacher

Teacher can interact with system in form of following tasks.

- Teacher can register himself in the system.

- Teacher can login into the system.

- Teacher can reset his password.

- Teacher can upload course assignments.

- Teacher can delete assignments.

- Teacher can **Add, Edit, View and delete** course content/notes.

- Teacher can approve or disapprove course enrollment requests of students.

- Teacher can download and view students submitted assignments.

- Teacher can start/end recording lectures.

- Teacher can delete course lectures.

- Teacher can add, delete and edit classes.

- Teacher can view students list.

- Teacher can add announcement.

- Teacher can view and edit course related announcements.

- Teacher can delete announcements.

1.9.1.3 Students

Student can interact with system in form of following tasks.

- Student can register himself in the system.

- Student can login into the system.

- Student can reset his password.

- Student can view courses.

- Student can enroll in any course.

- Student can view course content.

- Student can view course assignments.

- Student can download course assignments.

- Student can submit course assignments.

- Student can play course lectures.

- Student can download course lectures.

- Student can view and download course content.

- Student can view course announcements.

1.9.2 Online Tutors

Online tutors can use DBM. There can be different types of users in online tutors as well:

FIGURE 1.2: Digital Board Marker Application: Online Tutors

1.9.2.1 Tutors

Tutor can interact with system in form of following tasks.

- Tutor can login into our system.

- Tutor can start/end recording lectures.

- Tutor can delete, download and play lectures.

1.9.2.2 Users

Users can interact with system in form of following tasks.

- User can play tutorials.

- User can view lectures list.

- User can download lecture.

1.9.3   Sketch Artist

Sketch artists can use the system just like online education and showing their sketch skills and help others in improving theirs.

FIGURE 1.3: Digital Board Marker Application: Sketch Artists

1.9.3.1   Industrial Presentations

Digital board marker can be helpful in industrial presentation so that if any person cannot appear at the particular time, that person can watch the recorded (storage efficient) presentation later.

FIGURE 1.4: Digital Board Marker Application: Industrial Presentations

Chapter 2

Literature Review

2.1 Literature Review

This paper presents a technique that aimed to accomplish an efficient balance between video compression using H.265 protocol and retention of 8K resolution. The study implements multi-level of optimization in the encoding process using H.265 where JPEG2000 standards play a crucial role. The study also applies a novel concept of orthogonal projection that manages pixels metadata required in every frame transition followed by motion compensation. By using multiple file formats of 30 video datasets, the outcome of the study is found to be accomplishing approximately 49% of enhancement in data quality and around 59% of improvement in video compression in comparison to the existing techniques of HEVC-based video compression.[19]

Web-based lecture technologies are being used increasingly in higher education. One widely-used method is the recording of lectures delivered during face-to-face teaching of on-campus courses. The recordings are subsequently made available to students on-line and have been variously referred to as lecture capture, video podcasts, and Lectopia. We examined the literature on lecture recordings for on-campus courses from the perspective of students, lecturers, and the institution. Literature was drawn from major international electronic databases of Elsevier ScienceDirect, PsycInfo, SAGE Journals, SpringerLink, ERIC and Google Scholar. Searches were conducted using key terms of lecture capture, podcasts, vodcasts, video podcasts, video streaming, screencast, webcasts, and online video. The reference sections of each article were also searched and a citation search was conducted. Institutions receive pressure from a range of sources to implement web-based technologies, including from students and financial imperatives, but the selection of

appropriate technologies must reflect the vision the institution holds. Students are positive about the availability of lecture recordings. They make significant use of the recordings, and the recordings have some demonstrated benefits to student learning outcomes. Lecturers recognise the benefits of lecture recordings for students and themselves, but also perceive several potential disadvantages, such as its negative effect on attendance and engagement, and restricting the style and structure of lectures. It is concluded that the positives of lecture recordings outweigh the negatives and its continued use in higher education is recommended. However, further research is needed to evaluate lecture recordings in different contexts and to develop approaches that enhance its effectiveness.[20]

The flipped classroom has become more widely used in engineering education. However, a systematic and quantitative assessment of its achievement outcomes has not been conducted to date. Purpose: To address this gap, we examined the findings from comparative articles published between 2008 and 2017 through a meta-analysis to summarize the overall effects of the flipped classroom on student achievement in engineering education. We searched and analyzed journal and conference publications on flipped classroom studies in engineering education in K-12 and higher education contexts. Twenty-nine comparative interventions were included in a meta-analysis involving 2,590 students exposed to flipped classroom and 2,739 students exposed to traditional lectures. A content analysis was also conducted to determine how the flipped engineering classroom benefits student learning. Conclusions: The meta-analysis comparing these 29 traditional flipped interventions in relation to student achievement showed an overall significant effect in favor of the flipped classroom over traditional lecturing (Hedges' g = 0.289, 95% CI [0.165, 0.414], p ¡.001). A moderator analysis showed that the effect of the flipped classroom was further enhanced when instructors offered a brief review at the start of face-to-face classes. Our qualitative findings suggest that self-paced learning and more problem-solving activities were the two most frequently reported benefits that promoted student learning. Based on quantitative and qualitative support, several implications are identified for future practice, such as offering a brief in-class review of preclass materials. Some recommendations for future research are also provided.[15]

Videos have enhanced the value of teaching and learning, particularly in tertiary education. Recent studies have investigated students' attitudes toward video lectures for educational purposes; however, the relationship between students' attitudes and different usage patterns such as platforms used, video duration, watching period and students' experience, is yet to be explored. To investigate potential

attitudinal differences among the diverse video lectures usage patterns, the present study incorporates responses from 40 students who participated in a video-assisted software engineering course. Our results suggest that usage patterns affect students' attitudes to video lectures as a learning tool. The overall outcomes are expected to promote theoretical development of students' attitudes, video-platform design principles, and better and more efficient use of video lectures.[8]

The literature is mixed as to whether the addition of lecture capture technologies provide for better student success. In this work, we consider not just the broad effect of lecture capture technology on academic achievement between cohorts, but whether this effect is related to patterns of viewership among learners. At the centre of our interest is determining whether there are strategies learners take in their reviewing of content week-to-week that may result in better achievement. To investigate this, we describe a method for modelling learners based on their interactions with lecture capture systems. Unlike investigations done by others, our models emerge from the activities of the learners themselves, and are based on the results of applying unsupervised machine learning (clustering) techniques to student viewership data. These models describe five different classifications of learner interactions, and we show that one of these is positively correlated with academic achievement. We further validate our results through repeated experimentation, and describe how such models might be used by early-alert systems.[3]

Instructors use various strategies to facilitate learning and actively engage students in online courses. In this study, we examine student perception on the helpfulness of the twelve different facilitation strategies used by instructors on establishing instructor presence, instructor connection, engagement and learning. One hundred and eighty eight graduate students taking online courses in Fall 2016 semester in US higher education institutions responded to the survey. Among the 12 facilitation strategies, instructors' timely response to questions and instructors' timely feedback on assignments/projects were rated the highest in all four constructs (instructor presence, instructor connection, engagement and learning). Interactive visual syllabi of the course was rated the lowest, and video based introduction and instructors' use of synchronous sessions to interact were rated lowest among two of the four constructs. Descriptive statistics for each of the construct (instructor presence, instructor connection, engagement and learning) by gender, status, and major of study are presented. Confirmative factor analysis of the data provided aspects of construct validity of the survey. Analysis of variance failed to detect differences between gender and discipline (education major versus non-education major) on all four constructs measured. However, undergraduate students rated

significantly lower on engagement and learning in comparison to post-doctoral and other post graduate students.[17]

This paper reports findings from a case study of the impact that teaching using guided notes has on university mathematics students' note-taking behaviour. Whereas previous research indicates that students do not appreciate the importance of lecturers' non-written comments and record in their notes only what is written on the board when taught with the traditional chalk and talk method, some students in our study recorded the non-written comments as well as some of their own links between sections of the lecture. We did not, however, find students' attitude towards those comments to be different from what previous research found. We conclude that guided notes can be an appropriate way of teaching university mathematics but on their own cannot make the pedagogical intentions of the lecturer clearer to the students. We also found that the educational environment plays a big part for all aspects of student learning, including decisions related to note-taking during lectures.[10]

Online video lectures are widely used in e-learning environments. They provide several advantages for students such as preparing for class and controlling their learning pace. However, essential features of videos, such as transient information and learner control, can also increase learners' cognitive load and disorientation, particularly for learners with low prior knowledge. This study analyzed data collected from a questionnaire, students' examination and homework scores, and system logs to examine the effects of prior knowledge on the engagement level, frequency of viewing strategies used, attitudes, and learning performance of students who watched video lectures. The results showed that the students demonstrated the same engagement levels of watching video lectures, regardless of whether they had high or low prior knowledge. However, high prior knowledge learners used a higher frequency of viewing strategies, had a more positive attitude toward watching the video lectures, and exhibited higher learning performance than the low prior knowledge learners did. These results are discussed in this article, and several suggestions for personalized prior knowledge support are proposed.[13]

Thousands of students enroll in Massive Open Online Courses (MOOCs) to seek opportunities for learning and selfimprovement. However, the learning process often involves struggles with confusion, which may have an adverse effect on the course participation experience, leading to dropout along the way. In this paper, we quantify that effect. We describe a classification model using discussion forum behavior and clickstream data to automatically identify posts that express confusion. We then apply survival analysis to quantify the impact of confusion

on student dropout. The results demonstrate that the more confusion students express or are exposed to, the lower the probability of their retention. Receiving support and resolution of confusion helps mitigate this effect. We explore the differential effects of confusion expressed in different contexts and related to different aspects of courses. We conclude with implications for design of interventions towards improving the retention of students in MOOCs.[24]

Although online courseware often includes multimedia materials, exactly how different video lecture types impact student performance has seldom been studied. Therefore, this study explores how three commonly used video lectures styles affect the sustained attention, emotion, cognitive load, and learning performance of verbalizers and visualizers in an autonomous online learning scenario by using a two-factor experimental design, brainwave detection, emotion-sensing equipment, cognitive load scale, and learning performance test sheet. Analysis results indicate that, while the three video lecture types enhance learning performance, learning performance with lecture capture and picture-in-picture types is superior to that associated with the voice-over type. Verbalizers and visualizers achieve the same learning performance with the three video types. Additionally, sustained attention induced by the voice-over type is markedly higher than that with the picture-in-picture type. Sustained attention of verbalizers is also significantly higher than that of visualizers when learning with the three video lectures. Moreover, the positive and negative emotions induced by the three video lectures do not appear to significantly differ from each other. Also, cognitive load related to the voice-over type is significantly higher than that with by the lecture capture and picture-in-picture types. Furthermore, the cognitive load for visualizers markedly exceeds that of verbalizers who are presented with the voice-over type. Results of this study significantly contribute to efforts to design of video lectures and also provide a valuable reference when selecting video lecture types for online learning.[5]

We apply Carroll's model of school learning, which theorizes about the relationship between time and learning, to motivate the design of a large, first-year, university mathematics course, where students have the choice to attend lectures and/or watch online videos. The theoretical model informs how the course and resources are designed in order to assist students to spend the time they need to master a task in an efficient manner. We examine the relationship between learning and time spent on lectures and/or videos, by analysing data collected on lecture attendance, videos accessed, and mathematical achievement, prior to, and at the end of, the course. Findings show that students use videos as either a complement to, or substitute for, the lecture, and time spent using either or both resources has

a significant impact on learning.[18]

Lecture recording plays an important role in online learning and distance education. Most of they are recorded by a cameraman or a static camera. In this paper, we propose an automatic lecture recording system. A Pan-Tilt-Zoom (PTZ) camera is shooting as it operated by a cameraman. Three partsare developed in this system. The first one is preprocessing for detecting the position of the lecturer and the screen. The second part is designed to track their motion to define the lecture information. According to the tracking result, we can control the PTZ camera in the third part based on the camera action table designed beforehand.[6]

E-learning concept is becoming a vital need for higher and lower education students. It has been observed from the interaction with students of gulf region that they have challenges with the online method of knowledge delivery in higher education. There are multiple reasons for this belief. In this case, there is possibility to add some extra features in the online or virtual classes to make them more beneficial and more informative. If the video lectures are added to these classes, there can be much better utilisation of the content. To explore the possible effects of video lecture, on the cognitive empowerment of the students, the current research was conducted on 124 undergraduate students of Qatar University (QU), which is one of the leading higher education institutions in the GCC-based country Qatar. The data is collected by distributing questionnaires and QU registration department data. Relevant statistical tools are applied to evaluate and analyse the data.[11]

The design of online course materials is rarely informed by learning theories or their pedagogical implications. The goal of this research was to develop, implement and assess a virtual learning environment (VLE), SOFIAA, which was designed using the cognitive apprenticeship model (CAM), a pedagogical model based on learning-centered theory. We present an instructional design case study that reveals the steps taken to improve student performance in a master's level blended learning course on program evaluation. The case study documents four phases of improving on-line instruction in program evaluation, starting with Online Course Materials (OCM) that contained resources and information required to complete team field projects. In phase 1, quantitative analyses revealed that there was improvement of student test scores using the OCM, however, qualitative analyses of think-aloud sessions found that students failed to attain key course objectives. In phase 2, a team of experts reviewed the materials and suggested ways to improve opportunities for student learning. In phase 3, a (VLE) was designed based on the results of phase 2 using a reconceptualization of CAM as a design

model. In phase 4, the VLE was validated using experts' appraisal of content and presentation, and student achievement, which indicated that use of the VLE led to significant improvement in learning over use of OCM. The design process is discussed in terms of a reconceptualization of CAM as a general strategy for instructional design that can be used to improve both the content and quality of online course materials.[7]

In contrast to traditional video, multi-view video streaming allows viewers to interactively switch among multiple perspectives provided by different cameras. One approach to achieve such a service is to encode the video from all of the cameras into a single stream, but this has the disadvantage that only a portion of the received video data will be used, namely that required for the selected view at each point in time. In this paper, we introduce the concept of a 'multi-video stream bundle' that consists of multiple parallel video streams that are synchronized in time, each providing the video from a different camera capturing the same event or movie. For delivery we leverage the adaptive features and time-based chunking of HTTP-based adaptive streaming, but now employing adaptation in both content and rate. Users are able to change their viewpoint on-demand and the client player adapts the rate at which data are retrieved from each stream based on the user's current view, the probabilities of switching to other views, and the user's current bandwidth conditions. A crucial component of such a system is the prefetching policy. For this we present an optimization model as well as a simpler heuristic that can balance the playback quality and the probability of playback interruptions. After analytically and numerically characterizing the optimal solution, we present a prototype implementation and sample results. Our prefetching and buffer management solution is shown to provide close to seamless playback switching when there is sufficient bandwidth to prefetch the parallel streams.[4]

This paper describes a fully automated Real-Time Lecturer-Tracking module (RTLT) and the seamless integration into a Matter horn-based Lecture Capturing System (LCS). The main purpose of the RTLT module is obtaining a lecturer's portrait image for creating an integrated slides lecturer single-stream ready to distribute and consume in portable devices, where displayed contents must be optimized. The module robustly tracks any number of presenters in real-time using a set of visual cues and delivers frame-rate metadata to plug into a Virtual Cinematographer module. The so-called Gal tracker RTLT module allows broadcasting live in conjunction with the LCS, Gal caster, or processing off-line as a video-production engine inserted into the Matter horn workflow. [9]

The decrease in cost and increase in automation of audio visual systems for the

classroom has led to widespread deployment of lecture capture within higher education. While a number of studies have examined the effectiveness of such systems within an institution, no study has characterized student background across institutions. In this paper we describe three different lecture capture systems deployed in three different higher education institutions worldwide. We note particular interesting investigations we have made into how students use these systems, and outline how our current work in the opencast community project will be used to provide more rigorous cross-institution analysis options of lecture capture systems.[2]

Online video-based learning has been increasingly used in educational settings. However, students usually do not have enough cognitive capacity and metacognition skills to diagnose and record their attention status during learning tasks by themselves. This study thus presents an attention-based video lecture review mechanism (AVLRM) that can generate video segments for review based on students' sustained attention status, as determined using brainwave signal detection technology. A quasi-experiment nonequivalent control group design was utilized to divide 55 participants from two classes of an elementary school in New Taipei City, Taiwan, into two groups. One class was randomly assigned to the experimental group, and used video lectures with the AVLRM support for learning. The other class was assigned to the control group, and used video lectures with autonomous review for learning. Analytical results indicate that students in the experimental group exhibited significantly better review effectiveness than did the control group, and this difference was especially marked for students who had a low attention level, were field-dependent, or were female. The findings show that AVLRM based on brainwave signal detection technology can precisely identify video segments that are more useful for effective review than those picked by student themselves. This study contributes to the design of learning tools that aim to support independent learning and effective review in online or video-based learning environments.[14]

Massive Open Online Courses have gained more and more popularity in the recent years. Video Content contributes a vital aspect of the learning experience in MOOCs. The paper at hand proposes ways to optimize the video experience in MOOCs. Single stream videos will be considered as well as the openHPI's dual stream video player. openHPI is the MOOC platform of the Hasso Plattner Institute, providing MOOCs to thousands of users since 2012. One of the unique features of our video player is the possibility to play two synchronized video streams. Based on collected usage data of our html5 based video player we

evaluate the learners acceptance of features, such as adaptive playback speed, dual video scaling, full-screen mode, slide navigation and subtitles. Furthermore, we will discuss the impact on the users learning outcome.[22]

Although thousands of students enroll in Massive Open Online Courses (MOOCs) for learning and self-improvement, many get confused, harming learning and increasing dropout rates. In this paper, we quantify these effects in two large MOOCs. We first describe how we automatically estimate stu- dents' confusion by looking at their clicking behavior on course content and participation in the course discussion forums. We then apply survival analysis to quantify the impact of confusion on students' dropout. The results demonstrate that the more confusion students express themselves and the more they are exposed to other students' confusion, the sooner they drop out of the course. We also explore the effects of confusion expressed in different contexts and related to different aspects of courses. We conclude with implications for the design of interventions to improve student retention in MOOCs.[25]

Student engagement increases student satisfaction, enhances student motivation to learn, reduces the sense of isolation, and improves student performance in online courses. This survey-based research study examines student perception on various engagement strategies used in online courses based on Moore's interaction framework. One hundred and fifty-five students completed a 38-item survey on learner-to-learner, learner-to-instructor, and learner-to-content engagement strategies. Learner-to-instructor engagement strategies seemed to be most valued among the three categories. Icebreaker/introduction discussions and working collaboratively using online communication tools were rated the most beneficial engagement strategies in the learner-to-learner category, whereas sending regular announcements or email reminders and providing grading rubrics for all assignments were rated most beneficial in learner-to-instructor category. In the learner-content category, students mentioned working on real-world projects and having discussions with structured or guiding questions were the most beneficial. This study also analyzed the effect of age, gender, and years of online learning experience differences on students' perception of engagement strategies. The results of the study have implications for online instructors, instructional designers, and administrators who wish to enhance engagement in the online courses.[16]

