A Hybrid Learning Model Using an XML-based Multimedia Podcasting System

Joseph Fong, Dawn Leung, San Kuen Cheung, and Frances Fong[2]

Department of Computer Science, City University of Hong Kong, Hong Kong,
email: csjfong@cityu.edu.hk
2 Zhong Guan Cun South Ave. Beijing 100086, China, Goethe-Institut, China

Abstract. Due to heavy workload and tight working schedule, it is difficult for part-time students at City University of Hong Kong to 'digest' course materials and to understand the content of the course. Therefore, it will be convenient if a lecture presentation with course materials is recorded and posted into the Internet. Then, students can easily attend the lecture on-line in anywhere or watch back the video archive of the presentation through the Web. This paper aims to provide a solution to achieve a Hybrid Learning Model (HLM) including eLearning and traditional teaching platform by synchronizing video, audio and image files which are used in a presentation. In addition, this is targeted to record and to retrieve by using an On-line Podcasting System and an XML SMIL technology respectively.

Keywords: Podcasting, Hybrid Learning Model, eLearning, XML SMIL

1 Introduction

The most important concept of the project is the application of Podcasting [2] which is a digital media file, or a series of such files, distributed over the Internet using syndication feeds for playback on portable media players and personal computers. A podcast is a specific type of webcast which, like 'radio', can mean either the content itself or the method by which it is syndicated; the latter is also termed podcasting. Another similar term is Video Podcast [1] which refers to a term used for the on-line delivery of video on demand video clip content. The term is an evolution specialized for video, coming from the generally audio-based podcast and referring to the distribution of video to which users can subscribe using a PC, TV, set-top box, media center or mobile multimedia device. The following is the definition of Podcasting in this project: 'A podcast is a web-based technology to synchronize multimedia elements including video, audio, and any graphic files. It also refers to the distribution of the mentioned elements which users can retrieve them by using a podcast player.'

Besides, this project introduces SMIL 2.0 [6, 7] which stands for Synchronized Multimedia Integration Language, and which is a text-based, XML standardized format. It is a language to combine animation, picture, and media objects into single

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coherent presentation to standardize all the documents for Podcasting through the Web. The reason for choosing this language for Podcasting purpose is because SMIL provides a time element insides its library. We can simply control the multimedia elements in and out or play and stop in the screen at any moment of time by a few codes of programme. Another web technology used is AJAX. AJAX [5, 8] stands for "Asynchronous JavaScript and XML". The architecture of AJAX can be explained in the following diagram. They can be shown in Figure 1.

When a Web browser, or client, makes a GET or POST request to the Web server, the server formats an HTML response with some JavaScript code on it. That code calls back the server for more information as needed. Those requests can be made as simple GET or POST requests. The JavaScript code then parses the response, often encoded as XML, and updates the HTML on the page dynamically to reflect the new data. In addition to XML, engineers are returning data encoded in the JavaScript Serialized Object Notation (JSON) format. This data is easier for a browser to understand but not for other client types.

AJAX helps the project in displaying the multimedia elements, especially for graphic files. It supports a quicker communication between the server and client machine. Therefore, it helps in displaying documents (i.e. Power-Point files) in graphic format (i.e. jpeg files) and also in support drawing (i.e. writing explanatory notes) by a hand-writing pad. Furthermore, the main programming language for the project is C# which is a simple, type-safe, object-oriented, general-purpose programming language. It provides code-focused developers with powerful tools and language support to build rich, connected Web and client applications on the ASP.NET Framework. The reason to choose this language is because it has a variety of libraries and APIs which helps the development of the system.

1.1 The Framework of the System

The development of the Hybrid Learning Module will be divided into two phrases: (1) Developing an On-line Tutorial System and (2) Developing a Podcasting System. In the first phrase, the system UI and the functionality of On-line Tutorial System will be developed. There are three systems that are the main development goal for this phrase.

- On-line Document Display System
- Visual/ Voice System
- Hand-writing System

The On-line Document Display System provides an interface for lecturers to upload documents prepared for a presentation such as power-point files and to displays it whenever they want. Again, AJAX will be used for the main development language. In addition, before uploading documents to a database, it has a function to convert from power-point files to jpeg files that are used when starting a presentation.

