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

The Thesis Abstract is written here (and usually kept to just this page). The page is kept centered vertically so can expand into the blank space above the title too. . .

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   Summary of Research Papers

Chapter 3

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Chapter 4

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Future Work

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