

# Multimedia Presentation Authoring System for E-learning Contents in Mobile Environment

Meekyeong Kim<sup>1</sup>, Chuleui Hong<sup>2</sup>, Deakyung Kwon<sup>1</sup> and Sungchul Hong<sup>1</sup>

<sup>1</sup> Department of Computer and Information Sciences, Towson University, Maryland, USA

<sup>2</sup> Department of Computer Science, Sangmyung University, Seoul, Korea

*Corresponding author: Email: hongch@smu.ac.kr*

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**Abstract:** The development of wireless Internet technologies and mobile devices make it possible to move a large-scale Internet site to a mobile phone. The number of mobile users keeps continuously increasing. Therefore mobile learning is expected to go as a powerful educational tool and enables learners to study anytime and anywhere. In this paper, we are proposing the design and implementation of the Multimedia Presentation Authoring System (MPAS) that produces multimedia e-learning contents for mobile environment. The proposed MPAS makes it possible to create multimedia presentations that integrate diverse media types including images, video, sound, and texts for mobile devices. The proposed system provides an integrated authoring environment that enables authors to produce e-learning contents from media objects and edit or reconstruct existing presentations based on GUI (Graphic User Interface). Media objects are synchronized with the temporal and spatial information using Synchronous Multimedia Integration Language (SMIL) defined by W3C. The system has been developed with JDOM, JMF and SAX Parser and is composed of seven modules. When presentation is completed, the system compiles the presentation and generates the SMIL document automatically. The produced multimedia presentations can be stored locally on author's device or serviced through e-learning websites in mobile environment. The proposed MPAS provides authors a tool to create multimedia presentation e-learning contents easy to follow based on SMIL and make them available instantaneously through the Internet in mobile environment.

**Keywords:** Multimedia Presentation, E-learning, SMIL, Mobile Contents, Authoring System

## 1 Introduction

The mobile Internet is rapidly evolving and growing in the world and will be bigger than the fixed Internet based on desktops or laptops in the near future. With the phenomenal growth in the mobile Internet usage across the world, the number of mobile devices is increasing exponentially and the mobile Internet service is providing various multimedia contents including images, audio, video, games and GPS navigation to mobile users via their mobile devices.

The number of mobile phone users in the world had reached 5.3 billion by 2010 [1]. That is equivalent to 77 percent of the world population.

Therefore mobile learning is expected to go as a powerful educational tool for mobile users and enables learners to study and access multimedia e-learning contents anytime and anywhere.

SMIL(Synchronized Multimedia Integration Language) [2,8,9,12] is a XML based markup language by W3C recommendation to create multimedia presentations. SMIL integrates multimedia elements such as text, images, video and audio by synchronizing them. SMIL provides an easy way for authors to compose multimedia presentations.

Bouyakoub et al. [3,4] have proposed a temporal authoring tool for SMIL document with incremental authoring based on H-SMIL-Net model. Téllez [5] has presented an IMS formats authoring tool for Docbook to produce SMIL compositions and e-learning contents. Ha et al. [6] have proposed a system that enables to create SMIL document from temporal scripts and UML sequence diagram to improve reusability. Jokela et al. [7] have presented a Mobile Multimedia Presentation Editor that enables users to create audio-visual stories on mobile devices. Chung et al. [10,11] have proposed a new Timed Petri Net that enhances the OCPN (Object Composition Petri Net) model and captures the timing and synchronization in SMIL by the data structure.

In this paper, we are proposing an authoring tool called the Multimedia Presentation Authoring System (MPAS) for e-learning contents in mobile environment that helps authors to make multimedia presentations by themselves and easy way. The proposed MPAS makes it possible temporal and spatial synchronization of integrated diverse media types using SMIL. It enables authors to synchronize existing image(jpeg), text, audio and video files. It can also record audio and video and input text in real time with existing image files to create multimedia e-learning contents. Multimedia presentations in mobile environment are restricted by the screen size of mobile devices. Image files will be converted automatically to small size suited for capacity of multimedia presentation. Using existing images and video or while recording video or audio or inputting text with existing images, authors can specify time duration between images and video to synchronize them by clicking next or previous button on images. While making presentation, annotations can be used by drawing on images in layered architecture that separate images from annotation.

