Main tools for Learning Support Environment development

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Abstract: The paper presents an environment for assisting the learners comprising a tool for uploading files on the server, tools for developing metadata and learning objects organized in a contents package using the offered Model for describing, structuring, and organizing the learning objects. The "Content package" notion has been defined and its content has been discussed into a learning support environment.

Key words: *learning objects, learning support, web services.*

INTRODUCTION

There are many initiatives in the field of electronic study for standardising the description and modelling of the learning objects and their positioning in Learning Management System. Their development is mainly directed to the formulation of complete solutions showing how to perform publishing, search, exchange, and multiple use of the learning objects.

Some of these standards are Learning Object Metadata (LOM) of IEEE Learning Technology Standards Committee (LTSC) [4], Sharable Content Object Reference Model (SCORM) of Advanced Distributed Learning (ADL) [5] and the specification suggested by the Instructional Management System (IMS) [6].

The purpose of the work is to complement the existing standards and to show an approach for development, storage, and management of the contents packages.

The research of the present work is also aimed at finding solutions for Learning Support Environment (LSE) development. It offers a summarized approach allowing the development of modelled learning objects in LSE suitably annotated by meta contents describing the structure and application of the learning object.

WEB SERVICES TECHNOLOGY

MS VisualBasic 6.0 has been used in the initial application of the model for describing, structuring, and organizing the learning objects. This programme language uses an approach based on an application logic level and a component-based software limiting the application of some of the basic requirements of the international standards and specifications for developing such environments assisting the study. Due to the specified reason the practical application of the Model for describing, structuring, and organizing the learning objects is accomplished by applying the web services technology.

The software application of the model has been achieved on the Microsoft.NET platform and ASP.NET, C#, and ADO.NET have been used.

Using the web services the objects on the server receive calls from the client through HTTP and return an XML-based reply. They offer a new way of performing the remote method calls over HTTP that can make use of the SOAP.

SOAP (Simple Object Access Protocol) is an XML-based standard that details how method calls may be made over HTTP[2].

WSDL (Web Service Description Language) provides a description of the possibilities of a given web service using XML.

ASP.NET (Active Server Pages.NET) is a technology for developing dynamic documents on a web server. The web service is in fact an ASP.NET page, returning the XML document to the client.

The applications and web services described in the report use an object model on the part of the server and the client and .NET classes allowing the integration of services. Using C# with ADO.NET enables the access to the data stored in the database.

MODEL FOR DESCRIBING, STRUCTURING, AND ORGANIZING THE LEARNING OBJECTS

Analyzing the existing standards and specifications and the most promising web technologies the report author has achieved the model development and has explained its application in several main tools necessary for the development of a single LSE.

The basic principles for LSE development have been presented in the following modules of the model:

Module 1: Contents module

In conformity with the IMS Contents Packaging Information Model [4] the text files, the multimedia files, and all other physical files which can be used in a single learning environment are a combination of means defined as "contents". These means cannot exist independently. Therefore, they are described in an XML file called manifest [1].

Using the model the developer of the course contents shows the structure of a Learning Support Environment on figure 1.

