Digital Board Marker

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1 Introduction

1.1 Overview of Project

Digital board marker is a size efficient, bandwidth saving lecture recording system. It can record a lecture, providing automated google search of key points. Provides on the spot wiki. Lecture text notes can be generated automatically. A lecture can be named and divided into topics and sub-topics automatically. According to a survey, 94% students go for online help of recently attended lectures because they can't fully grab the concepts at the same time of lecture. 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 a huge amount of extra space available, especially for the CSE students, as they already use bulky software and students also don't have a large bandwidth of internet available.

1.2 Background

The 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 resources easily to the students with this system.

1.3 Motivation

The motivation and purpose to do DBM 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 the internet. The first motivation is to deal with the large amount of storage that normally video lectures take. Proposed 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 a 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 the internet requires a 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 a 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 the lecture. Moreover, students can get benefit by watching 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.

In proposed system, whatever written on the white board can be recorded i.e. lectures as well as presentations of any kind and can be live streamed at up to 100X size efficiency, in a text file by storing the position of marker running on the board. Live stream can take place on an average internet connection, so even if the internet connection is not strong live stream can take place. Lecture frame is a framework that is sensitive to anything that is residing in its boundary. It includes touch frame, a pre-processing phase controller and software.

Using lecture frame, an ordinary white board will be turned into a touch surface. Anything written on a White Board will be recorded and a lecture file which will be text file is generated as well as live streamed on network. Students that are not in the class can attend live lecture either on their laptops or can listen it later using a lecture file which will be helpful in their exams preparation also.

Video output viewed by a student will be same as real video lecture(e.g. on Khan Academy). Everything written on the white board will be recorded and will be saved in the lecture file. Lecture file will be the text file have very low memory space. Whole lecture will be recorded and processed once after that we will make a compressed version of each frame and save the data in a text file which will decrease its size almost 100 times to minimize the use of memory. So, we can record many lectures and provide them to students without need of a database of petabytes size. So that students can save all the lectures within the small amount of memory.

We will provide an application for students to view all the lectures easily. Student can get any lecture of any subject from this application. Students of other institutes can also get benefit from this application. It will be helpful for the learners at different locations. The environment of the lecture frame will be different for each board we will setup that environment as it requires some software as well as hardware. All the measurements will be according to the board we are providing and on the basis of those measurements we will extract data from each image frame.

We will build it in such a way that it works efficiently in every situation and it will easy to handle. This is advancement and improvement in a lecture system if it used all over the world then it will be a great help for students.

2 Objectives

2.1 Industry Objectives

Objectives of implementing the proposed system is to provide industry with a solution of storage and bandwidth which is smart an efficient. Following are some targets for industry:

- To provide a reliable and efficient system to industry to reduce their storage issues.

- To provide a system to access all the industrial presentations on a single platform.

- To provide a smart system to access all presentation at any time even with minimum storage available and with minimum internet bandwidth utilization.

- To provide ease of accessing meeting discussion at any time with minimum available resources.

2.2 Research Objectives

Digital board marker have following research objectives:

- To flourish the research in the field of machine learning an computer vision.

- To research in the field of handwriting recognition for automatic google searching of difficlt or important words.

- To research in the field of machine learning and handwriting recognition for automatic notes generation for ease of students and teacher.

2.3 Academic Objectives

The key academic objectives of implementing the system are:

- To provide the educational institutes with a solution of class lectures availability ar any time with much less internet data and storage utilization.

- To provide a platform with much ease of accessing class lectures of all courses.

- To provide a most reliable solution of the problem that student face while listening and jotting down the lecture at the same time.

- To provide students with high resolution video lectures without compression.

- To provide teachers the ease of accessing all the students submitted assignments from a single platform i.e. LMS.

- To provide system with a smart solution of providing all course related content for the students.

3 Scope of the project

The proposed system will focus on recording a lecture with two stereo vision cameras frame rate 60 FPS. Proposed system will animate a lecture on web application and also offline with the help of offline player. It will serve as an innovative LMS. Recording of voice and board marker position data will occur using custom developed wireless modules. System will record the lecture on a whiteboard of dimension 3-by-4 ft. System will play lectures on a dedicated player(json to video player). It will store json data in encrypted format which will be later result in the animation of video lectures.

4 Target Audience

4.1 Educational Institutes

4.1.1 Admin

Admin can interact with system in form of following tasks.

- Admin can login directly into the system.

- Admin can create different groups/roles.

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

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

- Admin can add courses.

- Admin can assign courses to teachers.

- Admin can update and delete the courses.

