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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Abbreviations

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 run-through 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.[16]

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.[17]

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.[13]

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.[7]

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.[2]

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.[14]

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.[9]

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.[11]

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.[19]

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.[4]

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.[15]

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.[5]

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.[10]

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.[6]

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.[3]

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. [8]

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.[1]

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.[12]

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.[18]

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.[20]

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

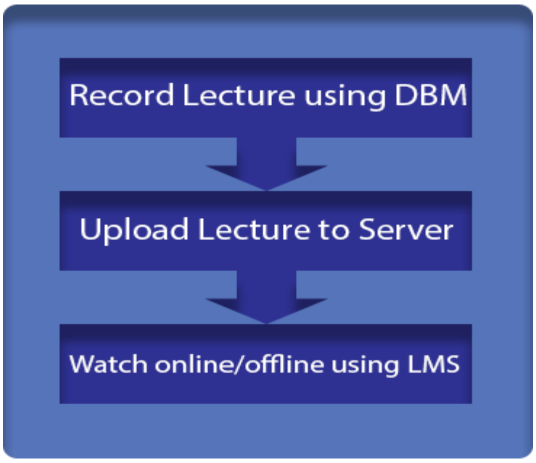

FIGURE 3.1: General Methodology View of the System

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

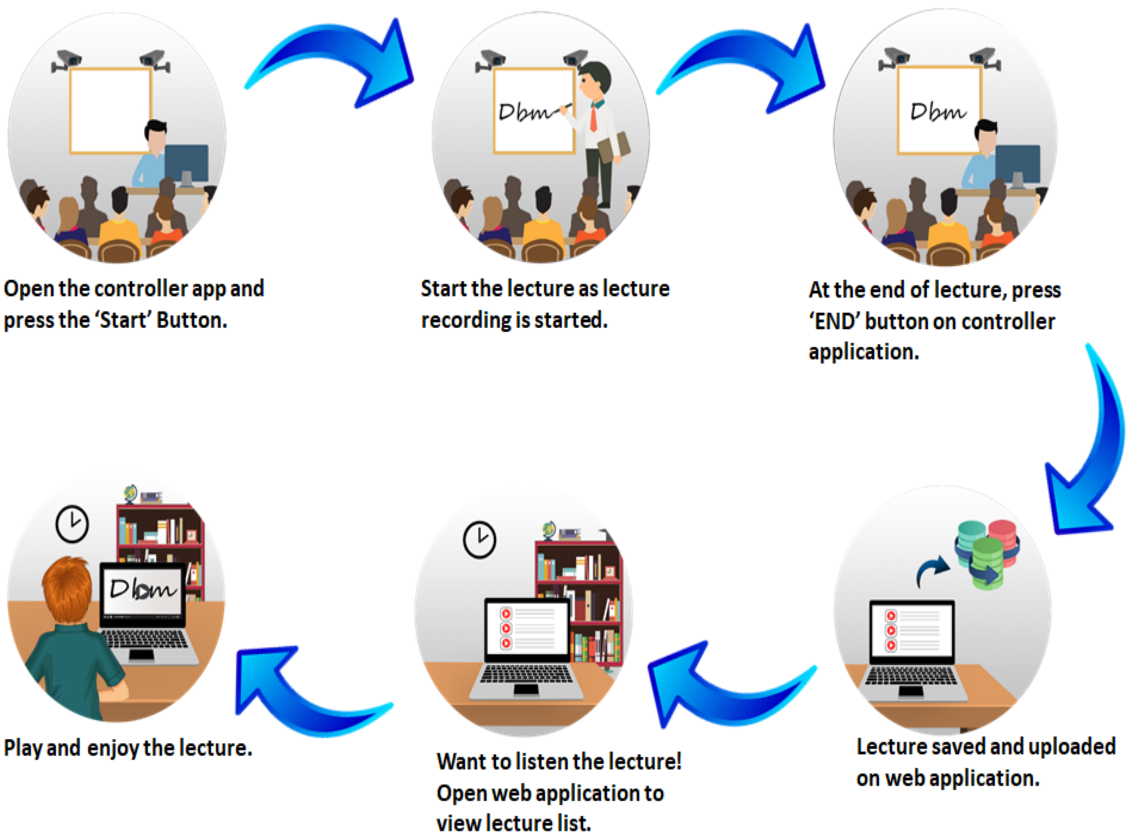

FIGURE 3.2: General Flow of the Project

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.	$q_{IB} = \begin{bmatrix} \cos(\psi/2) \\ 0 \\ 0 \\ \sin(\psi/2) \end{bmatrix} \begin{bmatrix} \cos(\theta/2) \\ 0 \\ \sin(\theta/2) \\ 0 \end{bmatrix} \begin{bmatrix} \cos(\phi/2) \\ \sin(\phi/2) \\ 0 \\ 0 \end{bmatrix}$
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

