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WRITING ON-LINE MATHEMATICAL DOCUMENTS

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Abstract: *Scriptrunner3 is a program for remote execution of your programs written in various programming languages and mathematic tools and publishing of interactive documents with software support on the Web. Besides mathematical equations and symbols, these documents can contain editable and executable programming examples. On-line writing of documents in Scriptrunner3 is possible through the LaTeX toolbar or internal HTML editor.*
Scriptrunner3 is a Web application based on the client/server technology, so only browser is needed for work in a user-friendly environment. It is an educational tool intended for all courses that use mathematics and computer programs, so the posibility of its usage is fairly wide.
Key words*: web publishing, mathematics on web.*

1. INTRODUCTION

The World Wide Web has given educators unprecedented opportunities to provide information to students both within their own classes and around the globe. This paper describes the development and implementation of the interactive learning tools which should be used in courses of mathematics, informatics and automatic control at our Faculty. The need to provide students with both a strong theoretical base and engineering ability is a major challenge for education. Theoretical issues, typically related to mathematical techniques, can be well taught in the ordinary classroom style. Engineering ability, on the other hand, requires insight and intuition, which are not so easy to convey. To join these two requirements and make learning math and engineering technics easy to students, we have developed Scriptrunner3 computer program, which can be accessed through the Intranet or Internet.
Scriptrunner3 is a Web application that enables editing and remote execution of the computer programs written in various programming languages. It also enables creation of the interactive e-books that can contain ready-to-run programming examples. These examples can be displayed either as an editable source code or as an executable file in such e-books. It is possible to change the input parameters of programs, thus creating the opportunity for the users to experiment. The e-books can also include images, equations, tables, etc. with automatic renumeration support.
Scriptrunner3 supports writing and execution of programs written in standard programming languages: C/C++, Pascal, Fortran, Java, JavaScript and PHP which are all executed using open source (GNU) compilers. It also supports programs for a variety of professional mathematic tools, both open source (Octave and Scilab) and commercial (Matlab and WRI Mathematica). You can run a program written in source code in your browser by selecting an appropriate compiler and clicking on a 'Run' button.
Scriptrunner3 is built using PHP/MySQL programming languages, and also uses JavaScript in the graphics interface. It is designed to run on Linux system.
Since Scriptrunner3 is a Web application built on client/server technology it is surprisingly easy to use - all you need to have is a Web browser. Every user has his/her own work environment and all settings and files created during on-line session remain on the server for the next session. There is also a 'Public Files' folder where users can publish their files for others to see and execute.
The administrator has the privileges that enable him/her to create or remove users, administer users permissions and published documents. This is also done through web graphics interface.
The primary purpose of the Scriptrunner3 is in the field of distance learning, especially for courses in which supported programming languages are used. It can also be used for creating the databases of computer programs, collecting the interactive on-line textbooks and tutorial etc.

2. THE REMOTE FILE SYSTEM

Your programs and interactive documents are stored on a remote computer (server) on a built, specially developed, remote filesystem. The user interface is similar to that of the MS Windows Explorer program.

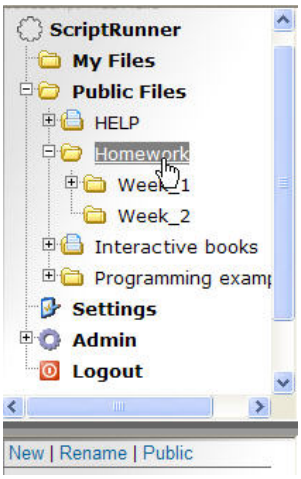

Fig. 1. The remote file system

Folder tree structure enables marking, renaming, deleting and moving (with all subbranches). Besides folder action frame in the GUI, also rightclicking the folder can be used for the most common actions.

3. ON-LINE MATHEMATICAL DOCUMENTS

A very interesting possibility provided by Scriptrunner3 is writing and publishing of the digital books. That possibility spreads usage of Scriptrunner to a much wider range than program running and working in program languages. Moreover, each such book becomes 'live' because the programs with the

preferred, regularly different, input data can be called from it. The document (book, script, handbook) in Scriptrunner has numeration of tables, figures, equations, expressions or other objects together with their assigned references (references to objects). When the final document is created or published, re-numeration of titles and quoted objects and their references is also possible.

It is usual to split a book or a document into chapters and subchapters. The same way, each chapter and subchapter in Scriptrunner are wholes.

