SATELLITE BASED INTERNET EDUCATION DELIVERY AND E-LEARNING OBJECTS EVALUATION: SOI ASIA AND CODEWITZ PERSPECTIVE

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ABSTRACT

Development of Internet based distance education facilities and e-Learning objects development is commensurate with the capacity building and modernization process of Bangladesh University of Engineering and Technology (BUET) and congruent with the long term objective of the institution regarding facilitation of continuing education satisfying the temporal and spatial constraints. To fulfill the objectives, BUET has established satellite based School On the Internet (SOI) project and become active partner in the global e-Learning object development program through CodeWitz project. In this paper we present, (i) the technology used to deliver the real time lectures through SOI, (ii) the content and quality assessment of the delivered lecture by the participants and its overall impact in the human resource development in BUET, (iii) the development of e-Learning objects for different programming languages, and (iv) the quality evaluation of the developed objects and interest from other stakeholders of the CodeWitz project

1. INTRODUCTION

Today, Internet is a tool that empowers society to school the illiterate, bring job training to the unskilled, open universe of wondrous images and knowledge all the students and enrich the understanding of the lifelong learners (Saiful 2003). Internet based education is a form of distance education in which the course contents are delivered and the interaction are provided by the technologies and methodologies of the Internet. It may occur in places where there is none, extends resources where there are few, expends the learning day and opens the learning place. It is possible to connect people, communities and resources to support learning (Aggrawal 2000). The real revolution now taking place is not the hardware and of technology, but the intellectual technology of information, communication and augmentation of human intelligence.One of the toughest parts of Internet based education is creating effective contents/objects. Content that suits the learning style of users and relevant learning scenarios improve the success rate of an e-Learning initiative significantly. Content development plays a key role in e-Learning (Mitra 2000). Designing of contents/objects with good interactivity is essential for an effective teaching and learning system. Development of such interactive objects is not an easy task for instructors who lack technical knowledge. It requires a collaborative work among experts from various fields (Cornford, 2000).In this paper we try to address issues mainly related to Internet based education; like, content delivery mechanism via satellite based Internet infrastructure, the quality of delivered content through SOI network and the creation of quality e-Learning objects specially for programming languages in CodeWitz project that will ultimately enhance the learning capability of the students and teachers alike.

2. SATELLITE BASED INTERNET: SOI ASIA

Satellites are playing a key role in national or global infrastructures. Satellite-based Internet systems could play an important role in distance learning (DL). A satellite earth station can be installed anywhere on the ground as long it can receive satellite signal. Thus satellite based Internet can provide Internet environment in a less expensive way for the universities located where Internet environments are insufficiently developed. The broadcast capabilities of

satellite networks make them inherently multicast-enabled and as a result satellites have been, and continue to be, used for DL implementations. Using the multicast capability of satellites, SOI Asia project was launched Internet based DL in 2001 (Mikawa 2003), to contribute to higher education in Asian region by utilizing satellite based internet Infrastructure. SOI Asia used the Asian Internet Inter-connection Initiative (AI3) project network infrastructure using C-band satellite communication which gives a total 9 Mbps unidirectional receive only bandwidth to Asian regions. SOI Asia project utilizes satellite based Internet environments in a less expensive, easy to deploy and more feasible way for universities located in Asian regions and development of the necessary technology for IT human resource development in Asia while using the environments and try to establish a new distance educational methodology for universities in Japan as well as educational institutions abroad through field experiments.Depending on the activities SOI Asia designed 1) lecturer site, 2) gateway site and 3) student site. The overview of SOI environment is shown in Fig.1.