4.1.2 Teacher

Teacher can interact with the 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 enrolment 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 announcements.

- Teacher can view and edit course related announcements.

- Teacher can delete announcements.

4.1.3 Students

Student can interact with the 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 enrol 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.

4.2 Online tutors

4.2.1 Tutor

Student can interact with the 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.

4.2.2 Users

Users can interact with system in form of following tasks.

- User can play tutorials.

- User can view lectures list.

- User can download lecture.

5 Possible Applications of Work

Following are areas where Digital Board Marker can be used.

- It can be used in industries for presentations that can be listened again if someone missed any important point. It can also help in making meeting minutes.

**Industrial
Presentations**

FIGURE 5.1: Industrial Presentation

- It can be used by online tutors since it will be a less burden for their audience to download and store lectures with less memory used and less internet bandwidth.

FIGURE 5.2: Online Tutors

- Sketch artists can use the digital board marker as their audience need to see the sketch made by artists again and again to learn how to sketch. This can take a lot of internet bandwidth, so this system will reduce internet usage.

FIGURE 5.3: Sketch Artists

- In universities, it will be a lot of help for students who have a lot less internet bandwidth and storage. It will reduce students and teachers problems of assignments and lectures by providing a single platform, i.e. LMS.

FIGURE 5.4: Educational Institutes

6 Existing System

6.1 Comparison of Existing Systems

Online video lecture systems that exist now-a-days are: MIT open course ware, Virtual University open course ware, Lynda online courses, Udemy etc. These are the system which are very helpful to users and can be accessed by everyone. They provide video lectures of class recording the video and audio. Almost all the systems use this same procedure of recording with camera and microphone.

6.2 Drawbacks of Existing Systems

6.2.1 Structured Limitations

Technologies used by current systems for information storage contains the structure limitations. That is there is much less flexibility in data storage. A good quality video needs a lot of memory. It might not be a problem for the institute or web platform they are using but that might be a problem for users/students who have limited storage and limited bandwidth for watching and downloading lectures.

7 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.

8 Proposed System

Digital board marker is an innovation and need of the hour because it is solving the basic problem of all students in society because it saves their time to note the lecture and they can concentrate on the topic completely. It is a ready-made wiki. Implementing machine learning, proposed system can recognize a hand drawn objects on whiteboard. Student can easily understand what is written on the white board. As most of the student lost their concentration while writing the detailed lecture. Moreover, sometimes we skip an important part of our lecture in the effort of writing whole details on our notebook. So, digital board marker

is leading-edge to solve all these Issues. It has some potential for having positive effect on student learning. It will increase students learning ability because if they hear everything teacher say they can think about it clearly and understand it. The main advantage of the digital board marker is that it will also helpful for the students to get better grades even if they miss lectures. Moreover, teacher will get rid of repeating the lecture. So it will be icing on the cake. It is actually a real time lecturing system to provide easiness for the learners in the different location. It resides in the domain of image processing and vision. By image processing, we can extract all the necessary data needed to get the exact results so it is undeniable that Digital board marker will provide sample of benefits for the learners. Digital board marker will have online stream feature as well. It will require much less internet bandwidth as compared to a regular video stream.

9 Feasibility Study

9.1 Technical Feasibility

- The main focus of this project is to help educational institutions and students so that the institutes can provide much more resources to students to utilize and student can use these resources to improve their studies. The internet bandwidth issue with students is so common DBM also resolves this issue.

- Every student can use it with so less cost.

- The bandwidth issue can be resolved with this product and students can focus on their studies more precisely.

- We asked students about their problems and their views about this system.

- Almost 81.6 percent students were agreed that they face the problem of noting down the lecture at the same time it is delivered.
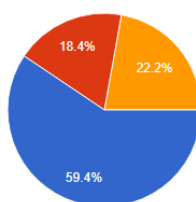

FIGURE 9.1: Writing & listening problem together

- There were almost 65 percent students who have storage space issue because they can't store high quality video lectures.
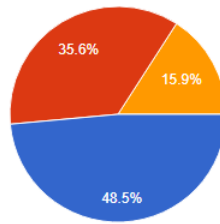
FIGURE 9.2: Storage issue

- Almost 94 percent students want to access all the lectures at any time on a single platform.
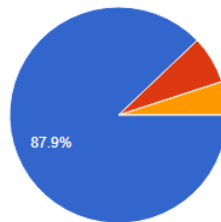

FIGURE 9.3: Access lecture at anytime.