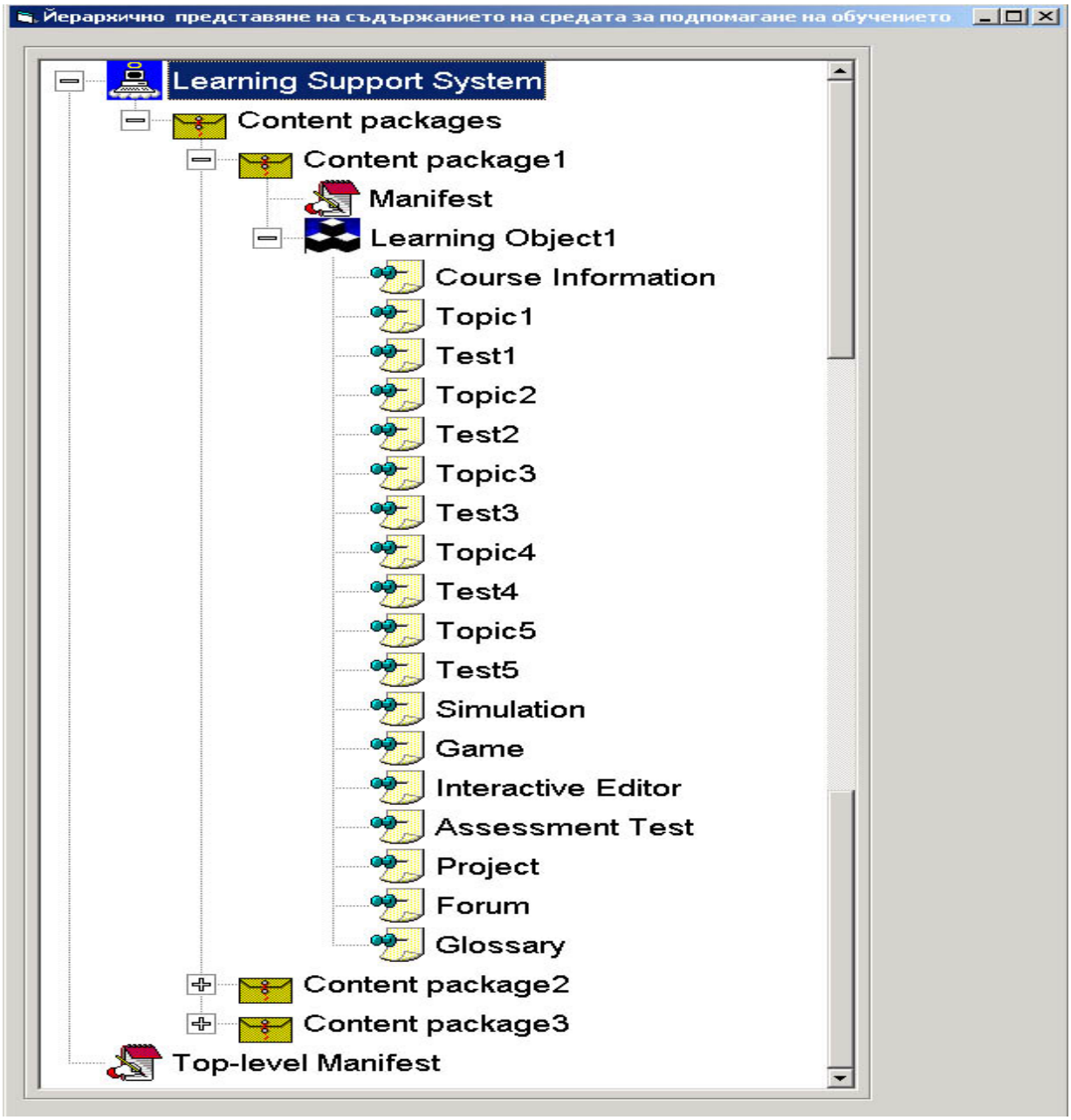

Figure 1. A hierarchical representation of the learning support environment content

It consists of several learning courses. Each course represents a basic independent structure called learning object.

Module 2: Contents package

The contents package is an independent element of an environment assisting the study comprising a learning object suitably annotated by metadata and a manifest. Its organization allows the multiple use of the separate elements forming the learning object as well as their use in other learning objects.

The metadata are used for describing the learning object and its characteristics in particular. The metadata also describe the elements included in the learning objects and their relations and give classified information of their status.

In conformity with the IMS Contents Packaging Specification [4] the contents package in the environment includes two components – an XML file describing the course structure called imsmanifest.xml and the physical files forming the course structure.

Using the metadata development tools presented below two schemes can be worked out for the application of XML files.

The characteristics offered by the Learning Object Metadata Standard [4] are used in the first tool grouped in the following order: general, lifecycle, meta-metadata, technical, educational, rights, relation, annotation, and classification categories.

The XML files developed with the second tool are suitable for searching the learning objects stored using the HtmlInputFile tool in the Learning repository of the server.

Module 3: Instructional design

The existing standards and specifications offer rules which do not follow any specific strategy of study. Therefore, the author has used the instructional design theory.
Following this theory the following key processes for study using the Internet can be specified included in the learning support environment.

Modelling – the user is enabled to follow the accomplishment of a particular task step by step using the offered multimedia application in the environment, which facilitates the process of explanation and modelling.

Scaffolding and fading – these are learning technologies, where the assistance given by the environment slowly reduces and the responsibility of the user for developing an independent software application increases [1].

The tool "Interactive HTML and script editor" [3] included in the environment for the application of a VBscript code shown on figure 2 can be cited as an example for performing the described process.