Sufficient tools for students with Learning Disabilities and Attention Deficit Disorder have not yet been established. We believe that the current tools these students can use call for a drastic change in traditional learning paradigms by either the instructor or the pupil. To fill this gap, we propose our tool, Taking Notes Together

(TNT), as a collaborative note taking tool that will help in equalizing the classroom for students with disabilities. This tool allows students to collaboratively tag classroom lecture/discussion in real time through synchronized transcription and audio recording. TNT provides a visualization that highlights the important classroom points and we argue facilitates better recall and a deeper understanding of the classroom material. Through our evaluation we were able to prove that all students can benefit from this tool. We also present a case study of one student with ADD and how they benefited. The tool makes the learning experience, particularly for students with special needs like LD and ADD, less stressful while still being active in the notes taking. [23]

The huge usage of digital multimedia via communications, wireless communications, Internet, Intranet and cellular mobile leads to incurable growth of data flow through these Media. The researchers go deep in developing efficient techniques in these fields such as compression of data, image and video. Recently, video compression techniques and their applications in many areas (educational, agriculture, medical . . .) cause this field to be one of the most interested fields. Wavelet transform is an efficient method that can be used to perform an efficient compression technique. This work deals with the developing of an efficient video compression approach based on frames difference approaches that concentrated on the calculation of frame near distance (difference between frames). The selection of the meaningful frame depends on many factors such as compression performance, frame details, frame size and near distance between frames. Three different approaches are applied for removing the lowest frame difference. In this paper, many videos are tested to insure the efficiency of this technique, in addition a good performance results has been obtained.[1]

The video compression technique developed by MPEG covers many applications from interactive systems on CD-ROM to delivery of video information over telecommunications networks. The MPEG video compression algorithm relies on two basic techniques: block based motion compensation for the reduction of the temporal redundancy and transform domain based compression for the reduction of spatial redundancy. Motion compensation techniques are applied with both predictive and interpolative techniques. The prediction error signal is further compressed with spatial redundancy reduction (DCT). The quality of the compressed video with the MPEG algorithm at about 1.5 Mbit/s has been compared to that of consumer grade VCR's.[12]

The use of video as instructional content has become popular in web-based learning environments. Considering that there are fragments of a video lecture that

may be of particular interest, in our study we analyzed the effects on interaction behavior and on students' perceived experience of providing an instructional video enriched with an interactive timeline highlighting points of interest. We offered a content test for a control group and an experimental group. In the former, participants used a video player with a conventional timeline. In the latter, participants used a video player with an additional interactive timeline indicating points of interest, corresponding to topic transitions in the lecture, which provided direct access to the point where a topic is introduced. Our findings indicate that the annotated interactive timeline affected students' behavior and improved their personal experience and efficiency in terms of interaction in video-based tasks. The experimental group significantly performed a lower number of clicks to find information and also reported diminished perceived workload scores when compared to the control group. Also, participants in the experimental group presented a more predictable and patterned search behavior than participants in the control group.[21]

Chapter 3

Proposed Methodology

3.1 Proposed Solution

The proposed system focuses on size efficiency of the output video. System acts well in the environment where there is storage issue and bandwidth issue in terms of internet transfer rate. Ultra-durability makes the system more portable to use and more reliable to handle. Re-positionable cameras make the system able to work well in different canvas sizes i.e. size of writing board. System automates the process of video compression technique. Video of the lecture is not recorded as it as video format rather only the important data is extracted. By utilizing the stereo vision and high-speed cameras and low wireless latency, video animation and sound quality is maintained in noisy environment as well.

3.2 General Proposed Model

General working model of the system can be seen below
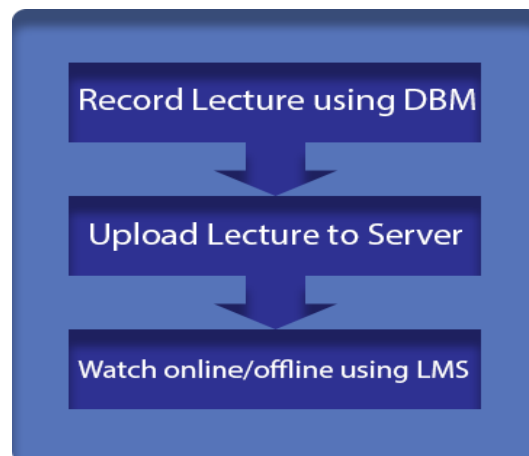
FIGURE 3.1: General Methodology View of the System

3.3 General Flow

The system consists on several modules and deliverables one of which is controller application. This application is quite important because it include major functionalities and complex image processing algorithms. Furthermore, the instructor in mainly connected to the controller application so that he/she is controlling the recording of lecture i.e. he can start, pause or stop the recording. After the lecture is recorded, he can replay the lecture for any further changes. When the lecture is finally uploaded to central computer, students can play lecture online or save the lecture file in .dbm(file extension) extension to watch later.

Offline player is also one of the major modules of the project. It plays the downloaded lecture file just like video player. Learning management system is the online platform where all uploaded online lecture hierarchy is accessible. It is a comprehensive management system designed by placing the convenience of instructor and student in focus. Reliability, security and quality are the top priorities. A simple visual of the working of system can be seen below
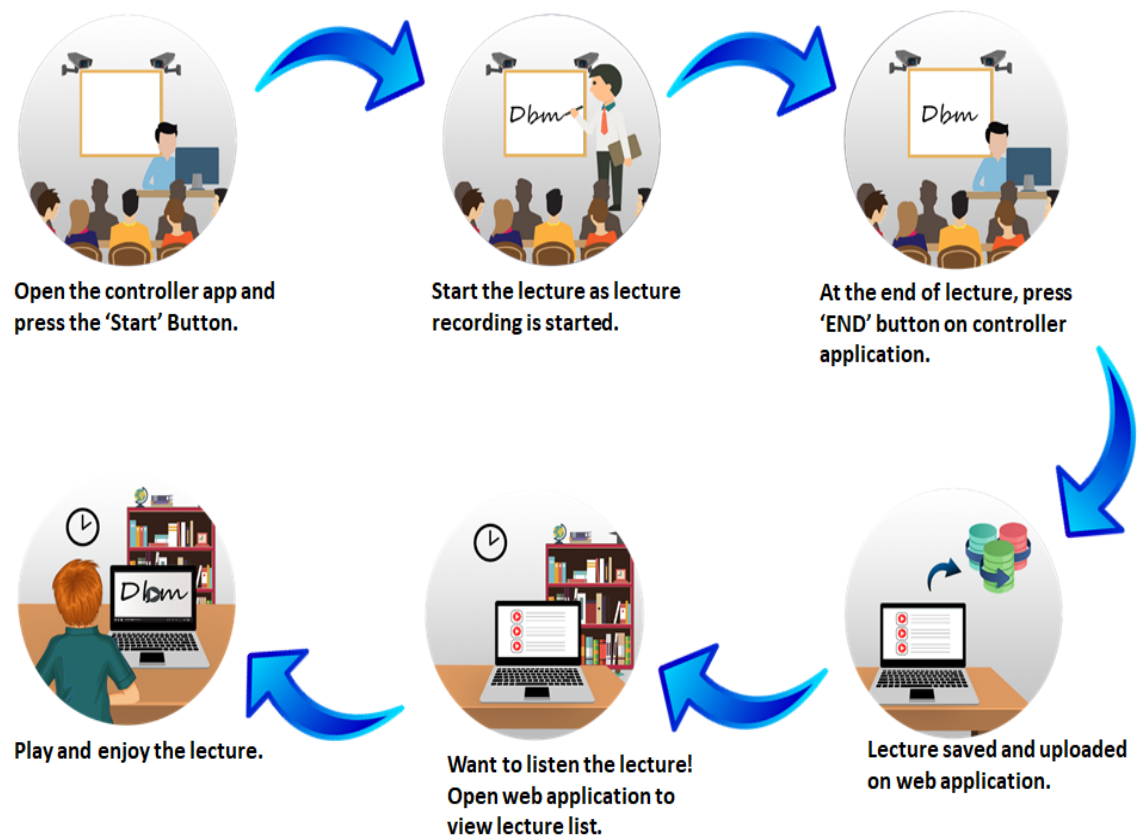
FIGURE 3.2: General Flow of the Project

3.4 Formulas Used

Descriptor	Explanation	Formula
Euler Angles Rotation Matrices	Transpose of the fixed-axis matrix. Used in orientation extraction of Board Marker	$$R_x(\theta) = \begin{bmatrix} 1 & 0 & 0 \\ 0 & \cos\theta & -\sin\theta \\ 0 & \sin\theta & \cos\theta \end{bmatrix}$$ $$R_y(\theta) = \begin{bmatrix} \cos\theta & 0 & \sin\theta \\ 0 & 1 & 0 \\ -\sin\theta & 0 & \cos\theta \end{bmatrix}$$ $$R_z(\theta) = \begin{bmatrix} \cos\theta & -\sin\theta & 0 \\ \sin\theta & \cos\theta & 0 \\ 0 & 0 & 1 \end{bmatrix}$$
Quaternion to Euler conversion	Used in Marker calibration when an offset is given in particular dimension.	$$\mathbf{q}_{IB} = \begin{bmatrix} \cos(\psi/2) \\ 0 \\ 0 \\ \sin(\psi/2) \end{bmatrix} \begin{bmatrix} \cos(\theta/2) \\ 0 \\ \sin(\theta/2) \\ 0 \end{bmatrix} \begin{bmatrix} \cos(\phi/2) \\ \sin(\phi/2) \\ 0 \\ 0 \end{bmatrix}$$
Euclidean distance formula	Used to compute the distance in one-dimension.	$$d(x,y) = \sqrt{\sum_{i=1}^{n}(x_i - y_i)^2}$$
Equation of line in slope-intercept form	Used to draw lines and get relative position of Marker with respect to cameras.	$y = mx + c$

TABLE 3.1: Formulae and Equations used

3.5 Use-Case Diagrams

To describe the system requirements, use-case diagrams in form of simple user interaction are detailed below

3.5.1 Controller Application

The main end user of controller application is the class instructor or teacher. Teacher use the controller application in

- Calibrating hardware

- Record the Lecture

- Live Stream Lecture

- Generate Lecture File and annotate it

- Send Lecture file to Central Server
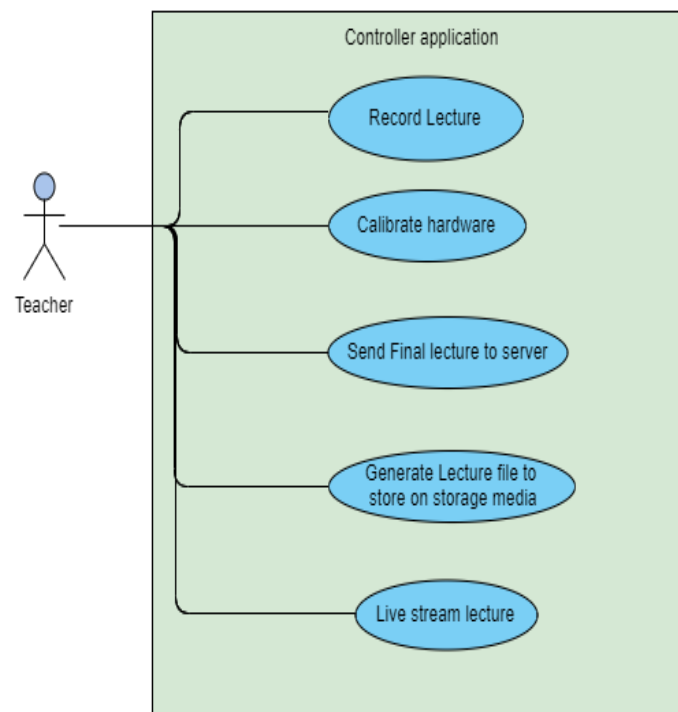
FIGURE 3.3: Use-case Diagram of Controller Application

3.5.2 Player Application

Just like media player, the player application plays the lecture. Common end user of Player Application is student. Teacher and Student are end users of controller application. Typical actions of Player application are:

- View Playlist

- Play Lecture

- Live Stream Lecture
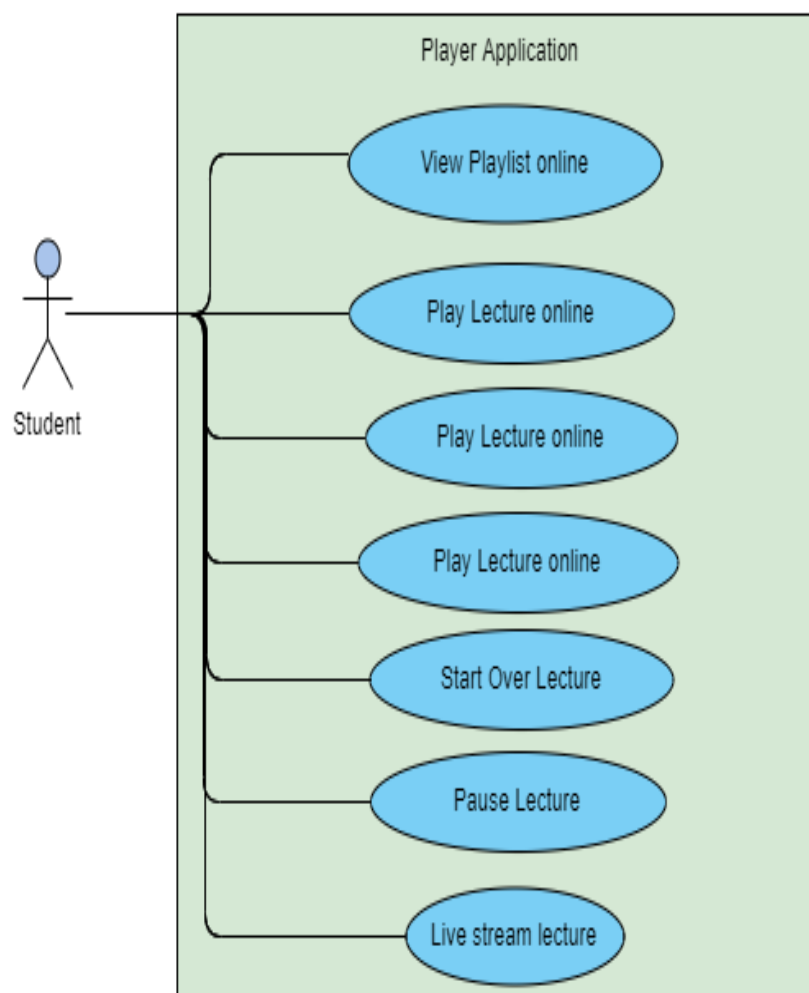
FIGURE 3.4: Use-case Diagram of Player Application

3.5.3 LMS Web Application

LMS application is major module in terms of accessibility. Students, Teachers and administration can have access to this module simultaneously. LMS functionality is sub-divided into following different users:

- Admin, who manages the institute.

- Teacher, who manages students

- Users, who are students
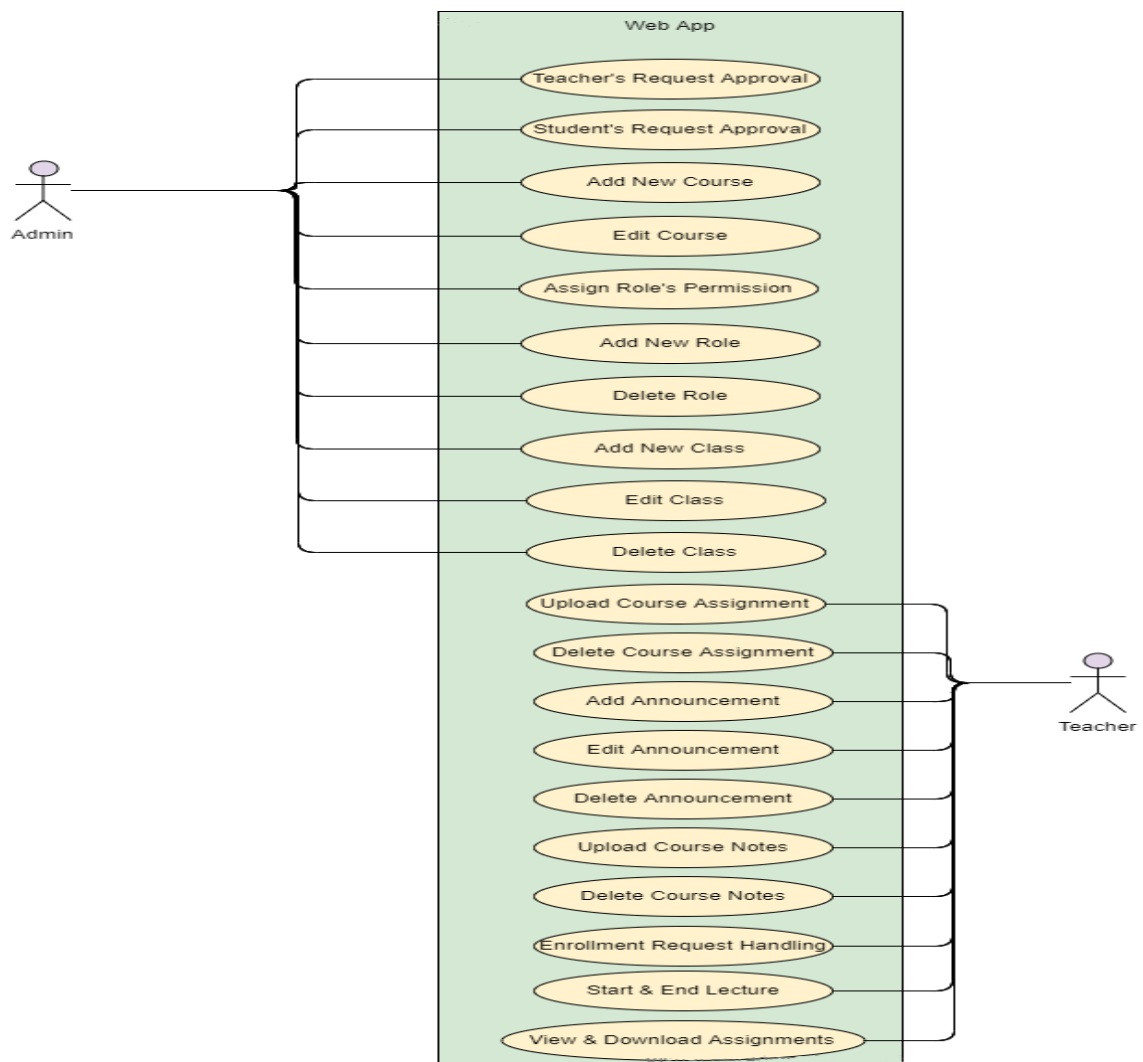
FIGURE 3.5: Use-case Diagram of LMS Web Application Part-I
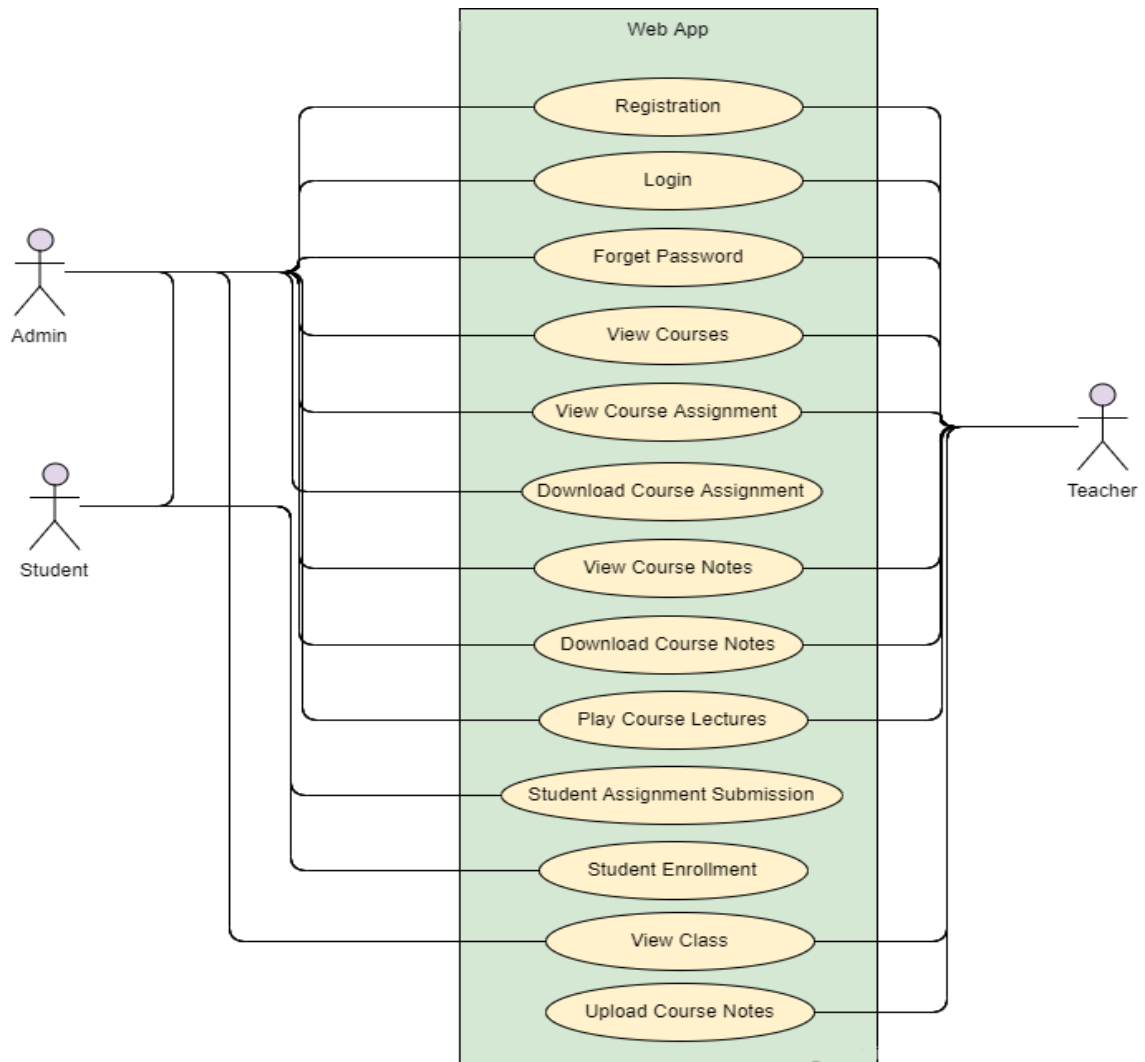
FIGURE 3.6: Use-case Diagram of LMS Web Application Part-II