- According to the survey form almost 95 percent students want this system to be installed in their institutes.
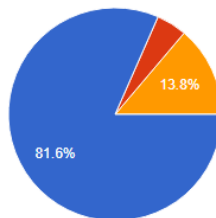

FIGURE 9.4: System should be installed.

9.2 Operational Feasibility

DBM solves the storage and bandwidth problems so efficiently that it decreases the storage size 100 times less than the usual size and bandwidth will be so less

because instead of sending frames it is sending json data which is of very low size. It fits the market because there are conventional systems working right now which provides the same features but with much greater cost and bandwidth which is the main problem the use of these system is impractical. People in places with no internet connectivity or less bandwidth face issue to use these conventional sites so DBM is resolving their issue.

For operational feasibility we asked the teachers of different institutes about their need of system.

- According to recent measures almost 92 percent of teachers want their lectures to be available on a single platform.
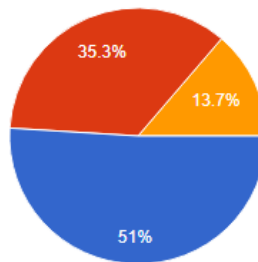

FIGURE 9.5: Lectures on single platform(Teacher).

- Almost 98 percent of teachers wants this system to be installed in their institutes.
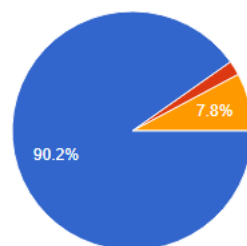

FIGURE 9.6: System should be installed(Teacher).

9.3 Economical Feasibility

DBM is not so expensive as compare to other running systems in market which try to provide the same thing as DBM. Conventional systems are costly and requires

much greater bandwidth. DBM is providing those things along with enhanced features with so less cost. Some systems are trying to provide these features, but the cost of these systems is so high that it is impractical to use them at places where we can't spend so much money so DBM is resolving this problem very smartly. The total cost of the system is estimated around 10000. All the other conventional systems are three times expensive, then DBM so DBM is economically feasible.

10 Limitations and challenges

10.1 Hardware

- Board Marker Transmitter and Receiver are in range of 2 meters for less noise and preventing latency issues.

- Lipo Battery is assumed to give 5 volts to Arduino nano mainboard. For this purpose, a dc-dc boost converter is hooked up with the battery to achieve continuous 5V output.

- Board Marker Transmitter has at least 30deliver 5V output.

- Power Switch of Board Marker Transmitter is assumed to be turned on while in working mode.

- Power Switch of Board Marker Transmitter is assumed to be turned off while in debugging USB connection mode.

- In order to calculate the orientation of marker correctly, following alignment of the marker is assumed in which Board Marker Transmitter is aligned in the negative Z direction.
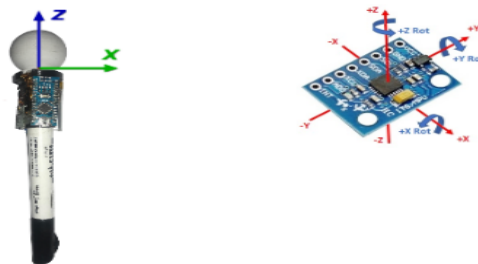

FIGURE 10.1: Transmitter Alignment.

- Appropriate RS232 serial connection drivers are installed on the desktop with which Receiver module is connected.

10.2 Web Application

10.2.1 Linking of front-end with back-end

We can face following problems while linking the front end with the back end.

- Front-end is not properly linked with the back-end project.

- Front-end functionality is not accessible in the back-end.

- Front-end design is not working after linkage with the back-end.

10.2.2 Front-end design

As we will use Angular 8 framework for the front-end design. There may occur some problems while working with angular 8. Some of problems mentioned here.

- Styling of the front end.

- Libraries are not working properly.

- Conflicts occur with other libraries.

- Problems while routing.

10.2.3 Requirements changing for some business reason

After website development completion, we may face a problem while adjusting the project with new requirements i.e. Some requirements needs to be changed for customer satisfaction or according to customer demands. Some problems are mentioned here.

- Database is not supporting the new requirements.

- Requirements can not be accommodated in our system due to risk of increase in cost of project.

- Problem of renegotiate the whole project.

- Requirements implementation result in the huge change in the project.

10.3   Offline Player

- Multi-threading was the main problem in the offline player when you are trying to run two or more process at once then you need multi-threading to be implemented, but handling multiple threads was a difficult job.

- Reading data from json file and drawing it according to time was a difficult task to attain.

- Synchronizing the drawing of data and playing the audio with track bar has some lag because we have to keep track of previously drawn data.