Study of Digital Learning and its implementation on Student Mobility in Engineering Education

Rita Jain, B. L. Pal

Abstract: The advent of information and communication technologies (ICT), learning has entered into an era of change unparalleled in this generation. The issue is, how theoretical knowledge can apply to real world problem? Academics worldwide have come to the conclusion that traditional learning methods must give way to Digital learning (D-learning). However, in order to change a paradigm, there must be a change in the way that people believe, think and act. A change to Digital learning in engineering education is a paradigm that has its associated challenges. Innovations are required so as to accomplish Digital learning in engineering education. Developing Digital learning tools that will take engineering education beyond traditional capabilities is a part of this challenge.

In this paper, I have presented a review on design and development of virtual classroom environment using real-time streaming technology for live and online activity. Student can access the lecture even in presence of mobility for engineering education and exchange their views and ideas on education matter with teachers. This virtual classroom environment with digital learning education can transform the conventional paper education to the paper less education.

Keywords: Digital learning, Real Time Streaming, Virtual Classroom Environment, BestESM(Best Enhance Student Mobility)

I. INTRODUCTION

The rapid growth of the Internet and global network systems for the development, presentation and transfer of digital information is causing educators to rethink the method in which they provide information. Digital Learning is becoming recent phenomenon. People used personal computers at home, school or even at work. Digital learning is now a reality that has been made possible by very recent advances in technology; several learning tools use network technology to create, deliver and to enhance learning through Internet. Digital Learning opened the door for new methods to enhance and transform the traditional education process.

Today, the need of engineering education has been changed. Due to the nature of today's higher education, learner as being one who seeks flexibility and continued developments in technology, the demand for Digital learning services is steadily increasing. Enrolments, course offerings and the availability of distance education increased rapidly during the 1990s. After introduction of new economic policies in 1991 in our country the demand of new engineers are huge. More and more state govt. is allowing private engineering colleges in their state but the availability of trained educators are scare. In 2000 alone, 7.6% of

undergraduate and 12.3% postgraduate students, totaling a little over one million, participated in distance learning in the India [1]. Further, 20% of 2- and 4-year institutions also planned to start offering distance education courses between 1998 and 2001. These figures in the USA were projected to increase to about 2.2 million [2].

Despite the dramatic expansion in Digital learning and distance education, Digital learning in engineering education still faces a number of challenges and setbacks that prevents an equivalent expansion rate. For effective and complete learning in engineering, science and technology, education requires a mixture of theoretical and practical sessions. In order to understand how theoretical knowledge can apply to real world problems, practical exercises are essential [3][4].

While it is relatively easy to simulate experiments, performing practical experiments online has continued to be a challenge [3-5]. Coupled with this, engineering software is often very expensive and may not be easily affordable by the ordinary Digital learner and instaurations. Although low cost alternatives that utilize freeware have been successfully developed and tested, practical application in which student access lecture even in presence of mobility that support engineering education is a real challenge.

Digital learning is any instructional practice that is effectively using technology to strengthen the student learning experience. Digital learning encompasses a wide spectrum of tools and practices, i.e. using online and formative assessment, increasing focus on quality of teaching resources and time, online content and courses, applications of technology in the classroom , adaptive software for students with special needs, learning platforms, participating in professional communities of practice, providing access to high-level and challenging content and instruction, and many other advancements technology provides to teaching and learning. In particular, blended learning is any time a student learns, at least in part, at a supervised brick-and-mortar location away from home and, at least in part, through online delivery with some element of student control over time, place, path, and/or pace.

Most educators plan and aim the best for their students. They will always reflect their teaching style in term of its effectiveness in helping students to learn. This is a normal process that should happen among educators. They will keep searching the best teaching and learning process should be implemented in their classes. [6], many students do not have access to the best teachers, the best teaching strategies, and enriching learning experiences. With help of significant changes in teaching and learning system, we can swift action to create a more innovative, effective and efficient education system that the needs of all students.