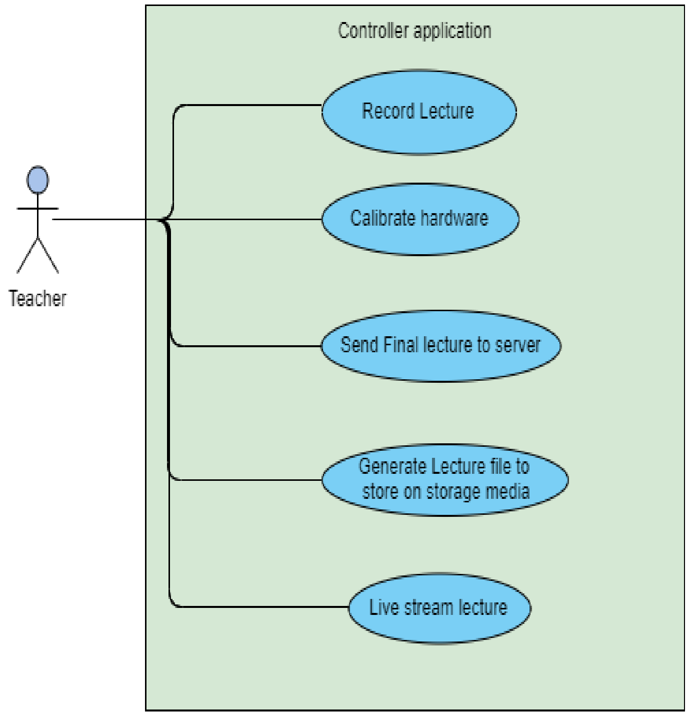

FIGURE 3.3: Use-case Diagram of Controller Application

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

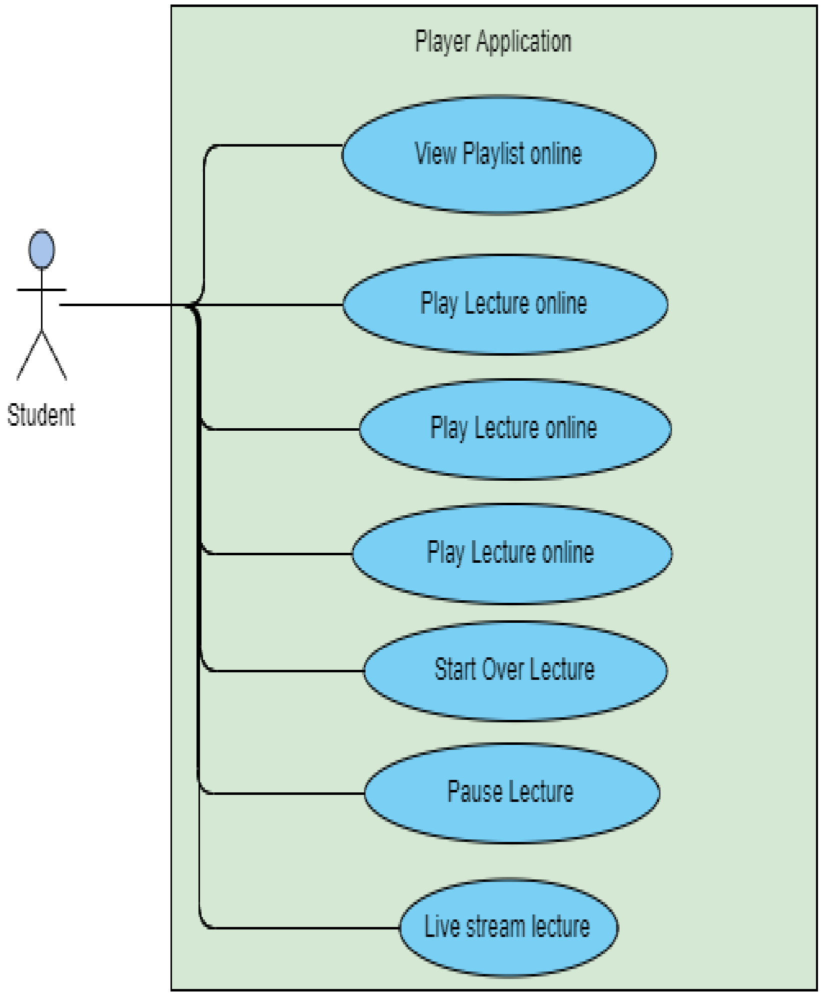

FIGURE 3.4: Use-case Diagram of Player Application

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

