

Implementation of LogicSim in LMS Moodle

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Abstract— As the way of managing the distance learning process are commonly used LMS and LCMS, but it can also serve as a supplement of full-time study. In our case we teach with the support of e-courses, in which teachers insert different types of static as well as dynamic (interactive) materials. The importance of the interactivity in e-learning courses is often neglected. The interactivity allows learners to develop and shape their thinking, knowledge and skills. The paper deals with using of open-source simulator of electronic components and logic gates (logics) in LMS Moodle. It deals with the possibility of interactive communication between the Java applet and the Moodle server. Students are able to send the realized task in the form of the screenshot of logic circuits directly from the applet to teachers.

Keywords— *LogicSim, simulation, Java applet, simulator in LMS Moodle*

I. INTRODUCTION

In today's world we are surrounded by a large number of programs that have different purposes. A large group of programs is realized as connection between the computer and the user, with the aim of facilitating people to work with computers and the work in general. By [1], education and possible further studies have become a rather demanding investment. At the time of imperfect technology, i.e. technology of the previous period, it was a very difficult and doubtful task [1]. Some developers are aware of the importance of education and therefore also create programs to support the learning process (Young Digital Planet). However it is only a small amount compared with other software [13]. Along with the emergence of these programs and the introduction of e-learning was the need to develop educational tools and executable directly in the web browser, which are thus suitable for learning in a virtual environment.

A virtual study environment is a significant contribution to education and its role in the education industry is growing constantly [8]. Basic requirements, which are imposed on LMS (Learning Management System) from the point of view of the needs of a teacher, are to present the contents of instruction, manage the instruction, communicate with students, motivate them to study, observe their progress and evaluate them [2]. Basic functions of LMS are usually extended by implementing of multimedia applications or by addition of a new module. Other effective way how to improve the possibilities of LMSs is to update existing module, e.g. testing module [15], or to make an interconnection with other professional systems [16].

Implemented multimedia applications (Java applets) in LMS together with individual approaches within the didactic process substantially influence education. They

give us an excellent chance how to support not only demonstrating and visualizing the explained subject matter to be much clearer and comprehensible, but also enable us to prepare such study material for students that optimizes their study habits [6]. By using of specially designed educational multimedia application we may change also negative attitudes to unpopular school subjects [17]. Multimedia applications as Java applets give us an excellent chance how to support not only demonstrating and visualizing the explained subject matter to be much clearer and comprehensible, but also enable us to prepare various kinds of test for students. The feedback provided through tests helps students to recognize what they already knew and what they didn't know and need to improve [7].

II. LOGICSIM

If you are considering the use of Java applets as learning support, for example to the design of logic circuits [9][10][12], we have at present several options. On the market is product with a commercial character (Multisim), but also freely available simulators (Easy Java simulations, Logic Gate Simulator, Cedar Logic Simulator), which can be directly implemented into the e-learning system (in our case Moodle). The general problem of this implementation is the absence of connections from e-learning system and Java applet. Without this connection the system and the applet cannot form a single unit. This connection enables to record student's results and also the way of student's work with the Java applet automatically into a database of e-learning system (e-learning system can this data gradually evaluate).

One of the on-line logic circuit simulators, which have no commercial character, is simulator with LogicSim.

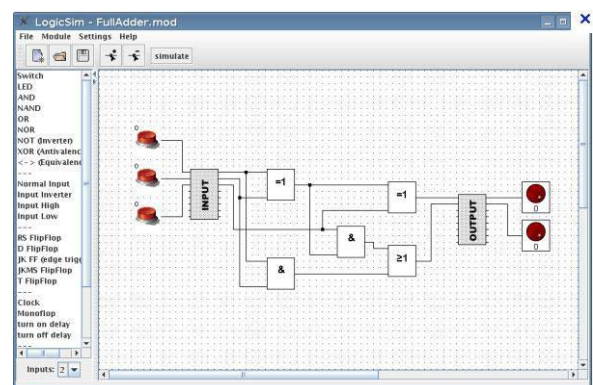


Figure 1. LogicSim [14]

The simulator is written in Java. With a simple toolbar, environment and folding simulations of circuits, is a powerful tool to explain the work of logic circuits.

Original idea of simulator logical circuits - LogicSim is date back to 1995, when the author, Andreas Tetzle created the first version of the application. Program in the form of a Java applet created in 2007. In the current version, it has not very attractive user interface, but for learning purposes is fully sufficient. In spite of the visual aspect, its functionality is in a very high level, and until this day has become an inspiration for several other projects.

A. Slovak language localization

The latest version of the simulator LogicSim contains several language versions. Slovak language localization is not among them. Author LogicSim on their web site allows creating of any other language locations under GNU General Public License. Former included language locations could be change during the running of application, but the following restart is necessary. The application reads titles and descriptions from files, which are stored in a folder named "languages". Language data are stored in text files with the structure `symbol_language.txt`. According the `en.txt` we created a new text file `sk.txt`. All English titles and captions of buttons are now translated into the Slovak language. We have translated also the descriptions of the individual components logical circuits. We do not change only the basic designation for logical circuits.

