Interactive Learning Objects

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ABSTRACT

This paper describes a project which enhances learning in the area of Computer Science through the development of interactive learning objects. To achieve this a unique system was developed for their interactive download, categorisation, and storage. This system provides a central access point through which faculty can access learning objects and also facilitates the identification of areas not supported by currently existing learning objects. New learning objects were developed to fill these gaps. The software tools, learning objects, and searchable database we developed are available free on the web.

Keywords

Learning objects, multimedia, java applets, database, SASSLO

1. INTRODUCTION

There are a significant number of interactive learning objects available on the Internet. A well designed learning object can be extremely useful when used appropriately as part of a teaching program. However, these are typically distributed 'piecemeal' across the web. From the point of view of Computer Science at least, there is no central repository in which interactive objects may be easily searched and accessed by interested staff and/or students.

This paper outlines a project developed to support the use of interactive learning objects for teaching, specifically for courses in the Department of Computer Science and Engineering. However, the database system we developed has been designed so it can be used to build a collection of many forms of multimedia learning objects, meaning that it can be applied to courses in any discipline.

2. A DATABASE FOR LEARNING OBJECTS

Clearly, learning objects developed for this project would be most useful if they complemented, and not duplicated, those already freely accessible. Moreover, they need to be presented in the context of others already available, so the instructor has the opportunity to choose the most effective and appropriate learning object for the learning task at hand.

With these issues in mind, a learning objects database system was created. Called SASSLO (Spider and Search System for Learning Objects), it can be used to assemble a collection of learning objects into a database. Metadata can be entered to describe the objects, and the metadata can be searched. An overview of the basic system operation is shown in figure 1.
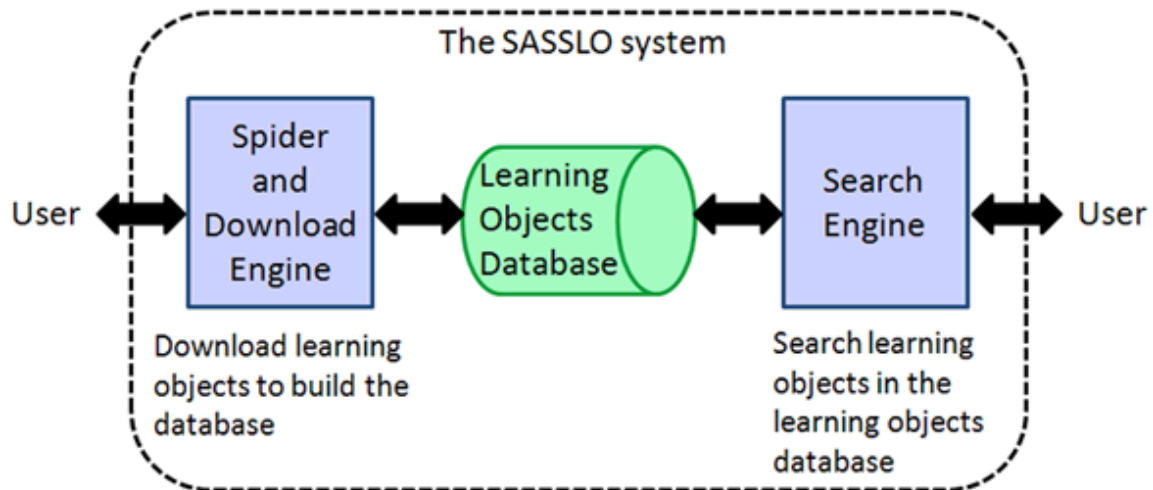

Figure 1.The SASSLO system

The process of populating a SASSLO database may be summarized as follows. This is illustrated conceptually on the left side of figure 1.

- Firstly, a search engine such as google.com is used to determine web pages or web sites holding objects of interest.
- Secondly, the primary web page URL is entered. SASSLO then retrieves all the objects on the page. If the user has selected multiple depth search then other pages which the selected page links to are also searched, and their objects also downloaded.
- Thirdly, the objects are presented to the user. He/she needs to select which are to be kept and which discarded.
- After the unwanted objects are discarded, the desired objects are added to the database. Some metadata is automatically added by the system, and the user can add more.

The SASSLO system was designed to be very flexible. It can be used to build a collection of multimedia learning objects for any discipline, not just those related to computer science. Moreover, SASSLO can be used to accumulate any type of multimedia file. It has been freely distributed as an open source project (links are provided at the end of the paper) so anyone can download and install the system on their own computer to develop a database for their area of learning. As it is an open source project the code may be used as the base for further system development.

3. SEARCHING THE DATABASE

A powerful search feature is provided. Conceptually, it is depicted on the right side of figure 1. Several types of search are supported.