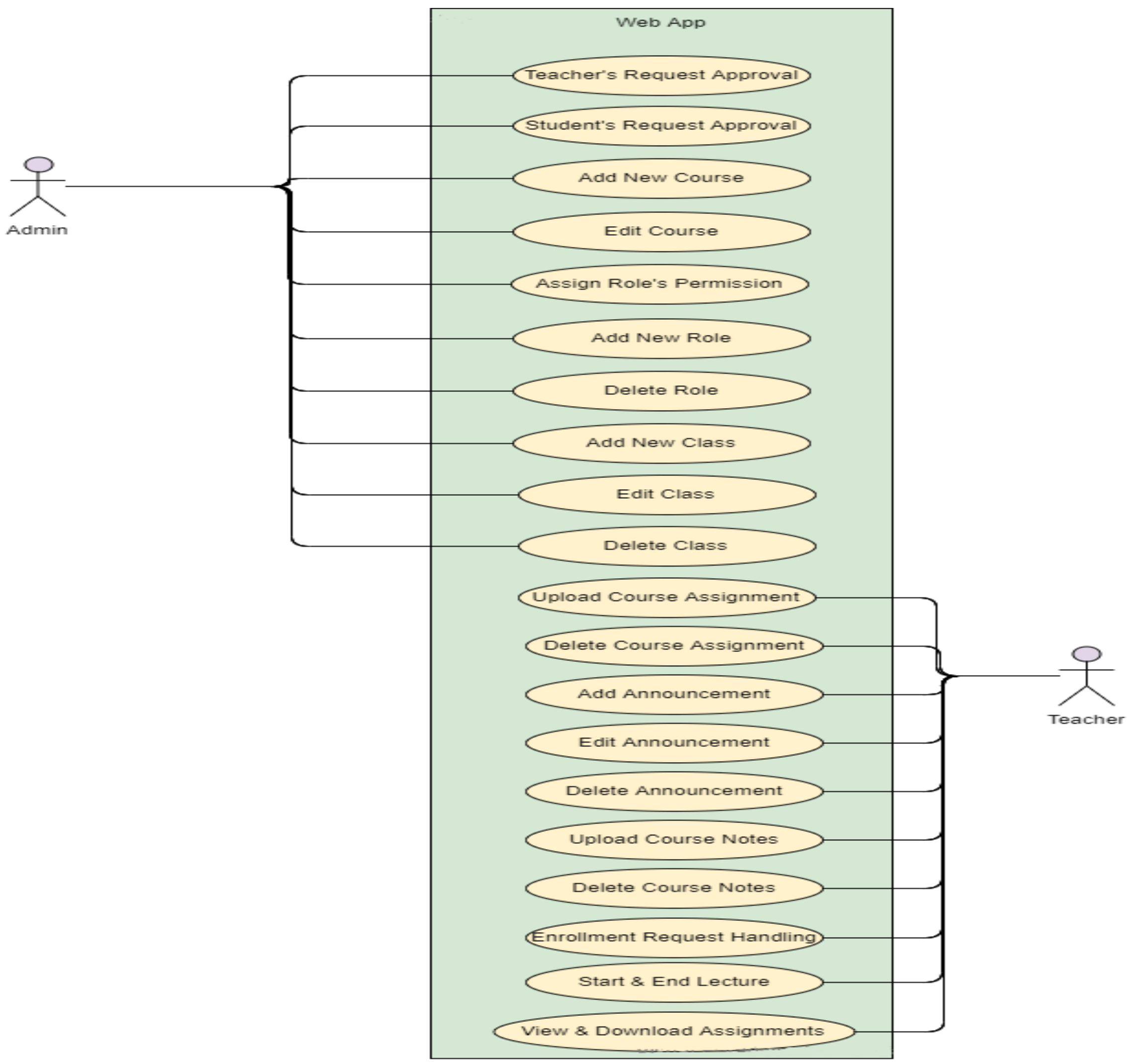

FIGURE 3.5: Use-case Diagram of LMS Web Application Part-I

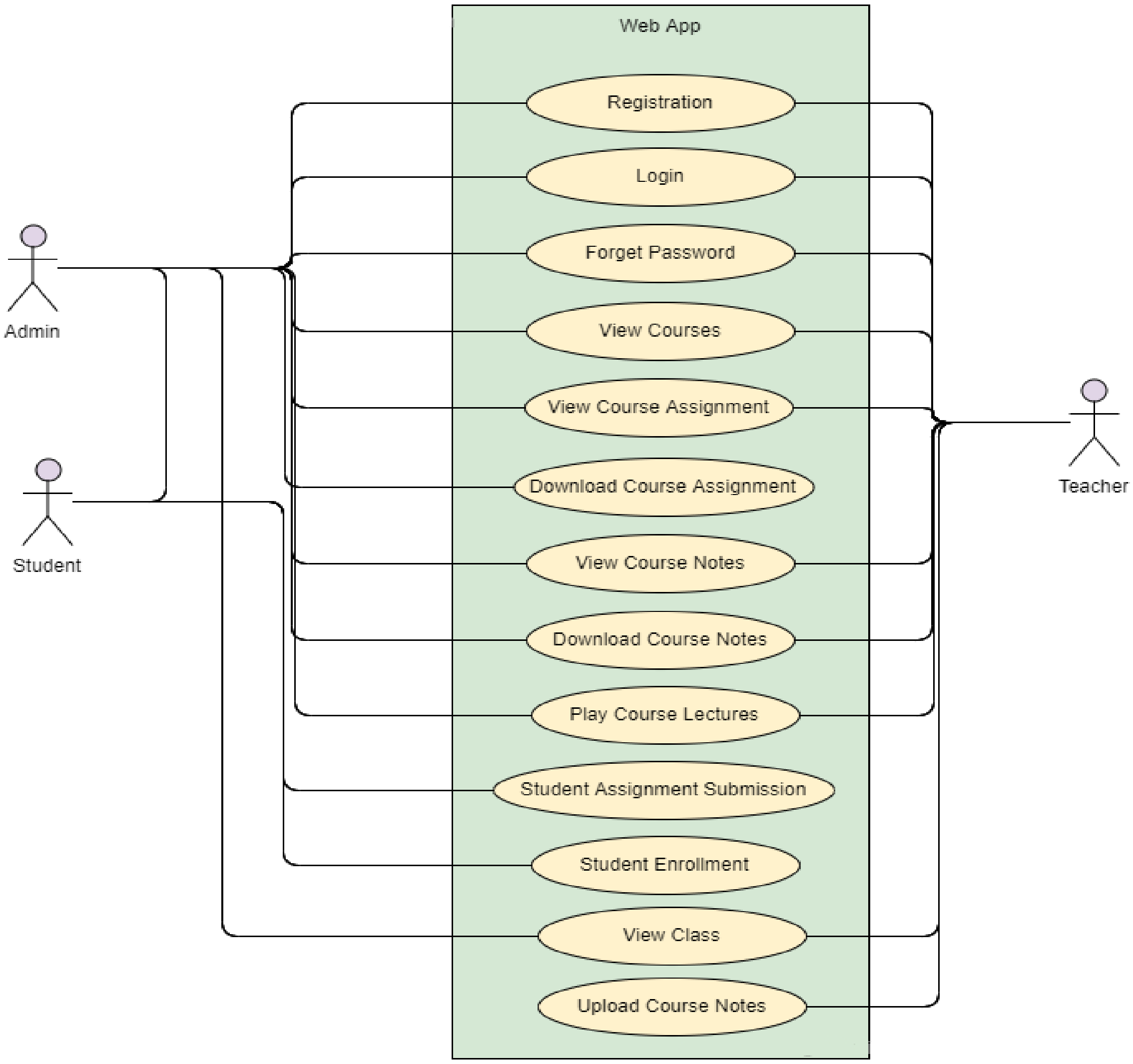

FIGURE 3.6: Use-case Diagram of LMS Web Application Part-II

3.6 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

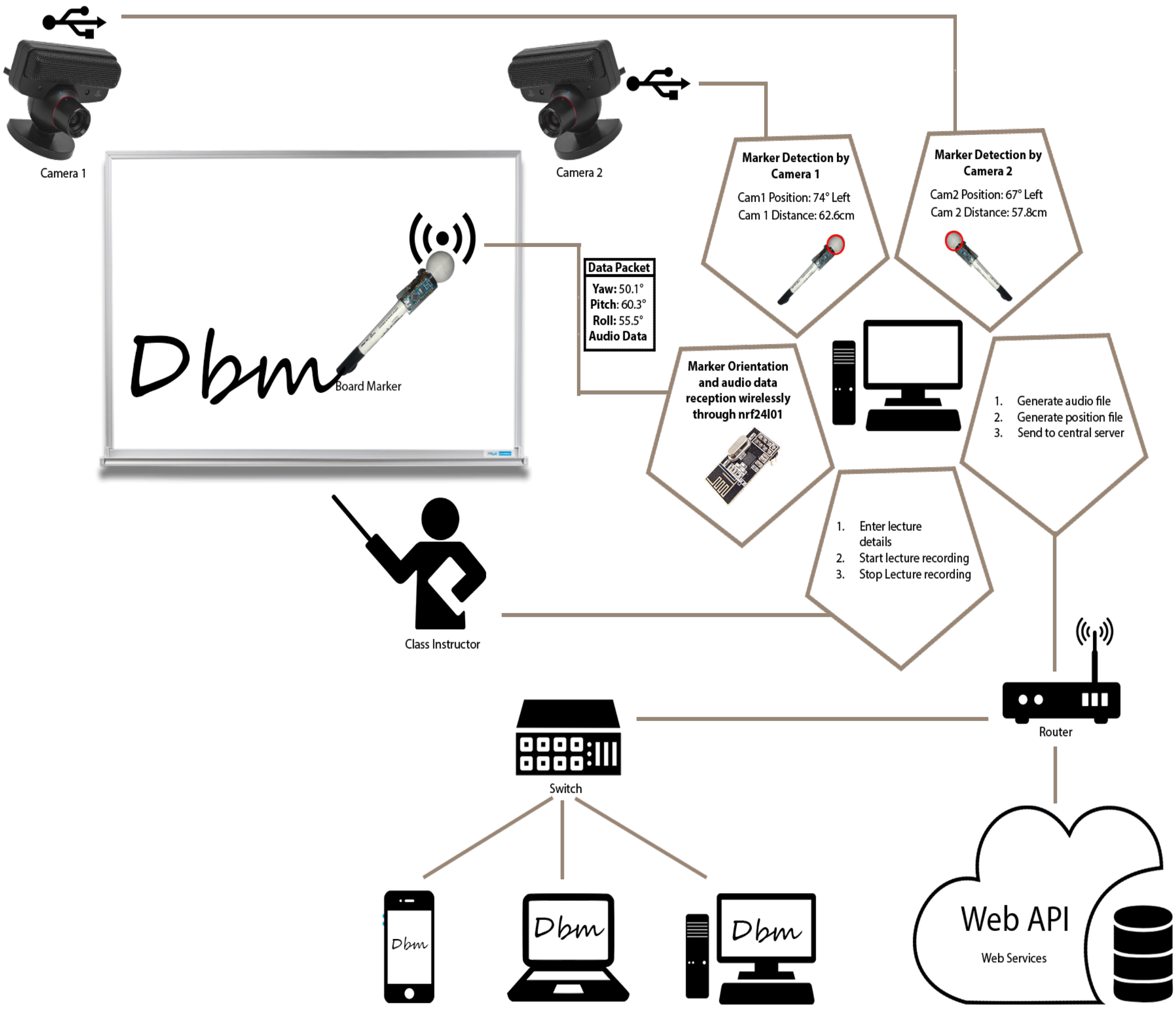

FIGURE 3.7: Architecture Diagram of Digital Board Marker

3.7 Modules Methodology Description

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

3.7.1 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

3.7.1.1 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.

