Graphical User Interface of an Interactive System for Schemes Design, Used in Distance Learning

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Abstract: Distance education, in which the teacher and students are separated by time and place, is currently the fastest growing form of domestic and international education.

An Graphical User Interface (GUI) of an artificial intelligence system for self learning and testing of students' knowledge about electronic circuits schemes design has been presented in this paper. The system could be used in all subjects where schematic diagrams have been included.

Java has been used as powerful programming language for developing platform independent interactive and computational based software that can be used through a Java-enabled Web browser.

Key words: Electronic circuits scheme design, elearning, artificial intelligence and distance education;

INTRODUCTION

In recent years, it has become apparent that computers and technology have helped to revolutionize the notion of knowledge. Information technology can be extremely empowering, extremely motivating and extremely conducive in creating new and exciting classroom environments. However, we need to develop a better understanding of how new technologies will positively effect our learning environment [1, 2]. New opportunities are emerging in the area of web-based distance education as bandwidth and transmission speeds increase. These new opportunities are increasing accessibility and quality of distance education.

The goals of this paper is to suggest an ingenious solution of a GUI, that could be used for drawing of every electronic circuit schemes [3, 5], consisting of building elements (having one or more inputs) and connections between them.

An object oriented approach [8, 9] should be used to make the system easy to extend and an omni purpose.

The GUI is a part of an AI system, that could be used in the distance learning environment [4, 5] for both - self learning and as a building part of a Testing knowledge module.

The AI system compares the scheme created by the student (input scheme) with a model scheme, given in advance by the teacher.

The result obtained from the comparing depends on the chosen from the student building elements only and the connections between them and does not depend of the position of the elements in the working area of the system and their mutual layout at all.

The system transforms the electronic circuit schemes (etalon and input) to graphs, divides these graphs to a sub graphs and compares the corresponding resulting sub graphs. This way the explosion of the state space during the increasing the number of the building elements is avoid and system makes the comparison in a polynomial time. The applicability of the method is limited only to electronic circuits diagram comparison, but it is fast enough to make the comparison in a real time.

SYSTEMS DESCRIPTION

The system consist of two parts – a teacher's side part and a student's side part. The student has a convenient and simple interface, to create, edit, save and open files from a data carrier. It has the following menus:

-File (New, Open, Save, Save as, Graph/Scheme, Exit);

-Edit (Select all, Rotate, Delete);

There is not an "Unselect all" submenu, because this operation is done by a single click by the left mouse button (further in the text only "click") in the drawing field.

-Elements (Resistor, Transistor, Condenser, Inductivity);

-Help;

The "Elements" menu is not a standard one.

It contents all needed for the creating of the electronic circuit scheme elements. The student catch the element by a click on the submenu (the cursor changes to a cross-hair cursor until the element is carried) and drops it in the drawing field.

The way of drawing of the element is so organized, that it becomes visible below, to the right side of the place where the cursor is at the moment of the click.

The program is completely written using pure Java, that gives the possibility a new elements to be created easily only by inheritance of the base for the elements parent class Element.class

In the existing system the standard conventional symbols are not used, but rectangles that have a letter in them, determining the kind of the element and points of the terminals. The electronic circuit scheme created this way looks like an experimental realization.

There is a possibility of rotation of the elements to –90 degrees and back, just after they are put in the drawing field and any time after that, if they are selected. An element could be selected by a single click on it. A connection could be selected by a single click on the rectangle that is in the middle of the connection. Connection between the elements is made by a mouse down on the start terminal, drag and mouse up on the end terminal. A connection could be made only between the elements' terminals. Elements' terminals allow multiple connections from and to a particular terminal.

Corrections of the existing scheme could be made by moving of a dropped element (if it is selected) or by moving of a group of selected elements by drag & drop (in this case the layout between the selected elements does not change). A selected element or a group could be deleted. If an element is (or elements are) moved, all the connections to these elements are saved and moved to the new place of the elements. A group of elements could be selected by a drag and rounding by the rectangle that appears. If an element or a group of a selected elements are deleted all the connections from or to these elements are deleted too.

Some of the most used submenus are made as buttons:

File | Open, File | Save, Edit | Delete, Edit | Rotate, Graph/Scheme. Using Graph/Scheme button or menu the student can see the graph of the drawn scheme.

Teacher's side part has a similar graphical user interface. It has three extra buttons: "setEtalonSch" - to load the model scheme, "setInputSch" - to load the input scheme and "Compare", to make the comparison between them. There should be a data base containing all electronic schemes, that could be given as a task, available for the teacher's part during the comparison.

The process of the creation and check of the student's scheme is shown on the Fig.2.

