Knowledge Exchange E-Learning System for Rural Africa

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Abstract

This paper will focus on issues relating to an e-learning system for rural Africa about the building of multimedia presentations under a certain framework. The issues addressed include the theoretical principles upon which the system is based, the effective and appropriate use of multimedia and the format of presentation delivery. Knowledge Exchange E-learning System is an advanced education supporting system that ensures the maximum flexibility and deliverability for building multimedia presentation. A presentation author can create his/her own streaming video along with the Power Point slide shows and other useful information through Multimedia Presentation Building-up Sub-System. It simplifies the way to access latest SMIL technique and the outputs of an e-learning system.

Keywords

E-learning System, Multimedia Synchronization, Rural Areas

1. Introduction

The potential of Internet as a source of learning and information sharing has been widely used in all avenues in developing and developed countries. However, the access problem is particularly acute in rural and under-served areas, where not only computers and phone connections are nonexistent, but also even electricity may not be available [1].

To achieve self-sustainable Internet service, in a rural and under-served setting, the Internet is likely for some time to be delivered as a community resource, rather than a personal one. In other words, each community might have shared resources that are financially sustained through some combination of user fees and outside revenue [2].

In this scenario, WLAN based on IEEE 802.11b standard using an existing Ethernet backbone is proposed as a possible solution to provide access to rural and under-served areas on a multi-user basis. Meanwhile, Wi-Fi can be adopted as a viable technology for rural and under-served connectivity solutions to connect schools, clinics, library and community centers to each other and to the Internet because it is easy to set-up, use, and maintain. It has relatively high bandwidth and, most importantly, it is relatively low cost for both users and providers.

Another approach of small entrepreneurs to provide Internet and voice services within their own communities is to purchase inexpensive basic radio equipment and transmit on unlicensed frequencies. For example, more than a thousand villages in Ethiopia have had phones, thanks to the installation of 470 Very Small Aperture Terminals (VSATs) and about 200 Digital Radio Multi-Access Subscriber Systems (DRMASS) [3]. Outdated open wire systems have been replaced. In the year 2000 each village had at least one phone and the rural areas have begun their link into the global information network.

Knowledge Exchange E-learning System (abbr. KEES) is a truly unique online learning system based upon the current infrastructure conditions. It offers the maximum possibility to create the teaching material and publish it on the Internet or archive it into a local database.

2. Design

When faced with new information, the receptors do not begin by “reading”. Instead, they will be absorbed by “watching”. Videos and pictures are usually the first choice for them because it makes their comprehension easy. However, comprehension does not necessarily lead to learning - at least, not to learning of a meaningful, useful kind. Learning takes place when the new information becomes meaningful and useful and the information can be called “meaningful” only after it is richly interconnected with related knowledge. KEES consists of three sub-systems: Multimedia Presentation Building-up System (abbr. MPBS), Knowledge Distribution System (abbr. KDS) and Knowledge Feedback System (abbr. KFS).

A novel idea in KEES is the system acts as multimedia synchronization presentation management and publication, dealing with the problem of playing media from different sources or locations to create easily used output for the learner. It provides a uniform and independent multimedia synchronization framework, which is better for delivering knowledge because of the pervasive use of internet, computers and the standardized semantic web technologies. As shown in Figure 1, the output of KEES is

composed of three main parts: video display, content display and web resources display, which are run in the Internet Explorer browser.

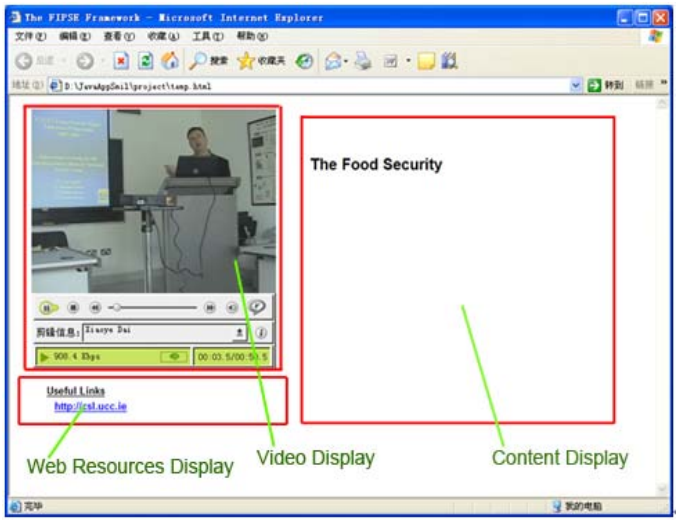

Fig.1 Output of KEES

The system is based on the intangible and tangible designs, which are described in the following sub sections: Pedagogical Design and Technical Design.

