Journal of Applied Sciences

ISSN 1812-5654

science alert

ANSInet
an open access publisher
http://ansinet.com

Journal of Applied Sciences 8 (1): 127-133, 2008
ISSN 1812-5654

S-Point A Semantic Based E-learning Content Development Tool

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Abstract: Microsoft® PowerPoint is the most popular e-learning content development tool. The effectiveness and easy to use of PowerPoint together with third party tools seems to make the idea to develop e-learning with PowerPoint work but PowerPoint cannot be considered as a premier e-learning tool. The reason might be the drawbacks of PowerPoint in terms of its file size, inter-operability and openness. This research describes architecture of a new e-learning content development tool that not only has the look and feel of PowerPoint but also overcomes the drawbacks of PowerPoint. We call this tool as S-Point-A Semantic Based eLearning Content Development tool that is based on the Open Reusability Benchmark. With help of this tool teachers can develop learning objects that are more semantically meaningful and semantically searchable.

Key words: E-learning, content development tool, semantic computing, open reusability

INTRODUCTION

According to Open and Distance Learning Quality Council in the UK (ODL QC, 2005), e-learning is defined by the effective learning process created by combining digitally delivered content with (learning) support and services. Thus for e-learning an important word comes out to be digitally delivered content-content delivered electronically by CDS, cell phones, the computer and the Internet. The effectiveness of e-learning enhances when e-learning content is semantically organized. Many e-learning Content Development tools exist and the most popular of them is the Microsoft PowerPoint® (Microsoft, 2007) to build on-line courses.

PowerPoint can be a useful tool for storyboarding courseware as it is an easy-to-use tool for creating sequence that has simple schema and various layout designs. And of course, most of the material that instructional designers receive already exists in PowerPoint.

On the other hand, PowerPoint cannot be considered as a real content development tool. The reason is that the PowerPoint presentation files do not satisfy the Open Reusability Benchmark (Ihsan *et al*., 2005, 2006) in terms of Accessibility, Inter-Operability, Partial Reusability and Integration. PowerPoint uses slide by slide approach in which all the contents and presentational design are incorporated in a singular file making Personalization impossible.

Still now, many lecturers are using PowerPoint to author e-learning courses and there can be a good reason for this. Perhaps a higher quality product can be developed in minimum time and with a very little investment, or the course is short enough that a simple PowerPoint version will do just fine. Therefore a PowerPoint course might be perfectly suitable for a given situation.

Various researches going on in the world are focusing on identifying a quicker solution that requires little technical expertise known as rapid e-learning (Jennifer, 2004). Rapid e-learning tools provide an easy-to-use interface that enables a course to be assembled quickly into a single file. PowerPoint uses OLE (Object Link Embedding) to create a singular file that embeds all the information like its schema, media objects (Audio, Video and Picture etc.) and presentational template in itself. There are various third party tools available that convert PowerPoint files into XML (XML, 2007) files that are based on the graphical location of media objects on a particular slide and not the semantic placement of the objects. An object placed in the title of the slide has more semantic value than the object area. Therefore, the schema should be in a form that semantically arranges the media objects and the focus of the ongoing researches should be on the development of tools that create learning objects on the base of semantic schema with easy to use interface. Apart from using semantic schema for building learning objects, there is a need to use separate files for schema, contents and presentational templates. By doing this, one can change the schema and the contents get adjusted automatically. Another aspect is that by using different presentational templates, one learning object can be adjusted in variety of display devices such as Laptop, PDA or a Smart Phone, making learning objects semantically reusable, searchable and personalizable.

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Therefore, a need arises to develop an e-learning Content Development Tool that overcomes the drawbacks of PowerPoint while keeping all of its good points intact. To develop such a Tool that satisfies the Open Reusability Benchmarks, we need to adapt the restructured definition of Learning Objects known as Semantically Meaningful Units-SMUs (Ihsan *et al*., 2005, 2006).

Semantically meaningful units: An SMU is a self-contained XML media unit based on a single learning objective. It contains the links of Media, Metadata and Design Templates using XML, enabling itself to be delivered across different platforms unchanged or unmodified (Fig. 1). This helps in facilitating the discovery and Open Reusability by course-builders and instructors using Open Reusability Benchmark for Learning Objects.

E-learning content development tool: e-learning Content Development Tool takes input from the user in a similar fashion in which one can create a slide using Microsoft® PowerPoint and then by storing the information in the form of XML according to the SMU Schema (Ihsan *et al*., 2006). The user also provides a presentational template to make an SMU more presentable. The user can choose a template from the existing Templates Database or can develop a Template of his own. After SMU creation, next phase is the Metadata Collection that is the responsibility of Meta Collector that also classifies the SMU according to a taxonomic path. All of this information (schema, presentational template and metadata) are kept in separate files and linked through a main SMU XML file.