3.6 Use Cases(Web App)

3.6.1 Use Case UC-1: User Registration

Stakeholders: University, Educational Institutes
Primary Actors: Student, Teacher
Post Condition:
User data successfully sent to admin request approval page.
Main Success Scenario:

1. User wants to register.

2. User clicks on the Register link from the main Page header.

3. Registration page will be open by the system.

4. User will enter First Name, Last Name, Email, CNIC, Password and Date of birth.

5. User will select Institute name from the select list.

6. User select whether he is teacher or a student from the select list.

7. If user is student then system will show a input box for student registration No.

8. Student will enter his registration Number.

9. User clicks the **Sign Up** button.

10. System then send data to the Admin Request Approval page for the student request approval.

Alternative Flow:

*a. At any time system fails.

1. User must check the internet connectivity.

2. Restart the browser and try again.

3. Try after sometime might be servers are down.

3a. Registration page is not opened.

1. Refresh the browser.

2. Reload the page and try again.

4a. User entered the invalid First Name, Last Name.

1. System will show the error message.

2. System will ask the user to enter the data again.

4b. User entered the invalid Email.

1. System will show the error message.

2. System will ask the user to enter the data again.

4c. User entered the invalid CNIC.

1. System will show the error message.

2. System will ask the user to enter the data again.

4d. User entered the invalid Registration No.

1. System will show the error message.

2. System will ask the user to enter the data again.

4e. User entered the invalid Date of birth.

1. System will show the error message.

2. System will ask the user to enter the data again.

8a. Student entered the registration No. in invalid format.

1. System will show the error message.

2. System will ask the user to enter the data again.

9a. Required fields are empty.

1. System will show the error message.

2. System will ask the user to complete all the required fields.

9b. Sign Up button is not clicked.

1. information will be saved as a draft for later use.

Frequency of Occurrence:
One time per user.

3.6.2   Use Case UC-2: User Login

Stakeholders: University, Educational Institutes
Primary Actors: Student, Teacher, Admin
Preconditions:

- User is approved by the admin.

- User is identified and authenticated.

- User's record is saved.

Post Condition:

- User is logged in into the system.

- User has access to different functionality of the system.

Main Success Scenario:

1. User wants to login.

2. User clicked on the login link to access the login page from the header.

3. System open the login page for the user.

4. User enter email address along with the password.

5. User clicked the **Sign In** button.

6. System validates the user email and password.

7. System will redirect the user to next page.

Alternative Flows:

*a. At any time, system fails.

1. User must check the internet connectivity.

2. Restart the browser and try again.

3. Try after sometime might be servers are down.

3a. Login page is not opened.

1. Refresh the browser.

2. Reload the page and try again.

4a. User entered invalid email and password.

1. System will show the error message.

2. System will ask the user to enter the data again.

5a. Required fields are empty.

   1. System will show the error message.

   2. System will ask the user to complete all the required fields.

6a. User is not identified or authenticated.

   1. System will show error message.

   2. System will ask the user to register yourself first.

Frequency of Occurrence:
Whenever the user wants to login.

3.6.3 Use Case UC-3: Teacher's Requests Approval/Disapproval

Stakeholders: University, Educational Institutes
Primary Actors: Admin
Preconditions:

- Admin is logged in the system..

- Admin is identified and authenticated.

Post Conditions:

- Requests are approved / disapproved.

- On approval / disapproval, Email is sent to the teacher.

- Teachers can login to the system.

Main Success Scenario:

1. Admin wants to handle the requests of teachers.

2. Admin clicks on the Teacher requests approval link from the header.

3. System open the **teachers request approval** page for the admin.

4. Admin can see the list of all the requests of teachers.

5. Admin clicks on the **Approve** button for approval of request.

6. System send the approval email to that teacher.

7. System show the success message to admin that email is sent.

8. System saves the record of the teacher.

9. System removes the request from the page.

10. Admin disapprove the request of a teacher by clicking on **Disapprove** button.

11. System delete that temporary record of the user.

12. System send an disapproval email to the teacher.

13. System show the success message to admin that email is sent.

14. System removes the request from the page.

Alternative Flows:

*a. At any time, system fails.

1. User must check the internet connectivity.

2. Restart the browser and try again.

3. Try after sometime might be servers are down.

3a. Page is not opened.

1. Refresh the browser.

2. Reload the page and try again.

5a. Approve button is not working properly.

1. Admin must have to refresh the page.

2. Restart the browser and try again.

3. May be some backend issue, resolve that issue.

6-7a. Email is not sent to the teacher.

1. Admin must again approve the request of teacher.

2. May be some backend issue, resolve that issue.

8-9a. Request is not removed from the page and record is unsaved.

1. Admin must again approve the request of teacher.

2. May be some backend issue, resolve that issue.

10a. Disapprove button is not working properly.

1. Admin must have to refresh the page.

2. Restart the browser and try again.

3. May be some backend issue, resolve that issue.

12-13a. Email is not sent to the teacher.

1. Admin must again approve the request of teacher.

2. May be some backend issue, resolve that issue.

14a. Request is not removed from the page.

1. Admin must again approve the request of teacher.

2. May be some backend issue, resolve that issue.

Frequency of Occurrence:
Whenever the requests appear on the page.
Open Issues:
What will happen if admin has mistakenly approve or disapprove the request of teacher?

3.6.4 Use Case UC-4: Student's Requests Approval/Dis-approvals

Stakeholders: University, Educational Institutes

Primary Actors: Admin

Preconditions:

- Admin is logged in the system..

- Admin is identified and authenticated.

Post Conditions:

- Requests are approved / disapproved.

- On approval / disapproval, Email is sent to the student.

- Students can login to the system.

Main Success Scenario:

1. Admin wants to handle the requests of students.

2. Admin clicks on the student requests approval link from the header.

3. System open the **Students Request Approval** page for the admin.

4. Admin can see the list of all the request of students.

5. Admin clicks on the **Approve** button for approval of request.

6. System send the approval email to that student.

7. System show the success message to admin that email is sent.

8. System saves the record of the student.

9. System removes the request from the page.

10. Admin disapprove the request of a student by clicking on **disapprove** button.

11. System delete that temporary record of the user.

12. System send an disapproval email to the student.

13. System show the success message to admin that email is sent.

14. System removes the request from the page.

Alternative Flows:

*a. At any time, system fails.

1. User must check the internet connectivity.

2. Restart the browser and try again.

3. Try after sometime might be servers are down.

3a. Page is not opened.

1. Refresh the browser.

2. Reload the page and try again.

5a. Approve button is not working properly.

1. Admin must have to refresh the page.

2. Restart the browser and try again.

3. May be some backend issue, resolve that issue.

6-7a. Email is not sent to the student.

1. Admin must again approve the request of student.

2. May be some backend issue, resolve that issue.

8-9a. Request is not removed from the page and record is unsaved.

1. Admin must again approve the request of student.

2. May be some backend issue, resolve that issue.

10a. Disapprove button is not working properly.

1. Admin must have to refresh the page.

2. Restart the browser and try again.

3. May be some backend issue, resolve that issue.

12-13a. Email is not sent to the teacher.

1. Admin must again approve the request of student.

2. May be some backend issue, resolve that issue.

14a. Request is not removed from the page.

1. Admin must again approve the request of student.

2. May be some backend issue, resolve that issue.

Frequency of Occurrence:
Whenever the admin get requests from students.
Open Issues:
What will happen if admin has mistakenly approve or disapprove the request of student?

3.6.5   Use Case UC-5: Add New Course

Stakeholders: University, Educational Institutes
Primary Actors: Admin
Preconditions:

- Admin is logged in the system.

- Admin is identified and authenticated.

Post Condition:
Course is added successfully.
Main Success Scenario:

1. Admin want to add new course.

2. He clicks on the course link from the header.

3. All courses screen will be open.

4. Admin clicks the **Add Course** button to add new course.

5. System open a new page.

6. Admin add all course related information.

7. Admin clicks the **Submit** button.

Alternative Flows:

*a. At any time, System fails.

1. User must check the internet connectivity.

2. Restart the browser and try again.

3. Try after sometime might be servers are down.

2a. Courses link is not shown on the header.

1. Admin must have to refresh the page.

2. Restart the browser and try again.

3a. All courses page is not opened.

1. Admin must check the internet connectivity.

2. Refresh the browser.

3. Reload the page and try again.

4a. Add button not working.

1. Admin must check the internet connectivity.

2. Refresh the browser.

3. Reload the page and try again.

4. May be some backend issue, try to resolve that issue.

5a. New page is not appearing.

1. Admin must check the internet connectivity.

2. Refresh the browser.

3. Try for sometime, may be servers are down.

6a. Admin enter invalid data.

1. System will prompt an error message.

2. System will ask the user to enter valid data.

7a. Required fields are empty.

1. System will prompt an error message.

2. System will ask the user to enter all the required information.

7b. Admin don't click on **Add** button.

1. System will save the record as draft for later use.

Frequency of Occurrence:
Whenever the admin wants to add new course.

3.6.6 Use Case UC-6: Edit Course

Stakeholders: University, Educational Institutes
Primary Actors: Admin
Preconditions:

- Admin is logged in the system.

- Admin is identified and authenticated.

- Course must be added.

Post Condition:
Course is updated successfully.

Main Success Scenario:

1. Admin wants to edit particular course.

2. Admin clicks on the courses link from the header.

3. System open a page of all courses.

4. Admin click on the **Edit** button of course which he wants to update.

5. Course Edit screen will appear.

6. Admin update the required information.

7. Admin clicks the **Update Course** button.

8. System update the course.

Alternative Flows:

*a. At any time, System fails.

1. User must check the internet connectivity.

2. Restart the browser and try again.

3. Try after sometime might be servers are down.

2a. Courses link is not shown on the header.

1. Admin must have to refresh the page.

2. Restart the browser and try again.

3a. All courses page is not opened.

1. Admin must check the internet connectivity.

2. Refresh the browser.

3. Reload the page and try again.

4a. Edit button not working.

1. Admin must check the internet connectivity.

2. Refresh the browser.

3. Reload the page and try again.

4. May be some backend issue, try to resolve that issue.

5a. Edit Course page is not appearing.

1. Admin must check the internet connectivity.

2. Refresh the browser.

3. Try for sometime, may be servers are down.

6a. Admin enter invalid data.

1. System will prompt an error message.

2. System will ask the user to enter valid data.

7a. Required fields are empty.

1. System will prompt an error message.

2. System will ask the user to enter all the required information.

7b. Admin don't click on **Update Course** button.

1. System will save the record as draft for later use.

Frequency of Occurrence:
Whenever the user wants to update the course information.

3.6.7   Use Case UC-7: Delete Course

Stakeholders: University, Educational Institutes
Primary Actors: Admin
Preconditions:

- Admin is logged in the system.

- Admin is identified and authenticated.

- Course must be added.

Post Condition:
Course is deleted successfully.
Main Success Scenario:

1. Admin wants to delete particular course.

2. Admin clicks on the courses link from the header.

3. System open a page of all courses.

4. Admin click on the **Delete** button of course which he wants to delete.

5. A pop message show "Are you sure you want to delete the course?".

6. Admin clicks the sure button.

7. System delete that course from the record.

Alternative Flows:

*a. At any time, System fails.

1. User must check the internet connectivity.

2. Restart the browser and try again.

3. Try after sometime might be servers are down.

2a. Courses link is not shown on the header.

1. Admin must have to refresh the page.

2. Restart the browser and try again.

3a. All courses page is not opened.

1. Admin must check the internet connectivity.

2. Refresh the browser.

3. Reload the page and try again.

4a. Delete button not working.

1. Admin must check the internet connectivity.

2. Refresh the browser.

3. Reload the page and try again.

4. May be some backend issue, try to resolve that issue.

5a. Admin clicks the sure button but course is not deleted.

1. May be servers are down. Try again after sometime.

2. Press again the delete button.

Frequency of Occurrence:
Whenever the admin wants to delete a course. **Open Issues:**
What will happen if admin has mistakenly deleted the course?

3.6.8 Use Case UC-8: View Courses

Stakeholders: University, Educational Institutes
Primary Actors: Admin,Teacher, Student
Preconditions:

- User is logged in the system.

- User is identified and authenticated.

- Courses must be added.

Post Condition:
Courses List is viewed successfully.
Main Success Scenario:

1. Admin wants to view all courses.

2. Admin clicks on the courses link from the header.

3. System open a page of all courses.

Alternative Flows:

*a. At any time, System fails.

1. User must check the internet connectivity.

2. Restart the browser and try again.

3. Try after sometime might be servers are down.

2a. Courses link is not shown on the header.

1. Admin must have to refresh the page.

2. Restart the browser and try again.

3a. All courses page is not opened.

1. Admin must check the internet connectivity.

2. Refresh the browser.

3. Reload the page and try again.

Frequency of Occurrence:
Whenever the user wants to view all course.

3.6.9 Use Case UC-9: Upload Course Assignment

Stakeholders: University, Educational Institutes
Primary Actors: Teacher
Preconditions:

- Teacher is logged in the system.

- User is identified and authenticated.

- Course is assigned to the teacher.

Post Condition:
Course assignment is uploaded successfully.
Main Success Scenario:

1. Teacher wants to upload course assignment.

2. Teacher clicks on the courses link from the header.

3. System opens a page of all courses.

4. Teacher clicks on the **View** button of course of which he wants to upload assignment.

5. System opens a course dashboard page.

6. Teacher clicks on the **Assignments** tab.

7. System opens the assignments page.

8. Teacher click on **Upload Assignment** button.

9. System opens upload assignment page.

10. Teacher enters all the data.

11. System validates the data.

12. Teacher press the **Upload Assignment** button.

13. System saves the assignment record.

Alternative Flows:

*a. At any time, System fails.

1. User must check the internet connectivity.

2. Restart the browser and try again.

3. Try after sometime might be servers are down.

2a. Courses link is not shown on the header.

1. User must have to refresh the page.

2. Restart the browser and try again.

3a. All courses page is not opened.

1. User must check the internet connectivity.

2. Refresh the browser.

3. Reload the page and try again.

4a. View button not working.

1. User must check the internet connectivity.

2. Refresh the browser.

3. Reload the page and try again.

4. May be some backend issue, try to resolve that issue.

5a. Course dasboard page is not opened.

1. User must check the internet connectivity.

2. Refresh the browser.

3. Reload the page and try again.

6a. Assignments tab not working.

1. Reload the page and try again.

2. May be some backend issue, try to resolve that issue.

7a. Assignments page is not opened.

1. User must check the internet connectivity.

2. Refresh the browser.

3. Reload the page and try again.

8a. Upload assignment button not working.

1. Reload the page and try again.

2. Check the internet connectivity.

3. May be some backend issue, try to resolve that issue.

9a. Upload assignment page is not opened.

1. User must check the internet connectivity.

2. Refresh the browser.

3. Reload the page and try again.

10-11a. User enter invalid data.

1. System will show error message.

2. System will ask the user to enter the data again.

12a. Required fields are empty.

1. System will show error message.

2. System will ask the user to enter the required data.

Frequency of Occurrence:
Whenever user wants to upload assignments.

3.6.10 Use Case UC-10: View Course Assignments

Stakeholders: University, Educational Institutes
Primary Actors: Teacher, Student
Preconditions:

- User is identified and authenticated.

- User is logged in the system.

- Student is enrolled in that course.

- Course is assigned to teacher.

Post Condition:
Course Assignment viewed successfully.
Main Success Scenario:

1. User wants to view course assignment.

2. User clicks on the courses link from the header.

3. System opens a page of all courses.

4. User clicks on the **View** button of course of which he wants to view assignment.

5. System opens a course dashboard page.

6. User clicks on the **Assignments** tab.

7. System opens the assignments page.

Alternative Flows:

*a. At any time, System fails.