The features of the proposed MPAS are summarized as follows. First, it provides an integrated graphical authoring environment for authors through GUI (Graphic User Interface) that enables authors to synchronize media objects and generate SMIL files without knowing SMIL. Second, it offers very efficient and useful editing function that involves deleting or inserting images, text, video, and existing presentation by the cutting and reconnecting algorithm. Media objects are resynchronized and the existing SMIL file is modified automatically. Third, it provides the preview function that facilitates to show and check a completed presentation without needing to play

before editing. Forth, it can produce multimedia e-learning contents with optimized size and capacity for limited screen size of mobile devices such as smart phone. Media objects are synchronized in temporal and spatial behavior.

The produced e-learning contents can be stored locally on author's device or serviced through the mobile Internet, mobile phone users can access to the contents.

## 2 SMIL Standards

SMIL [2,8,9,12] is an XML-based language for describing multimedia presentations and allows integrating diverse media types into a synchronized multimedia presentation.

SMIL document uses <smil> tag for opening and </smil> tag for closing as a root tag and is composed of <head> and <body> tags like HTML. <head> tag includes <layout>, <region> and <switch> tags with meta information. <layout> is divided into <region>s. <region> tag specifies the position and size of media object elements. In <body> tag, <text>, <audio>, <video> and <animation> tags are used for media objects, and <par> and <seq> tags are used for synchronization in parallel and sequential. The sample code of SMIL document for multimedia content is as follows.

```
<smil>
  <head> <layout>
    <root-layout width="500" height="380"/>
    <region id="A" width="500" height="280" top="0" />
    <region id="B" width="350" height="100" top="280"
left="55" />
  </layout> </head>
  <body>
    <par>
      <audio src="audio1.wav" begin="0s" dur="150s" />
      <video src="video.mpg" region="A" begin="0s"
dur="150s"/>
    <seq>
      
      
      
    <par>
      
      <text src="text1.txt" region="B" begin="90s"
dur="40s" />
      <text src="text2.txt" region="B" begin="130s"
dur="20s" />
    </par>
  </seq>
</par>
</body>
</smil>
```

The comparison between `<par>` tag and `<seq>` tag is shown in Figure 2.1 and Figure 2.2. In Figure 2.1 and Figure 2.2, the time durations of the image, video, and text objects are 20, 30 and 20seconds each.

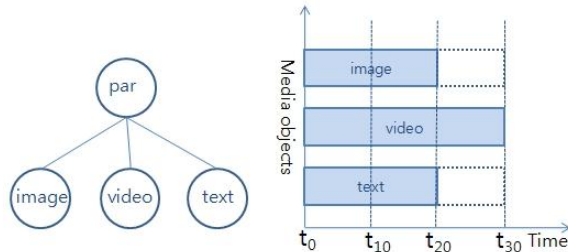


Figure 2.1: SMIL tree and synchronization in parallel of `<par>` tag

The synchronized media object elements are played at the same time by `<par>` tag and the total time duration is 30seconds ( $\max\{20,30,20\}$ ) in Figure 2.1. The synchronized media object elements are played sequentially by `<seq>` tag and the total time duration is 70seconds ( $\sum\{20,30,20\}$ ) in Figure 2.2.

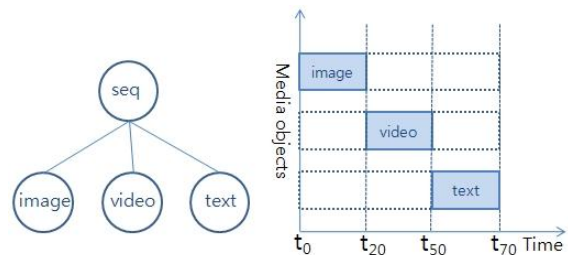


Figure 2.2: SMIL tree and synchronization in sequential of `<seq>` tag

### 3 Authoring System Architecture

The proposed MAPS system is composed of the following modules. The GUI of the system enables authors to use these modules without any knowledge for authoring e-learning contents.

#### 3.1 Creating Module

This module facilitates creating a new presentation. In order to initialize authoring a new presentation, it creates the presentation folder specified and named by an author, and road images and video or ready to record video. This module converts Power point slides to JPEG images with the small size which is fit for mobile devices and copy them from selected folder to the presentation folder. It specifies the layout that defines the

regions of media objects.

#### 3.2 Recording/Playing Module

This module records the video and audio during a presentation and enables the author to view the video screen being currently recorded during the recording progress by using JMF. Existing video and audio can be played and showed by this module.