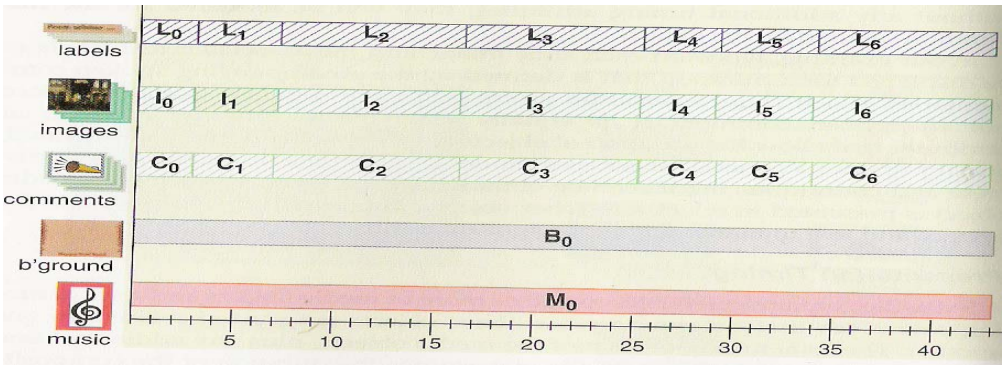
The Visual/ Voice System can be treated as the same function of running tradition lectures in a classroom. There is no class written for .Net on video conferencing. Therefore, there is a need to use H.323 protocol and TAPI 3 Telephony for the development. With the API of WaveIn/ WaveOut in C#, it can be achieved. The goal for this system is to create a kind of video conferencing system so that the image and

voice of lectures can be displayed through camera to the Web. Sample for displaying the video conference system is shown in Figure 2.

Sample code for SMIL

```
--><!DOCTYPE smil PUBLIC "-//W3C//DTD SMIL 2.0//EN"
"http://www.w3.org/2001/SMIL20/SMIL20.dtd"><smil
xmlns="http://www.w3.org/2001/SMIL20/Language">
  <head>
    <meta name="title" content="Empty SMIL2 Slideshow"/>
    <meta name="generator" content="GRiNS Pro for SMIL 2.0, v2.0 alpha win32 build 71"/>
    <meta name="project_html_page" content="external_player.html"/>
    <layout>
        <root-layout id="PC_Window" backgroundColor="navy" width="640" height="480" />
        <region id="audioRegion_1_P" />
        <region id="bkgd_imageRegion_P" left="0" width="640" top="2" height="480" z-index="1"
/>
        <region id="MainView_P" left="364" width="220" top="115" height="180" z-index="2" />
        <region id="Controls_P" left="420" width="120" top="405" height="31" z-index="2" />
        <region id="Captions_P" left="366" width="225" top="323" height="48" z-index="2" />
        <region id="MS_P" left="1" width="342" top="282" height="90" z-index="2" />
        <region id="Local_P" left="1" width="342" top="185" height="90" z-index="2" />
        <region id="NS_P" left="66" width="237" top="87" height="93" z-index="2" />
        <region id="Ad_P" left="24" width="322" top="418" height="58" z-index="2" />
        <region id="Titles_P" left="0" width="342" top="0" height="368" z-index="3" />
        <region id="Branding" regionName="Branding_P" left="381" width="259" top="462"
height="15" z-index="2"/>
    </layout>
```