1. User must check the internet connectivity.

2. Restart the browser and try again.

3. Try after sometime might be servers are down.

2a. Courses link is not shown on the header.

1. User must have to refresh the page.

2. Restart the browser and try again.

3a. All courses page is not opened.

1. User must check the internet connectivity.

2. Refresh the browser.

3. Reload the page and try again.

4a. View button not working.

1. User must check the internet connectivity.

2. Refresh the browser.

3. Reload the page and try again.

4. May be some backend issue, try to resolve that issue.

5a. Course dasboard page is not opened.

1. User must check the internet connectivity.

2. Refresh the browser.

3. Reload the page and try again.

6a. Assignments tab not working.

1. Reload the page and try again.

2. May be some backend issue, try to resolve that issue.

7a. Assignments page is not opened.

1. User must check the internet connectivity.

2. Refresh the browser.

3. Reload the page and try again.

Frequency of Occurrence:
Whenever user wants to view assignments.

3.6.11 Use Case UC-11: Download Course Assignment

Stakeholders: University, Educational Institutes
Primary Actors: Teacher, Student
Preconditions:

- User is logged in the system.

- User is identified and authenticated.

- Course is assigned to the teacher.

- Student is enrolled in that course.

Post Condition:
Course assignment is downloaded successfully.
Main Success Scenario:

1. User wants to download course assignment.

2. User clicks on the courses link from the header.

3. System opens a page of all courses.

4. User clicks on the **View** button of course of which he wants to download assignment.

5. System opens a course dashboard page.

6. User clicks on the **Assignments** tab.

7. System opens the assignments page.

8. User click on **Download Assignment** button.

9. System downloads the assignment file for the user.

Alternative Flows:

*a. At any time, System fails.

1. User must check the internet connectivity.

2. Restart the browser and try again.

3. Try after sometime might be servers are down.

2a. Courses link is not shown on the header.

    1. User must have to refresh the page.

    2. Restart the browser and try again.

3a. All courses page is not opened.

    1. User must check the internet connectivity.

    2. Refresh the browser.

    3. Reload the page and try again.

4a. View button not working.

    1. User must check the internet connectivity.

    2. Refresh the browser.

    3. Reload the page and try again.

    4. May be some backend issue, try to resolve that issue.

5a. Course dasboard page is not opened.

    1. User must check the internet connectivity.

    2. Refresh the browser.

    3. Reload the page and try again.

6a. Assignments tab not working.

    1. Reload the page and try again.

    2. May be some backend issue, try to resolve that issue.

7a. Assignments page is not opened.

    1. User must check the internet connectivity.

    2. Refresh the browser.

   3. Reload the page and try again.

8a. Download assignment button not working.

   1. Reload the page and try again.

   2. Check the internet connectivity.

   3. May be some backend issue, try to resolve that issue.

Frequency of Occurrence:
Whenever user wants to download assignments.

3.6.12   Use Case UC-12: Delete Course Assignment

Stakeholders: University, Educational Institutes
Primary Actors: Teacher
Preconditions:

- Teacher is logged in the system.

- User is identified and authenticated.

- Course is assigned to the teacher.

Post Condition:
Course assignment is deleted successfully.
Main Success Scenario:

1. Teacher wants to delete course assignment.

2. Teacher clicks on the courses link from the header.

3. System opens a page of all courses.

4. Teacher clicks on the **View** button of course of which he wants to upload assignment.

5. System opens a course dashboard page.

6. Teacher clicks on the **Assignments** tab.

7. System opens the assignments page.

8. Teacher click on **Delete Assignment** button.

9. A pop message show "Are you sure you want to delete the assignment?".

10. Teacher clicks the sure button.

11. System delete that assignment from the record.

Alternative Flows:

*a. At any time, System fails.

1. User must check the internet connectivity.

2. Restart the browser and try again.

3. Try after sometime might be servers are down.

2a. Courses link is not shown on the header.

1. User must have to refresh the page.

2. Restart the browser and try again.

3a. All courses page is not opened.

1. User must check the internet connectivity.

2. Refresh the browser.

3. Reload the page and try again.

4a. View button not working.

1. User must check the internet connectivity.

2. Refresh the browser.

3. Reload the page and try again.

4. May be some backend issue, try to resolve that issue.

5a. Course dasboard page is not opened.

1. User must check the internet connectivity.

2. Refresh the browser.

3. Reload the page and try again.

6a. Assignments tab not working.

1. Reload the page and try again.

2. May be some backend issue, try to resolve that issue.

7a. Assignments page is not opened.

1. User must check the internet connectivity.

2. Refresh the browser.

3. Reload the page and try again.

8a. Delete assignment button not working.

1. Reload the page and try again.

2. May be some backend issue, try to resolve that issue.

10-11a. Teacher clicks the sure button but assignment is not deleted.

1. May be servers are down. Try again after sometime.

2. Press again the delete button.

Frequency of Occurrence:
Whenever user wants to delete assignment.

3.6.13   Use Case UC-13: Add Course Announcement

Stakeholders: University, Educational Institutes
Primary Actors: Teacher
Preconditions:

- Teacher is logged in the system.

- Teacher is identified and authenticated.

- Course is assigned to the teacher.

Post Condition:

Course Announcement is added successfully.

Main Success Scenario:

1. Teacher wants to add course related announcement.

2. Teacher clicks on the courses link from the header.

3. System opens a page of all courses.

4. Teacher clicks on the **View** button of course of which he wants to add announcement.

5. System opens a course dashboard page.

6. Teacher clicks on the **Announcement** tab.

7. System opens the announcement page.

8. Teacher click on **Add Announcement** button.

9. System opens add announcement page.

10. Teacher enters all the data.

11. System validates the data.

12. Teacher press the **Add Announcement** button.

13. System saves the announcement record.

Alternative Flows:

*a. At any time, System fails.

1. User must check the internet connectivity.

2. Restart the browser and try again.

3. Try after sometime might be servers are down.

2a. Courses link is not shown on the header.

1. User must have to refresh the page.

2. Restart the browser and try again.

3a. All courses page is not opened.

1. User must check the internet connectivity.

2. Refresh the browser.

3. Reload the page and try again.

4a. View button not working.

1. User must check the internet connectivity.

2. Refresh the browser.

3. Reload the page and try again.

4. May be some backend issue, try to resolve that issue.

5a. Course dasboard page is not opened.

1. User must check the internet connectivity.

2. Refresh the browser.

3. Reload the page and try again.

6a. Announcement tab not working.

1. Reload the page and try again.

2. May be some backend issue, try to resolve that issue.

7a. Announcement page is not opened.

1. User must check the internet connectivity.

2. Refresh the browser.

3. Reload the page and try again.

8a. Add announcement button not working.

1. Reload the page and try again.

2. May be some backend issue, try to resolve that issue.

9a. Add announcement page is not opened.

1. User must check the internet connectivity.

2. Refresh the browser.

3. Reload the page and try again.

Frequency of Occurrence:
Whenever user wants to add announcement.

3.6.14   Use Case UC-14 :Edit Course Announcement

Stakeholders: University, Educational Institutes
Primary Actors: Teacher
Preconditions:

- Teacher is identified and authenticated.

- Teacher is logged in the system.

- Course is assigned to the teacher.

Post Condition:
Course Announcement is updated successfully.

Main Success Scenario:

1. Teacher wants to edit course related announcement.

2. Teacher clicks on the courses link from the header.

3. System opens a page of all courses.

4. Teacher clicks on the **View** button of course of which he wants to edit announcement.

5. System opens a course dashboard page.

6. Teacher clicks on the **Announcement** tab.

7. System opens the announcement page.

8. Teacher click on **Edit Announcement** button of the announcement.

9. System opens edit announcement page.

10. Teacher edit the required data.

11. System validates the data.

12. Teacher press the **Update Announcement** button.

13. System updates the announcement record.

Alternative Flows:

*a. At any time, System fails.

1. User must check the internet connectivity.

2. Restart the browser and try again.

3. Try after sometime might be servers are down.

2a. Courses link is not shown on the header.

1. User must have to refresh the page.

2. Restart the browser and try again.

3a. All courses page is not opened.

1. User must check the internet connectivity.

2. Refresh the browser.

3. Reload the page and try again.

4a. View button not working.

1. User must check the internet connectivity.

2. Refresh the browser.

3. Reload the page and try again.

4. May be some backend issue, try to resolve that issue.

5a. Course dasboard page is not opened.

1. User must check the internet connectivity.

2. Refresh the browser.

3. Reload the page and try again.

6a. Announcement tab not working.

1. Reload the page and try again.

2. May be some backend issue, try to resolve that issue.

7a. Announcement page is not opened.

1. User must check the internet connectivity.

2. Refresh the browser.

3. Reload the page and try again.

8a. Edit announcement button not working.

1. Reload the page and try again.

2. May be some backend issue, try to resolve that issue.

9a. Update announcement page is not opened.

1. User must check the internet connectivity.

2. Refresh the browser.

3. Reload the page and try again.

10a. Teacher enters the invalid data.

1. System prompts the error message.

2. System will ask the user to enter the data again.

12a. Required fields are empty.

1. System prompts the error message.

2. System will ask the user to enter the data in the empty fields.

Frequency of Occurrence:
Whenever user wants to update announcement.

3.6.15 Use Case UC-15: Delete Course Announcement

Stakeholders: University, Educational Institutes

Primary Actors: Teacher

Preconditions:

- User is identified and authenticated.

- User is logged in the system.

- Course is assigned to the teacher.

Post Condition:

Course announcement is deleted successfully.

Main Success Scenario:

1. Teacher wants to delete course announcement.

2. Teacher clicks on the courses link from the header.

3. System opens a page of all courses.

4. Teacher clicks on the **View** button of course of which he wants to delete announcement.

5. System opens a course dashboard page.

6. Teacher clicks on the **Announcements** tab.

7. System opens the announcements page.

8. Teacher click on **Delete Announcement** button.

9. A pop message show "Are you sure you want to delete the announcement?".

10. Teacher clicks the sure button.

11. System delete that announcement from the record.

Alternative Flows:

*a. At any time, System fails.

1. User must check the internet connectivity.

2. Restart the browser and try again.

3. Try after sometime might be servers are down.

2a. Courses link is not shown on the header.

1. User must have to refresh the page.

2. Restart the browser and try again.

3a. All courses page is not opened.

1. User must check the internet connectivity.

2. Refresh the browser.

3. Reload the page and try again.

4a. View button not working.

1. User must check the internet connectivity.

2. Refresh the browser.

3. Reload the page and try again.

4. May be some backend issue, try to resolve that issue.

5a. Course dasboard page is not opened.

1. User must check the internet connectivity.

2. Refresh the browser.

3. Reload the page and try again.

6a. Announcement tab not working.

1. Reload the page and try again.

2. May be some backend issue, try to resolve that issue.

7a. Announcement page is not opened.

1. User must check the internet connectivity.

2. Refresh the browser.

3. Reload the page and try again.

8a. Delete announcement button not working.

1. Reload the page and try again.

2. May be some backend issue, try to resolve that issue.

10-11a. Teacher clicks the sure button but announcement is not deleted.

1. May be servers are down. Try again after sometime.

2. Press again the delete button.

Frequency of Occurrence:
Whenever user wants to delete announcement.
Open Issues:
What will happen if teacher have mistakenly delete the announcement?

3.6.16 Use Case UC-16: Student Assignment Submission

Stakeholders: University, Educational Institutes
Primary Actors: Student
Preconditions:

- User is identified and authenticated.

- User is logged in the system.

- Student is enrolled in that course.

Post Condition:
Assignment is submitted successfully.

Main Success Scenario:

1. Student wants to submit course assignment.

2. Student clicks on the courses link from the header.

3. System opens a page of all courses.

4. Student clicks on the **View** button of course of which he wants to submit assignment.

5. System opens a course dashboard page.

6. Student clicks on the **Assignment** tab.

7. System opens the assignment page.

8. Student click on **Submit Assignment** button.

9. System open a new page.

10. Student upload assignment file which he/she wants to submit.

11. Student clicks on the **Submit** button.

12. System save the assignment of student in the record.

Alternative Flows:

*a. At any time, System fails.

1. User must check the internet connectivity.

2. Restart the browser and try again.

3. Try after sometime might be servers are down.

2a. Courses link is not shown on the header.

1. User must have to refresh the page.

2. Restart the browser and try again.

3a. All courses page is not opened.

1. User must check the internet connectivity.

2. Refresh the browser.

3. Reload the page and try again.

4a. View button not working.

1. User must check the internet connectivity.

2. Refresh the browser.

3. Reload the page and try again.

4. May be some backend issue, try to resolve that issue.

5a. Course dasboard page is not opened.

1. User must check the internet connectivity.

2. Refresh the browser.

3. Reload the page and try again.

6a. Assignment tab not working.

1. Reload the page and try again.

2. May be some backend issue, try to resolve that issue.

7a. Assignment page is not opened.

1. User must check the internet connectivity.

2. Refresh the browser.

3. Reload the page and try again.

8a. Submit assignment button not working.

1. Reload the page and try again.

2. May be some backend issue, try to resolve that issue.

9a. Submit assignment page is not opened.

1. User must check the internet connectivity.

2. Reload the page and try again.

3. May be some backend issue, try to resolve that issue.

11a. Assignment file is not attached.

1. System will show error message.

2. System will ask the user to attach the file first.

Frequency of Occurrence:
Whenever user wants to submit assignment.

3.6.17   Use Case UC-17: Upload Course Notes

Stakeholders: University, Educational Institutes
Primary Actors: Teacher

Preconditions:

- Teacher is logged in the system.

- User is identified and authenticated.

- Course is assigned to the teacher.

Post Condition:
Course notes uploaded successfully.
Main Success Scenario:

1. Teacher wants to upload course notes.

2. Teacher clicks on the courses link from the header.

3. System opens a page of all courses.

4. Teacher clicks on the **View** button of course of which he wants to upload assignment.

5. System opens a course dashboard page.

6. Teacher clicks on the **Notes** tab.

7. System opens the Notes page.

8. Teacher click on **Add Notes** button.

9. System opens upload notes page.

10. Teacher enters all the data.

11. System validates the data.

12. Teacher press the **Submit** button.

13. System saves the notes.

Alternative Flows:
*a. At any time, System fails.

1. User must check the internet connectivity.

2. Restart the browser and try again.

3. Try after sometime might be servers are down.

2a. Courses link is not shown on the header.

1. User must have to refresh the page.

2. Restart the browser and try again.

3a. All courses page is not opened.

1. User must check the internet connectivity.

2. Refresh the browser.

3. Reload the page and try again.

4a. View button not working.

1. User must check the internet connectivity.

2. Refresh the browser.

3. Reload the page and try again.

4. May be some backend issue, try to resolve that issue.

5a. Course dasboard page is not opened.

1. User must check the internet connectivity.

2. Refresh the browser.

3. Reload the page and try again.

6a. Notes tab not working.

1. Reload the page and try again.

2. May be some backend issue, try to resolve that issue.

7a. Notes page is not opened.

1. User must check the internet connectivity.

2. Refresh the browser.

3. Reload the page and try again.

8a. Upload notes button not working.

1. Reload the page and try again.

2. Check the internet connectivity.

3. May be some backend issue, try to resolve that issue.

9a. Upload notes page is not opened.

1. User must check the internet connectivity.

2. Refresh the browser.

3. Reload the page and try again.

12a. Required fields are empty.

1. System will show error message.

2. System will ask the user to enter the required data.

Frequency of Occurrence:
Whenever user wants to upload course notes.

3.6.18   Use Case UC-18: View Course Notes

Stakeholders: University, Educational Institutes
Primary Actors: Teacher, Student
Preconditions:

- User is identified and authenticated.

- User is logged in the system.

- Student is enrolled in that course.

- Course is assigned to teacher.

- Course Notes are added.

Post Condition:
Course notes viewed successfully.

Main Success Scenario:

1. User wants to view course notes.

2. User clicks on the courses link from the header.

3. System opens a page of all courses.

4. User clicks on the **View** button of course of which he wants to view notes.

5. System opens a course dashboard page.

6. User clicks on the **Notes** tab.

7. System opens the notes page.

Alternative Flows:

*a. At any time, System fails.

1. User must check the internet connectivity.

2. Restart the browser and try again.

3. Try after sometime might be servers are down.

2a. Courses link is not shown on the header.

1. User must have to refresh the page.

2. Restart the browser and try again.

3a. All courses page is not opened.

1. User must check the internet connectivity.

2. Refresh the browser.

3. Reload the page and try again.

4a. View button not working.

1. User must check the internet connectivity.

2. Refresh the browser.

3. Reload the page and try again.

4. May be some backend issue, try to resolve that issue.

5a. Course dasboard page is not opened.

1. User must check the internet connectivity.

2. Refresh the browser.

3. Reload the page and try again.

6a. Notes tab not working.

1. Reload the page and try again.

2. May be some backend issue, try to resolve that issue.

7a. Notes page is not opened.

1. User must check the internet connectivity.

2. Refresh the browser.

3. Reload the page and try again.

Frequency of Occurrence:
Whenever user wants to view course notes.

3.6.19   Use Case UC-19: Download Course notes

Stakeholders: University, Educational Institutes
Primary Actors: Teacher, Student
Preconditions:

- User is logged in the system.

- User is identified and authenticated.

- Course is assigned to the teacher.

- Student is enrolled in that course.

- Course notes are added.

Post Condition:
Course notes downloaded successfully.
Main Success Scenario:

1. User wants to download course notes.

2. User clicks on the courses link from the header.

3. System opens a page of all courses.

4. User clicks on the **View** button of course of which he wants to download notes.

5. System opens a course dashboard page.

6. User clicks on the **Notes** tab.

7. System opens the notes page.

8. User click on **Download Notes** button.

9. System downloads the notes file for the user.

Alternative Flows:

*a. At any time, System fails.

1. User must check the internet connectivity.

2. Restart the browser and try again.

3. Try after sometime might be servers are down.

2a. Courses link is not shown on the header.

1. User must have to refresh the page.

2. Restart the browser and try again.

3a. All courses page is not opened.

1. User must check the internet connectivity.

2. Refresh the browser.

3. Reload the page and try again.

4a. View button not working.

1. User must check the internet connectivity.

2. Refresh the browser.

3. Reload the page and try again.

4. May be some backend issue, try to resolve that issue.

5a. Course dasboard page is not opened.

1. User must check the internet connectivity.

2. Refresh the browser.

3. Reload the page and try again.

6a. Notes tab not working.

1. Reload the page and try again.

2. May be some backend issue, try to resolve that issue.

7a. Notes page is not opened.

1. User must check the internet connectivity.

2. Refresh the browser.

3. Reload the page and try again.

8a. Download notes button not working.

1. Reload the page and try again.

2. Check the internet connectivity.

3. May be some backend issue, try to resolve that issue.

Frequency of Occurrence:
Whenever user wants to download notes.