#### 3.3 Timing Module

Timing module enables to specify the time duration of a presentation with time stamp by author's command. When an author starts and finishes authoring a presentation, it records the beginning and end time with time stamp for the video and audio and calculates the total time duration for the presentation. When author's command is occurred for images, this module specifies the beginning time and time duration of each image, and uses that information to synchronize media objects.

#### 3.4 Compiling Module

Compiling module corrects the temporal and spatial information about media objects from other modules and compiles it. This module provides the functionality enabling to generate a SMIL for synchronizing media objects and makes it possible to create a SMIL document without any knowledge of SMIL language for authors by hiding the source file of the SMIL document through the GUI. SAXParser and JDOM have been used for implementing this module. SMIL document is generated as follow.

```
Element smil = new Element("smil");
Document doc = new Document(smil);
Element par = writeXmlHead(smil);
Element head = new Element("head");
Element body = new Element("body");
```

#### 3.5 Editing Module

This module enables authors to edit existing presentations. This module allows an author to change the slide images in existing presentations to different slides. It offers very useful editing function that involves inserting images, text, audio, video and existing presentation and deleting slide with video or slide only or video only by using the

cutting and reconnecting algorithm.

When this module is activated, it reads SMIL document and is ready to update the SMIL document. Each editing operation by author's command is reflected immediately to SMIL document. SAXParser and JDOM have been used for implementing this module. For example, if an author deletes video only in any block time, this module marks the time stamps for the start and end time to be deleted in the video, and then cut that block in the video and reconnects the divided videos using the time stamps. The total time duration of the presentation will be reduced as much as deleted block time. After the cutting and reconnecting, media objects are resynchronized and the existing SMIL file is modified immediately.

The pseudo code for the cutting algorithm is as follows.

```

<Cutting Algorithm>
Input: Object,  $C_{begin}$ ,  $C_{end}$ 
Output: SMIL Document
Set of objects,  $O = \{O_1, O_2, \dots, O_N\}$ 
Set of time stamps,  $T = \{O_{1begin}, O_{1dur}, \dots, O_{Nbegin}, O_{Ndur}\}$ 

Mark time stamps for  $C_{begin}$  and  $C_{end}$ 
Calculate time duration for cutting ( $C_{dur}$ )
Cut block from the object
Reconnect the divided objects
Reduce total time duration of the presentation with  $C_{dur}$ 
for all same type of objects
  if  $O_{begin} > C_{begin}$  then
    recalculate beginning time of object
Resynchronize objects with time stamps
Regenerate new SMIL Document

```

### 3.6 Previewing Module

This module provides the functionality to preview and check the temporal presentation under creation before editing or playing with a media player. It displays the image slide thumbnails in the temporal presentation through the navigation pane that helps the author to navigate the image objects and easy to move in the presentation.

### 3.7 Reconstructing Module

This module facilitates reusing existing multimedia presentations. It allows an author to copy, combine, and delete existing presentations with the synchronized SMIL documents. The

system architecture of the MPAS is shown in Figure 3.1.

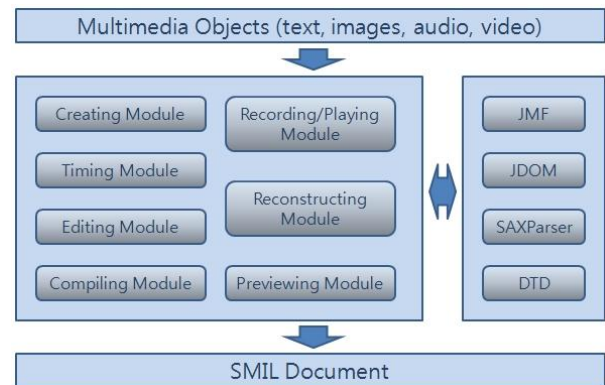


Figure 3.1: System architecture of MPAS

## 4 Implementation

We offer an authoring tool providing an easy to use authoring and editing environment with the graphic user interface to authors who want to produce multimedia e-learning contents that are available to be accessed by mobile users. It has been designed and implemented using Java with JMF, JDOM and SAXParser. We have used NetBeans IDE 7.0 development environment. The proposed system is composed of three parts: authoring part, editing part, reconstructing part.

### 4.1 Authoring Part

Authoring part enables authors to produce multimedia presentations based on GUI. It is divided into four panes: slide pane, video/audio pane, navigation pane, annotation pane.