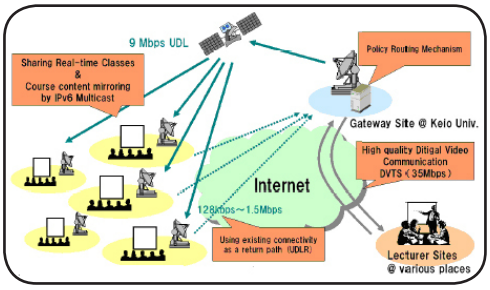

Figure 1: Overview of SOI Asia environment

The lecturer site can be built anywhere as long as it has sufficient bandwidth to carry lecture video and audio in good quality to the gateway site. There are 4 types of lecturer site application configurations according to the network bandwidth: 1) site over 100 Mbps connection to the gateway site, 2) sites over 1 Mbps connection to the gateway site, 3) sites with over 128 kbps connection to the gateway site, and 4) gateway site is the lecturer site. Mirror servers are located at the student sites for the students to the archived lectures, so that they don't have to connect to remote/overseas original server. From students' site, the lecturers gets the feedback by video, audio, character based communication, phone or fax. Each site chooses the way in which they would send the feedback from the student's site considering the most suitable mode in light of their existing terrestrial Internet infrastructure.At present, the gateway site is at KEIO University, Shonan Fujisawa Campus (SFC), Japan that has 1 Gbps connection to the Japanese network backbone and also has AI3 project's C-band satellite that can deliver Ethernet packets in 9 Mbps using UDLR (Uni Directional Link Routing, RFC 3077) technology. By using this environment the gateway is able to deliver good quality of video and audio to student site.

2.1 SOI Asia Project: IICT, BUET Perspective

Internet relay chat (IRC). Institute of Information and Communication Technology (IICT) of Bangladesh University of Engineering and Technology (BUE) aim to contribute to the Asian countries by sharing BUET professors' research results and also to enhance their own expertise by participating other university professors' cutting edge technology lecture, through e-Learning system of School On the Internet Asia project (SOI Asia). SOI Asia was launched in 2001 by WIDE Project (Tomomitsu 2001) and KEIO University. As of June 2007, the project has 25 partner universities and research institutes in 12 countries in Asia, and has deployed receive-only satellite earth stations at each partner site to share the distribution of live lectures from various part of the world as well as archived lectures. BUET has joined the SOI Asia in October 2004 and IICT is the SOI Asia BUET focal point.Since joining SOI Asia in October 2004, BUET has participated in the live lecture and shared various lecture contents provided by SOI Asia, such as Information Technology, Disaster Management and so on. From the beginning, BUET SOI Asia environment basically is a student site. For the first time (2007) BUET professors' also contribute to this project by delivering course contents, especially in field of renewable energy. Since the Internet connection from Bangladesh to the SOI Asia gateway, KEIO University (SFC), is not broad enough for real-time video and audio transmission. Therefore, for lecture broadcasting, BUET combines

1) archived contents broadcasting, and 2) real-time question and answer session by using dedicated 192 kbps for 30 to 40 minutes per lecture and become a lecturer site in a limited manner.

2.2 SOI Asia Project Content Delivery and Evaluation

To assess the quality of the delivered content and appropriateness of the offered courses (June 2006- May 2007) to the partner institutions SOI Asia provided a 'SOI Asia Lecture monitoring Sheet'. In BUET site, we conducted a survey using this questionnaire sheet among the par ticipants and results are summarized in Table 1. From the table we found that except the courses on advanced topics on marine sciences, all other offered courses evoked high interest among the faculty members of different departments and as well as postgraduate students.Still, the participants of the courses felt inconvenience during the question answer session, because this session did not have the facility of video and communication between the lecturer and students mostly by audio and character based facility through

Table 1

SI no.	Course title	Target audience	No. of participant	Level of lecture	How was the main topic?	Use of archire lecture	Reason for non-participation
1.	Advance topics for marine science	Nil	0	0	0	0	No marine Science Depart. in BUJET
2.	Tsunami phenomena and disaster	Faculty member	10	Easy	Very interested	Quite often	N/A
3.	Advance topics for marine tech. & logistics	Nil	0	0	0	0	No marine Science Depart. in BUJET
4.	Earthquakes and their disaster reduction	Faculty member	12	Easy	Interested	Sometime	N/A
5.	Advance Internet technology - III: Wireless network and mobile systems	Postgraduate	25	Appro-priate	Interested	Quite often	N/A
6.	Object oriented software development	Postgraduate	25	Easy	Very interested	Sometime	N/A
7.	Metropolitan wireless mesh networks	Postgraduate	18	Difficult	Interested	Not at all	N/A
8.	Emergency care and long term recovery process	Faculty member	11	Easy	Interested	Quite often	N/A