3.6.20 Use Case UC-20: Delete Course Notes

Stakeholders: University, Educational Institutes

Primary Actors: Teacher

Preconditions:

- Teacher is logged in the system.

- User is identified and authenticated.

- Course is assigned to the teacher.

- Course notes are added.

Post Condition:

Course notes deleted successfully.

Main Success Scenario:

1. Teacher wants to delete course notes.

2. Teacher clicks on the courses link from the header.

3. System opens a page of all courses.

4. Teacher clicks on the **View** button of course of which he wants to delete notes.

5. System opens a course dashboard page.

6. Teacher clicks on the **Notes** tab.

7. System opens the notes page.

8. Teacher click on **Delete Notes** button.

9. A pop message show "Are you sure you want to delete the notes?".

10. Teacher clicks the sure button.

11. System delete that notes from the record.

Alternative Flows:

*a. At any time, System fails.

1. User must check the internet connectivity.

2. Restart the browser and try again.

3. Try after sometime might be servers are down.

2a. Courses link is not shown on the header.

1. User must have to refresh the page.

2. Restart the browser and try again.

3a. All courses page is not opened.

1. User must check the internet connectivity.

2. Refresh the browser.

3. Reload the page and try again.

4a. View button not working.

1. User must check the internet connectivity.

2. Refresh the browser.

3. Reload the page and try again.

4. May be some backend issue, try to resolve that issue.

5a. Course dasboard page is not opened.

1. User must check the internet connectivity.

2. Refresh the browser.

3. Reload the page and try again.

6a. Notes tab not working.

1. Reload the page and try again.

2. May be some backend issue, try to resolve that issue.

7a. Notes page is not opened.

1. User must check the internet connectivity.

2. Refresh the browser.

3. Reload the page and try again.

8a. Delete notes button not working.

1. Reload the page and try again.

2. May be some backend issue, try to resolve that issue.

10-11a. Teacher clicks the sure button but notes not deleted.

1. May be servers are down. Try again after sometime.

2. Press again the delete button.

Frequency of Occurrence:
Whenever user wants to delete notes.
Open Issues:
What will happen if teacher has mistakenly deleted the course notes?

3.6.21 Use Case UC-21: Student's Course Enrolment

Stakeholders: University, Educational Institutes
Primary Actors: Student
Preconditions:

- User is identified and authenticated.

- User is logged in the system.

- Course must be added.

Post Condition:
Course enrollment request sent to the teacher successfully.
Main Success Scenario:

1. Student wants to enroll in a course.

2. Student clicks on the courses link from the header.

3. System open a page of all courses.

4. Students clicks on the **Enroll** button of the course.

5. System change the status of enrollment from Not Enrolled to pending.

6. System send the enrollment request to the course teacher.

Alternative Flows:

*a. At any time, System fails.

1. User must check the internet connectivity.

2. Restart the browser and try again.

3. Try after sometime might be servers are down.

2a. Courses link is not shown on the header.

1. Student must have to refresh the page.

2. Restart the browser and try again.

3a. All courses page is not opened.

1. Student must check the internet connectivity.

2. Refresh the browser.

3. Reload the page and try again.

4a. Enrollment link is not working.

1. Student must check the internet connectivity.

2. Refresh the browser.

3. Reload the page and try again.

5a. Enrollment status is not changed.

1. Refresh the browser.

2. Reload the page and try again.

Frequency of Occurrence:
Whenever the user wants to enroll in a course.

3.6.22 Use Case UC-22: Course Enrolment Requests Handling

Stakeholders: University, Educational Institutes

Primary Actors: Teacher

Preconditions:

- Teacher is identified and authenticated.

- Teacher is logged in the system.

- Course is added.

- Teacher is assigned a course.

Post Conditions:

- Course enrollment requests are approved / disapproved.

- On approval / disapproval, Email is sent to the student.

- Students can view course details.

Main Success Scenario:

1. Teacher wants to handle the requests of student's course enrollment.

2. Teacher clicks on courses link from the header.

3. System opens a page of course assigned to teacher.

4. Teacher clicks on the enrollment requests button of the course of which he wants to approve/disapprove requests.

5. System open the **Course Enrollment Requests** page for the teacher.

6. Teacher can see the list of all the request of students.

7. Teacher clicks on the **Approve** button for approval of request.

8. System send the approval email to that student.

9. System show the success message to admin that email is sent.

10. System now allow the student to view all course details.

11. System removes the request from the page.

12. Teacher disapprove the request of a student by clicking on **disapprove** button.

13. System delete that temporary record of the user.

14. System send an disapproval email to the student.

15. System show the success message to admin that email is sent.

16. System removes the request from the page.

Alternative Flows:

*a. At any time, system fails.

1. User must check the internet connectivity.

2. Restart the browser and try again.

3. Try after sometime might be servers are down.

3a. Assigned Course page is not opened.

1. Refresh the browser.

2. Reload the page and try again.

4a. Enrollment request link is not working.

1. Teacher must have to refresh the page.

2. Restart the browser and try again.

3. May be some backend issue, resolve that issue.

5a. Course Enrollment Requests page is not opened.

1. Refresh the browser.

2. Reload the page and try again.

7a. Approve button is not working properly.

1. User must have to refresh the page.

2. Restart the browser and try again.

3. May be some backend issue, resolve that issue.

8-9a. Email is not sent to the student.

1. User must again approve the request of student.

2. May be some backend issue, resolve that issue.

11a. Request is not removed from the page.

1. User must again approve the request of student.

2. May be some backend issue, resolve that issue.

12a. Disapprove button is not working properly.

1. User must have to refresh the page.

2. Restart the browser and try again.

3. May be some backend issue, resolve that issue.

14a. Email is not sent to the teacher.

1. User must again approve the request of student.

2. May be some backend issue, resolve that issue.

16a. Request is not removed from the page.

1. Admin must again approve the request of student.

2. May be some backend issue, resolve that issue.

Frequency of Occurrence:
Whenever the teacher get course enrollment requests from students.
Open Issues:
What will happen if teacher has mistakenly approve or disapprove the course enrollment request of student?

3.6.23 Use Case UC-23: Assign Courses

Stakeholders: University, Educational Institutes

Primary Actors: Admin

Preconditions:

- User is logged in the system.

- User is identified and authenticated.

- Courses must be added.

Post Condition:

Course is assigned successfully.

Main Success Scenario:

1. Admin wants to assign courses to teacher.

2. Admin clicks on the courses link from the header.

3. System open a page of all courses.

4. Admin clicks the **View** button.

5. System open the course dashboard.

6. Admin clicks on the **Assign Course** button.

7. System open the assign course page for the user.

8. Admin select the teacher to which he wants to assign course.

9. Admin clicks the **Submit** button.

10. System saves the record i.e assign course to the teacher.

Alternative Flows:

*a. At any time, System fails.

1. User must check the internet connectivity.

2. Restart the browser and try again.

3. Try after sometime might be servers are down.

2a. Courses link is not shown on the header.

    1. Admin must have to refresh the page.

    2. Restart the browser and try again.

3a. All courses page is not opened.

    1. Admin must check the internet connectivity.

    2. Refresh the browser.

    3. Reload the page and try again.

4a. View button is not working.

    1. Reload the page and try again.

    2. May be some backend issue. Admin must resolve it.

5a. Course dashboard page is not opened.

    1. Admin must check the internet connectivity.

    2. Refresh the browser.

    3. Reload the page and try again.

6a. Assign course button is not working.

    1. Reload the page and try again.

    2. May be some backend issue. Admin must resolve it.

7a. Assign Course page is not opened.

    1. Admin must check the internet connectivity.

    2. Refresh the browser.

    3. Reload the page and try again.

9a. User didn't select any teacher.

    1. System show error message.

    2. System will ask the user to select atleast one teacher.

Frequency of Occurrence:
Whenever the user wants to assign course.

3.6.24 Use Case UC-24: View Students Assignments

Stakeholders: University, Educational Institutes

Primary Actors: Teacher

Preconditions:

- Teacher is identified and authenticated.

- Teacher is logged in the system.

- Course is added.

- Teacher is assigned a course.

- Course assignments uploaded.

Post Conditions:

Students assignments viewed successfully.

Main Success Scenario:

1. Teacher wants to view students assignments.

2. Teacher clicks on courses link from the header.

3. System opens a page of all courses.

4. Teacher clicks on the course which he is assigned and click on the button of submitted assignments.

5. System open the **Students Assignments** page for the teacher.

6. Teacher can see the list of all the assignments of students.

Alternative Flows:

*a. At any time, system fails.

1. User must check the internet connectivity.

2. Restart the browser and try again.

3. Try after sometime might be servers are down.

3a. Assigned Course page is not opened.

1. Refresh the browser.

2. Reload the page and try again.

4a. Students Assignments button is not working.

1. Teacher must have to refresh the page.

2. Restart the browser and try again.

3. May be some backend issue, resolve that issue.

5a. Students Assignments page is not opened.

1. Refresh the browser.

2. Reload the page and try again.

Frequency of Occurrence:
Whenever the teacher wants to view the students assignment.

3.6.25 Use Case UC-25: Download Student's Assignments

Stakeholders: University, Educational Institutes
Primary Actors: Teacher
Preconditions:

- Teacher is identified and authenticated.

- Teacher is logged in the system.

- Course is added.

- Teacher is assigned a course.

- Students have submitted the assignments.

Post Conditions:
Teacher downloaded the assignments successfully. **Main Success Scenario:**

1. Teacher wants to download the students assignments.

2. Teacher clicks on assigned courses link from the header.

3. System opens a page of all courses assigned to teacher.

4. Teacher clicks on the **Students Assignments** link.

5. System open the **Students Assignments** page for the teacher.

6. Teacher can see the list of all the students assignments.

7. Teacher clicks on the **Download** button.

8. System download the Assignments files for the user.

Alternative Flows:

*a. At any time, system fails.

1. User must check the internet connectivity.

2. Restart the browser and try again.

3. Try after sometime might be servers are down.

3a. Assigned Course page is not opened.

1. Refresh the browser.

2. Reload the page and try again.

4a. Students Assignments link is not working.

1. Teacher must have to refresh the page.

2. Restart the browser and try again.

3. May be some backend issue, resolve that issue.

5a. Students Assignments page is not opened.

1. Refresh the browser.

2. Reload the page and try again.

7a. Download button is not working properly.

1. User must have to refresh the page.

2. Restart the browser and try again.

3. May be some backend issue, resolve that issue.

8a. Assignments files not downloaded.

1. User must have to refresh the page.

2. Restart the browser and try again.

3. May be some backend issue, resolve that issue.

Frequency of Occurrence:
Whenever the teacher wants to download the Students Assignments.

3.7 Use Cases (Offline Player)

3.7.1 Use Case UC1: User Authentication

Stakeholders: University, Educational Institutes
Primary Actors: Student, Teacher
Post Condition:
User data successfully sent to server and token successfully saved in local database.
Main Success Scenario:

1. User has to authenticate to use other features.

2. User clicks on the authenticate button on dashboard.

3. Authentication page will be opened.

4. User will enter username and password.

5. User clicks the **Login** button.

6. System then send data to the web api to authenticate user and show proper message based on data.

Alternative Flow:
a*. At any time system fails.

1. User must check the internet connectivity.

2. Try after sometime might be servers are down.

3a. Authentication page is not opened.

1. Make sure the internet connectivity.

2. try again.

4a. User entered the invalid username.

1. System will show the error message.

2. System will ask the user to enter the data again.

4b. User entered the invalid password.

1. System will show the error message.

2. System will ask the user to enter the data again.

3.7.2 Use Case UC2: View Lecture Playlist(Online)

Stakeholders: University, Educational Institutes
Primary Actors: Student, Teacher
Post Condition:
All the downloaded and recently fetched lectures from website are shown in lecture playlist.
Main Success Scenario:

1. User must have the authentication token in local database which is not expired.

2. User must have the stable internet connection.

3. If token is expired then fresh token can be fetched from website.

4. User will open lecture playlist page from navbar.

5. User clicks the **Fetch Lectures** button on lecture playlist page.

6. System then send request to website with token.

7. All the downloaded lectures will be same and newly fetched lectures will be shown on page.

Alternative Flow:
a*. At any time system fails.

1. Start the application again.

2. User must check the internet connectivity.

3. Try after sometime might be servers are down.

3a. Lecture playlist is not opened.

1. Make sure the internet connectivity and token is present in local database which is not expired.

2. try again.

3.7.3 Use Case UC3: View Lecture Playlist(Offline)

Stakeholders: University, Educational Institutes
Primary Actors: Student, Teacher
Post Condition:
All the downloaded and previously fetched lectures from website are shown in lecture playlist.
Main Success Scenario:

1. User must have the authentication token in local database which is not expired.

2. If token is expired then fresh token can be fetched from website but it requires internet connectivity.

3. User will open lecture playlist page from navbar.

4. All the downloaded and previously fetched lectures will be shown on page.

Alternative Flow:
a*. At any time system fails.

1. Start the application again.

3a. Lecture playlist is not opened.

1. Make sure the token is present in local database which is not expired.

2. try again.

3.7.4 Use Case UC4: Play Lecture(Online)

Stakeholders: University, Educational Institutes

Primary Actors: Student, Teacher

Post Condition:

All the downloaded lectures can be played in lecture player and recently fetched lectures can be downloaded.

Main Success Scenario:

1. User must have the stable internet connection.

2. User must have the authentication token in local database which is not expired.

3. If token is expired then fresh token can be fetched from website.

4. User will open lecture playlist page from navbar.

5. All the downloaded and newly fetched lectures will be shown on page.

6. Then user can download any lecture by clicking on checkbox of that lecture.

7. When checkbox is ticked it means lecture is downloaded user can play that lecture by clicking on **Play** button.

8. It will open the lecture player where user can play, pause and start over that lecture.

Alternative Flow:

a*. At any time system fails.

1. check the internet connectivity.

2. Start the application again.

3a. Lecture player is not opened.

1. Make sure the lecture is downloaded and checkbox is ticked.

2. Make sure the token is present in local database which is not expired.

3. try again.

3.7.5 Use Case UC5: Play Lecture(Offline)

Stakeholders: University, Educational Institutes

Primary Actors: Student, Teacher

Post Condition:

All the downloaded lectures can be played in lecture player.

Main Success Scenario:

1. User must have the authentication token in local database which is not expired.

2. If token is expired then fresh token can be fetched from website but it requires internet connectivity.

3. User will open lecture playlist page from navbar.

4. All the downloaded and previously fetched lectures will be shown on page.

5. Then user can play any lecture which is downloaded whose checkbox is ticked.

6. When checkbox is ticked it means lecture is downloaded user can play that lecture by clicking on **Play** button.

7. It will open the lecture player where user can play, pause and start over that lecture.

Alternative Flow:

a*. At any time system fails.

1. Start the application again.

3a. Lecture player is not opened.

1. Make sure the lecture you are trying to play is downloaded.

2. Make sure the token is present in local database which is not expired.

3. try again.

3.7.6   Use Case UC6: View About page

Stakeholders: University, Educational Institutes

Primary Actors: Student, Teacher

Post Condition:

About page of dbm offline player is shown successfully.

Main Success Scenario:

1. User will open the About page from navbar.

2. User will click **About** button on navbar.

3. About page will be opened.

4. Now user can read about our terms and condition and how to use Offline player.

Alternative Flow:

a*. At any time system fails.

1. Start the application again.

3a. About page is not opened.

1. try again.

3.7.7   Use Case UC7: View Contact us page

Stakeholders: University, Educational Institutes

Primary Actors: Student, Teacher

Post Condition:

Contact us page of dbm offline player is shown successfully.

Main Success Scenario:

1. User will open the Contact us page from navbar.

2. User will click **Contact us** button on navbar.

3. Contact us page will be opened.

4. Now user can read contact info in case of any problem user can contact us by that information.

Alternative Flow:

a*. At any time system fails.

    1. Start the application again.

3a. Contact us page is not opened.

    1. try again.

3.8   Architecture Diagram

Interaction among different modules of the system is not simple but can be simplified and easy to understand. The set of rules and concepts concerned by the overall project are visually explained by the Architecture Diagram shown below. It consist of follow modules:

- Stereo Vision Cameras

- Marker Hardware

- Audio Hardware

- Controller Application

- Player Application

- Learning Management System

3.9   Modules Methodology Description

System consists of five major modules. General work flow of each module is detailed using visuals and diagrams.

3.9.1   Board Marker

Board marker transfer the position data of currently written word on the platform i.e. Whiteboard. It is subdivided in two sub-modules

3.9.2   Audio Hardware

Wireless voice transmission is done by this module. Voice data is accepted at transmitter module. This data is converted into digital audio. Digital audio is then transmitted to receiver at another end. Receiver module decode the digital
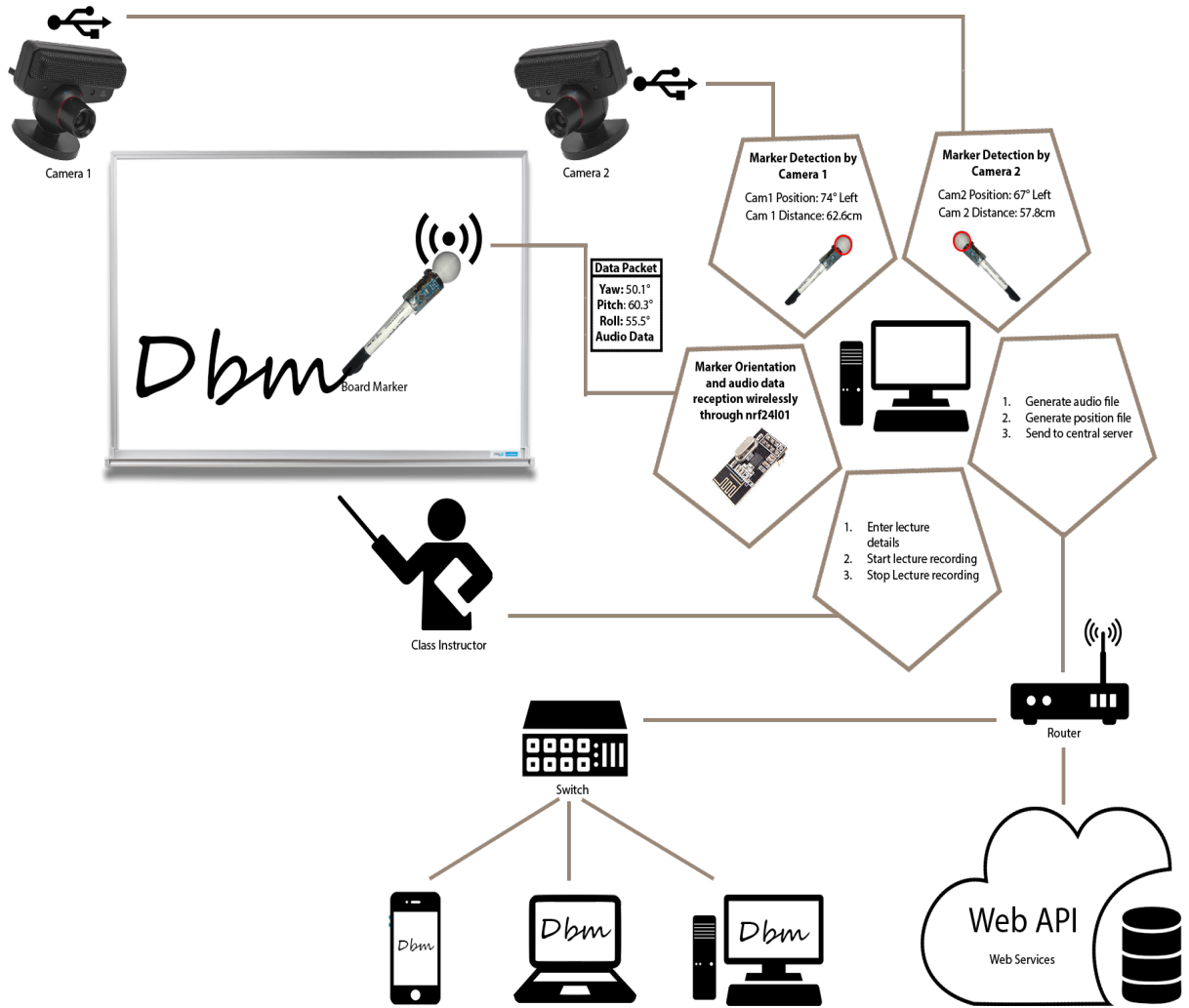
FIGURE 3.7: Architecture Diagram of Digital Board Marker

audio into analogue audio. Receiver module is attached to computer through Line-in[2] on which controller application is being executed. Controller application encode the analogue audio into lightweight ogg(file extension) file format. After the audio file generation is successful, audio file is then embedded into lecture file and uploaded to central server.