2.1. The Pedagogical Design

Interactive multimedia presentations represent an asynchronous collaboration between the presentation author and the presentation viewer. The role of the presentation author is to design an interactive presentation at the present time that will result in an individual experience for a variety of potentially unknown viewers at a future time.

Viewer's participation is defined as the ability of the KDS sub-system (in this case a webpage interface) to respond to requests. The role of the presentation viewer is to cognitively absorb the message inherent within the presentation and to provide responses when viewer participation is requested. To build an effective multimedia educational presentation, the presentation author should be allowed to exercise control over the system's interface of building the presentation. Here, control is defined as the ability to skip ahead, skip behind and modify any point within the presentation.

The educational resources used to build the multimedia presentation can be text, images, audio, video or animations, or combinations of media as in a lecture with synchronized audio, video and slides. While playing back a recorded lecture, the presentation viewer might want to look at the material the speaker talked about and other useful resources online. The sub-system MPBS of KEES is designed to help the presentation author to generate such an e-learning environment. (See Figure 1)

KEES intends to meet any educational needs that emerge in the traditional class or e-learning environment. That is why it must process a wide range of educational queries. The types of queries can be sorted by complexity level:

- non-verbal communication queries (e.g. to promote the motivation of the learner by showing the presentation maker's body language);
- simple queries (e.g. to give a definition of some concept and explain it by examples);
- queries for an additional educational program that consists of a set of related courses (e.g. relative sources available online);
- queries for a full basic educational program (e.g. high technical education in selected specialty);

To organize effective query processing, two types of entities need to be considered: frameworks and learning objects. A framework is a studied entity (notion, fact, method, etc.) to standardize the output of educational resources for multimedia synchronization, which is accessible for all educational services operating in up-to-date web environment. A learning object is any accessible resource, including Web resources, which can be used in educational purposes either separately or in combination with other learning resources.

2.2. The Technical Design

In order to build an interactive and widely distributable multimedia presentation for education, a presentation author must rely on a handy and flexible framework of synchronization in order to specify:

- The temporal layout, or synchronization, of the different media/learning objects involved in the presentation. This includes fine-grained relationships, which are primarily between media/learning objects; i.e. between their start and end events.
- The participation required and/or requested from the viewer.
- The distribution of the presentation.

The presentation author must be able to specify each of the above in order to ensure that the integrity of the presentation's message is clear and easily received.

2.2.1. Model

The approach for building a synchronization model with these properties would be to extend an already existing synchronization model. The core synchronization

mechanisms of SMIL are based on sequential and parallel grouping tags [4]. SMIL also supports link-style navigation (asynchronous interaction) within a presentation. This is accomplished using mechanisms similar to those used within HTML but with the added ability to specify temporal sub-parts of media/learning objects. This project started with an existing media-based toolkit, and built a synchronization layer on top of it. The synchronization layer provides the ability to express:

- Synchronous interactions: An example would be to present a recorded lecture sequentially, which could be paused or rewound by the viewer for some educational purpose.
- Asynchronous interactions: As an example, consider a presentation, which could refer to different web resources with URL links. The viewer should then be allowed to make a decision to link to a resource during the presentation, rather than being forced to wait and go through every link sequentially.
- Fine-grained relationship: An example would be to synchronize events at specific time points between and within media objects.

The framework of the synchronization model should aim to support fine-grained relationships in conjunction with viewer participation and control.

2.2.2. Fine-grained Synchronization

To support rich synchronization semantics, temporal constraints in KEES are expressed as fine-grained relationships involving a timeline. Using a single timeline as the basis of a synchronization model provides a natural and intuitive method for synchronizing events between and within media objects. For example, specifying that one image should be displayed after other text content cannot be directly specified unless the display duration of the first image is known exactly. Fine-grained relationships based on a single timeline allows specifying different content shifting if each item has clear start and end point. Thus, fine-grained models allow specifications between media objects and within them. (See Figure 2)

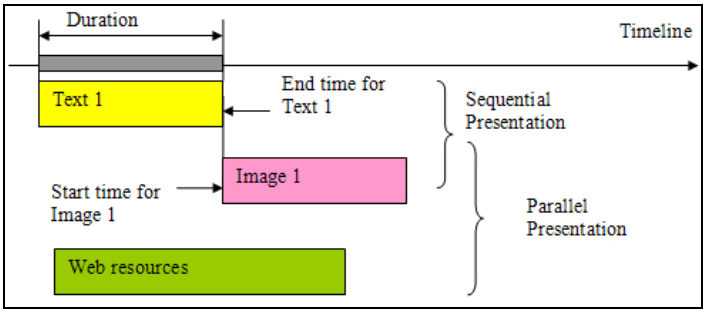

Fig.2 Temporal layout in MPBS

3. Implementation

As introduced before, KEES is comprised of three sub-systems to fulfill the cognitive knowledge exchange learning strategies and the basic configuration of the system is shown in Figure 3. In this chapter, the sub-systems will be analyzed with more details.