Time element for SMIL



The Ajax model of Client-Server interaction

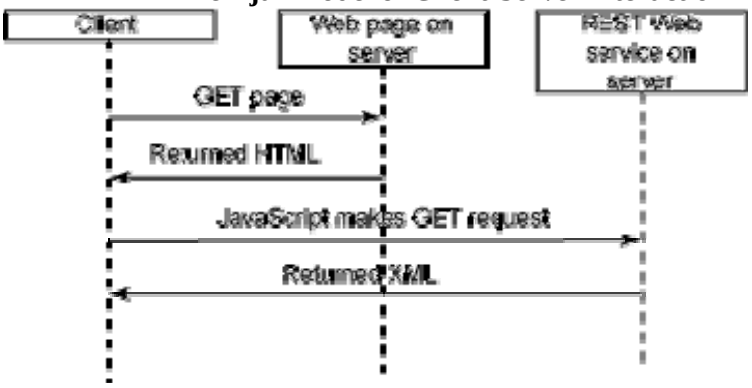


Fig. 1. Sample of SMIL and AJAX interaction

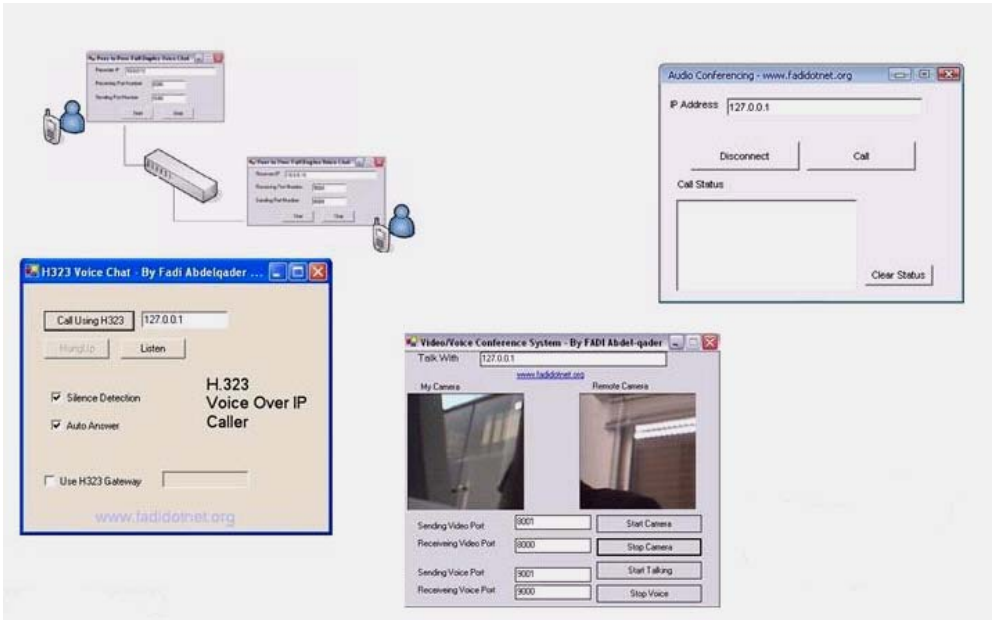


Fig. 2. Video conference sample

AJAX technology will be used to develop a hand-writing system as well. The explanation of AJAX can be found from previous section. With regard to the system, it can be used to write explanatory notes using a hand-writing pad by lecturers during a presentation. In order to write notes freely, the whole system will be developed for presentation using a tablet PC. Presenters can write their notes in a defined pad shown on an interface as shown in Figure 3.

Fig. 3. Sample for Hand written notes computerization

After that, the Podcasting System will finally be developed in the second phrase. There are two systems that are the main development goal for this phrase.

- SMIL Conversion System
- Podcasting System

The SMIL conversion system will convert the existing multimedia files (video, audio, pictures, etc) into a single SMIL file. Then all of these elements will be organized in a web server for users' streaming through our system. As for the Podcasting System, it will be used to run all elements as a movie according to the structure of the SMIL file constructed by the SMIL Conversion System. It will embed a SMIL player (like Real Player, Windows Media Player, or any player supporting SMIL). The following shows how the system will look like. The system will be divided into several regions. Different regions are responsible for displaying different multimedia elements. Sample for running a SMIL file is shown in Figure 4.

Fig. 4. Sample Screen for a Running SMIL

2 Methodology

The whole project can be split into five systems named (1) On-line Document Display System, (2) Video/ Audio System, (3) Hand Writing Display System, (4) SMIL Conversion System, and (5) Podcasting System. The architecture of the Module is illustrated in Figure 5.

2.1 Step 1 – On-line Document Display System

This system helps to convert document(s) used for presentation to JPEG files. Another function is to display the JPEG files to screen. It is divided into several modules: Document Convert Module, Document Display Module, and AJAX Listener.