1) At the simplest level, the user can enter a word or multiple words he/she wishes to search. If the word appears in any metadata for any record then the details are shown.
2) More advanced search capabilities are also supported. For example, a search operation can take place on any single field in the database. This means the user can simply select which course he/she is interested in, and all related material is shown.
3) There is comprehensive support for regular expressions, meaning highly complex queries can be entered.
4) An advanced file type search is also supported. This permits the user to search for specific types of file stored in the database. For example, if a user is only interested in image files, he/she can select 'Image files' and exactly which type(s) of image files are of interest. This is illustrated in figure 2.
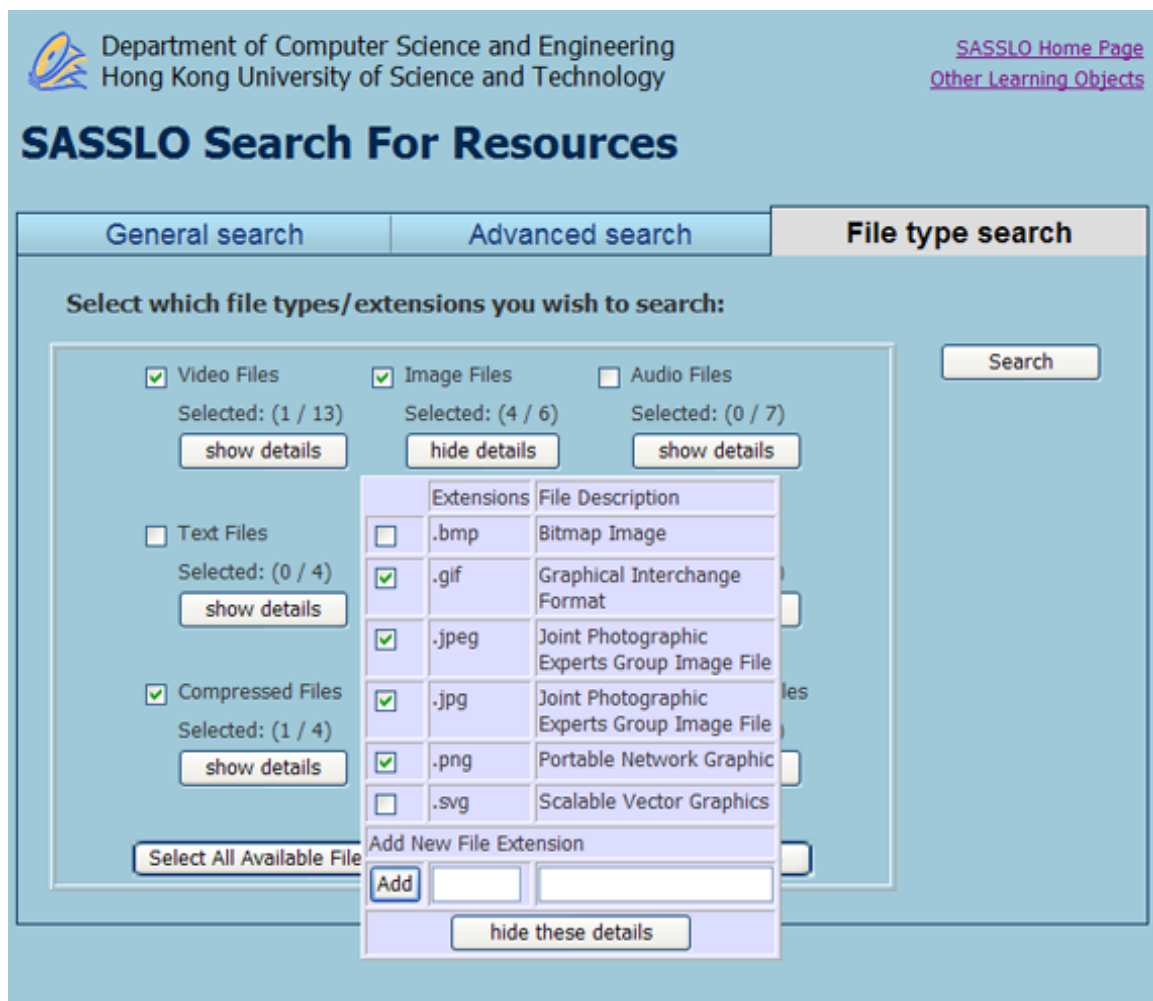

Figure 2. An illustration of advanced multimedia file searching in the SASSLO system

4. DEVELOPING A DATABASE OF COMPUTER SCIENCE LEARNING OBJECTS

A copy of the SASSLO system was installed on a server. It was then populated with Computer Science learning objects downloaded from the web. More than 500 learning objects useful for teaching and learning a variety of different computer science courses were added.

For example, tree data structures and tree traversal algorithms are important areas of

Computer Science. Figure 3 shows an example of using the SASSLO system to search for learning objects that can be used to teach related techniques. The search term 'tree' was entered. A variety of relevant learning objects is listed in the search results.

Figure 3. An example of the SASSLO system being used to retrieve learning objects

5. THE CONSTRUCTION OF NEW LEARNING OBJECTS

Once the database was completed it became a relatively easy task to identify which areas were lacking in interactive learning material. After consultation with relevant faculty to identify areas requiring support we constructed a number of new learning objects. These have been mostly implemented as Java Applets, which means they will work on almost any computer, including many mobile devices. New interactive learning objects have been developed in the following areas of computer science / computer engineering, with more under development.