S-Point architecture: S-Point is an e-Learning Content Development Tool where a user can create an SMU slide by slide. The layout of S-Point is quite similar to that of Microsoft® PowerPoint. A user can enter Title, Body and Footnote to a slide before moving to the next one. A user can also import images, audio or video files to link with a particular slide. The S-Point provides the facility to move forth and backwards on different slides and can edit them as well. User can also associate a presentational template with SMU for its appearance. After completing the SMU, the user is directed to the metadata collection section. This section contains all the elements that are defined within SMU Metadata schema according to IEEE Metadata Standards (IEEE, 2005). This SMU and its related files are stored in a central XML based repository from where it can be retrieved later for viewing in S-Point slide show Fig. 2.

Learning Object Manger deals with the Creation and Rendering of the SMU. It is the main work area of S-Point and is connected to different Modules for proper working of S-Point.

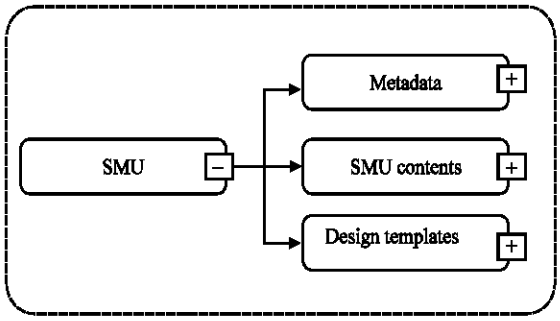

Fig. 1: Semantically meaningful unit

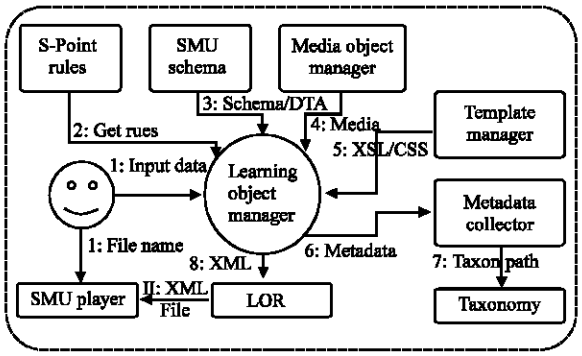

Fig. 2: S-point architecture

Rules are defined in order to associate the XML Schema, Media Objects, Templates and Metadata with central XML file of Learning Object.

Media Object Manager deals with the insertion of the media objects within SMU. Media objects comprise of Text, Images, Audio and Video etc.

Metadata Collector deals with the collection of the metadata information according to SMU Metadata Schema.

Taxonomy deals with classification of SMU according to Faculty, Field and Course defined by SMU.

Learning Object Repository deals with the storage and retrieval of the SMU. It contains the SMU (XML File) and it's associated Schema, Media Objects, Design Templates and Metadata.

SMU Player retrieves and plays the SMU in the form of a slide show.

S-Point use cases: There are various functionalities in S-Point but we have listed the five main use cases. These use cases are Create SMU, Edit SMU, Create Template, Collect Metadata and Play SMU. There are four actor roles namely Teacher, Student, Template Designer and Annotator. These actors or users perform different functionalities and their association with various use cases is shown in Fig. 3.

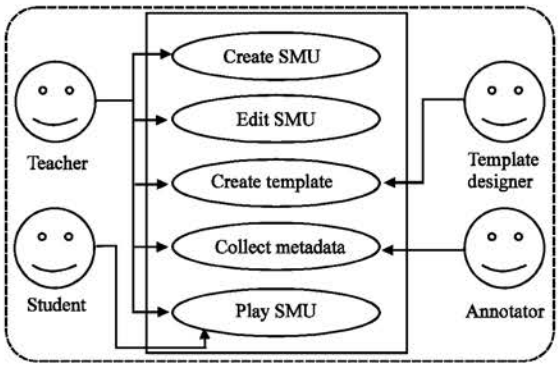

Fig. 3: S-Point use case diagram

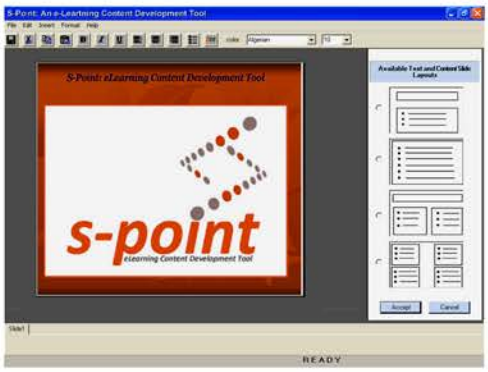

Fig. 4: S-point slide editor (screenshot)