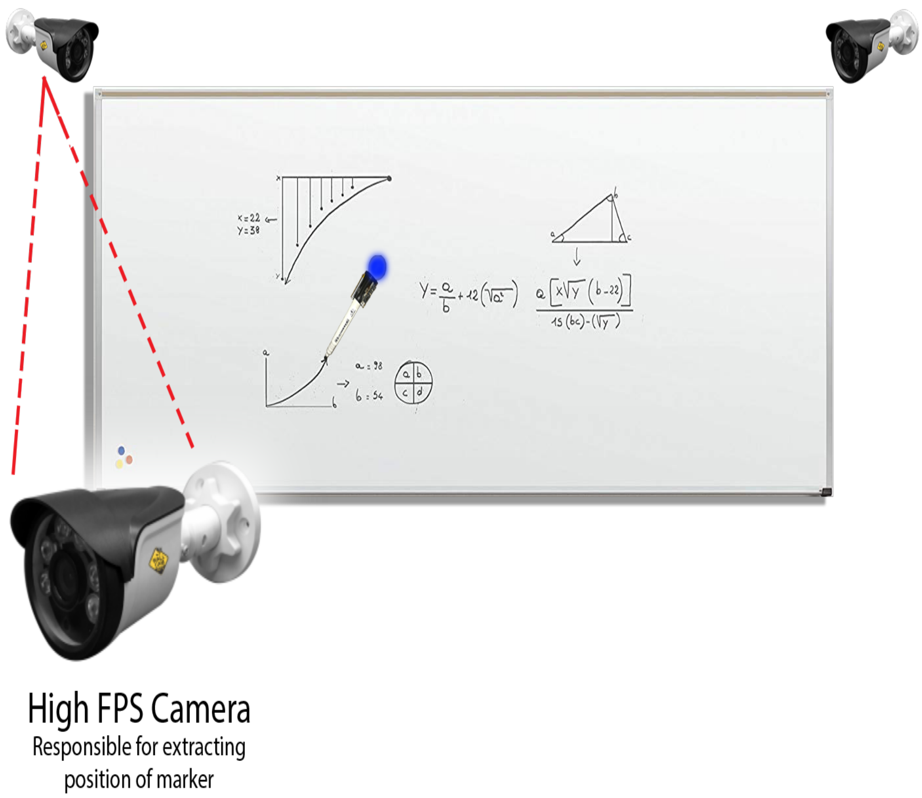

FIGURE 3.8: High frame rate camera placement

3.7.1.2 Marker Hardware

To extract marker orientation, Marker Hardware is connected to controller application.

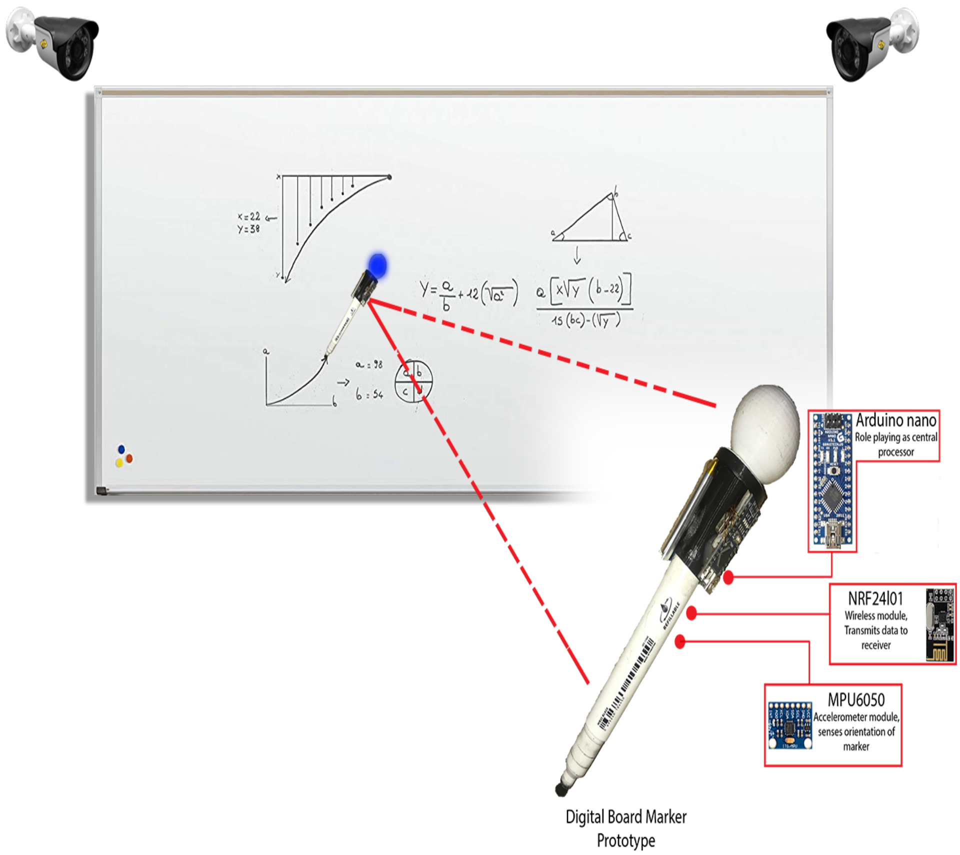

FIGURE 3.9: Marker Hardware working methodology

3.7.2 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 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.