Revised Manuscript Received on 30 October 2012
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Retrieval Number: E0280091512 /12©BEIESP
Journal Website: www.ijitee.org

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Published By:
Blue Eyes Intelligence Engineering
and Sciences Publication (BEIESP)
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The BestESM (Best Enhance Student Mobility) program is an example of how the technology can be used to improve student mobility and student performance with significant focus on professional development support provided to teachers as well as the technology itself. External evaluations verify how significant changes in student performance can result from intensive professional development and the use of high level of technology in the classroom. The combination of high-quality instruction and technology creates a platform that allow students to outperform peers who are not in classrooms equipped with the technology and whose teachers have not participated in the BestESM professional development program. See in figure-1 Architecture of BestESM ,

First, client will visit the website through browser and after that client will be connected to the Application server using HTTP protocol. User will have to choose the option "Attend live lecture" or "Pre-recorded lecture". Then user will be redirected to Flash media Server using RTMP protocol where user will get SWF file playing in the flash media player. With this, user can see live or pre recorded lecture.
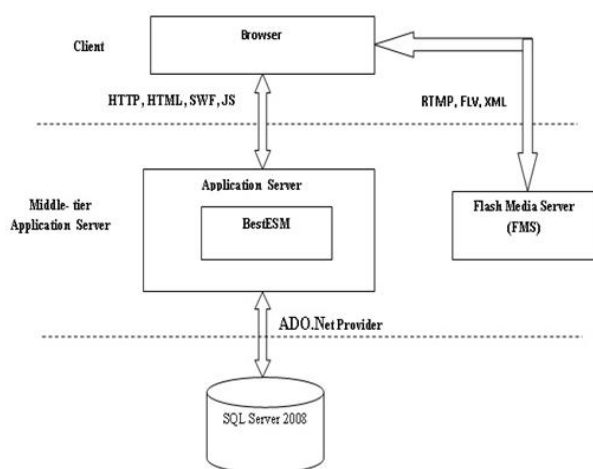

Figure-1 Architecture of BestESM

II. VIRTUAL CLASSROOMS

A concept of virtual classroom means a physical separation of instructor and student. "In the near future, it will become apparent that computers and other forms of technology are heavily used in classrooms and their objectives and results of those objectives will be heavily monitored and scrutinized."[7]

In Virtual Classroom Environment, Digital learning can be done either synchronously or asynchronously. Asynchronous digital Learning refers to "on-demand" learning materials where learner can access and use whenever and wherever he or she wants. Synchronous allows you to deliver live training to remote learners. This means that your learners are listening and responding to a live event with an instructor, but the learners are accessing the course or class from their computer in a remote location. The learners attending the session can see any document or application at the same time as the instructor. The students can behave in a similar fashion to a traditional classroom session. They can virtually raise their hand, ask questions through instant messaging or even "drive" the software application as BestESM.

III. REAL TIME STREAMING TECHNOLOGY

Streaming is a technique for transferring data where data can be processed as a steady and continuous stream. For streaming to work, the client side receiving the data must be able to collect the data and send it as a steady stream to the application that is processing the data and converting it to sound or pictures. Also, we can say streaming in an embedded media player. With streaming, the client browser or plug-in can start displaying the data before the entire file has been transmitted. To transmit the data using the stream media, there exist two types of connection over the stream media - unicast and mulicast connection.
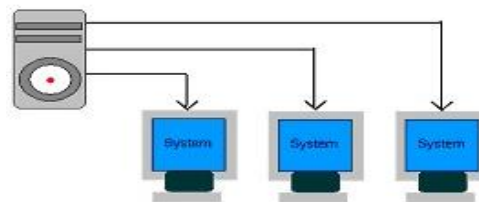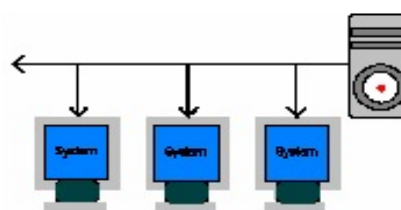

Figure- 2 Unicast Connection

Figure- 3 Multicast Connection

Unicast connections require multiple connections from the same streaming server even when it streams the same content

Multicasting connections require single connections over the entire network to broadcasts the same copy of the multimedia over the entire network to a group of clients BestESM applying Multicasting connection to deliver the lecture.

IV. BEST ENHANCE STUDENT MOBILITY

A Best Enhance Student Mobility (BeatESM) is a Virtual Classroom environment which uses "Real Time Streaming Technology "to deliver synchronous and asynchronous lecture over the Internet. Several Internet based Real Time Streaming applications have been already developed by NPTL, NEEDs etc. But most of these applications are based either on demand or live. But BestESM is the solution to facilitate the student to access the lecture on demand as well as live with the presence of mobility. It replaces the conventional lecturing of engineering education.

BestESM server application has mainly following these parts:

➢ The client (user) display a user interface to start, stop or pause (pause is not possible in live, but in on demand - later on while viewing) a video (See Figure 4) where client run flash media player.

➢ Client and Server side action script code handles the user interaction and connection to the server and define what should happen when user connect and disconnect, create play lists and connect to external data source.

➢ Camera and microphone capture live video and audio lecture.