3.9.2.1 Stereo Vision Cameras

At least two high framerate cameras get the video of back ball and send it to controller application. Stereo vision is important for accurately extracting marker position by placing these cameras at such position so that different angles make same alignment to the writing platform irrespective to size. Square and rectangular boards can be mapped to same parent algorithm with simple to calibrate camera placement guide.
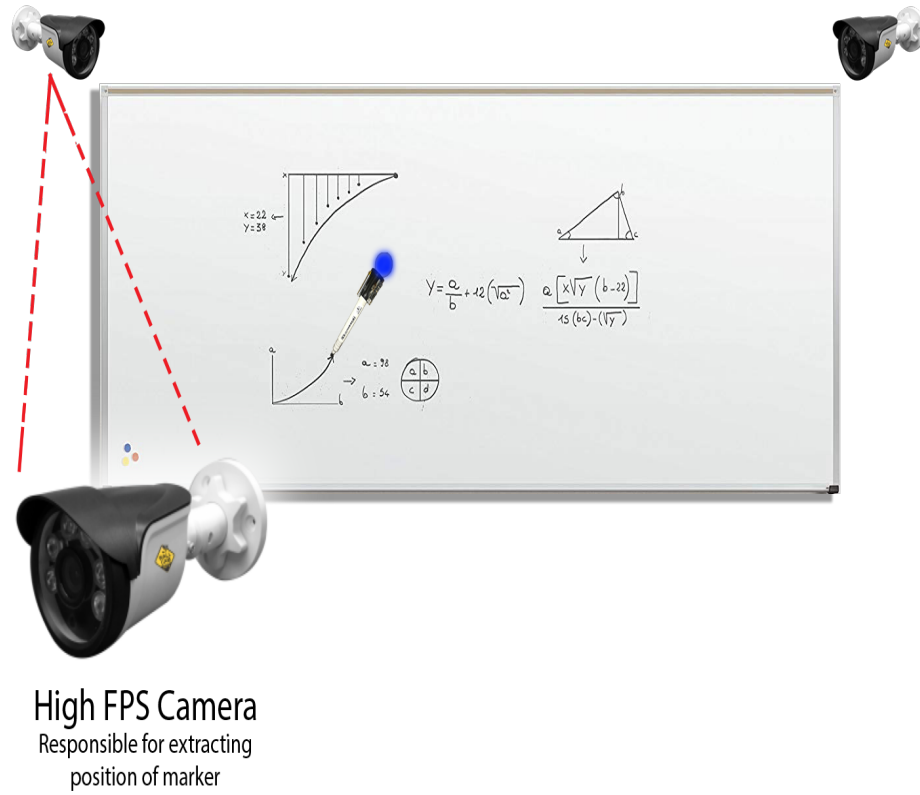
FIGURE 3.8: High frame rate camera placement

3.9.3 Controller Application

Controller application plays several roles in the project. First of all, it is responsible for application of computer vision algorithms to detect marker and extract the position data. At least two camera perspectives are considered for position extraction. Manual calibration system aids in the setup and view port positioning of multiple cameras. Marker position data and audio data have to be synchronously written in the final output file.

Second, it is also responsible for decoding the orientation data. Orientation data is sent using encoded packet by Marker Hardware and received by the controller application. Orientation is extracted using quaternions. Euler angles then extracted using converted quaternion to avoid gimble lock. Position of the marker is extracted.

Third, it can play the lecture file before uploading the lecture. Lecture can be paused, resumed and replayed. also, the lecture can be annotated by the instructor i.e. topic and sub-topic markings. Audio and video quality can be controlled over performance of lecture play media.
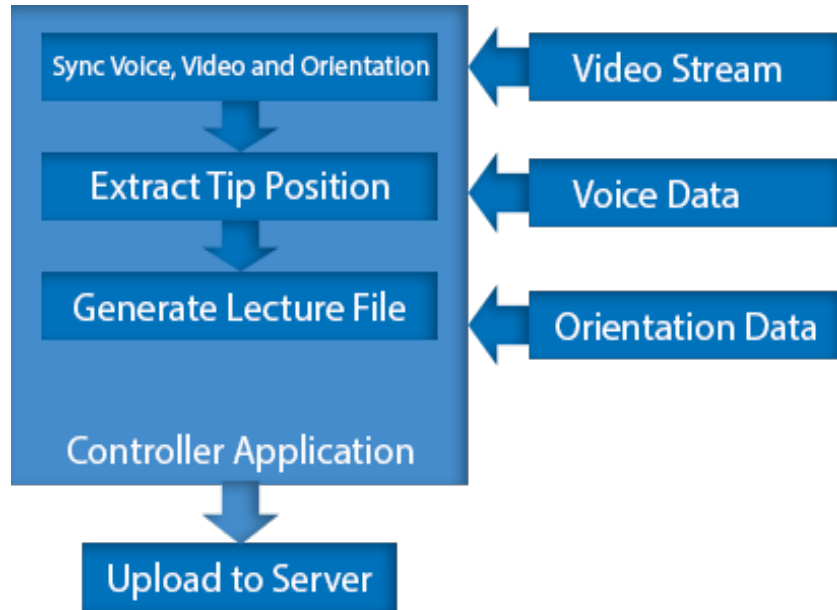
FIGURE 3.9: Controller Application General Methodology

3.9.3.1 Marker Hardware

To extract marker orientation, Marker Hardware is connected to controller application.
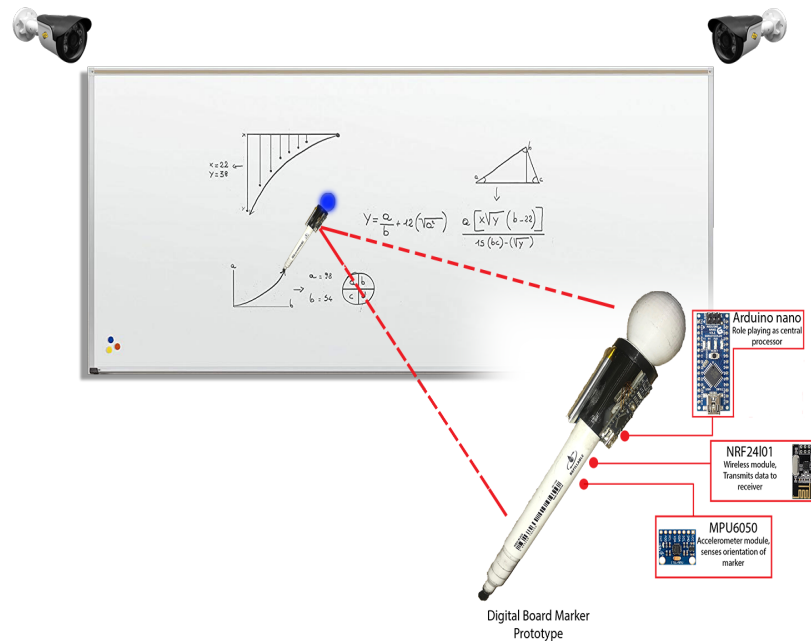
FIGURE 3.10: Marker Hardware working methodology
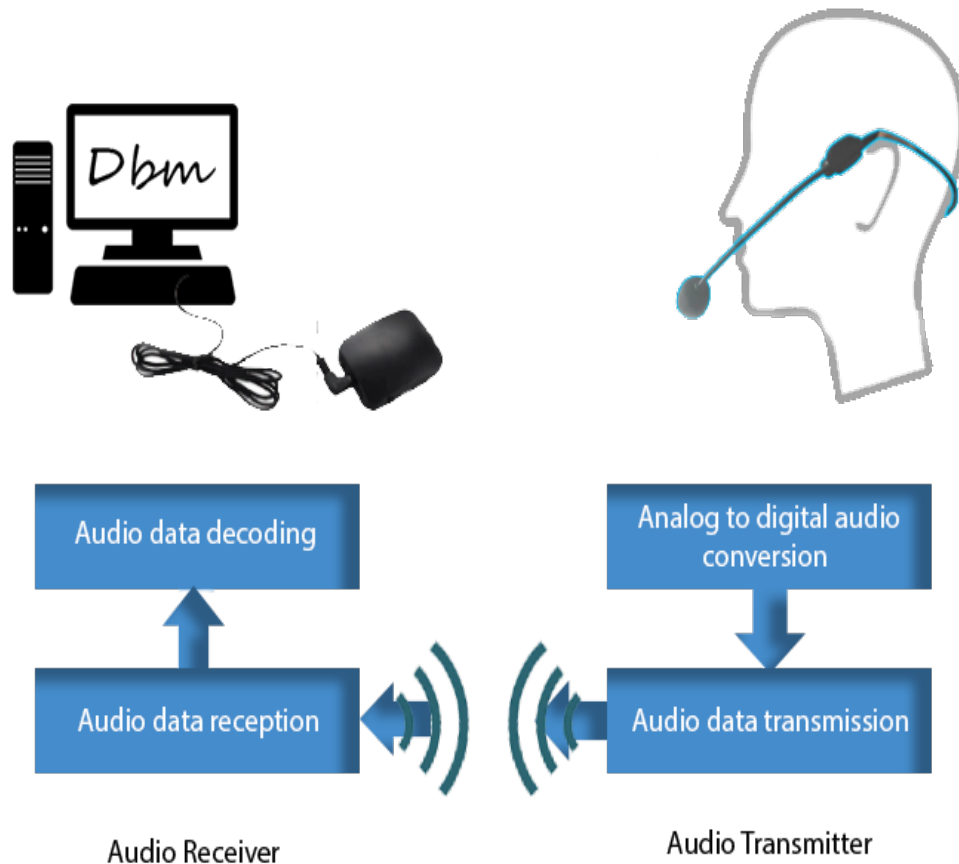
FIGURE 3.11: Audio Hardware General Methodology

3.9.4 Player Application

Just like media player, the player application plays the lecture. Common end user of Player Application is student. Player application has two version based on data availability.

3.9.5 Offline Player

Lecture file can be played on the computer via Offline Player with no interaction with internet at all. Typical end user is student. A student can rewind, play, pause, stop and resume while watching the lecture. As the lecture is being played by generated lecture file So, there is no compromise on quality.
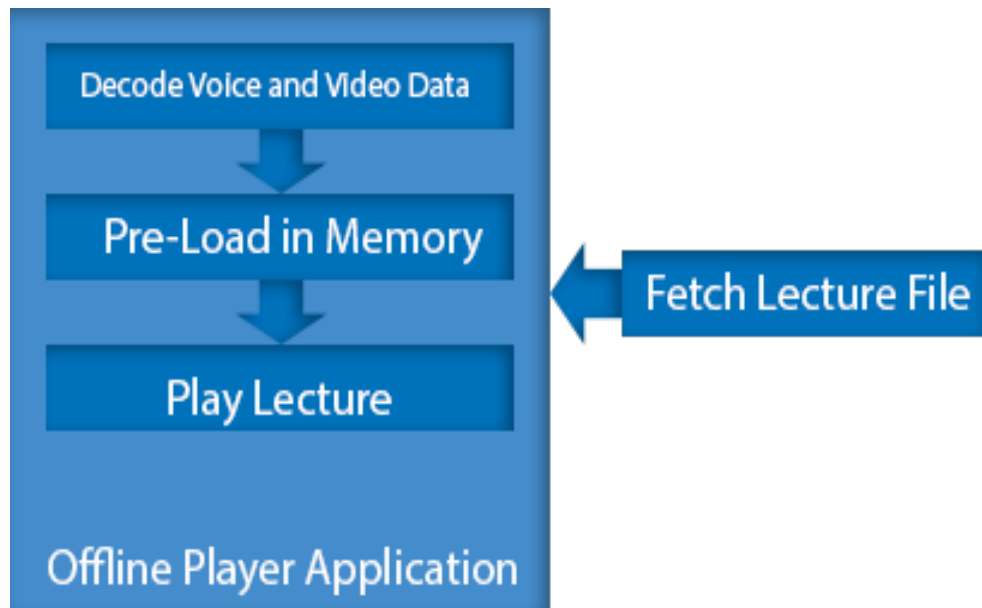
FIGURE 3.12: Offline Player Application General Methodology

3.9.6 WebGL Player

It is an online in-browser player that streams the lecture right in the webpage. Similar to video media player, flow of video can be controlled by user. This online player first loads its necessary packages and plugins before it could be fully functional. While browsing the lecture hierarchy, any lecture can be played by user and annotated by an instructor.
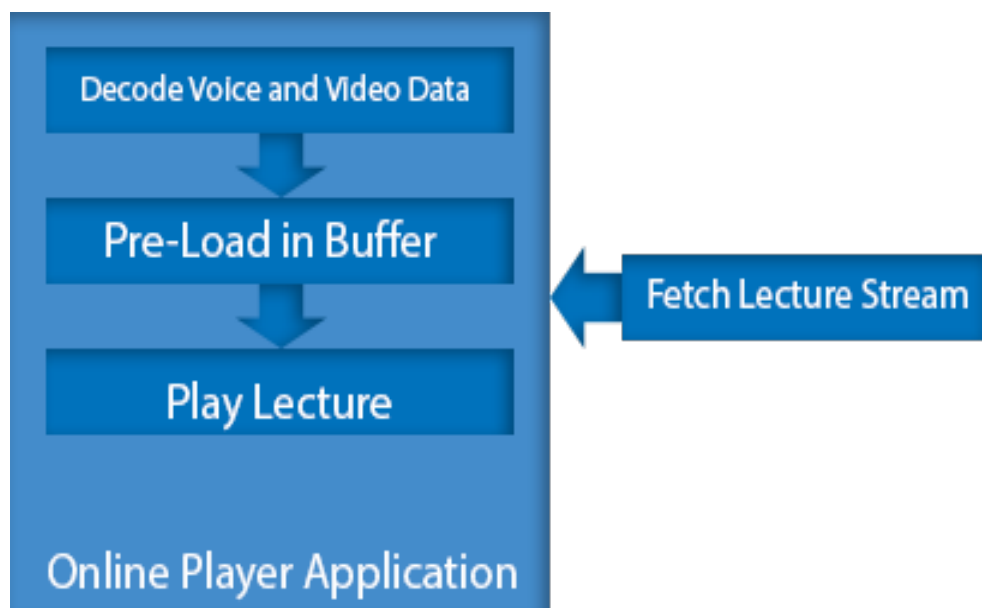
FIGURE 3.13: Online Player Application General Methodology

3.9.7 Learning Management System

LMS System that provides platform for playing online lectures, assignment submission and course content management. This module will act as a final deliverable when integrated with Online Lecture Player. This module consists of many submodules and functionalities. It also acts as an online portal for students and play important role in maintaining their profile. Below is further detailed discussion about this module. LMS developed for this project has other features including Administration, Access to high quality study material and learning data, email updates for students as well as teachers, fast delivery of learning material guided by the instructor and organized by existing institute, updates of emerging technologies to make students up-to-date and excel in their career in future. Report generation is another major advantage of the developed module. Using this functionality, instructor of the class can generate reports daily, weekly, monthly and so on. Also, reports are not only about the students. They can be about course material and Lecture data as well. Attendance of students and instructors as well can be maintained and reported easily. Concerned party can view the generated report at any time. Students can view timetable. Concerned instructor can suggest the adjustments to the timetable that administration can see and adjust accordingly. The application is web based so that accessibility of the system could be increased. Reliability and security are major concerns to the system. Administration can suspend the user by analysing the suspicious activity performed by the corresponding person.