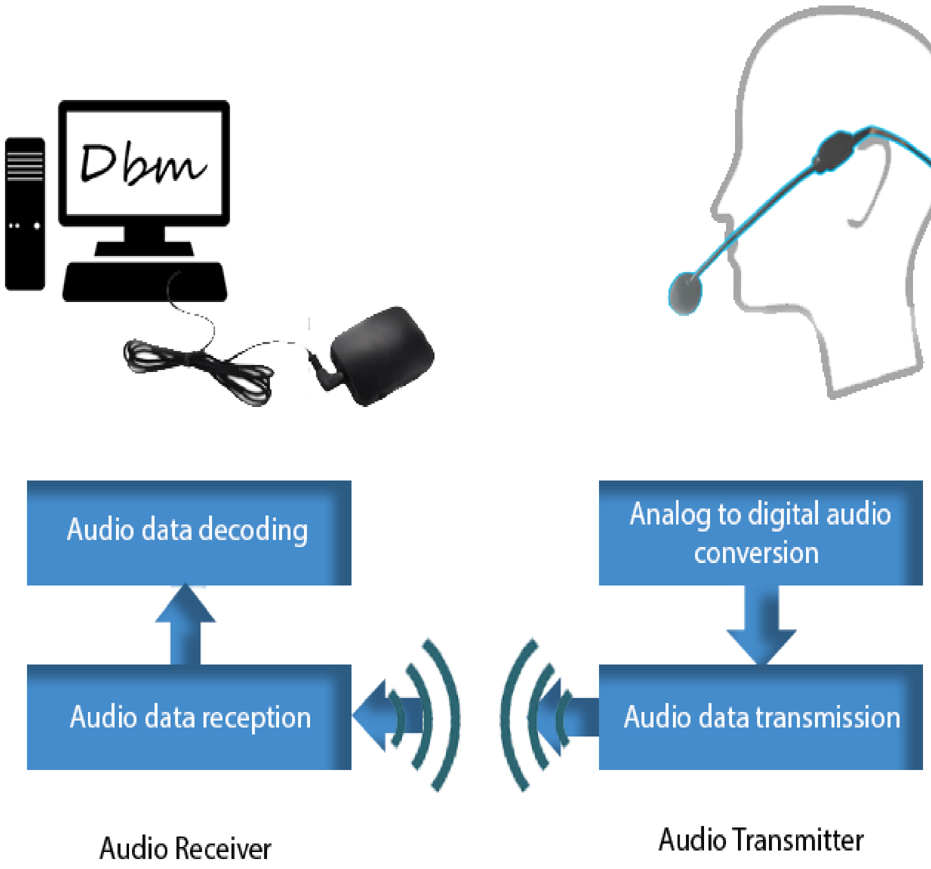

Figure 3.10: Audio Hardware General Methodology

3.7.3 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.

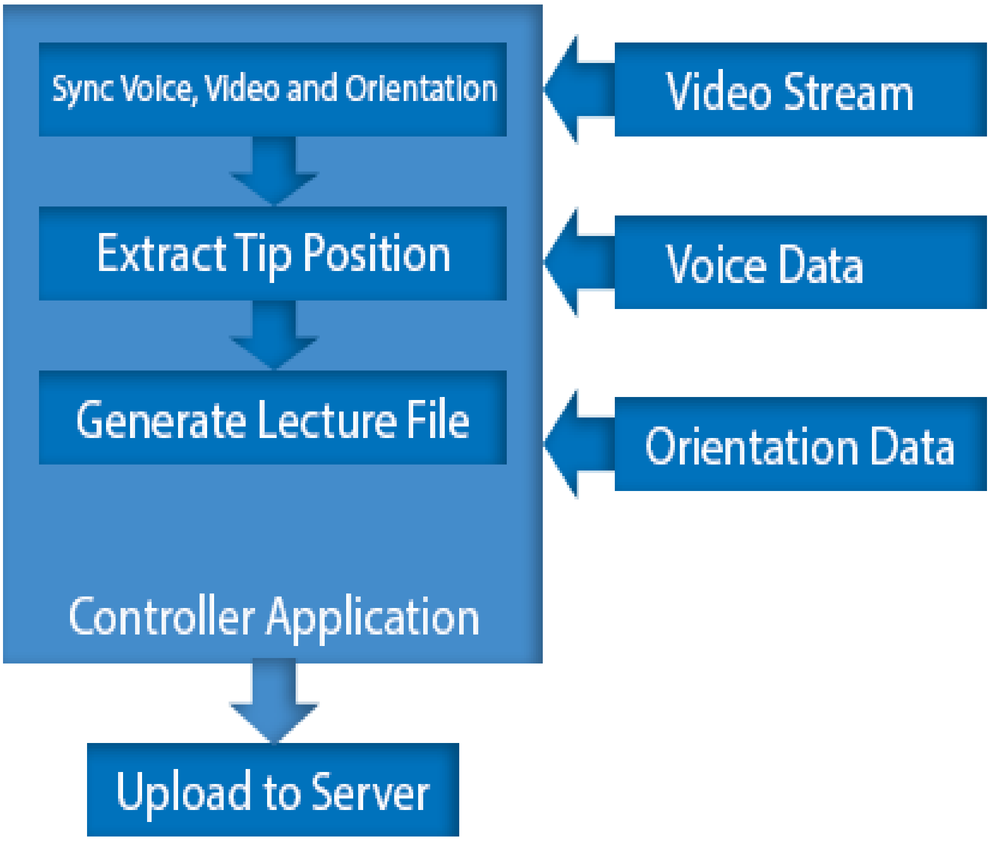

FIGURE 3.11: Controller Application General Methodology

3.7.4 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.

3.7.5 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.