Firstly, a document file will be passed to Document Convert Module. The module will be used to convert the file into several JPGE files and to store them into database. Secondly, On-line Document Display Module will be assisted by calling AJAX Listener. The AJAX Listener will get the JPEG files from the Database and send it back into the Document Display Module. Finally, The On-line Document Display Module will also be used to display the JPEG files on screen.

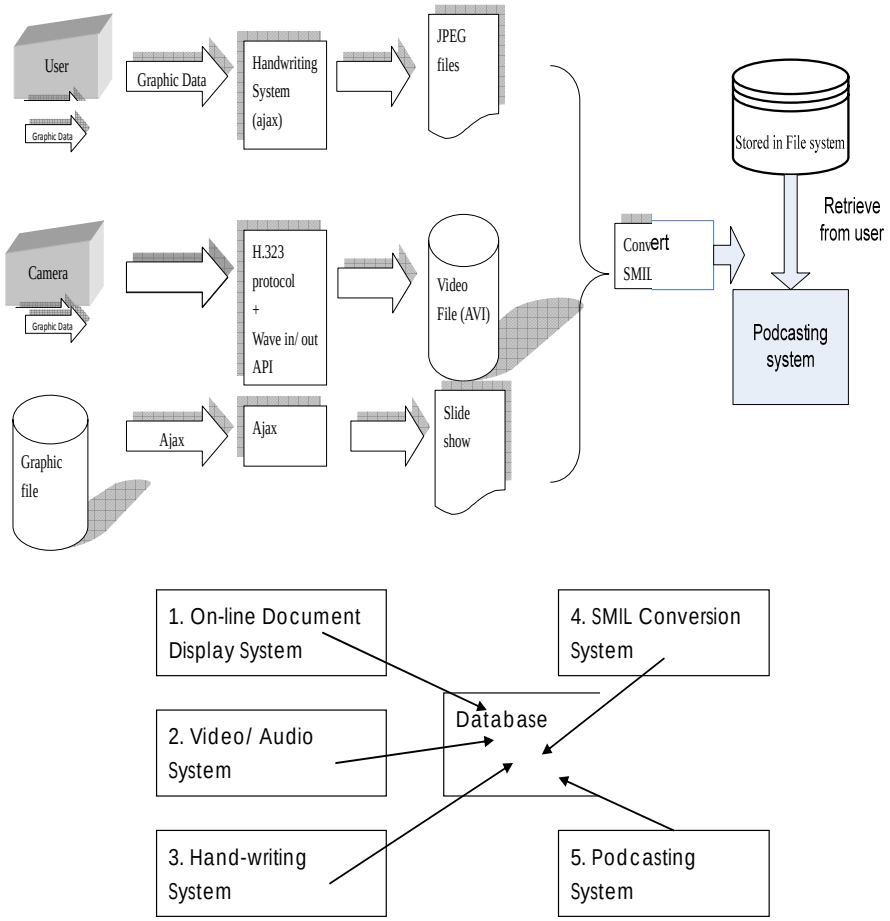
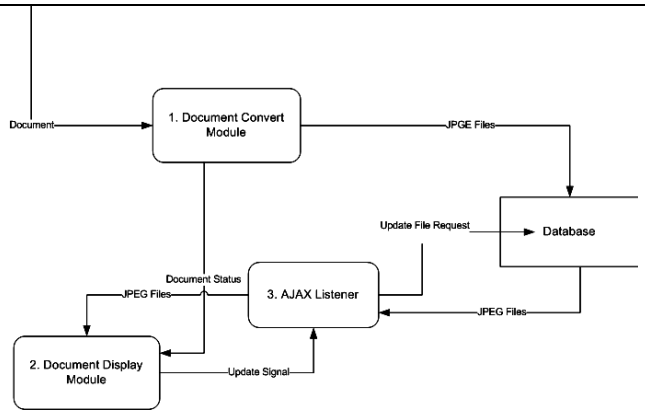


