

E-education and content development: An experience

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Abstract—This paper presents the work done in Indian Institute of Technology, Kanpur on the dissemination of educational information via intranet or internet. The work started by using a trial version of software WebCT developed by University of British Columbia. This was later replaced by Brihaspati which is developed by us in IIT Kanpur and distributed as opensource free software. We have also experimented with the generation of multimedia course contents, which can be streamed through Realserver. The students need to have *Real Player* which is available for free. We are currently developing our own opensource free software which can be used to hold live classroom sessions over internet. Overall experience indicates that an E-education system can complement the existing systems to make them more effective.

Keywords—E-education, E-learning, Brihaspati, Multimedia course generation

I. INTRODUCTION

The evolution of internet and world wide web (WWW) has affected all part of life dramatically. Also the area of education has not remained untouched. Previously, student used to spend their time in library searching for information in books and journals. Now a days they use web search engines and figure out the web sites containing the required information. The information sharing has become very easy due to access to Internet.

Before delving further into the impact of internet on education, let us try to understand the terms teaching, education and learning. In order to understand these, one need to find how a person acquires the knowledge. An immediate observation is that teaching, education and learning all have a common purpose, i.e., to impart knowledge to their subjects to enable them to do certain tasks. Elaborating further, learning is done by subjects and the process involves cognitive abilities of subject, which leads to learning via experience via all the senses. Teaching is the effort done by teacher (instructor). The system where teaching and learning both happens in a harmonious fashion is education. Consequently, education is a paradigm.

Teaching in essence creates an environment which leads to learning experience for the student. The ability of teacher lies in the fact that he can create an environment which leads to a certain desired experience for the student. In the conventional scenario, the teacher takes the feedback by evaluating the students through examination or by the questions asked by the students. On the basis

of this feedback, the environment is modified to enable the student to learn.

The mechanism by which teaching and learning take place constitutes education. In conventional scenario, the education system consists of teacher, black board, chalk, books, students, classroom and laboratory and interaction between them. The teacher uses this environment to create problems for student and then guides them through to experiences leading to desired learning.

Here one important point is that all the components except teacher and students of an education system are dependent on technology and has evolved over the development of civilization. With the evolution of internet and proliferation of computing devices all over with the progression of time, the tools are going to change. But their basic essence is going to remain same. One can classify the tools of an education system as follows

- study material - can be in form of book, can be delivered on line, web pages etc..
- Interactivity tools - Black board, white board with writing tool (chalk etc.)
- Space - classroom and associated facility - Infrastructure for operation of educational system.

In this paper, we have reported the efforts which are underway in Indian Institute of Technology (IIT) Kanpur to find how information technology (IT) based system can be integrated with the existing education system in IIT. Next section discusses the various options available to build an education system. In the section III, experiences of IT based education system in IITK are presented. In the last, the conclusions are drawn and some new challenges are mentioned. These need to be overcome to effectively utilize the IT based educational infrastructure to improve the existing educational system.

II. INFRASTRUCTURE FOR E-EDUCATION

The basic setup for the E-education in IIT Kanpur needed the creation of facilities which can be used by student with ordinary x-terminals or Windows machines. Since, web browsers can be assumed omnipresent, the system should be such that at student end web browser should suffice. The basic system schematic is shown in Fig 1.

A. Basic system

In the most basic system, Brihaspati [8] is used. Brihaspati is a web application built using turbine framework. It allows the creation of separate webspace for each of the

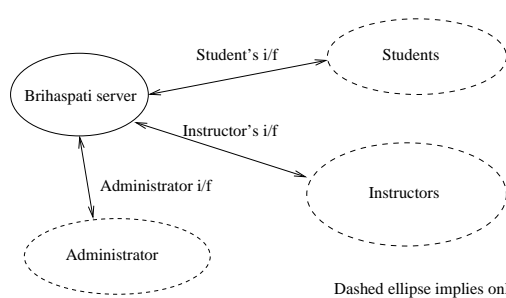


Fig. 1. Schematic of the basic infrastructure for Educational Technology Services

courses. For each course, there are three types of users, a) administrator, b) Instructor, and c) students. It provides facilities for uploading, publishing of files, management of students, notification system, discussion board and chat system for interaction. All the three types of users need to use only web browser with javascript and java support. In this mechanism instructor creates the course notes in MS-word, Powerpoint, \LaTeX or html. All the material is uploaded to the course area by the instructor.

The students after logging into the course area can browse through the published course material. The student should use appropriate plugins or helper applications for viewing different types of files. Since these viewers are freely available, one can assume that all the student can have it on their machines. The students are provided appropriate access permissions so that they can browse only the course in which they are registered. In order to interact with classmates and instructor individually or in groups, whiteboard, chat and discussion groups are provided in communication tools. The first two can be used to hold live discussions. This will be very useful when components of the class i.e., instructor and students are scattered in space.