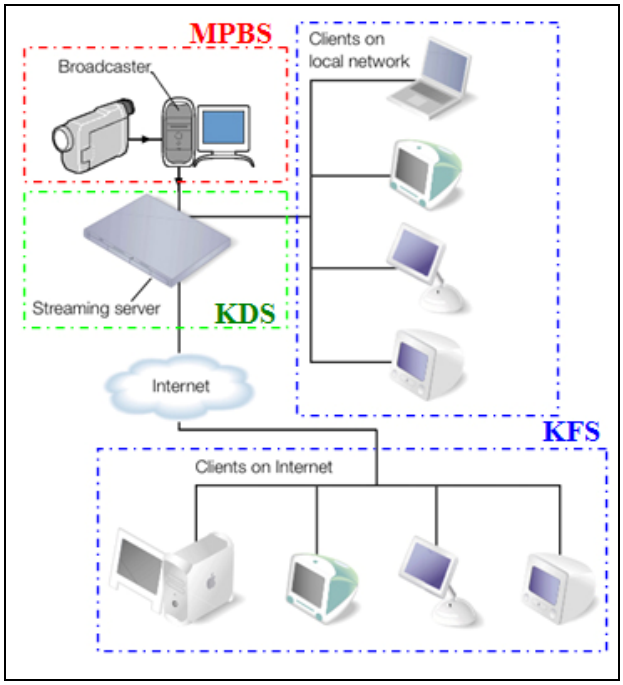

Fig.3 Sub-systems configuration in KEES

3.1 Multimedia Presentation Building-up System

The MPBS interface (see Figure 4) displays editing options for each object's content and allows the presentation author to publish his/her professional knowledge with no need to learn SMIL first. The editorial process system is a critical part of the e-learning system. The MPBS editorial process (see Figure 5) enables the presentation author to build a presentation by taking advantage of all existing media with a real-time preview. While it meets the requirements of the different learning objects, educational and structural aspects of the content inside the objects are taken into account. All relative texts and images are sequentially synchronized and can be parallel to other learning objects in the same period along with a chosen video resource; these are all plotted along a given timeline. Such an educational content management tool helps the author to perceive the experience of the presentation as a potential viewer, and thus gets as much useful information as possible about the presentation they are creating.

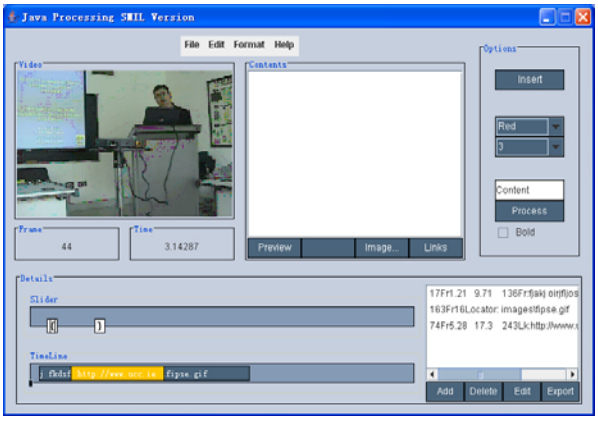

Fig.4 MPBS interface for presentation content editing

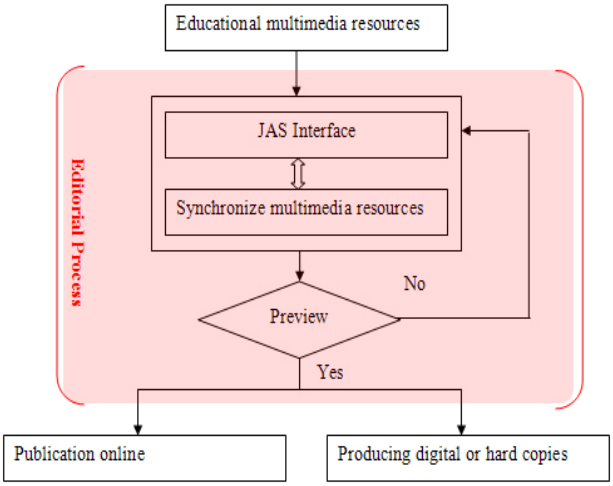

Fig.5 Educational process in MPBS sub-system

3.2 Knowledge Distribution System

The preview and the final output of KEES system is undertaken by KDS whose result is an HTML file embedded with XML-based (Extensible Markup Language) SMIL files. All presentations were implemented under the framework in MPBS supported by Java GUI (Graphical User Inter-face) and JMF (Java Media Framework). The multimedia presentation of educational resources is exported in SMIL syntax. It is flexible and standard for publication on the Internet, increasing the potential of the distribution of knowledge over as broad an area as possible. It is also feasible to make digital or hard copies of all or part of the output for personal or classroom use.