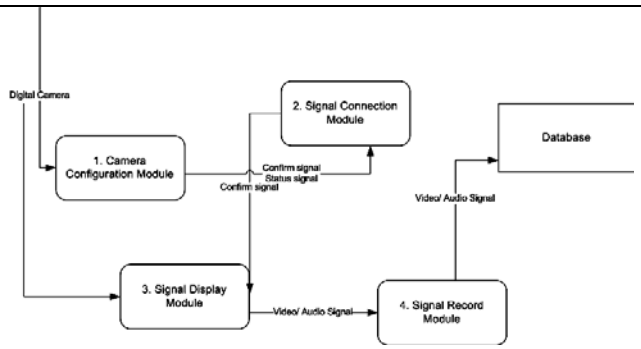
Fig. 5. Architecture of the Module

Table 1. Algorithm for handling Power Point File

	Begin
	Input file name of source ppt
	Input file name of target jpeg
	Call document convert module with source ppt
	Store jpeg files to database after converting by the module
	If presentation start
	Display jpeg files
	Store time frame
	Endif
	End

2.2 Step 2 - Video/ Audio System

Table 2. Algorithm for handling video file

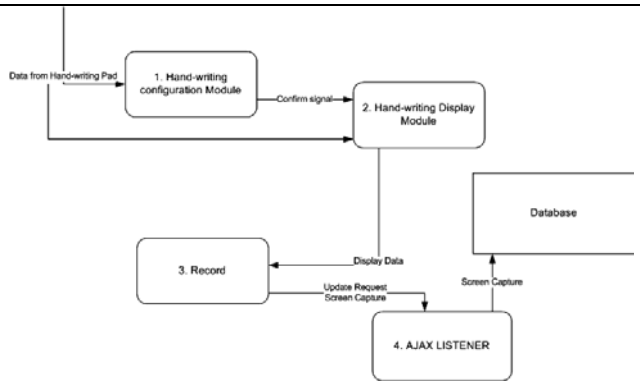
	Begin
	Input camera configuration
	Check network and video signals
	If signals correct and presentation start
	Start to record and to display
	Store time frame to database
	Store video and audio to database
	Endif
	End

2.3 Step 3 - Hand-writing System

This system helps to display hand-written notes used for presentation. Another function is to record the notes into several JPEG files. It is divided into several modules: Hand-writing Configuration Module helps to configure the hand-writing pad in a good condition. Hand-writing Display Module helps to display the hand-written note on screen. Record Module helps to record the screen displayed the hand-written

note into JPGE file, and AJAX Listener is used to update the screen capture to the database. We expect that 10 pages will be reserved for each presentation.

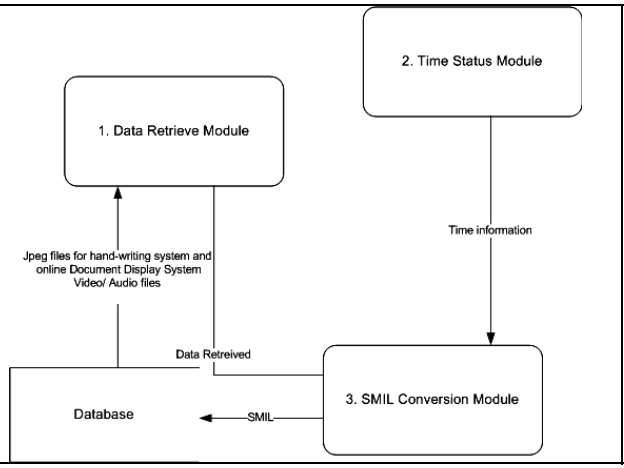
Table 3. Algorithm for handling handwriting File

	Begin
	Check handwriting configuration
	If signal correct and presentation start
	Input handwriting note on pad
	Record note to jpeg via Listener
	Store time frame to database
	Store jpeg files to database
	Endif
	End

2.4 Step 4 - SMIL Conversion System

This system helps to convert multimedia elements stored in the database to SMIL format. A SMIL file designed for podcasting is needed to be defined a lot of requirements so that we use Time Status and SMIL Conversion Models to build up this file. Data Retrieve Module aims to retrieve all the data from the database. Time Status Module helps to add time element to a SMIL format file. SMIL Conversion Module helps to combine data from two modules to the SMIL file and to store it into the database.