3.9.7.1 Entity Relationship Diagram
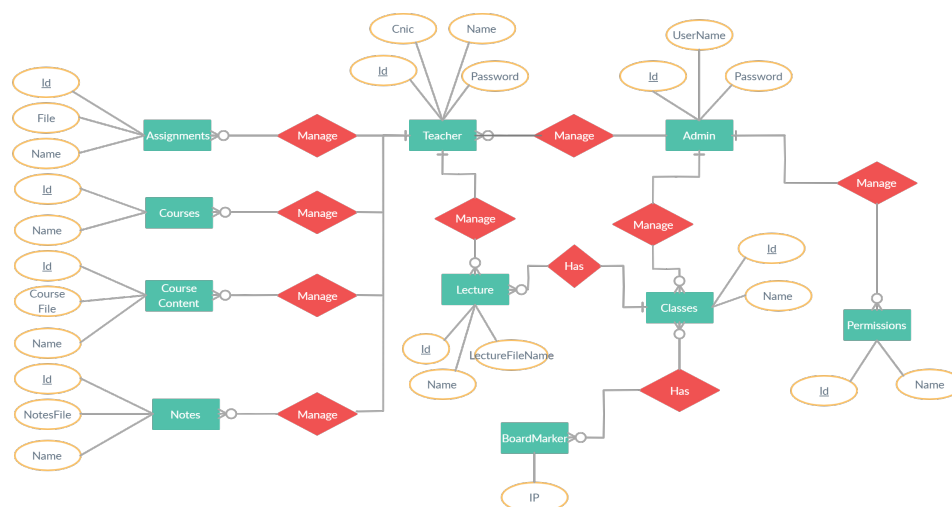
FIGURE 3.14: ER Diagram of LMS

3.9.7.2 Database Diagram
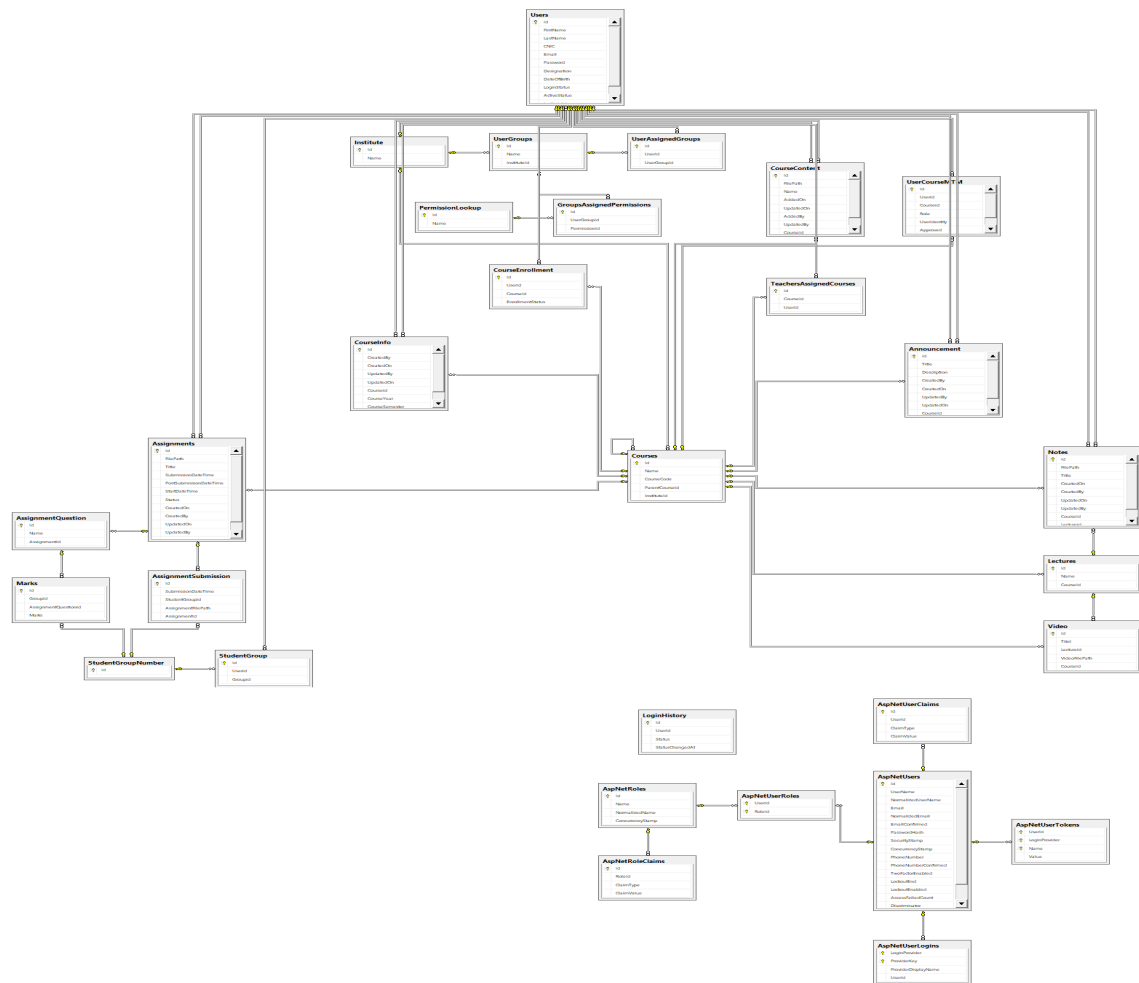
FIGURE 3.15: DB Diagram of LMS

Chapter 4

Implementation

Chapter 5

Evaluation Criteria

Here are the test cases for evaluation of the project:

5.1 Web Application

5.1.1 Test Scenario TS-1: User Registration Functionality

Post-Conditions: User data successfully sent to admin request approval page.

5.1.1.1 Test Case TC-1: Enter all valid credentials

Test Steps:

- Enter valid First Name, Last Name, Email, Password and Registration Number.

- Select a designation & date of birth.

- Click on register button.

- Registration Number: 2016-CS-123

Test Data:

- First Name: abc

- Last Name: xyz

- Email: someone@example.com (Email should be already registered on any service.)

- Password: abcd (At least four characters).

- Registration Number: 2016-CS-123

5.1.1.2   Test Case TC-2: Enter Invalid First Name

Test Steps:

- Enter invalid First Name

- Enter valid Last Name, Email, Password and Registration Number.

- Select a designation & date of birth.

- Click on register button.

Test Data:

- First Name: abc12

- Last Name: xyz

- Email: someone@example.com (Email should be already registered on any service.)

- Password: abcd (At least four characters).

- Registration Number: 2016-CS-123

5.1.1.3   Test Case TC-3: Enter Invalid Last Name

Test Steps:

- Enter invalid Last Name

- Enter valid First Name, Email, Passwordand Registration Number.

- Select a designation & date of birth.

- Click on register button.

- Registration Number: 2016-CS-123

Test Data:

- First Name: abc

- Last Name: xyz12

- Email: someone@example.com (Email should be already registered on any service.)

- Password: abcd (At least four characters).

- Registration Number: 2016-CS-123

5.1.1.4 Test Case TC-4: Enter Invalid Email

Test Steps:

- Enter invalid Email

- Enter valid First Name, Password and Registration Number.

- Select a designation & date of birth.

- Click on register button.

- Registration Number: 2016-CS-123

Test Data:

- First Name: abc

- Last Name: xyz

- Email: someone.com (Email should be already registered on any service.)

- Password: abcd (At least four characters).

- Registration Number: 2016-CS-123

5.1.1.5 Test Case TC-5: Enter Invalid Password

Test Steps:

- Enter invalid Password.

- Enter valid First Name, Password and Registration Number.

- Select a designation & date of birth.

- Click on register button.

- Registration Number: 2016-CS-123

Test Data:

- First Name: abc

- Last Name: xyz

- Email: someone@example.com (Email should be already registered on any service.)

- Password: abc (At least four characters).

- Registration Number: 2016-CS-123

5.1.1.6 Test Case TC-6: Enter Invalid Registration Number

Test Steps:

- Enter invalid Registration Number.

- Enter valid First Name, Password and Registration Number.

- Select a designation & date of birth.

- Click on register button.

- Registration Number: 2016-CS-123

Test Data:

- First Name: abc

- Last Name: xyz

- Email: someone@example.com (Email should be already registered on any service.)

- Password: abcd (At least four characters).

- Registration Number: 2016-CS–1, 2016-CS-A, 2008-123-A, 2016-!A-1, 2016-!A-A, 2019-!A-£, 20!1-AB-1

5.1.2 Test Scenario TS-2: User Login Functionality

Pre-Conditions:

- User is approved by the admin.

- User identified and authenticated.

- User's record is saved.

Post-Conditions: User is successfully log in to the system.

5.1.2.1 Test Case TC-1: Enter all valid credentials

Test Steps:

- Enter valid Email and Password.

- Click on login button.

Test Data:

- Email: someone@example.com (Email should be already registered in that system.)

- Password: abcd (password should already registered into the system).

5.1.2.2 Test Case TC-2: Enter Invalid Email

Test Steps:

- Enter invalid Email

- Click on login button.

Test Data:

- Email: someone.example.com (Email should be already registered in that system)

- Password: abcd (password should already registered into the system).

5.1.2.3 Test Case TC-3: Enter Invalid Password

Test Steps:

- Enter invalid Password.

- Enter valid First Name, Password and Registration Number.

- Select a designation & date of birth.

- Click on register button.

- Registration Number: 2016-CS-123

Test Data:

- Email: someone@example.com (Email should be already registered in that system)

- Password: c*d (password should already registered into the system).

5.1.3 Test Scenario TS-3: Teacher's Request Approval Functionality

Pre-Conditions:

- Admin is logged into the system.

- Admin is identified and authenticated.

- Registration request is sent by the teacher.

Post-Conditions: Request is approved by system and approval email is sent to the teacher.

Test Steps:

- Click on the approve button.

- Approval email is sent to the user.

5.1.4 Test Scenario TS-4: Teacher's Request Disapproval Functionality

Pre-Conditions:

- Admin is logged into the system.

- Admin is identified and authenticated.

- Registration request is sent by the teacher.

Post-Conditions: Request is disapproved by system and disapproval email is sent to the teacher.

Test Steps:

- Click on the disapprove button.

- Disapproval email is sent to the user.

5.1.5 Test Scenario TS-5: Students' Request Approval Functionality

Pre-Conditions:

- Admin is logged into the system.

- Admin is identified and authenticated.

- Registration request is sent by the student.

Post-Conditions: Request is approved by system and approval email is sent to the student.

Test Steps:

- Click on the approve button.

- Approval email is sent to the user.

5.1.6 Test Scenario TS-6: Students' Request Disapproval Functionality

Pre-Conditions:

- Admin is logged into the system.

- Admin is identified and authenticated.

- Registration request is sent by the student.

Post-Conditions: Request is approved by system and approval email is sent to the teacher.

Test Steps:

- Click on the disapprove button.

- Disapproval email is sent to the user.

5.1.7 Test Scenario TS-7: Add Course Functionality

Pre-Conditions:

- Admin is logged into the system.

- Admin is identified and authenticated.

Post-Conditions:

- Course is successfully added into system.

5.1.7.1 Test Case TC-1: Enter all valid data

Test Steps:

- Enter valid Course Name and Course Code.

- Click on Add Course button.

Test Data:

- Course name: ABC (course name should contain only alphabets)

- Course Code: 201 (Course code should be unique and not already registered in the system)

5.1.7.2 Test Case TC-2: Enter Invalid Course Name

Test Steps:

- Enter invalid Course Name.

- Click on Add Course button.

Test Data:

- Course name: ABC12 (course name should contain only alphabets)

- Course Code: 201 (Course code should be unique and not already registered in the system)

5.1.7.3 Test Case TC-3: Enter Invalid Course Code

Test Steps:

- Enter invalid Course Code.

- Enter valid Course Name.

Test Data:

- Course name: ABC (course name should contain only alphabets)

- Course Code: 2B1 (Course code should be unique and contains only numbers)

5.1.8 Test Scenario TS-8: Update Course Functionality

Pre-Conditions:

- Admin is logged into the system.

- Admin is identified and authenticated.

Post-Conditions:

- Course is successfully updated.

5.1.8.1 Test Case TC-1: Enter all valid data

Test Steps:

- Enter valid Course Name and Course Code.

- Click on Add Course button.

Test Data:

- Course name: ABC (course name should contain only alphabets)

- Course Code: 201 (Course code should be unique and contains only digits.)

5.1.8.2 Test Case TC-2: Enter Invalid Course Name

Test Steps:

- Enter invalid Course Name.

- Click on Add Course button.

Test Data:

- Course name: ABC12 (course name should contain only alphabets)

- Course Code: 201 (Course code should be unique)

5.1.8.3 Test Case TC-3: Enter Invalid Course Code

Test Steps:

- Enter invalid Course Code.

- Enter valid Course Name.

- Click on the Add Course Button.

Test Data:

- Course name: ABC (course name should contain only alphabets)

- Course Code: 2B1 (Course code should be unique and contains only numbers)

5.1.9 Test Scenario TS-9: Course Deletion Functionality

Pre-Conditions:

- Admin is logged into the system.

- Admin is identified and authenticated.

- Course must be added successfully.

Post-Conditions:

- Course details are successfully deleted from the system.

Test Steps:

- Click on the delete button.

5.1.10 Test Scenario TS-10: View Course Functionality

Pre-Conditions:

- User is logged into the system.

- User is identified and authenticated.

- Course must be added successfully.

Post-Conditions:

- Course details are viewed.

Test Steps:

- Click on the View button.

5.1.11 Test Scenario TS-11: Upload Course Assignment Functionality

Pre-Conditions:

- Teacher is logged into the system.

- Admin is identified and authenticated.

- Course is added in the system.

- Course is assigned to that teacher.

Post-Conditions:

- Course assignment is uploaded successfully updated.

Test Steps:

- Upload assignment file.

- Click on Upload Assignment button.

5.1.12 Test Scenario TS-12: Downloading Assignment Functionality

Pre-Conditions:

- User is logged into the system.

- User is identified and authenticated.

- Assignment must be uploaded successfully.

Post-Conditions:

- Assignment is downloaded successfully.

Test Steps:

- Click on the download button.

5.1.13 Test Scenario TS-13: View Assignment Functionality

Preconditions:

- User is identified and authenticated.

- User is logged in the system.

- Student is enrolled in that course.

- Course is assigned to teacher.

Post Condition:

- Course Assignment viewed successfully.

Test Steps:

- Click on the download button.

5.1.14 Test Scenario TS-14: Assignment Deletion Functionality

Pre-Conditions:

- Teacher is logged into the system.

- Teacher is identified and authenticated.

- Assignment must be uploaded successfully.

Post-Conditions:

- Assignment is deleted successfully.

Test Steps:

- Click on the delete button.

5.1.15 Test Scenario TS-15: Add Course Announcement Functionality

Pre-Conditions:

- Teacher is logged in the system.

- Teacher is identified and authenticated.

- Course is assigned to the teacher.

Post-Conditions:

- Course Announcement is added successfully.

Test Steps:

- Go to particular course.

- Go to announcements tab.

- Click on Add Announcement button.

- Enter text for announcement.

- Click on add button.

5.1.16 Test Scenario TS-16: Edit Course Announcement Functionality

Pre-Conditions:

- Teacher is identified and authenticated.

- Teacher is logged in the system.

- Course is assigned to the teacher.

Post-Conditions:

- Course Announcement is updated successfully.

Test Steps:

- Go to particular course.

- Go to announcements tab.

- Click on edit button.

- Update the announcement.

- Click on save button.

5.1.17 Test Scenario TS-17: Delete Course Announcement Functionality

Pre-Conditions:

- User is identified and authenticated.

- User is logged in the system.

- Course is assigned to the teacher.

Post-Conditions:

- Course announcement is deleted successfully.

Test Steps:

- Go to particular course.

- Go to announcements tab.

- Click on delete button.

5.1.18 Test Scenario TS-18: Students Assignment Submission Functionality

Pre-Conditions:

- User is identified and authenticated.

- User is logged in the system.

- Student is enrolled in that course.

Post-Conditions:

- Assignment is submitted successfully.

Test Steps:

- Go to particular course.

- Click on submit link in front of particular assignment.

- Select assignment file from device.

- Click on submit button.

5.1.19 Test Scenario TS-19: Upload Course Notes Functionality

Pre-Conditions:

- Teacher is logged in the system.

- User is identified and authenticated.

- Course is assigned to the teacher.

Post-Conditions:

- Course notes uploaded successfully.

Test Steps:

- Go to particular course.

- Click on upload notes button.

- Select notes file from device.

- Click on upload button.

5.1.20 Test Scenario TS-20: View Course Notes Functionality

Pre-Conditions:

- User is identified and authenticated.

- User is logged in the system.

- Student is enrolled in that course.

- Course is assigned to teacher.

- Course Notes are added.

Post-Conditions:

- Course notes viewed successfully.

Test Steps:

- Go to particular course.

- Go to notes tab to all notes in a list.

5.1.21 Test Scenario TS-21: Download Course Notes Functionality

Pre-Conditions:

- User is logged in the system.

- User is identified and authenticated.

- Course is assigned to the teacher.

- Student is enrolled in that course.

- Course notes are added.

Post-Conditions:

- Course notes downloaded successfully.

Test Steps:

- Go to particular course.

- Go to notes tab.

- Click on download button in front of the notes in table.

5.1.22 Test Scenario TS-22: Delete Course Notes Functionality

Pre-Conditions:

- Teacher is logged in the system.

- User is identified and authenticated.

- Course is assigned to the teacher.

- Course lectures are added.

Post-Conditions:

- Course lectures deleted successfully.

Test Steps:

- Go to particular course.

- Go to notes tab.

- Click on delete button in front of the notes in table.

5.1.23 Test Scenario TS-23: Student Enrolment in Course Functionality

Pre-Conditions:

- User is identified and authenticated.

- User is logged in the system.

- Course must be added.

Post-Conditions:

- Course enrolment request sent to the teacher successfully.

Test Steps:

- Go to all courses page.

- Click on enrol button.

5.1.24 Test Scenario TS-24: Course Enrolment Requests Disapproval Functionality

Pre-Conditions:

- Teacher is identified and authenticated.

- Teacher is logged in the system.

- Course is added.

- Teacher is assigned a course.

Post-Conditions:

- Course enrolment requests are approved.

- On disapproval email is sent to the student.

Test Steps:

- Go to the particular course.

- Click on see enrolment requests button.

- Click on disapprove button to disapprove each student.

5.1.25 Test Scenario TS-25: Course Enrolment Requests Approval Functionality

Pre-Conditions:

- Teacher is identified and authenticated.

- Teacher is logged in the system.

- Course is added.

- Teacher is assigned a course.

Post-Conditions:

- Course enrolment requests are approved.

- On approval email is sent to the student.

- Students can view course details.

Test Steps:

- Go to the particular course.

- Click on see enrolment requests button.

- Click on approve button to approve each student.

5.1.26 Test Scenario TS-26: Assign Courses Functionality

Pre-Conditions:

- User is logged in the system.

- User is identified and authenticated.

- Courses must be added.

Post-Conditions:

- Course is assigned successfully.

Test Steps:

- Go to the assigned courses link.

- Select teacher from the dropdown.

- Select course from dropdown.

- Click on assign course button.

5.1.27 Test Scenario TS-27: View Students' Assignments Functionality

Pre-Conditions:

- Teacher is identified and authenticated.

- Teacher is logged in the system.

- Course is added.

- Teacher is assigned a course.

- Course assignments uploaded.

Post-Conditions:

- Students assignments viewed successfully.

Test Steps:

- Go to the particular course assigned to teacher.

- Click on all submitted assignments link to see all students assignments.

5.1.28 Test Scenario TS-28: Download Students' Assignments Functionality

Pre-Conditions:

- Teacher is identified and authenticated.

- Teacher is logged in the system.

- Course is added.

- Teacher is assigned a course.

- Students have submitted the assignments.

Post-Conditions:

- Teacher downloaded the assignments successfully.

Test Steps:

- Click on download link in front of students' registration number.

5.2 Offline Player Application

5.2.1 Test Scenario TS-1: User Authentication Functionality

Post-Conditions:

- User data successfully sent to server and token successfully saved in local database.

5.2.1.1 Test Case TC-1: Enter Valid Credentials

Test Steps:

- Enter valid email.

- Enter valid password.

- Click on login button.

Test Data:

- Email: abc@gmail.com

- Password: abcd

5.2.1.2 Test Case TC-2: Enter Invalid Email

Test Steps:

- Enter invalid email.

- Enter valid password.

- Click on login button.

Test Data:

- Email: abc.com

- Password: abcd

5.2.1.3   Test Case TC-3: Enter Invalid Password

Test Steps:

- Enter valid email.

- Enter invalid password.

- Click on login button.

Test Data:

- Email: abc@gmail.com

- Password: abc

5.2.1.4   Test Case TC-4: Enter All Invalid Credentials

Test Steps:

- Enter invalid email.

- Enter invalid password.

- Click on login button.

Test Data:

- Email: abc.com

- Password: abc

5.2.2   Test Scenario TS-2: View Lecture Functionality

Pre-Conditions:

- User must be authenticated.