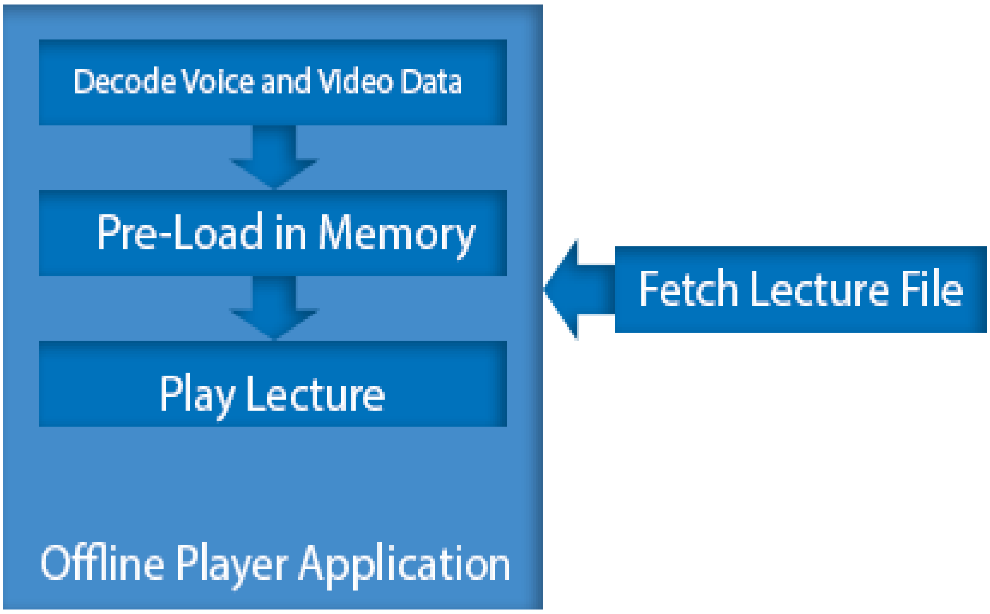

Figure 3.12: Offline Player Application General Methodology

3.7.6 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.

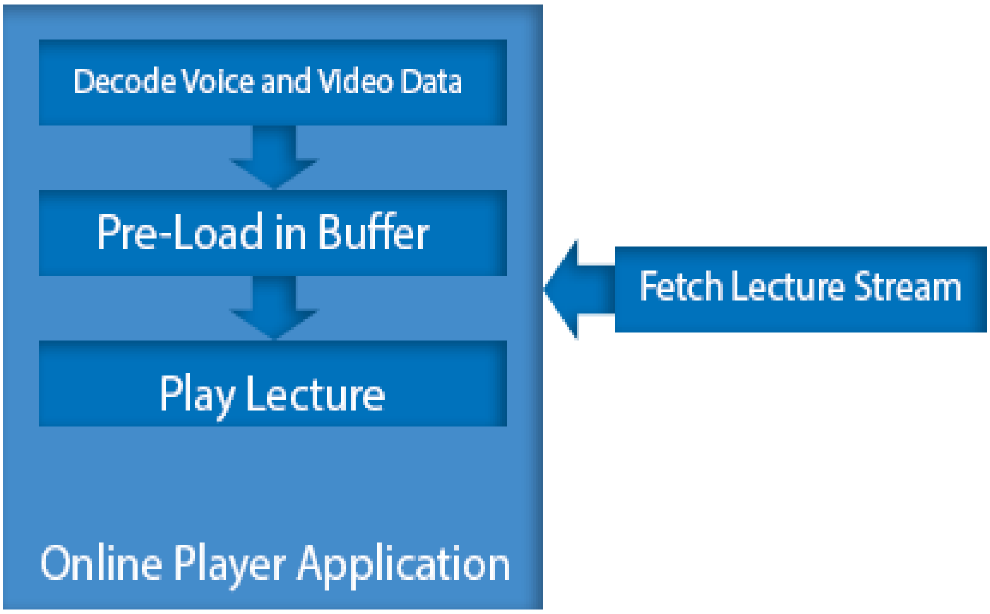

Figure 3.13: Online Player Application General Methodology

3.7.7 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 sub-modules 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.