Table 4. Algorithm for storing PPT, video and handwriting Files into SMIL

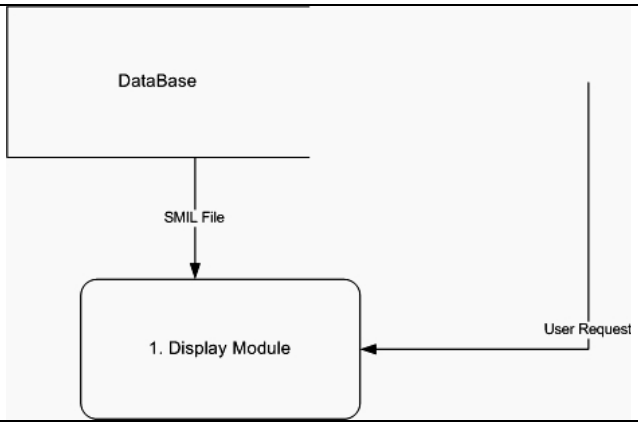
	Begin Open ppt jpeg files and time frame Open handwriting jpeg files and time frame Start to convert ppt & handwriting files according to time frame records Store SMIL file to database End

2.5 Step 5 - Podcasting System

This is the simplest system of the whole project and contains one module called Display Module. SMIL files are generated through the SMIL Conversion System. The module will listen to user requests and get the appropriate SMIL file from the database and play it by using SMIL player.

There are four modules in this system. Camera Configuration Modules helps to configure the camera in order to display on screen. Signal Connection Module aims to establish a network connection between the camera and the system. Signal Record Module helps to record the camera signal and Signal Display Module helps to display images.

Table 5. Algorithm for display SMIL File



Begin
Users connect to the system
Users invoke SMIL files
Podcast multimedia files via Internet
Using the Display Module
Stop and disconnect the system by users
End

3 Prototype with a Case Study

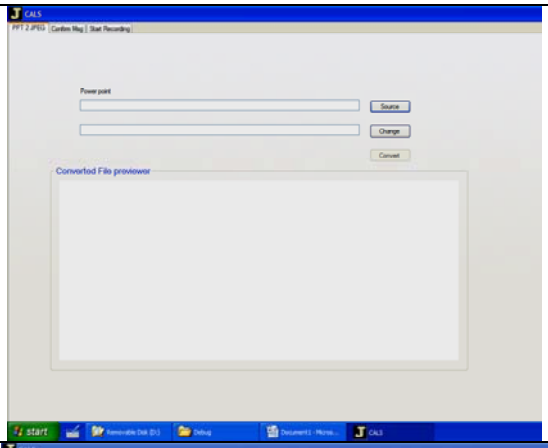
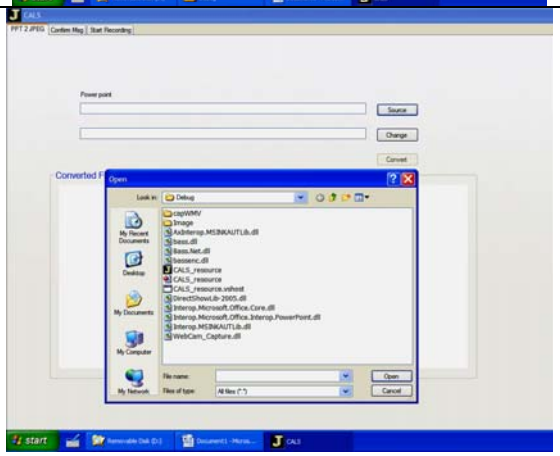
Dr. Fong, an Associate Professor of the City University of Hong Kong, lectures several computer courses. During these courses, he needs to deliver a power-point presentation and demonstration. Sometimes, he also needs to write down some explanatory notes in order to enhance the understanding of the course materials of the participants. In his experience, he discovered that the participants might not get a full understanding of the course materials. Therefore, he wants to take the advantage of using the on-line tutorial system to record the whole course and let his student view on-line or retrieve it later.