3. E-LEARNING OBJECTS AND CODE-WITZ PROJECT

E-learning, including both purely Internet web-based training and hybrid, or blended learning that combines web-based and traditional approaches is growing faster than any other sector of post-secondary and professional education. Students like accessibility of virtual classrooms. Employers love savings they can take to the bank. Many training companies have certain apprehension, however, worried about potential cannibalization of existing business. This is a legitimate concern. Nevertheless experience shows that fears of cannibalization do not materialize when e-Learning is taken as opportunities to both expands the reach and convert learning into truly year-round experience. This makes e-Learning a valuable part of class offering for increasing number of training companies and educational institutions (Kerry 2004, Pulichino 2003). One of the toughest parts of e-Learning is the development of effective contents or objects. Contents/objects that suit the learning style of users and relevant learning scenarios improve the success rate of an e-Learning initiative significantly. It is important for contents/objects to adhere to the objectives of the program and be powerful enough to engage the user. As e-Learning has become more widely used, the use of online content for learning has risen. However, much online content typically delivers low level outcomes and thereby produces a mismatch between outcomes derived in the face to face setting to those derived online. Development of e-Learning objects that matches intended outcomes and delivers the requisite cognitive load requires careful planning and structured development. IICT, BUET in September 2004 enter an agreement with Asia-Link programme of EU named Code-Witz project comprising 4 universities spanning from Asia and Europe. These universities are BUET, Shahjalal University of Science and Technology (SUST) of Bangladesh, Tempere University of Technology, Finland and

University of Applied Sciences, Berlin, Germany.

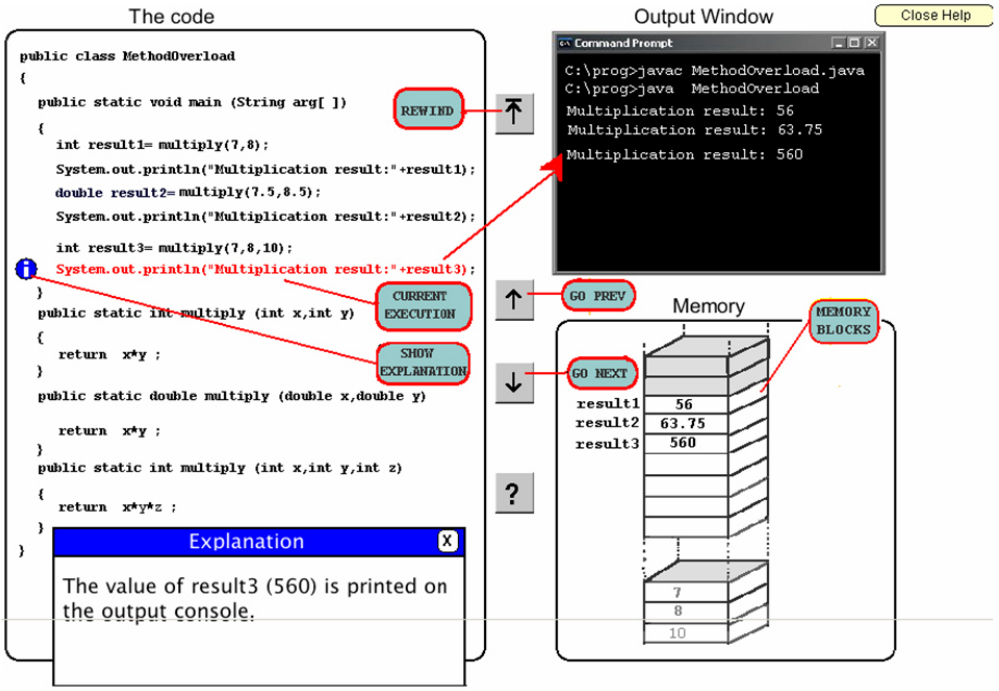

Figure 2: A typical e-Learning developed object (concept of method overloading in Java)