- Slide pane: It shows the loaded images with four buttons, start, previous, next, finish. The presentation is started by clicking start button. The author can specify the time duration of each slide by clicking the next and previous buttons to synchronize the slides with the video and audio. When the finish button is clicked, the presentation will be completed and the SMIL file will be generated. It calls the timing module and compiling module.

- Video/audio pane: It displays the screen for recording or playing video. It calls the recording/playing module, and the module is started by clicking the start button.

- Navigation pane: It shows image slide thumbnails. A slide can be selected by clicking the slide thumbnail in the navigation pane.

- Annotation pane: It enables authors to add



annotations by drawing or writing on images in layered architecture that separate images from annotation. Annotations are stored as images and synchronized with the slides.

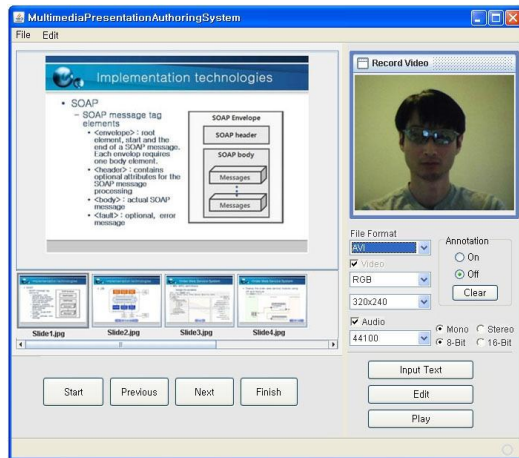


Figure 4.1: Authoring tool

#### 4.2 Editing Part

This Editing part enables authors to edit completed or existing presentations. It is divided into six panes: preview pane, time pane, change pane, insert pane, cut slide pane, cut video pane. It calls the previewing module and editing module.

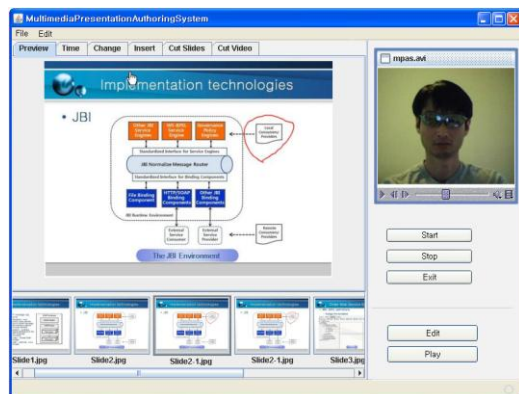


Figure 4.2: Editing tool including several functions

- Preview pane: It shows a temporal presentation to the author before editing or playing. It is composed of three parts which are the navigation pane area for showing slide thumbnails, slide area for playing slide show, screen area for playing video and audio.

- Time pane: It displays the time input boxes to modify the time duration of each slide.

- Change pane: It displays the select dialog boxes for changing each slide to a different slide.

- Insert pane: It enables authors to insert slides,

video or presentation in an existing presentation by selecting an object and choosing which order or time they want to insert.

- Cut slide and video panes: It allows authors to cut slides or video from a presentation by selecting slides or specifying time for video.

#### 4.3 Reconstructing Part

Reconstructing part enables authors to reconstruct existing multimedia presentations. It is composed of copy, combine, and delete menus. It calls the reconstructing module.

#### 4.4 Presentation with SMIL Document

The proposed MPAS helps authors to produce multimedia presentations for e-learning contents which are available to be accessed through the mobile Internet. As the output of authoring, slide image, text, video, audio files and SMIL document are created in the presentation folder. An example of multimedia presentation is shown in Figure 4.3. The synchronized media objects, audio, video, and image were played in the first screen shot and audio, image, and text were played in the second screen shot.