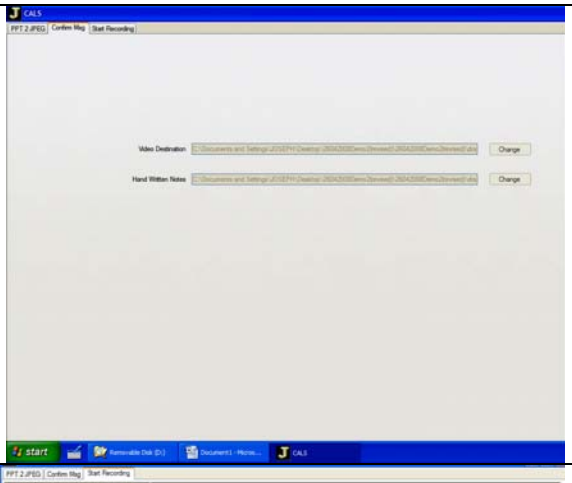
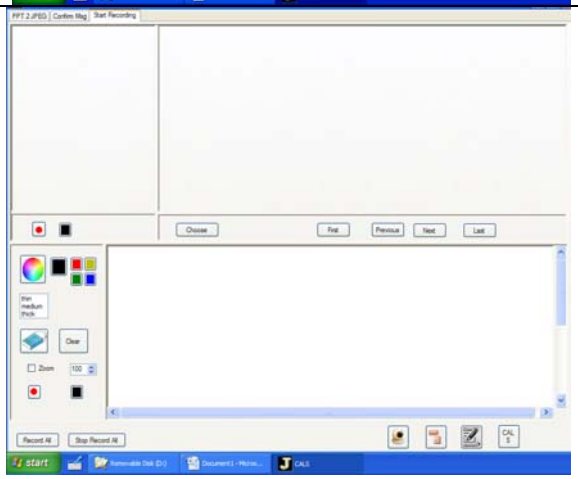
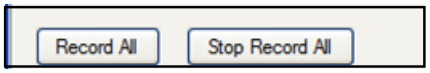
3.1 Preparing to Generate a SMIL File

The presenter needs to operate several systems such as On-line Document, Video/Audio, Hand Writing, and SMIL Conversion during his presentation in each lecture. The following explain how Dr. Fong operates the system to achieve the

purpose. He is going to lecture a course named Data Warehouse and Data Mining. In this lecture, he needs to prepare materials such as (1) Self presentation in mpeg format, (2) Power-Point in jpeg format, and (3) Hand-written explanatory notes in jpeg format. In order to facilitate this case study, the presentation is assumed to last for 5 minutes.

Table 6. Screen dumps for case study

1.	Before starting the course, Dr. Fong needs to login to the system by his own account. Then, he needs to input the path and file name of the source as well as the path and file name of the target in the first part of the On-line Document Display System in order to convert from a ppt file to several jpeg files that can be displayed by the Podcasting System.	
2.	Sometimes, if a presenter does not need to show a power-point file, the conversion process cannot be invoked. In this case, a power-point file is needed for the presentation; the system will display an interface to Dr. Fong to convert power-point slides to JEPG files. He also needs to implicitly indicate a path for storing the JEPG files. And then, he needs to pass the "Convert" button.	

3.	After converting the power-point file, he also needs to indicate the path and file name for storing videos as well as the path and name file for storing hand-writing notes. Actually, these two parts are in connection with the Video/ Audio and the Hand-writing Systems respectively.	
4.	The slides will be converted to JEPG files and it will be listed controlled by the presenter into the screen when the presentation starts. Before recording, Dr. Fong needs to configure the video camera and to make sure the camera that is connected to computer. We use a high standard webcam that has been installed into a tablet PC in advance. Dr. Fong will control the webcam by himself. In other words, we have no extra man-powers during the presentation.	
5.	As a hand-writing option is selected, the Hard-writing System will detect whether or not the hand-writing pad is connected to the computer.	Hand-Writing Pad is detected
6	Finally, the recording of video, slide, and hand-writing note will be started or stopped synchronously when 'Record All' button or 'Stop Record All' button is pressed. The SMIL Conversion System will be invoked when the 'Record All' button is pressed.	