Post-Conditions:

- All the downloaded and recently fetched lectures from website are shown in lecture play list.

Test Steps:

- Go to play list page.

- Click fetch lectures button.

5.2.3 Test Scenario TS-3: Play Lecture Functionality

Pre-Conditions:

- User must be authenticated.

Post-Conditions:

- All the downloaded and recently fetched lectures from website are shown in lecture play list.

Test Steps:

- Go to play list page.

- Click on play button and player screen will open.

5.2.4 Test Scenario TS-4: Download Lecture Functionality

Pre-Conditions:

- User must be authenticated.

Post-Conditions:

- Lecture is downloaded

Test Steps:

- Go to play list page.

- Click on download button.

5.2.5 Test Scenario TS-5: View About Page Functionality

Pre-Conditions:

- User must be authenticated.

Test Steps:

- Click on about tab.

5.2.6 Test Scenario TS-6: View Contact Us Page Functionality

Pre-Conditions:

- User must be authenticated.

Test Steps:

- Click on Contact Us tab.

Chapter 6

Results

6.1 Web Application

6.1.1 Test Scenario TS-1: User Registration Functionality

Postconditions:

- User data successfully sent to admin request approval page.

Test Case Id	Description	Expected Result	Actual Result	Executed By	Status
TC-1	Enter all valid credentials	Successful registration and pop up message "User Successfully registered"	Successful registration and pop up message "User Successfully registered"	Haris	Pass
TC-2	Enter Invalid First Name	Sign up button disabled	Sign up button disabled	Haris	Pass
TC-3	Enter Invalid Last Name	Sign up button disabled	Sign up button disabled	Haris	Pass

TC-4	Enter Invalid Email	Sign up button disabled	Sign up button disabled	Haris	Pass
TC-5	Enter Invalid Password	Sign up button disabled	Sign up button disabled	Haris	Pass
TC-6	Enter Invalid Registration Number	Sign up button disabled	Sign up button disabled	Haris	Pass

TABLE 6.1: Web App: Test Scenario TS-1 Results

6.1.2 Test Scenario TS-2: User Login Functionality

Pre-Conditions:

- User is approved by the admin.

- User identified and authenticated.

- User's record is saved.

Postconditions:

- User is successfully log in to the system.

Test Case Id	Description	Expected Result	Actual Result	Executed By	Status
TC-1	Enter all valid credentials	Successful login	Successful login	Haris	Pass
TC-2	Enter Invalid Email	Login button disabled	Login button disabled	Haris	Pass
TC-3	Enter Invalid Password	Login button disabled	Login button disabled	Haris	Pass

TABLE 6.2: Web App: Test Scenario TS-2 Results

6.1.3 Test Scenario TS-3: Teacher's Request Approval Functionality

Pre-Conditions:

- Admin is logged into the system.

- Admin is identified and authenticated.

- Registration request is sent by the teacher.

Post-Conditions: Request is approved by system and approval email is sent to the teacher.

Expected Result	Actual Result	Executed By	Status
Teacher's request approved and teacher can now login	Teacher's request approved and teacher can now login	Haris	Pass

TABLE 6.3: Web App: Test Scenario TS-3 Results

6.1.4 Test Scenario TS-4: Teacher's Request Disapproval Functionality

Pre-Conditions:

- Admin is logged into the system.

- Admin is identified and authenticated.

- Registration request is sent by the teacher.

Post-Conditions:

- Request is disapproved by system and disapproval email is sent to the teacher.

Expected Result	Actual Result	Executed By	Status
Teacher's request disapproved and teacher cannot login	Teacher's request disapproved and teacher cannot login	Haris	Pass

TABLE 6.4: Web App: Test Scenario TS-4 Results

6.1.5 Test Scenario TS-5: Students' Request Approval Functionality

Pre-Conditions:

- Admin is logged into the system.

- Admin is identified and authenticated.

- Registration request is sent by the student.

Post-Conditions: Request is approved by system and approval email is sent to the student.

Expected Result	Actual Result	Executed By	Status
Student's request approved and student can now login	Student's request approved and student can now login	Haris	Pass

TABLE 6.5: Web App: Test Scenario TS-5 Results

6.1.6 Test Scenario TS-6: Students' Request Disapproval Functionality

Pre-Conditions:

- Admin is logged into the system.

- Admin is identified and authenticated.

- Registration request is sent by the student.

Post-Conditions: Request is approved by system and approval email is sent to the teacher.

Expected Result	Actual Result	Executed By	Status
Student's request disapproved and student cannot login	Student's request disapproved and student cannot login	Haris	Pass

TABLE 6.6: Web App: Test Scenario TS-6 Results

6.1.7 Test Scenario TS-7: Add Course Functionality

Pre-Conditions:

- Admin is logged into the system.

- Admin is identified and authenticated.

Post-Conditions:

- Course is successfully added into system.

Test Case Id	Description	Expected Result	Actual Result	Executed By	Status
TC-1	Enter all valid data	Pop up message "Course Added Successfully"	Pop up message "Course Added Successfully"	Haris	Pass
TC-2	Enter Invalid Course Name	Add button disabled	Add button disabled	Haris	Pass
TC-3	Enter Invalid Course Code	Add button disabled	Add button disabled	Haris	Pass

TABLE 6.7: Web App: Test Scenario TS-7 Results

6.1.8   Test Scenario TS-8: Update Course Functionality

Pre-Conditions:

- Admin is logged into the system.

- Admin is identified and authenticated.

Post-Conditions:

- Course is successfully updated.

Test Case Id	Description	Expected Result	Actual Result	Executed By	Status
TC-1	Enter all valid data	Pop up message "Course Updated Successfully"	Pop up message "Course Updated Successfully"	Haris	Pass
TC-2	Enter Invalid Course Name	Save button disabled	Save button disabled	Haris	Pass
TC-3	Enter Invalid Course Code	Save button disabled	Save button disabled	Haris	Pass

TABLE 6.8: Web App: Test Scenario TS-8 Results

6.1.9   Test Scenario TS-9: Course Deletion Functionality

Pre-Conditions:

- Admin is logged into the system.

- Admin is identified and authenticated.

- Registration request is sent by the student.

Post-Conditions: Request is approved by system and approval email is sent to the teacher.

Expected Result	Actual Result	Executed By	Status
Pop up message "Course deleted successfully"	Pop up message "Course deleted successfully"	Haris	Pass

TABLE 6.9: Web App: Test Scenario TS-9 Results

6.1.10 Test Scenario TS-10: View Course Functionality

Pre-Conditions:

- User is logged into the system.

- User is identified and authenticated.

- Course must be added successfully.

Post-Conditions:

- Course details are viewed.

Expected Result	Actual Result	Executed By	Status
Course details page opens on View button click	Course details page opens on View button click	Haris	Pass

TABLE 6.10: Web App: Test Scenario TS-10 Results

6.1.11 Test Scenario TS-11: Upload Course Assignment Functionality

Pre-Conditions:

- Teacher is logged into the system.

- Admin is identified and authenticated.

- Course is added in the system.

- Course is assigned to that teacher.

Post-Conditions:

- Course assignment is uploaded successfully updated.

Expected Result	Actual Result	Executed By	Status
Pop up message "Course Assignment Added Successfully	Pop up message "Course Assignment Added Successfully	Haris	Pass

TABLE 6.11: Web App: Test Scenario TS-11 Results

6.1.12 Test Scenario TS-12: Downloading Assignment Functionality

Pre-Conditions:

- User is logged into the system.

- User is identified and authenticated.

- Assignment must be uploaded successfully.

Post-Conditions:

- Assignment is downloaded successfully.

Expected Result	Actual Result	Executed By	Status
Assignment downloaded successfully	Assignment downloaded successfully	Haris	Pass

TABLE 6.12: Web App: Test Scenario TS-12 Results

6.1.13 Test Scenario TS-13: Assignment Deletion Functionality

Pre-Conditions:

- Teacher is logged into the system.

- Teacher is identified and authenticated.

- Assignment must be uploaded successfully.

Post-Conditions:

- Assignment is deleted successfully.

Expected Result	Actual Result	Executed By	Status
Pop up message "Assignment Deleted Successfully	Pop up message "Assignment Deleted Successfully	Haris	Pass

TABLE 6.13: Web App: Test Scenario TS-13 Results

6.1.14 Test Scenario TS-14: Add Course Announcement Functionality

Pre-Conditions:

- Teacher is logged in the system.

- Teacher is identified and authenticated.

- Course is assigned to the teacher.

Post-Conditions:

- Course Announcement is added successfully.

Expected Result	Actual Result	Executed By	Status
Toast message "Announcement Added Successfully"	Toast message "Announcement Added Successfully"	Haris	Pass

TABLE 6.14: Web App: Test Scenario TS-14 Results

6.1.15 Test Scenario TS-15: Edit Course Announcement Functionality

Pre-Conditions:

- Teacher is identified and authenticated.

- Teacher is logged in the system.

- Course is assigned to the teacher.

Post-Conditions:

- Course Announcement is updated successfully.

Expected Result	Actual Result	Executed By	Status
Toast message "Announcement Updated Successfully"	Toast message "Announcement Updated Successfully"	Haris	Pass

TABLE 6.15: Web App: Test Scenario TS-15 Results

6.1.16 Test Scenario TS-16: Delete Course Announcement Functionality

Pre-Conditions:

- User is identified and authenticated.

- User is logged in the system.

- Course is assigned to the teacher.

Post-Conditions:

- Course announcement is deleted successfully.

Expected Result	Actual Result	Executed By	Status
Toast message "Announcement Deleted Successfully"	Toast message "Announcement Deleted Successfully"	Haris	Pass

TABLE 6.16: Web App: Test Scenario TS-16 Results

6.1.17 Test Scenario TS-17: Students Assignment Submission Functionality

Pre-Conditions:

- User is identified and authenticated.

- User is logged in the system.

- Student is enrolled in that course.

Post-Conditions:

- Assignment is submitted successfully.

Expected Result	Actual Result	Executed By	Status
Toast message "Assignment Submitted Successfully	Toast message "Assignment Submitted Successfully	Haris	Pass

TABLE 6.17: Web App: Test Scenario TS-17 Results

6.1.18 Test Scenario TS-18: Upload Course Notes Functionality

Pre-Conditions:

- Teacher is logged in the system.

- User is identified and authenticated.

- Course is assigned to the teacher.

Post-Conditions:

- Course notes uploaded successfully.

Expected Result	Actual Result	Executed By	Status
Toast message "Notes Added Successfully"	Toast message "Notes Added Successfully"	Haris	Pass

TABLE 6.18: Web App: Test Scenario TS-18 Results

6.1.19 Test Scenario TS-19: View Course Notes Functionality

Pre-Conditions:

- User is identified and authenticated.

- User is logged in the system.

- Student is enrolled in that course.

- Course is assigned to teacher.

- Course Notes are added.

Post-Conditions:

- Course notes viewed successfully.

Expected Result	Actual Result	Executed By	Status
Notes list shown	Notes list shown	Haris	Pass

TABLE 6.19: Web App: Test Scenario TS-19 Results

6.1.20 Test Scenario TS-20: Download Course Notes Functionality

Pre-Conditions:

- User is logged in the system.

- User is identified and authenticated.

- Course is assigned to the teacher.

- Student is enrolled in that course.

- Course notes are added.

Post-Conditions:

- Course notes downloaded successfully.

Expected Result	Actual Result	Executed By	Status
Notes file downloaded successfully	Notes file downloaded successfully	Haris	Pass

TABLE 6.20: Web App: Test Scenario TS-20 Results

6.1.21 Test Scenario TS-21: Delete Course Notes Functionality

Pre-Conditions:

- Teacher is logged in the system.

- User is identified and authenticated.

- Course is assigned to the teacher.

- Course lectures are added.

Post-Conditions:

- Course lectures deleted successfully.

Expected Result	Actual Result	Executed By	Status
Toast message "Notes file deleted successfully"	Toast message "Notes file deleted successfully"	Haris	Pass

TABLE 6.21: Web App: Test Scenario TS-21 Results

6.1.22   Test Scenario TS-22: Student Enrolment in Course Functionality

Pre-Conditions:

- User is identified and authenticated.

- User is logged in the system.

- Course must be added.

Post-Conditions:

- Course enrolment request sent to the teacher successfully.

Expected Result	Actual Result	Executed By	Status
Student enrolment request sent to admin.	Student enrolment request sent to admin.	Haris	Pass
Enrol button changes to pending.	Enrol button changes to pending.	Haris	Pass

TABLE 6.22: Web App: Test Scenario TS-22 Results

6.1.23 Test Scenario TS-23: Course Enrolment Requests Disapproval Functionality

Pre-Conditions:

- Teacher is identified and authenticated.

- Teacher is logged in the system.

- Course is added.

- Teacher is assigned a course.

Post-Conditions:

- Course enrolment requests are approved.

- On disapproval email is sent to the student.

Expected Result	Actual Result	Executed By	Status
Disapproval mail is sent	Disapproval mail is sent	Haris	Pass

TABLE 6.23: Web App: Test Scenario TS-23 Results

6.1.24 Test Scenario TS-24: Course Enrolment Requests Approval Functionality

Pre-Conditions:

- Teacher is identified and authenticated.

- Teacher is logged in the system.

- Course is added.

- Teacher is assigned a course.

Post-Conditions:

- Course enrolment requests are approved.

- On approval email is sent to the student.

- Students can view course details.

Expected Result	Actual Result	Executed By	Status
Approval mail is sent	Approval mail is sent	Haris	Pass

TABLE 6.24: Web App: Test Scenario TS-24 Results

6.1.25 Test Scenario TS-25: Assign Courses Functionality

Pre-Conditions:

- User is logged in the system.

- User is identified and authenticated.

- Courses must be added.

Post-Conditions:

- Course is assigned successfully.

Expected Result	Actual Result	Executed By	Status
Selected course get assigned to teacher and he can now manage that course	Selected course get assigned to teacher and he can now manage that course	Haris	Pass

TABLE 6.25: Web App: Test Scenario TS-25 Results

6.1.26 Test Scenario TS-26: View Students' Assignments Functionality

Pre-Conditions:

- Teacher is identified and authenticated.

- Teacher is logged in the system.

- Course is added.

- Teacher is assigned a course.

- Course assignments uploaded.

Post-Conditions:

- Students assignments viewed successfully.

Expected Result	Actual Result	Executed By	Status
Students assignment page shows all students assignment	Students assignment page shows all students assignment	Haris	Pass

TABLE 6.26: Web App: Test Scenario TS-26 Results

6.1.27 Test Scenario TS-27: Download Students' Assignments Functionality

Pre-Conditions:

- Teacher is identified and authenticated.

- Teacher is logged in the system.

- Course is added.

- Teacher is assigned a course.

- Students have submitted the assignments.

Post-Conditions:

- Teacher downloaded the assignments successfully.

Expected Result	Actual Result	Executed By	Status
Assignment file downloaded successfully	Assignment file downloaded successfully	Haris	Pass

TABLE 6.27: Web App: Test Scenario TS-27 Results

6.2 Offline Player Application

6.2.1 Test Scenario TS-1: User Authentication Functionality

Post-Conditions:

- User data successfully sent to server and token successfully saved in local database.

Test Case Id	Description	Expected Result	Actual Result	Executed By	Status
TC-1	Enter Valid Credentials	Successful login	Successful login	Hamza	Pass
TC-2	Enter Invalid Email	Pop up message "Invalid email or password"	Pop up message "Invalid email or password"	Hamza	Pass
TC-3	Enter Invalid Password	Pop up message "Invalid email or password"	Pop up message "Invalid email or password"	Hamza	Pass
TC-4	Enter all invalid credentials	Pop up message "Invalid email or password"	Pop up message "Invalid email or password"	Hamza	Pass

TABLE 6.28: Offline Player App: Test Scenario TS-1 Results

6.2.2 Test Scenario TS-2: View Lecture Functionality

Pre-Conditions:

- User must be authenticated.

Post-Conditions:

- All the downloaded and recently fetched lectures from website are shown in lecture play list.

Expected Result	Actual Result	Executed By	Status
Lectures view successfully	Lectures view successfully	Hamza	Pass

TABLE 6.29: Offline Player App: Test Scenario TS-2 Results

6.2.3   Test Scenario TS-3: Play Lecture Functionality

Pre-Conditions:

- User must be authenticated.

Post-Conditions:

- All the downloaded and recently fetched lectures from website are shown in lecture play list.

Expected Result	Actual Result	Executed By	Status
Player screen opens and lecture start.	Player screen opens and lecture start.	Hamza	Pass

TABLE 6.30: Offline Player App: Test Scenario TS-3 Results

6.2.4   Test Scenario TS-4: Download Lecture Functionality

Pre-Conditions:

- User must be authenticated.

Post-Conditions:

- Lecture is downloaded

Expected Result	Actual Result	Executed By	Status
Lecture downloaded successfully	Lecture downloaded successfully	Hamza	Pass

<div align="center">TABLE 6.31: Offline Player App: Test Scenario TS-4 Results</div>

6.2.5 Test Scenario TS-5: View About Page Functionality

Pre-Conditions:

- User must be authenticated.

Expected Result	Actual Result	Executed By	Status
About page opens	About page opens	Hamza	Pass

<div align="center">TABLE 6.32: Offline Player App: Test Scenario TS-5 Results</div>

6.2.6 Test Scenario TS-6: View Contact Us Page Functionality

Pre-Conditions:

- User must be authenticated.

Expected Result	Actual Result	Executed By	Status
Contact Us page opens	Contact Us page opens	Hamza	Pass

<div align="center">TABLE 6.33: Offline Player App: Test Scenario TS-6 Results</div>

Chapter 7

Future Work

Future work of this project will be to enhance its scope by adding on the concept of machine learning in the web portal and to make hardware module more portable and easy to use. Following are some improvements that can be made in future:

- **Use of ordinary board marker:**
  If the proposed system hardware is implemented using computer vision techniques then stereo vision cameras will be easily used to detect the position and orientation of even ordinary board marker.

- **Increase in Board Dimension:**
  With the use of high resolution cameras, the proposed system can be used to record the lecture i.e orientation and position extraction with large board dimensions.

- **Noise removal in audio:**
  With the implementation of different filtering techniques like adaptive filtering, Kalman filtering, sub-band filtering, gamma filtering and modified Wiener in the proposed project, the noise will be easily removed from the voice recorded.

- **Automatic notes generation:**
  With the implementation of machine learning algorithm in the online lecture, proposed project will be used for automatic notes generation of each lecture against each video provided on the web portal.

- **Complete LMS:**
  By adding more functionalities in the web portal e.g admission system, Fee

submission etc. the proposed can e used as a complete LMS for any educational institution in replacement with the manual work.

- **Recording in uncontrolled environment:**
  By making proposed system much more efficient i.e. training system on different conditions, the proposed system will be used to record the lecture in any environment mean under dim light of any colored light.

- **Automatic Google searching:**
  If the system is trained using machine learning algorithm then proposed system will be used for Google searching of tough terms of unique terms related to lectures automatically to provide the ease for the students to understand the lecture in a better way.

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