3.1 Features of e-Learning Objects

A learning object can be almost anything. Any stand alone piece of information capable of teaching something can be a learning object. It can be a chapter in a book, a video, an image, a wiring diagram, as interactive application, a simulation and so on. As well being of a flexible type, a learning object can be any size. A learning object should be a self-contained, reusable, smaller unit of learning that can be aggregated with other learning objects to produce more substantial units of learning. They are generally tagged with meta-data to allow them to be easily retrieved by a search. Each learning object should be developed such that it is self-contained so that it can be used without depending on other learning objects. These learning objects can be reused by the other courses that need to convey the same concept rather than requiring development of their own description. This can save both the time and the expense. The availability of computational power and network infrastructure that greatly facilitate distribution and sharing of learning objects coupled with their flexibility and re-usability creates a compelling economic rationale for e-Learning objects. In order to make such a system distributed and interoperable, we need to ensure that there is a common language that different systems understand and communicate. Extensible Markup Language, or XML, developed by the World Wide Web Consortium seems like the obvious solution for its two main reasons. First, it is structured so it is capable of representing an object hierarchy. Second, it is in plain text and easily machine-readable. Thus, it provides a means of distributing content to other systems no matter where they are located and no matter what program they are running. Thus, a piece of learning material, no matter where it is located, may be seamlessly integrated into an online course, provided the XML tags are employed consistently.

3.2 e-Learning Objects of CodeWitz Project

BUET as a partner university of CodeWitz project, we have developed more than 100 e-Learning objects in the area of C/C++, Java and

embedded system programming. In addition, we also developed some learning objects on data structure, algorithm and operating system as well. We have selected the most complex and critical topics for e-Learning object development. Fig.2 shows the snapshot of a developed e-Learning object in Java programming language for method overloading. The developed e-Learning objects are interactive and in some cases we incorporated animation for clear understanding. To ensure the quality, these objects are evaluated by a group of expert and with a brain storming environment. After accommodating the observations, the objects are uploaded to CodeWitz material bank (CMB). The uploaded objects in the CMB from each partner university are evaluated by other partner universities and system keeps the record of all comments, commendations and suggestions. In the bi-annual meeting of CodeWitz project observations on different e-Learning objects are discussed in detail and fix the date to address the shortcomings of the uploaded objects.

4. DISTANCE/E-LEARNING ENVIRONMENT AT BUET

Development of e-Learning/distance e-Learning facilities is consistent with the capacity building and modernization process of BUET and tuned with the long term objective of the university and also towards the fulfillment global trend in advanced education. Considering all these factors, in October 2004, BUET established the satellite based school on Internet (SOI) with the active cooperation of SOI Asia Project of Japan which is a totally advanced distance e-Learning facility. From its inception, lot of short courses and lectures on special topics were attended by the faculty members of different departments/institutes and postgraduate students. By attending these specialized courses they were immensely benefited. This year (2007) BUET faculty members also participated as a resource person of SOI Asia and as a result BUET become a member of the lecturer site. To run the daily activities of the BUET SOI site, human resource development is also important and SOI Asia There is no alternative of quality contents/ objects to make the web-based e-Learning more interesting. Without quality contents the objectives of e-Learning will not be materialized. Keeping this in mind, IICT, BUET joined the CodeWitz project in September 2004 which is aided by the Asia-Link programme of EU. Through this project we have developed e-Learning objects in different courses of information and communication technology and particular emphasis was given on programming languages. By utilizing these objects the undergraduate students and teachers of BUET will be highly benefited in terms of learning time and comprehension. Thus, working with these two projects BUET is establishing a pedagogical base for the effective and diverse use of Internet learning.

5. CONCLUSIONS

Internet is changing the very structure of society. The question is no longer if the Internet can not be used to transform learning in new and powerful ways, nor is the question should we invest the time, the energy and the money necessary to fulfill its promise in defining and shaping new learning opportunity. Our ability to use the Internet to reshape education and learning requires actions that also interrelated and interconnected. In this paper, we have discussed the two important avenues and their implementation i.e., satellite based Internet distance education and e-Learning object development for Internet based learning. Still, there are many other related issues to be addressed to reap the full potential of Internet and to make it available for all. Thus, through the successful implementation of the above mentioned projects IICT, BUET is gaining experience and will be able develop sustainable e-Learning model for Bangladesh in future.

6. ACKNOWLEDGEMENT

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