3.2 On-line Podcasting a SMIL File

Students can use RealPlayer to run and to view SMIL files. They can access our Podcasting system through the Internet and select an appropriate course code as shown in Figure 6. And then, the course information and each lecture will be display as shown in Figure 7 and can be selected by students. After that, a screen layout of a podcasting presentation will be run as shown in Figure 8. It has been consisted of video mpeg file, power-point jpeg file, and handwriting note jpeg file that have been constructed according to Section 3.1 - Preparing to Generate a SMIL File. Therefore, we assume that the system will have a delay. Students want to retrieve all the contents of the presentation. They should connect to the web server and pass some authentication procedures before viewing the presentation. And then, the Podcasting System will be invoked. After finishing the presentation, if students want to see more about the presenter, they can click on the top right-hand corner named “Presented by Dr. Joseph Fong”. Then, another presentation will be invoked as shown in Figure 9 for displaying presenter information.

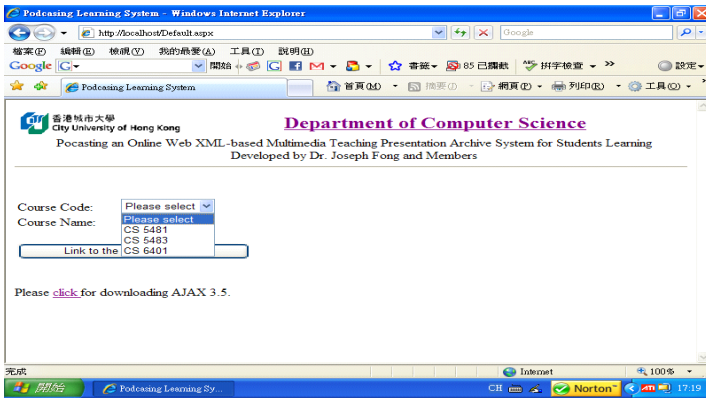


Fig. 6. Open page of the Podcasting Web

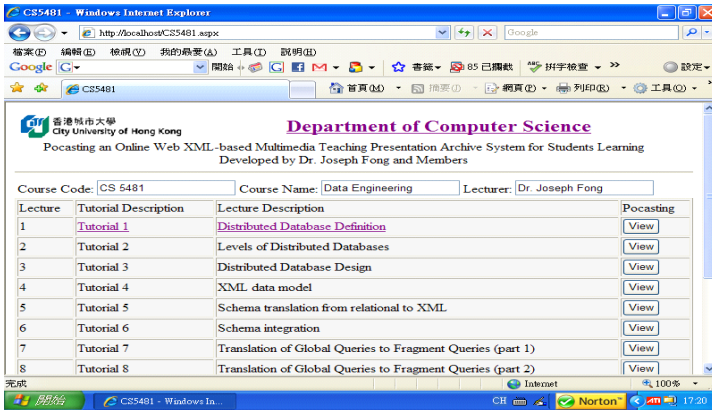


Fig. 7. Selecting a Podcasting Lecture

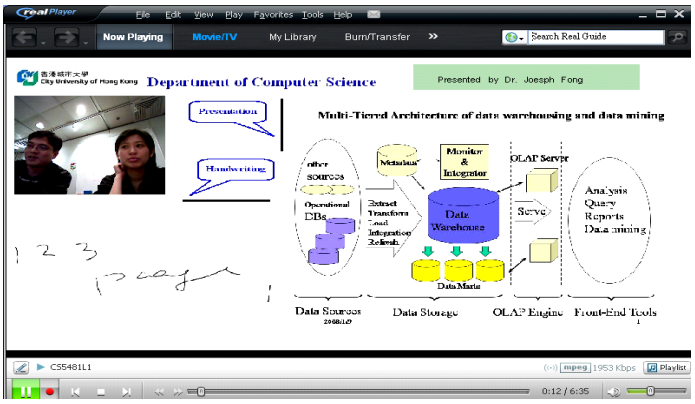


Fig. 8. Screen Layout of a Podcasting Presentation

Fig. 9. Presenter Information

4 Conclusion

The prototype of the on-line tutorial system is designed to demonstrate the feasibility of applying SMIL to implement a podcasting system consisting of power-point presentation, hand written notes computerization, and video conference recording. Students can facilitate to learn in any places or review their lectures as a supplement classroom learning by using the system. The success of this system depends on the utilization of the system by students and their learning productivity. The contribution of this paper is to enable students to combine classroom learning with eLearning (learning on the web) for classroom materials review on-line. It encourages students to learn anywhere and at any time by using the Internet. Future enhancement will be focused on how to improve the quality and performance of the system.

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