Table 1: S-Point Use Case - 1: Create SMU

UC1: Create SMU	
Primary actor:	Teacher
Stake holders and interests:	Teacher wants to create a New SMU
Preconditions:	None
Post conditions (Success guarantee)	New SMU is created
Main Success Scenario (Basic Flow):	1 User clicks New on the File Menu 2 User selects a Layout from the predefined Layouts 3 User can Insert Media objects to SMU 4 User can apply/change design templates to SMU 5 New SMU is created

Table 2: S-Point use case - 2: Edit SMU

UC2: Edit SMU	
Primary actor:	Teacher
Stake holders and interests:	Teacher wants to edit SMU
Precondition:	Some SMU must exist
Post conditions (Success guarantee)	SMU is Edited successfully
Main Success Scenario (Basic Flow):	1 User can click on open to render SMU 2 User can Insert new/change media objects to SMU 3 User can apply or change design templates to SMU 4 User can edit SMU's

Table 3: S-Point use case - 3: Create template

UC3: Create template	
Primary actor:	Teacher/Template Designer
Stake holders and interests:	Teacher/Template designer wants to create template for SMU presentation
Preconditions:	
Post conditions (Success guarantee)	Template is created successfully
Main success scenario (Basic Flow):	1 User will click on slide master to design template 2 User will provide fonts, styles and backgrounds 3 User will provide color scheme 4 Template will be created

Table 4: S-Point use case - 4: Collect Metadata

UC4: Collect meta data	
Primary actor:	Teacher/Annotator
Stake holders interests:	Teacher/annotator wants to perform metadata and collection
Preconditions:	Creation of SMU is necessary metadata.
Post conditions (Success guarantee)	Meta data collection is performed successfully
Main success scenario (Basic Flow):	1 User will provide required information 2 User will provide taxonomic path for classification 3 Meta data collection is performed successfully

Table 5: S-Point use case - 5: Play SMU

UC5: Play SMU	
Primary actor:	Teacher/student
Stake holders and interests:	Teacher/student wants to play SMU
Preconditions:	SMU already have been created
Post conditions (Success guarantee)	SMU will be played successfully
Main success scenario (Basic Flow):	1 User will click on SMU Player 2 User will open SMU 3 SMU will be played successfully

The descriptions of these use cases and their interaction with different actors is listed below. Table 1 describes use case for the creation of SMU and Table 2 explains the use case for modification of a created SMU. Table 3 illustrates the procedure for the development of a new Presentational Template where as Table 4 portrays the collection of metadata for the newly created SMU. In the last, Table 5 describes the mechanism for slide show presentation of an SMU.

S-Point prototype: For the proof of concept we have developed prototype of S-Point that is in testing phase. The screenshot of the S-Point is shown in Fig. 4. S-point Prototype has been developed under the IDE of Microsoft Visual Studio. NET 2003 (MSDN, 2007) using Microsoft Dotnet Framework 1.1.

S-Point uses the concept of MDI (Multi Document Interface) Forms to manage the various slides within an SMU. The Slides are developed as Windows Forms and

are listed as Tab Pages in the Windows Tab Control. Thus making the back and forth navigation of slides in a particular SMU easy.

Media Objects can be inserted in a particular slide. For the text media we have incorporated Rich Text Box, for Pictures and Images, we have used Picture Boxes where for Audio and Video Files we have adapted Windows Media Player (WMP, 2007). Images, Audio and Video files are kept external to SMU and SMU contains only the links.

The Design Templates comprise of the Background Image Theme Files where as the style and font settings are kept in the style sheet files (CSS File). These files are also linked in the particular SMU and are used at the time of slide show.

SMU is stored as an XML file which is portable across various platforms. Major APIs that are used in S-Point are;

- System.Drawing.Text
- System.Windows.Forms
- System.Xml
- System.IO

S-Point content editor: In S-Point we have initially used the SMU Schema that has been inspired by PowerPoint but various SMU schemes can be attached with S-Point and the behavior of the SMU changes accordingly.

The content schema of an SMU should be authored in accordance with a defined structure using a markup language such as SGML (Standard Generalized Markup Language) (SGML, 2007) or XML (eXtensible Markup Language). Authored content in the form of SGML/XML files can be stored in a content repository, which has capabilities for search, retrieval, revision and version control among other things. The SGML/XML file is accessible, interoperable and can be exchanged between different repositories. A sample SMU with two slides developed using S-Point Editor is shown in Fig. 5.