In essence this basic system provides offline mode material delivery and can be used in addition to conventional class room structure. Limited online interaction is possible via chat and whiteboard.

B. Slide show with audio

In the basic system the lecture material is delivered via the classroom and supported by lecture notes and reference material on the web. One can add to the basic system, contents consisting of slides and streamed audio. The lecture in this format can be created very easily using MS-PowerPoint. The slides and the script for the narration are made in advance. Thereafter using the narration recording facility in MS-Powerpoint, the audio is recorded. This presentation can be kept directly on the WebCT as *.ppt* or *.pps* (Powerpoint slideshow) file.

These kind of presentations can be converted to flash based presentation or other proprietary formats, which can be viewed by flash plugins or appropriate java applets [2], [3]. This makes the presentation operating system (OS) independent. We have tried the approach where audio is streamed using RealServer and slides are streamed and

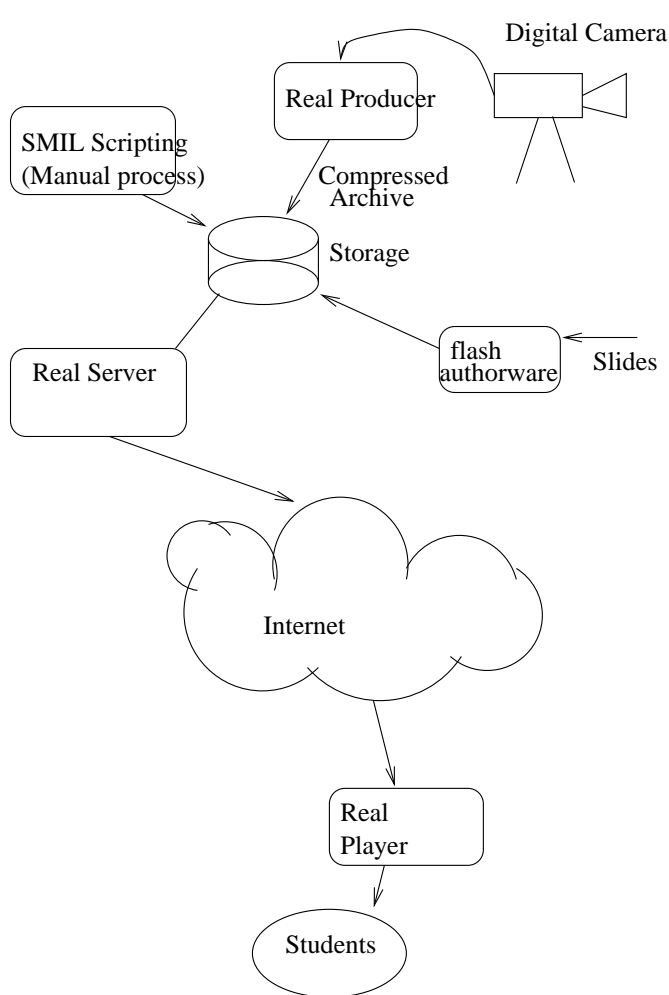


Fig. 2. Audio/ video streaming with slides in flash

synchronized using Flash [4] and SMIL scripting respectively (Fig. 2).

C. Offline video lectures

We have also created an infrastructure for recording of video lectures using digital cameras which are readily available in market. A video lecture implies video of presenter, slide show and audio are provided to students. There are three modes in which video lectures can be recorded.

C.1 Single camera video lecture

In this case, a single camera is used to capture the blackboard or demonstration given by the instructors. Once in while, the instructor's gesture are captured if conditions allow. This video does not require the preparation of PowerPoint slides. The instructor can give the whole lecture on blackboard. The captured audio and video is processed using Real Producer and stored as compressed file in the areas as specified by Real Server. Basic disadvantage of this system is poor quality of slides or blackboard capture by camera.