3.3 Knowledge Feedback System

KFS is a unique learning support sub-system to help KEES to enhance the learning result. It diagnoses users' learning problems, analyses and then offers feedback to adapt the problems. KFS has a user-friendly interface (see Figure 6) for giving all

useful feedbacks and users are encouraged to work out their own problems by watching the corresponding segment of videos.

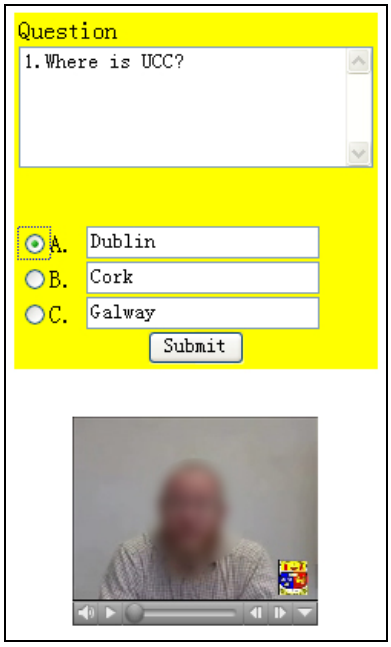

Fig.6 The interface of KFS

KFS interface will pop out an alert window to give user responses after he/she submits the feedback. According to the analyses KFS will decide to let user go on to the next question or to review the video again to find out the right answer. At the end of the quiz, KFS will give user the results and makes it possible for them to know to which extent they have acquired the knowledge.

KFS is the most interactive part in the whole system and it enables users to learn by watching and listening which promotes their learning motivation and improves the efficiency of study.

4. Usability Study

KEES is running for a symposium on Food Business in CSL (Center for Sustainable Livelihoods, URL) [5] as a prototype to distribute lectures about the sustainable livelihoods research results for FARA (Forum for Agricultural Research in Africa) with the supports from Multimedia Technology Team in University College Cork. The lecturers and researchers were satisfied with the convenience and profits of the system through testing. Nevertheless, they are still looking forward to keeping the system's original idea with the possibility of having the external links related to the topic.

Unfortunately, the research center holds a QuickTime streaming server so that it cannot handle real format files. JAS has been adjusted back into QuickTime file

format to meet the need of physical constrains and export outputs into two SMIL format files instead of one SMIL format file plus two Real Text format files. So the screenshot of the result for this moment is shown as Figure 7.

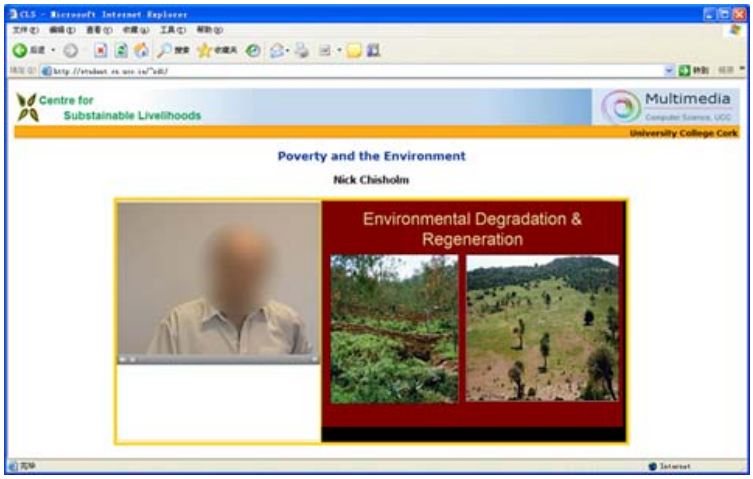

Fig.7 Experimental implementation result of KDS

Most users agree that the quiz session is helpful in improving the comprehension and helps to achieve successful learning online.

5. Conclusion

A conceptual view on advanced future educational environments and the preliminary results for creation of multimedia presentations in rural areas have been addressed in this paper. KEES provides a qualitatively new level of such services in e-learning systems, which improves knowledge distribution and optimizes the presentation viewer's perception. However, KEES is still insufficient at this stage on the side of introducing more interactive activities into KFS sub-system to enhance the knowledge acquiring and response.

6. Reference

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