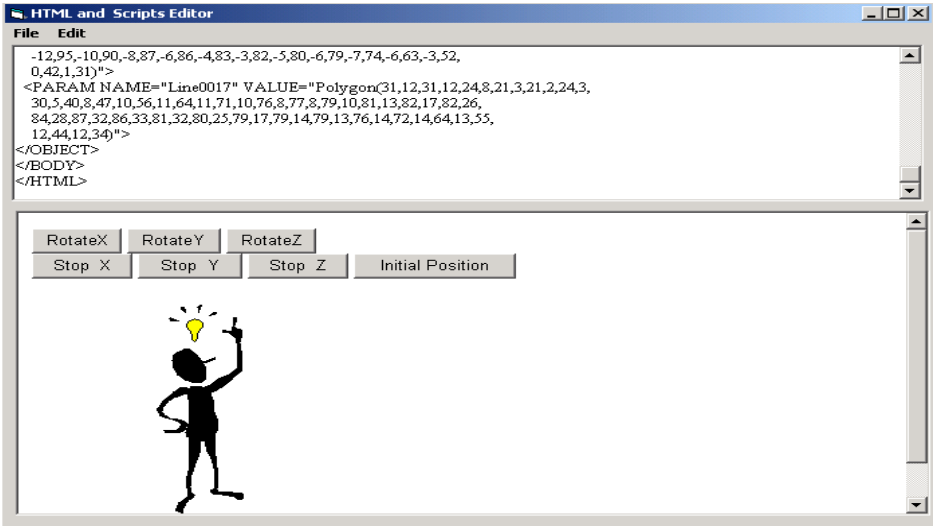

Figure 2. Interactive HTML and script editor

Articulation and reflection – the users need an analysis of their actions. One of the advantages of the developed learning environment is the possibility to record current activities and results for a subsequent analysis [1]. After the user has mastered the respective course subjects, he is given "graded" tests for examining the acquired knowledge.

MAIN TOOLS FOR LEARNING SUPPORT ENVIRONMENT DEVELOPMENT

The HtmlInputFile tool serves for uploading the files forming the structure of the separate learning objects in the Learning repository. Choosing a file to be uploaded on the server is carried out by the Browse button. The file name can be changed in the Save as filename (no path) field. For the purpose of uploading the files on the server the ASP.NET application uses the HtmlInputFile.PostedFile[7] property. The access to the Internet application as clients is achieved using the HTTP and TCP Internet protocols.

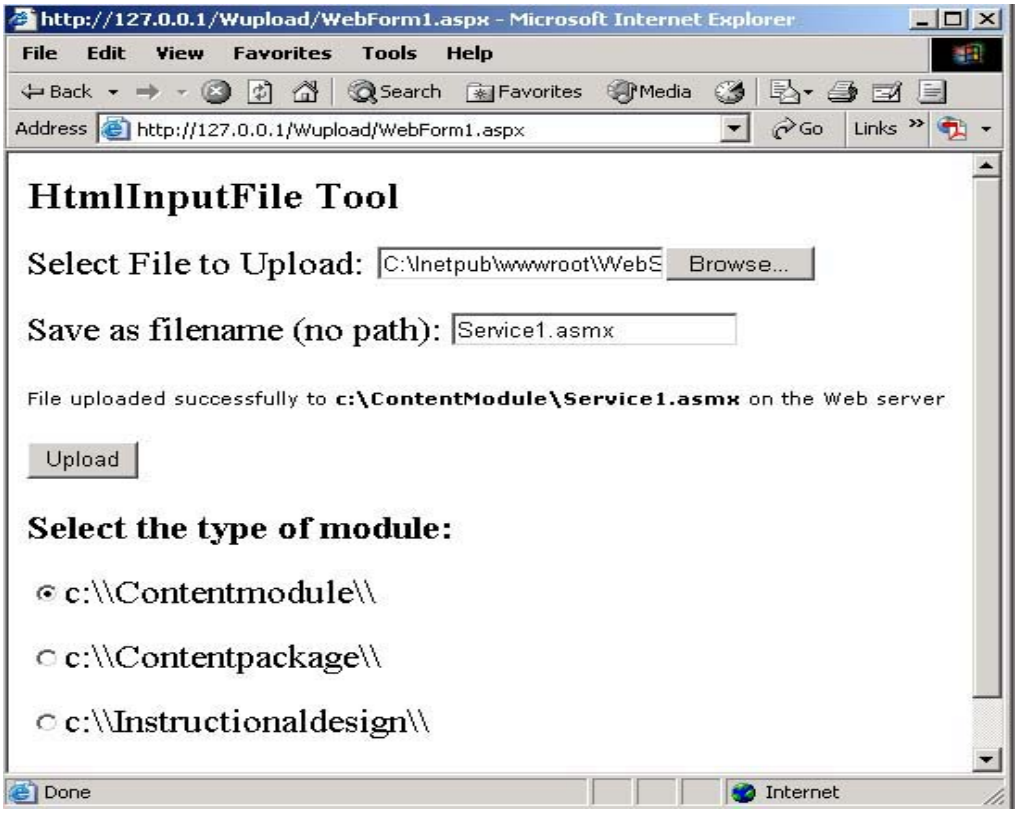

Figure 3. HtmlInputFile tool

The metadata development tool includes all elements contained by a Manifest file based on the LOM standard and the Model for describing, structuring, and organizing the learning objects created by the author. The characteristics offered by the Learning Object Metadata Standard [4] have been grouped in the following order: general, life cycle, meta-meta data, learning, technical, rights, relations, annotation, and classification categories.