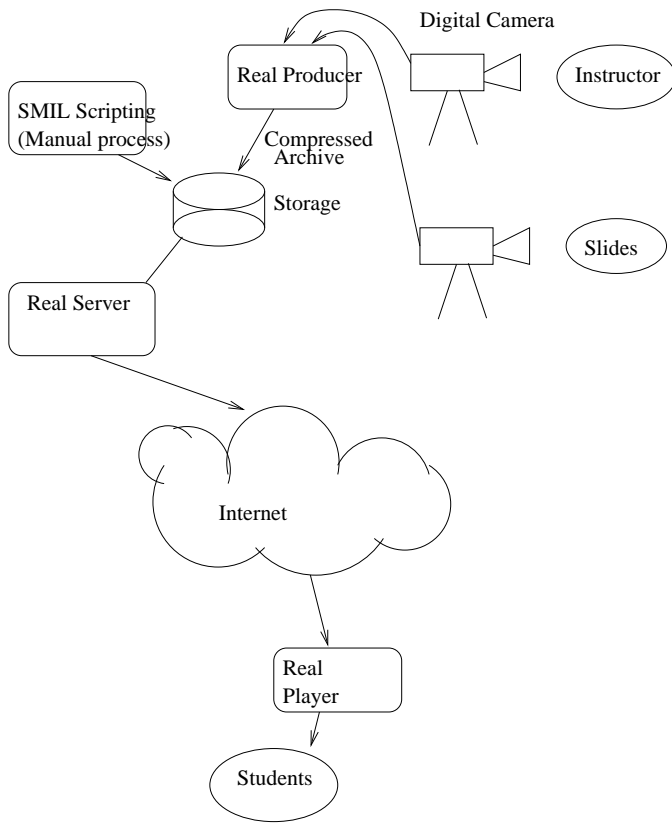


Fig. 3. Two camera technique for recording and streaming video lectures

C.2 Two camera video lecture

In second technique, two cameras are needed. One of them is used to capture gestures of instructors and the other one to capture the blackboard/ whiteboard or slide projected on a screen (Fig. 3). The two captured videos are compressed using Real producers and archived in designated areas of real server. A SMIL script file is used for synchronizing the two videos. This script helps in simultaneous synchronized viewing of slides as well as instructor's audio and video. This technique requires large bandwidth as compared to ppt with audio, flash with audio or imptica presentations [2]. Another alternative is to use a video mixing facility and by switching appropriately between the two video streams a single video output is created. This archived and streamed later.

C.3 single video with flash slides

This technique is preferred technique of production of lectures. In this the audio and video of instructor is captured and converted to format which can be streamed by real server. The slides to be streamed are produced manually using Macromedia flash authorware. The animation can also be embedded in these flash files. The video and flash files are again synchronized using SMIL scripts (Fig. 2). This technique requires less bandwidth than the two video format without mixing. It is also simple to produce than two video format with online mixing which require expert personnel. Two video with offline mixing can

be a good option since viewer focusses only on one entity i.e., either on instructor or at the slides at any instant of time.

C.4 Single video with PC screen capture

This mechanism is the one currently in use the E-classroom facility at IIT Kanpur. The writing of the blackboard or whiteboard by instructor is captured by e-beam capture system. In the PC we run screenwatch server [9] which captures whatever is happening on PC screen and converts it to proprietary format which is streamed via realserver. The viewers can view this screen capture by installing free screenwatch plugin.

In order to facilitate the interaction, we have used mbone tools [10] vic, rat and wbd. In case we use multicast network, infrastructure utilization is optimum.

This mechanism can be used for live lecture delivery as well as recording the lectures which can be viewed by users at their own will.

All the above techniques except of mixer equipment have been used used to create the lecture materials. Subjective judgement leads to conclusion that for offline as well as online mode video with screenwatch is very effective.

III. EXPERIENCE SO FAR

The facility started from first semester of 1999-2000 session. Since then different instructors from various discipline have used this facility in different ways.

Currently all the courses in IIT Kanpur (in any semester about 300) are being provided brihaspati access. All the students registered for a course in a semester are also provided access to material on brihaspati. Faculty posts the material onto the server in the form of slides converted to html format, placed reference material in pdf or html format in the form of Papers or external links. The challenge was posed by documents which consisted of not only the text but also figures and mathematical equations which get converted to gif or jpg format. This is taken care of publishing framework in Brihaspati.

A number of lectures were recorded in Multi-media format and are available to campus community through the Real Server. The recordings are made in various different formats for judging the efficacy qualitatively. These Different formats are: Two video files streamed in parallel, Real text format, Real Pix format, Flash format, web published lecture Format developed using a combination of Real Text, Real Pix and real media file. All the above formats have been synchronised using SMIL. We found that students were happy to access the material online, as the references were readily available and accessible 24 hrs. They could downloaded the material when it is needed.

IV. FUTURE PLANS

This facility has drawn upon the commonly available tools. There are many portions which can be improved upon in near future. Secondly, future will see many new web technologies. It is the time to find these and plan the developments of facility keeping them in mind.