Organization of the document can be performed by means of the *notebook* folder which, besides the files, contains the text as well. That text matches the text of the chapter of a certain book, while the folder matches a document chapter. A document structure is made using a tree frame. Each branch represents one (sub)chapter.

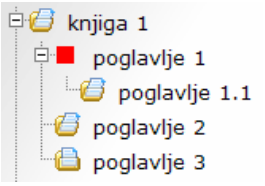

Fig. 2. Organization of a document

Each document can have one or more folders, i.e. (sub)chapters. The folder arrangement can be tailor-made; the user can make the document at his convenience. Any folder action can be applied to the notebook folder, i.e. *move*, *delete*, *rename* etc, which enables later restructuring and modifying of the document.

Writing of books, textbooks, scripts and similar is possible using two on-line ways:

- in LaTeX (MathML) form which is converted into pdf document
- in HTML form, which can have interactive (live) programming examples.

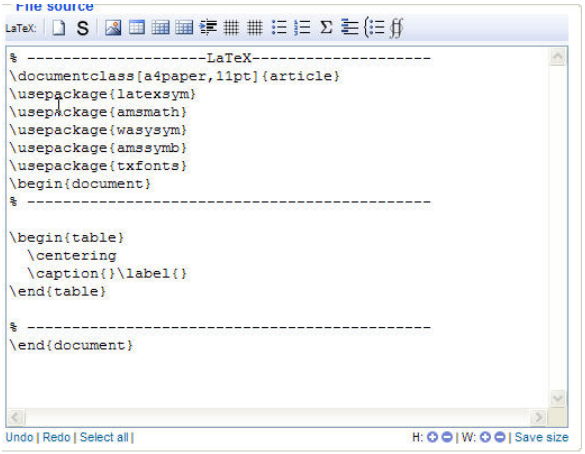

Fig. 3. The LaTeX toolbar

LaTeX toolbar has a standard LaTeX tags for matrices, fields, counts etc. and a pop-up window for a number of required symbols. Desired string is entered in the place of the cursor by clicking on its symbol.

LaTeX documents is saved on the database named as the file. By choosing LaTeX-pdf option in the drop-down menu, source code is transferred into pdf document, which appears in the browser window. Pdf document can be printed or saved on a local computer.

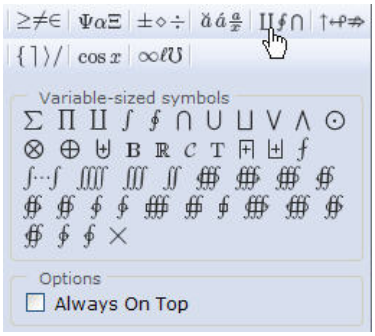

Fig. 4. One of the many LaTeX falling menu

For the LaTeX (MathML) form there is a LaTeX toolbar with many falling menus with numerous symbols. For the HTML form, HTML/Area Javascript program was used, which has the toolbars similar to those in WORD. All the options for writing the text are available here: size and font type, alignment, counting, entering pictures, tables hyperlinks etc. If a Word document is available on a local computer, formatted text can be copied and pasted in HTML editor thus preserving previous formatting from the document. Also, the written Word text can be dragged and dropped into editor window of Scriptrunner.

The documents written in Scriptrunner can be interactive. In this case it means that the forms with a program code which can be executed from a document itself can be inserted in the documents (books, scripts…). Also, if allowed, the reader can enter his/her code or change program code in these forms. That possibility spreads usage of Scriptrunner to a much wider range than program running and working in program languages.

In the published documents all captions objects and their references are given exact marks, depending on the number of the chapter and subchapter.

In case of erasing the particular chapter or inserting an additional chapter, all the objects are automatically re-numerated. This is a major feature of dynamic workbooks.

The personal settings are set in the *Settings* folder. Each Scriptrunner user can adjust certain properties related to appearance of the user interface, in accordance with his needs.

4. CONCLUSION

We believe that the Internet will completely change present learning methods: reading, learning and excercising. The new information contents should be short/abbreviated, illustrated, structured, in one word - hypertextual. The new presentations must be live, i.e. on-line experiments and off-line reviews. The new distance learning will be based on interactive, self paced learning with self-examinations.

Internet is a wonderful medium for these requirements. Therefore, we have implemented these ideas developing the Scriptrunner3 program http://coma.fsb.hr/scriptrunner3/ on our Web site. It shows the full power of all three keywords: hypertextual, live & interactive.

5. REFERENCE

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