The tool for developing metadata suitable for searching learning objects in the Learning repository uses a web service and a client's application. Two methods have been used for applying the web service – GetData() and AddEvent(). They receive data from the client, relate them to the database, and return the access to the client. The method GetData() of the web service is used by choosing the Submit button.

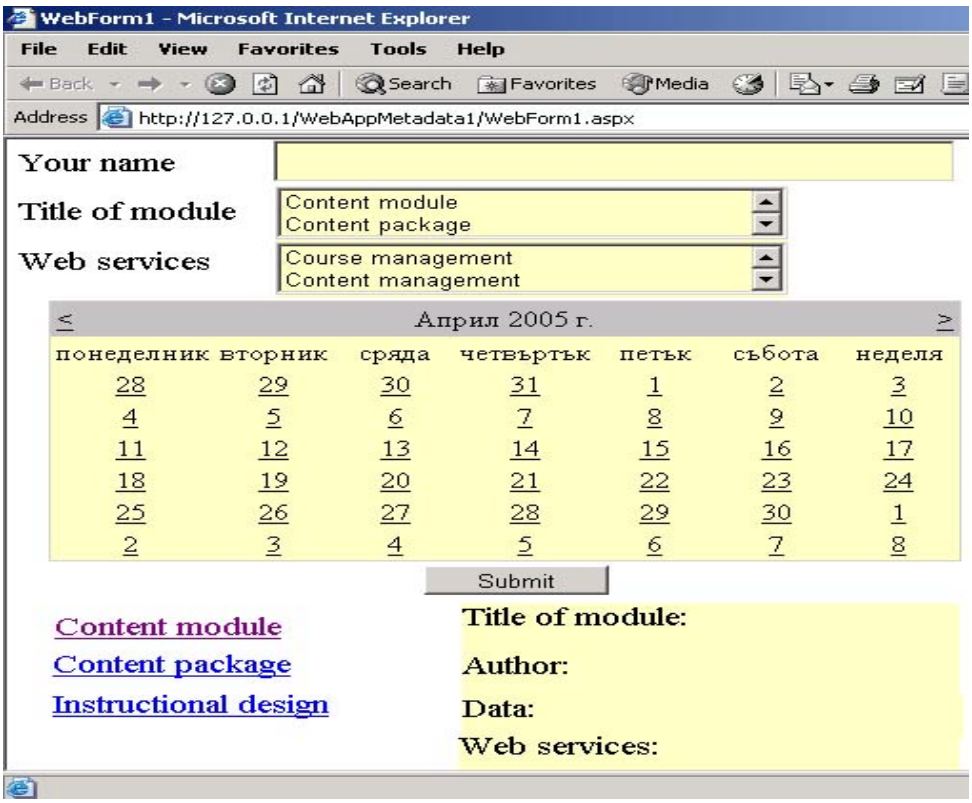

Figure 4 The tool for developing metadata suitable for searching learning objects (Client application)

The client's application performs an access to the database using a web service. A web reference to the web service is set in it. When choosing any of the module titles, presented as hyperlinks, information is shown of the authors, the date of development, and the web services included in the module.

Using the metadata development tools the author of a learning object fills in learning object metadata in textboxes or respectively using lists for checking information typed in advance and afterwards typing the necessary data in the HtmlInputFile tool. The learning object and the metadata are stored on the server by choosing the Submit button. The web service performs the positioning of the separate elements forming the metadata in a database of MS Access and uses them as input information for developing an XML file.

CONCLUSION AND FUTURE WORK

The development of the separate elements of the Environment assisting the study is based on the following standards – LOM of IEEE, SCORM of ADL, and the IMS specification.

The metadata development tools describing the learning objects in the environment are formed observing the requirements of the standards and expand them including a description of the services used for the application of the different modules of the Model for describing, structuring, and organizing the learning objects.

A new scheme for presenting the metadata is offered by applying the metadata development tool suitable for searching learning objects in the Learning repository.

The suggested requirements of the Instructional design theory applied to the series of learning activities using the LO elements improve the results of study using the Internet.

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