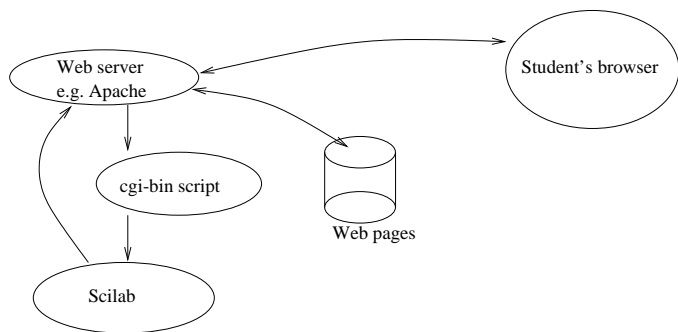


Fig. 4. Cgi-bin interface to use scilab

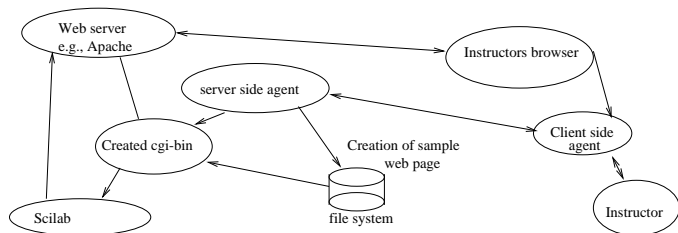


Fig. 5. Conceptualised system for creating of cgi-bin scripts by instructors

At the moment, in the Brihaspati system there is no interface to do mathematical calculations. This is important when the course contents would like to provide students design examples. In these students can feed values and submit the data. In return they get the design which may be in numerical or graphical form. Since we would like to give this flexibility of creating interface to Scilab to instructors in simplest form. A system (Fig. 5), in which the instructor goes to the websites, clicks for a java applet. This applet can communicate with a server programme running on the server side. The applet works like agent of server, and it is used to verify the user and it takes the data like, input variables, scilab program, output variable and their form. Alternatively, applet can be used as graphical programming tools for scilab interace. Thereafter all this information will be passed to server programme. The server program creates the necessary cgi-bin script, sample web page using this script. In this way instructor can create interfaces to scilab.

In the existing system, the lecture material is kept in html, pdf, doc or ppt format. One of the basic problem with html is that it does not identify information but identifies its rendition in the browser window. There is another derivative of SGML (standard generlised markup language) [5] known as XML (extensible markup language). This has capability of identifying the information. The rendition of this information is maintained in stylesheet document (written in XSL [5]). The style sheet processors can combine XSL stylesheet file with XML file and can generate the formatted documents. With this mechanism it is possible to separate the style with content. It is expected that in future, web will use XML extensively. Keeping this in mind, we would like to put the lecture material in XML format.

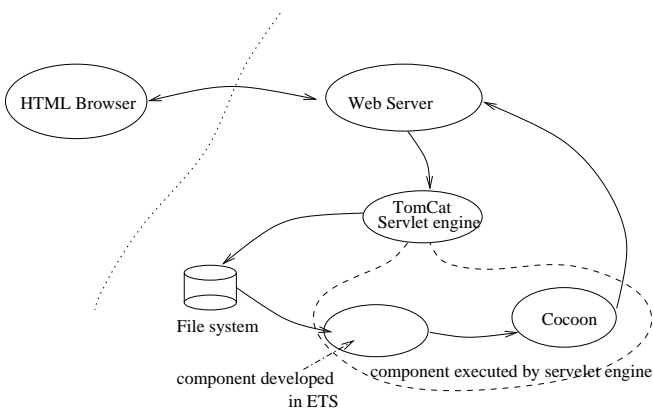


Fig. 6. system for handling web pages in xml format

But to view XML documents specific parsers and stylesheet processors are needed in the browsers. At the moment, XML browsers are not so common and most of the world is conversant with HTML browsers. Consequently, to implement a XML based system, we need a mechanism by which html browsers can access XML documents. Once such mechanism, is shown in Fig. 6. In this mechanism, a servelet engine is installed on server side. For our testbed we are using tomcat [6]. Within this engine, we have been using XML stylesheet processor Cocoon [7] to process the XML documents and converting them to HTML on the fly so that ordinary browsers can handle them. In this sytem, the servelet to handle mathml code on the fly is being worked upon. It will convert all mathml code to gifs for dplying it to users with ordinary html browsers. This is important for publishing mathematical content on the web.

ADLnet [11] has defined standards for learning contents (known as SCORM - shareable content object reference model). We will be building in brihaspati the capability to import or export to SCORM compliant learning objects.

V. CONCLUSION

In this paper, the system which is currently, evolving at IIT Kanpur to support the existing educational infrastructure has been described. The system at present have certain limitation. Over the period of time these limitation would be overcome.

In the system, technology part will keep on evolving based on the upcoming new technologies. But the use of this facility to make the educational system more effective is very important. We expect that the usage and effectiveness of this system will become better and better with passage of time.

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