S-Point metadata collector: S-Point Metadata Collector contains all the elements that are defined within SMU Metadata schema compliant with IEEE Metadata Standards (IEEE, 2005). Whenever a user is directed to this section, he is prompted to choose a particular Domain Profile and the metadata elements are automatically filled in, using its Basic, Domain Profile and with help of system

```
<?xml version="1.0" encoding="UTF-8" ?>

- <SMU ID="U-001" THEME="\Maple\Maple.bmp">
    - <Slide ID="1">
        <TEMPLATE1 />
        - <TITLE>
            - <TEXT Value="Testing S-Point"
                                BackColor="White">
                <TITLE_TEXT_DETAILS />
                <Bullet_Indexes Value="" /> </TEXT>
        </TITLE>
        - <DETAILS>
            - <TEXT Value="Developed By CDSC"
                                BackColor="White">
                - <DESCRIPTION_TEXT_DETAILS>
                    <SECONDARY start="0" length="17" font-family="Verdana" font-style="Regular"
                    font-size="20" color="White"
                    Allign="Left" />
                </DESCRIPTION_TEXT_DETAILS>
                <Bullet_Indexes Value="" />
            </TEXT>
        </DETAILS>
        - <FOOTER>
            <DATE Value="20 September 2006" />
            <FOOT_NOTES Value="Testing SPoint" />
            <SLIDE_NUMBER Value="1" />
        </FOOTER>
    </Slide>
    - <Slide ID="2">
        <TEMPLATE1 />
        - <TITLE>
            - <TEXT Value="S-Point " BackColor="White">
                <TITLE_TEXT_DETAILS />
                <Bullet_Indexes Value="" /> </TEXT>
        </TITLE>
        - <DETAILS>
            <IMAGES Value="logo_spoint.jpg" />
        </DETAILS>
        - <FOOTER>
            <DATE Value="20 September 2006" />
            <FOOT_NOTES Value="Testing SPoint"/>
            <SLIDE_NUMBER Value="2"/>
        </FOOTER>
    </Slide>
</SMU>
```

Fig. 5: SMUs content sample XML file

```
<SMU_Metadata>
  <General>
    <Identifier>U-113311</Identifier>
    <Title>Introduction to Computer Organization Architecture</Title>
    <Language>English</Language>
    <Description>This lecture defines …</Description>
    <Keywords>Computer, Architecture, CPU</Keywords>
    <Coverage>Students of MAJU</Coverage>
    <Structure>Collection</Structure>
    <Aggregation>1</Aggregation>
  </General>
  <LifeCycle>
    <Version>Alpha 1.1</Version>
    <Status>Final</Status>
    <Contribute>Imran Ihsan</Contribute>
    <Role>Author</Role>
    <Entity>Assistant Professor MAJU</Entity>
    <Date>12-AUG-2005</Date>
  </LifeCycle>
  <Technical>
    <Format>XML</Format>
    <Size>3KB</Size>
   <Location>\\cdsc\Objects\SMUs\smu_ca01.xml</Location>
    <Requirement>Internet Explorer</Requirement>
    <ORComposite>IE Ver 4.0 and Higher</ORComposite>
    <Duration>30 Minutes</Duration>
  </Technical>
<Educational>
    <iType>Mixed</iType>
    <SMUType>Slide</SMUType>
    <iLevel>Medium</iLevel>
    <sDensity>Medium</sDensity>
    <EndUserRole>Learner</EndUserRole>
    <Context>Higher Education</Context>
    <AgeRange>18+</AgeRange>
    <Difficulty>Easy</Difficulty>
    <LearningTime>30Min</LearningTime>
    <Description>This lecture defines …</Description>
    <Language>English</Language>
  </Educational>
  <Rights>
    <Cost>Freeware</Cost>
    <CopyRight>2006 All Rights Reserved</CopyRight>
  </Rights>
  <Relation>
    <Kind>Based on William Stallings Book</Kind>
    <Resource>Computer Architecture </Resource>
  </Relation>
  <Annotation>
    <Entity>Imran Ihsan</Entity>
    <Date>12-AUG-2005</Date>
    <Description>Assistant Professor MAJU</Description>
  </Annotation>
  <Classification>
    <Faculty>Computer Science</Faculty>
    <Field>Computer Systems Engineering</Field>
    <Course>Computer Architecture</Course>
  </Classification>
</SMU_Metadata>
```

Fig. 6: SMUs metadata sample XML file

```
.Title
{
font-family: Courier New
font-size: 24
font-style: Bold, Italic
color: Red
Allign: Center
}

.ObjectArea
{
font-family: Tahoma
font-size: 20
font-style: Regular
color: ffd6d6d6
Allign: Left
}

.Footer
{
font-family: Arial Black
font-size: 14
font-style: Bold
color: Red
}
```

Fig. 7: SMUs Design template sample XML file

generated data such as file format, size and time etc. Afterwards, the user can make minor adjustments to the populated metadata before saving it Fig. 6.