3.7.7.1 Entity Relationship Diagram

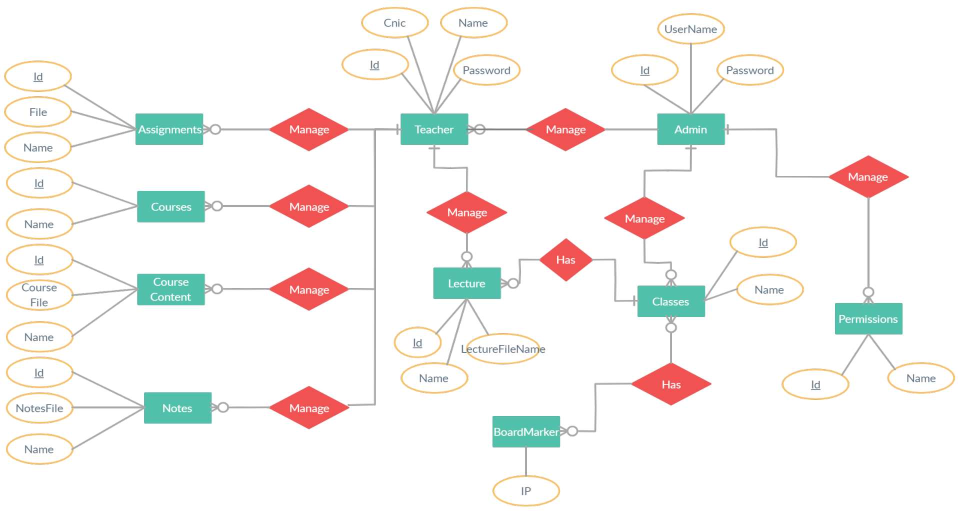

FIGURE 3.14: ER Diagram of LMS

3.7.7.2 Database Diagram

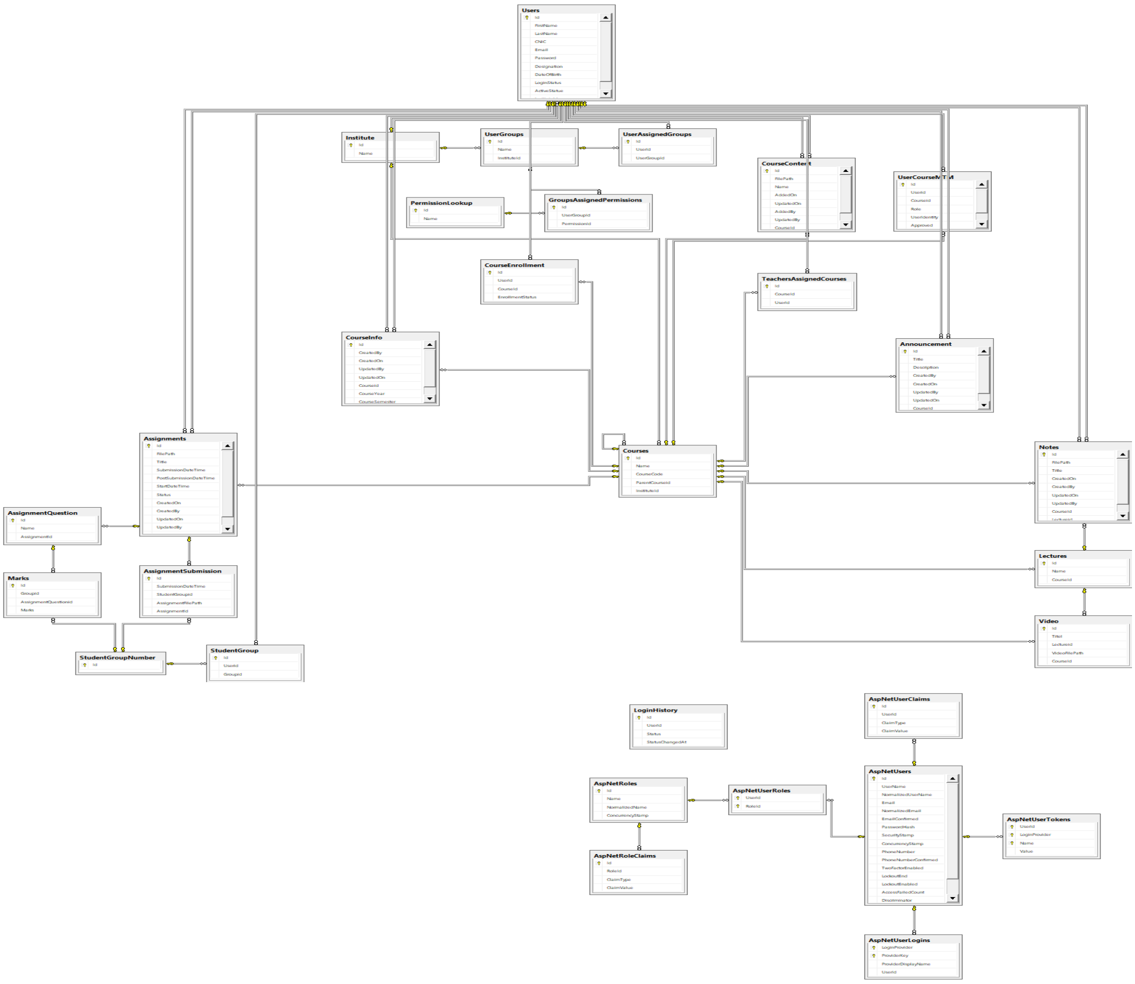

FIGURE 3.15: DB Diagram of LMS

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.

5.1.11.1 Test Case TC-1: Upload valid file

Test Steps:

- Upload assignment file.
- Click on Upload Assignment button.

Test Data:

- Asssignment file: abc.pdf Or abc.docx or abc.png or abc.jpg (file should be less than 20Mb)

5.1.11.2 Test Case TC-2: Enter Invalid Assignment File

Test Steps:

- Upload assignment file in invalid format or of size greater than 20Mb.
- Click on Upload Assignment button.

Test Data:

- Asssignment file: abc.pdf Or abc.docx or abc.png or abc.jpg (file should be less than 20Mb)

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: 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.

5.1.14 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.

Test Steps:

- Go to particular course.
- Go to announcements tab.
- Click on Add Announcement button.
- Enter text for announcement.
- Click on add button.

5.1.15 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.

Test Steps:

- Go to particular course.
- Go to announcements tab.
- Click on edit button.
- Update the announcement.
- Click on save button.

5.1.16 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.

Test Steps:

- Go to particular course.
- Go to announcements tab.
- Click on delete button.

5.1.17 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.

Test Steps:

- Go to particular course.
- Click on submit link in front of particular assignment.
- Select assignment file from device.
- Click on submit button.

5.1.18 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.

Test Steps:

- Go to particular course.
- Click on upload notes button.
- Select notes file from device.
- Click on upload button.

5.1.19 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.

Test Steps:

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

5.1.20 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.

Test Steps:

- Go to particular course.
- Go to notes tab.
- Click on download button in front of the notes in table.

5.1.21 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.

Test Steps:

- Go to particular course.
- Go to notes tab.
- Click on delete button in front of the notes in table.

5.1.22 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.

Test Steps:

- Go to all courses page.
- Click on enrol button.

5.1.23 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.

Test Steps:

- Go to the particular course.
- Click on see enrolment requests button.
- Click on disapprove button to disapprove each student.

5.1.24 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.

Test Steps:

- Go to the particular course.
- Click on see enrolment requests button.
- Click on approve button to approve each student.

5.1.25 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.

Test Steps:

- Go to the assigned courses link.
- Select teacher from the dropdown.
- Select course from dropdown.
- Click on assign course button.

5.1.26 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.

Test Steps:

- Go to the particular course assigned to teacher.
- Click on all submitted assignments link to see all students assignments.

5.1.27 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.

Test Steps:

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

5.2 Offline Player

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 <u>Test Case TC-1: Enter Valid Credentials</u>

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 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

Chapter 7

Future Work

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