- Computer music – learning objects for understanding MIDI digital music representation and processing.
- Image representation – for understanding digital image representation and effects on image quality.
- Audio representation – for digital audio representation and effects on audio quality.
- Video transition – for video transition algorithms.
- Array sorting – for data sorting algorithms.

- Unix file system – for understanding the commands used in the Unix file system and the consequences of the commands.
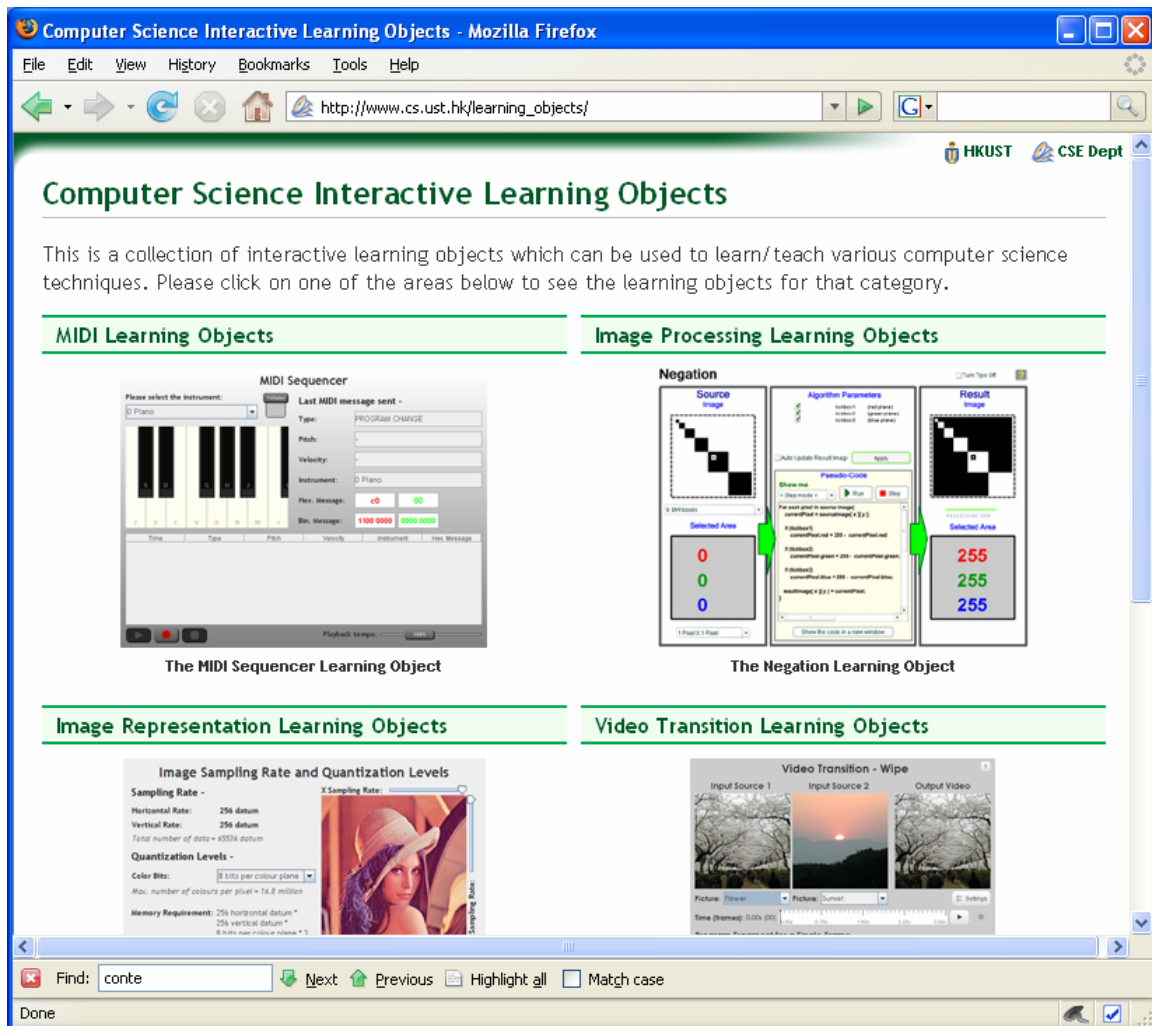

Figure 4.The web site for the learning objects we have developed.

6. CONCLUSIONS

A database system called SASSLO has been developed and used to accumulate a set of more than 500 interactive learning objects. New learning objects were subsequently developed for areas of teaching not addressed by currently available learning objects, and these objects were themselves added to the database. Feedback from faculty and students has indicated the system and learning objects have been highly useful for the learning process.

7. ACKNOWLEDGEMENTS

8. SUMMARY OF RESOURCES

The SASSLO system developed for this project may be downloaded from http://sasslo.sourceforge.net, which points to http://www.cse.ust.hk/sasslo/

The database of leaning objects may be accessed at http://143.89.191.10/Search/Search.php

Learning objects developed for the project are available at http://www.cse.ust.hk/learning_objects/