The Server and the client can communicate over a persistent connection using Real-Time Messing Protocol (RTMP) and Hyper Text Transfer Protocol (HTTP). Server delivers the client over HTTP. Client creates socket connection to the BestESM server over RTMP. The connection allows data to stream between client and server in real time.

See figure .4 A. Flash Player client. B. Application Server with database. C. Flash Media Server 1. HTTP Request 2. SWF file streams to client.
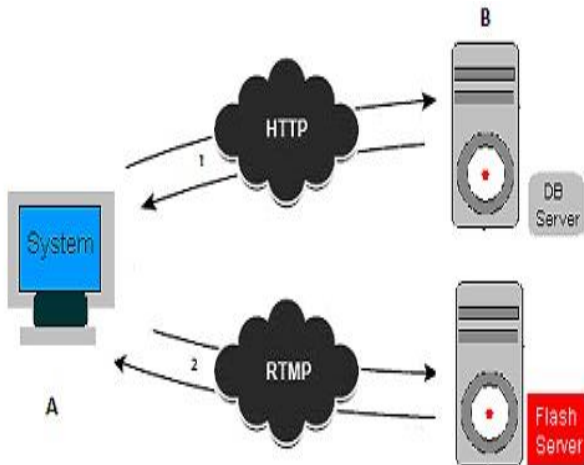

Figure-4 Basic Block diagram of Real Time Streaming

BestESM Server Application is developed with help of ASP.Net 3.5, JavaScript, AJAX, Adobe Flash CS3, ActionScript, SQL Server 2008 and Flash Media Server 4.5.1.
System Requirements for Flash Media Server are as follows:

Windows

- 3.2GHz Intel® Pentium® 4 processor (dual Intel Xeon® or faster recommended)
- Microsoft® Windows Server® 2008 R2 (64 bit) or Windows® 7 (32 bit; for Adobe® Flash® Media Development Server only)
- 64-bit operating systems: 4GB of RAM (8GB recommended)
- 1Gb Ethernet card recommended (multiple network cards and 10Gb also supported)

Linux

- 3.2GHz Intel Pentium 4 processor (dual Intel Xeon or faster recommended)
- Red Hat® Enterprise Linux® Server 5.5 (64 bit) or Linux CentOS 5.5 (64 bit)
- 64-bit operating systems: 4GB of RAM (8GB recommended)
- 1Gb Ethernet card recommended (multiple network cards and 10Gb also supported)

Basic Flow of Action with BestESM

With BestESM, the basic flow of action follows a two-step request/response model, whether the client requests for lecture or Server response.

For a Client request:

- The Client/Learner/Instructor requests a web browser to connect the BestESM Server, passing in the user name, password for login. If provided login information is wrong then login will fail and message will be return for incorrect login credentials.If provided login information is right then login will be successful and Client/Learner/Instructor can attend the live or on demand lecture.

For Server response:

- Response to the Client/Learner/Instructor. After Client/Learner/Instructor enter login information it will check the user name and password and it the information provided is right then server will give the permission to login and attend the lecture either it is live or on demand lecture.
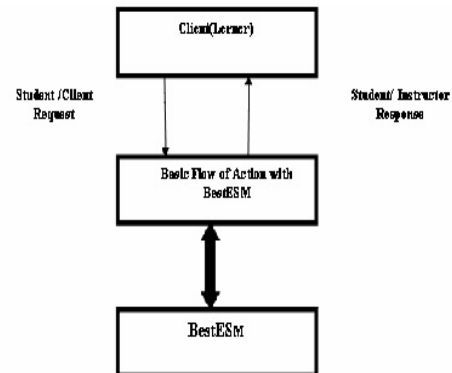

Figure-5 The basic flow of action with BestESM

- ✓ Captures and encodes video
- ✓ Displays the video as it's captured
- ✓ Streams video from the client to Flash Media Server.
- ✓ Sends metadata to the server that the server sends to clients when they play the live stream.
- ✓ Streams video from Flash Media Server back to the client when you click a button
- ✓ Displays the video streamed from the server