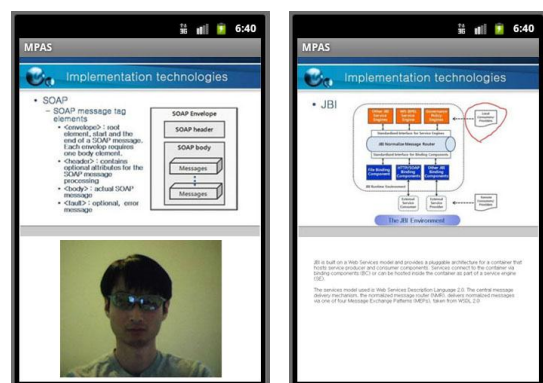


Figure 4.3: An example of multimedia presentation

MPAS generates the SMIL document automatically with the multimedia presentation. The tree structure of the SMIL document for the presentation in Figure 4.3, is shown in Figure 4.4. The synchronized media objects by SMIL document are shown sequentially during the total time duration of the presentation. Synchronized media object elements are played at the same time by <par>tag and played sequentially by <seq>tag. A media object element has a unique ID in SMIL document. Figure 4.5 represents the synchronization between media objects for the presentation.

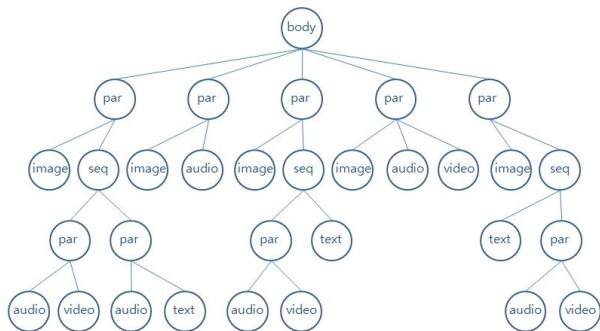


Figure 4.4: The tree structure of SMIL document

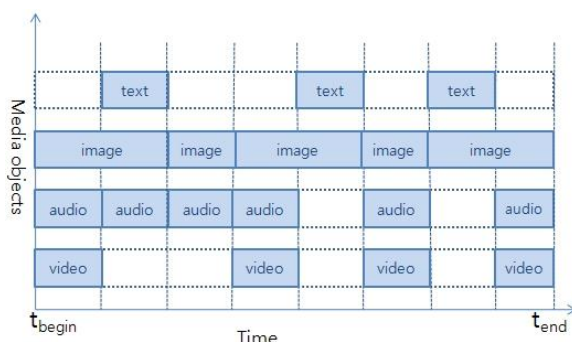


Figure 4.5: Synchronization of media objects

## 5 Conclusions

We have proposed an authoring tool called MPAS that helps authors to produce multimedia presentation for e-learning contents and enables the e-learning contents to be accessed by mobile user through the mobile internet. The proposed system makes it possible to integrate diverse media types including text, images, audio and video, and synchronize media objects by generating SMIL documents automatically. It offers an integrated authoring environment based on GUI (Graphic User Interface) that enables authors to produce e-learning contents without any programming knowledge and provides powerful and efficient editing and reconstructing functions. The size and capacity of e-learning contents can be optimized for mobile devices and available instantaneously to be serviced through the mobile Internet.

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**Meekyeong Kim** received the MS degree in computer science from Sangmyung University, Korea, She is currently a Student in Computer Science at Towson University, USA. Her research interests are in the areas of Multimedia File System, Multimedia Application, E-learning, Web service modeling and Computing, Mobile Computing, Intelligent Agent, Expert System.



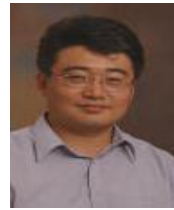
**Chuleui Hong** received M.S. degree and Ph.D. degree in Computer Science at New Jersey Institute of Technology, USA and University of Missouri-Rolla, USA, respectively. He was a senior researcher in Electronic and Telecommunications Research Institute, Korea. He joined

Sangmyung University as a faculty member and is currently professor of Computer Science Department at Sangmyung University, Seoul, Korea. His research interests include Parallel and Distributed System, Optimization Algorithm, Multimedia Application, and Intelligent Agent.



**Deakyung Kwon** received the MS degree in computer science from Sangmyung University, Korea, and the MS degree in computer science at Towson University, USA. He is currently a software engineer. His research interests are in the areas of

Multimedia Application, Web service modeling and Computing, Mobile Computing, Service Oriented Architecture, Voice over IP, Mobile communication, E-learning, ERP.



**Sungchul Hong** received the MS degree in computer science and PhD in MIS from University of Texas at Dallas, major in E-Commerce. He is currently a professor in Towson University which is located in Maryland, USA. His research interests are in the areas of Multi

Agent Systems in B2B Trading, Electronic commerce, Decision Support Systems, Generic Algorithm, Multimedia Application