S-Point Metadata Collector also has a module for the Taxonomy of SMU. The structure of classification is in terms of faculty, field and course. A user can set a classification scheme in advance and can use it later while entering the metadata. This defined scheme can be applied to a number of SMUs in a particular subject.

S-Point design template: Design Template is a file that contains the styles in a presentation, including the type and size of bullets and fonts; placeholder sizes and positions; background design and fill color schemes. There can be two different types of Design Templates and both of these have different semantic importance. These types are Master Template and Secondary Template.

S-Point Design Template Manager links the Master Template with the SMU where as the Secondary Template is embedded within the SMU contents. A sample CSS file for a Master Template is shown in Fig. 7. Sample CSS file describes the Font Families for Title, Object Area and Footer Area and will be applied to all slides within an SMU.

S-Point slide show: S-Point Slide Show is a place where a user can view an SMU slide by slide. The layout of Slide Show is quite similar to Microsoft® PowerPoint. S-Point Slide Show can be used to deliver lectures. It imports

Fig. 8: S-point slide show (screenshot)

image, audio or video files linked with a particular slide and plays them accordingly. It also applies the selected Master Template on to the SMU and can be played on various devices such as Smart Phones, PDAs and Laptops etc. It also provides the facility to move forth and backwards on different slides (Fig. 8).

CONCLUSION

After critically reviewing the Microsoft® PowerPoint, we have found some good points of PowerPoint in terms of its ease of use, its popularity and rapid content development. But we have also found some drawbacks of PowerPoint in terms of its Openness, Inter-Operability, Semantic Search-ability, Open Reusability and Personalization. In this study, we have proposed architecture of a new e-learning Content Development Tool known as S-Point that inherits all the good points of PowerPoint while overcoming its drawbacks. For a proof of concept, we have developed a prototype of S-Point that creates Semantically Meaningful Units-SMUs. It also stores SMUs and its IEEE compliant metadata and has classified an SMU on Faculty, Field and Course. We have also attached the XML Schema, Media Objects and Presentational Templates with SMU thus making it more Openly Reusable and Semantically Searchable. S-Point has defined an architecture that can increase the Open Reusability of Learning Objects, provide efficient storage and retrieval of Learning Objects and their integration for a Learning Activity. Due to this automation of the educational process, cost and time required can be reduced significantly.

REFERENCES

IEEE, 2005. IEEE Learning Technology Standards Committee ©2005. http://ltsc.ieee.org/wg12, IEEE Standards for Learning Object Metadata (1484.12.1).

Ihsan, I., M. Rehman, M.U. Ahmed, A. Qadir and N. Iftikhar, 2005. UREKA-grid enabled educational multimedia database. The 17th International Conference on Software Engineering and Knowledge Engineering, Taipei, Taiwan, Republic of China, July 14-16, pp: 485-490.

Ihsan, I., M.U. Ahmed, M. Rehman, A. Qadir and N. Iftikhar, 2006. Semantically meaningful unit-SMU: An openly reusable learning object for UREKA learning-object taxonomy and repository architecture-ULTRA. The 4th ACS/IEEE International Conference on Computer Systems and Applications AICCSA-06, Dubai/Sharja, UAE, March 8-11, pp: 1011-1018.

Jennifer, D.V., 2004. Rapid E-Learning: Groundbreaking New Research. LTI Newsline. Jun 30, http://www.elearningmag.com/ltimagazine/article/articleDetail.jsp?id=102399.

Microsoft, 2007. Microsoft Office PowerPoint Product Information. http://www.microsoft.com/office/powerpoint/prodinfo/default.mspx.

MSDN, 2007. Microsoft Developers Network. http://msdn2.microsoft.com/en-us/default.aspx.

ODL QC, 2005. Open and Distance Learning Quality Council: Standards in Open and Distance Learning. http://www.odlqc.org.uk/standard. doc, December.

SGML, 2007. Standard Generalized Markup Language. http://www.w3.org/MarkUp/SGML/.

WMP, 2007. Microsoft Windows Media Player. http://www.microsoft.com/windows/windowsmedia/default.mspx.

XML, 2007. Extensible Markup Language. http://www.xml.org.