BestESM has mainly two interfaces – one is user interface and another is instructor interface. See in figure 5 where instructor interface is provided. Instructor can see that how many students are attending the live lecture through the BestESM application. Instructor has a control to make speak enable or disable the student who is attending the lecture live and at the same time record the lecture. Once located, the instructor can start broadcast by clicking the "AV" button. Once the broadcast has started, all users can see the broadcast on one of their video windows.
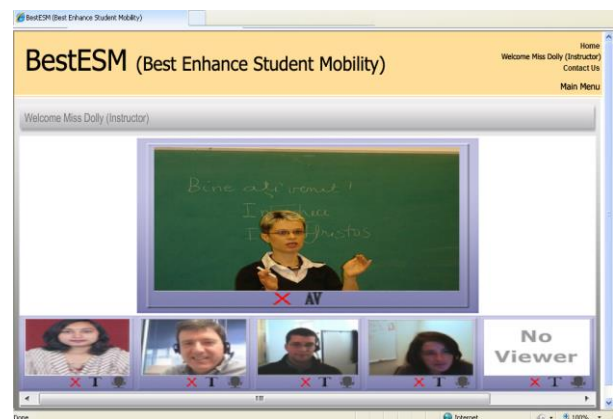
Instructor Side Interface

Figure-6 Instructor Interface

1. Stop whole Broadcasting to all the viewers by pressing "X" in red button.

2. Start Broadcasting by pressing "AV" button.
3. In the video list of connected/joined viewers/learners, the Instructor can stop broadcasting for any single viewer/learner by pressing "X" on that particular viewer/learner's thumbnail video at anytime.
4. When any viewer sends text chat request by pressing "T" button, instructor have a control to enable text chat or disable it and at the same time Instructor can broadcast the lecture.
5. When any viewer sends speak request by pressing "MIC" button, instructor have a control to make speak enable or disable and at same time Instructor can broadcast the lecture.
   6 When live lecture is going on, BestESM application will be recording whole lecture of Instructor's audio/video and only audio part of all other viewers (from the speaker output - when viewer asking any query) using another desktop application through another SWF file(specially designed to record audio/video only). This application requires another webcam for recording.

Client Side Interface

Client (User) requires an internet connection and flash media player to run BestESM on their computer or laptop. Client will visit the website and user will enter information for login. In case of incorrect login credential, login will fail and message will be displayed indicating invalid login. If login will be successful then user will be connected to the Application Server of BestESM to select the live lecture or online lecture, year, branch & subject etc. User can see live or pre-recorded lecture using following window.
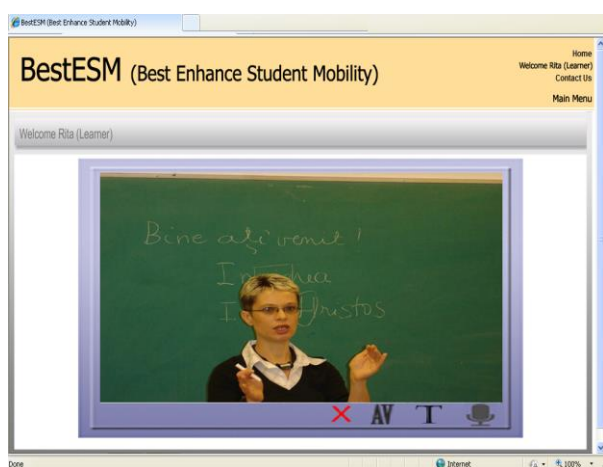

Figure-7 User Interface

Where learner can

1. Stop watching by pressing first button (X) in red.
2. Join by pressing "AV" button.
3. Do Text Chat by pressing "T" button.
4. Once learner will send request and when the instructor will approve that request then only learner will be able to do text chat.
5. Learner can speak by pressing "MIC" button.
6. Once Learner will send request and when the instructor will approve the request then only learner will be able to speak.

V. CONCLUSION

It clearly shows that digital learning has more benefits than conventional learning. Problems that exist within conventional learning can be solved partly through Digital learning. By utilizing digital learning effectively, university's ability to transfer knowledge and expertise to society can be enhanced. Also we are able to predict the future of learning in order to meet the needs of the changing world through continuous digital Learning activities. Before that, we must understand the problems that may happen within Digital learning. Integration of high technology with multimedia tools must be emphasized because digital learning relies heavily on technologies. Also, collaboration with government, private organizations and other universities is important to overcome the high cost involved in develop Digital learning. We also need to provide experienced personnel with technical skill needed to implement Digital learning. So, we could say that Digital learning is a good solution to conventional learning as it is able to solve most of the problems that exist in conventional learning.

Continuing Engineering Education in Digital mode there is no substitute for delivery of instruction in the class room, where the student can interact with the instructor directly and effectively. But under two most common circumstances, such contact mode of instruction proves impractical (a) In case of less common engineering subjects where teachers are few and students are geographically dispersed over a large area, and (b) When persons employed in industry cannot be spared by their job commitments to attend universities over extended duration. In such circumstances digital mode of communication provides the most practical means of delivering information.

This paper showed a BestESM (Best Enhance Student Mobility) through this application enhance digital mode in engineering education and these enhancement will become beneficial for learner as well as organization.

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