III. JAVA APPLET VS. LMS MOODLE

The concept and development of Moodle is based on the way of thinking that is sometimes briefly referred as a socio-constructivist pedagogy. The main idea says that people actively construct their knowledge and skills of the interaction with its environment. Anything we read, see, hear, feel and what we touch we put into the context of already acquired knowledge. If these new knowledge or skills are helpful to us, so we create other new knowledge and skills. Learning is particularly effective if we created something for the other. Moodle promotes a theory that if you make things together and for all, there will be a small culture of shared artifacts with shared meanings. When the student is as an individual placed in such group, he/she constantly learns how to be part of the group in many ways.

To the effectiveness of the learning using Moodle also contributes a fact that the system allows students studying at the time when it suits them. Mental and physical well-being of the student, as well as the home environment has a positive impact on the understanding of the curriculum [3].

Nowadays, people are proactive concerning Web-related issues and reasons for that could be explained by the availability of Web systems and the immediate response they provide. The same is also true whenever considering web-based courses. In this context, interactivity and automatic assessment may be responsible for keeping the learners' motivation. Also, these characteristics may promote active learning. Currently, Moodle is one of the most popular Learning Management System (LMS) to support courses through the web in which it is possible to embed animations, Java applets, or designed and programmed modules [11].

Applet can be defined as a program written in Java, which can be embedded into HTML pages as well as an

image. Contrary to the other programs, applet is not executable alone. If the user navigates to a website containing a Java applet, he/she needs a web browser that supports Java technology. Java applet has for security reasons no access rights to the file system.

Java applet can be run under Microsoft Windows, Linux and Mac OS X, which makes the applet easily portable between platforms. However Java applet is still not supported by some browsers. The biggest problems with Java applets have particular mobile operating systems - Apple iOS and Android, Java does not support it at all. As the other scripts created by the user, Java applets are not reliable for system application, so the user can have the problem not only with running the applet, but also to the actual use.

When using the applet LogicSim directly to in Moodle system, we can modify his internal code so, to be suitable for solving the problem of implementation to the e-learning system Moodle. For modify the Java code in the applet LogicSim, we may use different development environments. In our case, we used a standard development environment - NetBeans [5], as it is one of the best compilers for creating Java applets. Source code simulator LogicSim is possible downloaded from the official website.

A. LogicSim in Moodle

It is possible to send parameters to the LogicSim java applet, already during its importing to the Moodle. This parameters will be execute directly after the applet starts. Specifically, HTML tag `<param value="circuits/Counter.lsim" name="loadcircuit"/>` sends the variable "loadcircuit" to Java applet. Its initiate value is "circuits/Counter.lsim". By using the equivalent commands, we send other variables to this applet, and LogicSim try to processed them.

The `start ()` method of the applet "public void" handles all the variables obtained at the start of the applet. In this method we created favorable conditions for testing variables. However our applet needs to work with internally acquired values variables (eg. test button). Therefore we developed several methods for setting of these variables in the main class of the simulator. According to the new button "Test" and the reviewing of the database we have created the appropriate conditions for sending files outside of the applet. The first step was to creation a new method in the class `LSFrame`. The method was named according to its function `exportImageMoodle ()`. This method is intended to send the image to `upload.php` file, which located on the server. In the method `exportImageMoodle ()` we created a Java http request that sends image `test.jpeg` located in the same folder as the applet itself. For creation session with file `upload.php` we use http post request.

IV. SIGNED JAVA APPLET IN LMS MOODLE

Since that POST request, which the system Moodle needs for upload the file, is not possible to send from an unsigned applet, we decided to digitally sign an applet that can partially communicate with the server. In this case, not for the protection of library `java.security` this Java applet seen as a potential threat and library will not block its function.

From our experience we know that the Java applet may be signed with two ways.

The first way: to the applet to import the original developer license. This license is charged, therefore this solution is very costly. Such type a license from Sun (Oracle) is a few hundred per year. The advantage of this solution is trusted ownership license.

The second way: generate your own license and sign applet with this created license. This option is free, but applet is not fully signed. The user must applet in the first start designate as safe, otherwise it will not start at all Java platform. A detailed explanation of how to sign a Java applet provides Chen [4].

For economic reasons (test version of application), we decided to sign the applet suite license (we used keytool.exe program, which is part of Java installed on your computer.

For insertion of the certificate to the .jar file we used jarsigner.exe application. The application is located in the same folder as keytool.exe. The generated certificate was inserted into the LogicSimMoodle applet with command "-keystore". After that the applet has been signed. Digital signature of the applet was partially trusted to protect Java Security.

By signing applet LogicSimMoodle we gained the ability to export a file from an applet on the local disk.



Figure 2. Menu Export to Moodle

Exporting of solution in the form of .png image starts using the main menu – Export to Moodle. The students can send the result of their work using the module “Transferring files” directly into your course in system Moodle. The advantage of this method of solution is that it allows the teacher to comment and evaluate the file retrieved from students.

V. CONCLUSION

Nowadays is still increase of using e-learning courses in teaching, either as components of teaching or learning takes place only through them. Created e-learning courses may contain a number of interactive elements. In this paper we looked at creating another interactive element in the form of applets embedded in e-course and its interface with the system Moodle. The advantage of the presented solution is that this way of implementation of Java applet and its interface with the system Moodle is working properly than in older (<2.0), as well as in a new versions of the e-learning system.

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