The scheme is known and it is possible to formulate the task unambiguously by a text
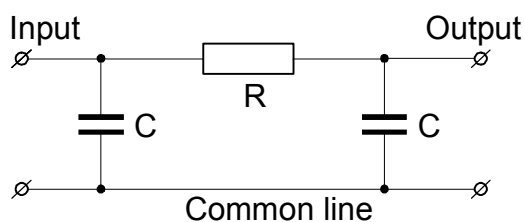

Fig. 1.   П - low frequency RC filter

sentence. For example: "A scheme of a П-low frequency RC filter, (Fig. 1), has to be drawn".
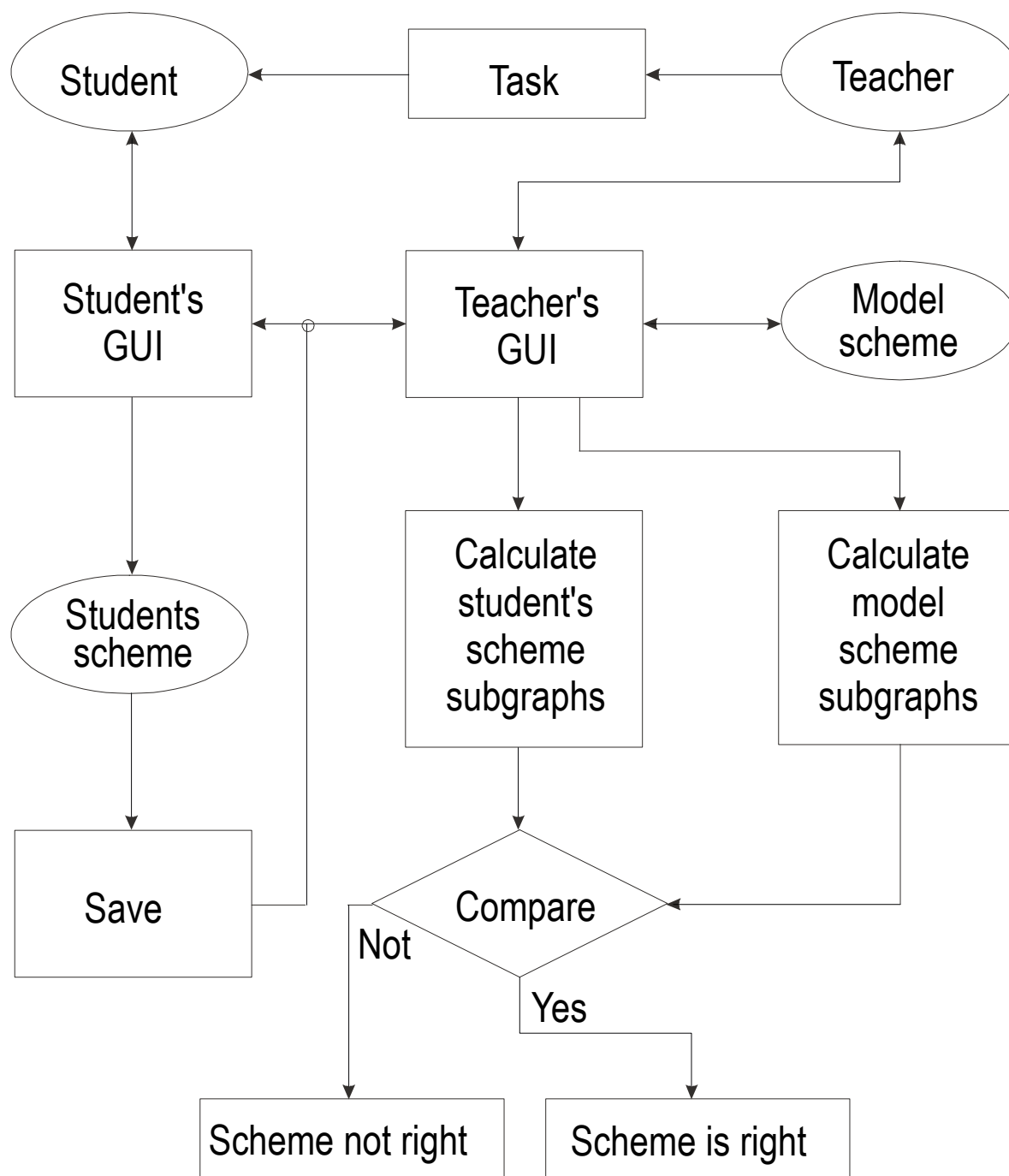
Fig. 2. Process of creation and check of the scheme

After the student made the scheme, he saves it on a data carrier (Floppy or HD) and transfers it to the teacher's side of the system. Use of an e-mail or a client-server communication between the student's side and teacher's side of the system is possible. Screenshot of the ready for check scheme (teacher's GUI) from Fig. 1 is shown on Fig. 3.

The file, that contents student's scheme is opened by the teacher's side part. The system calculates the corresponding to both schemes graphs and compares them. If the student's solution is right, the result is positive.
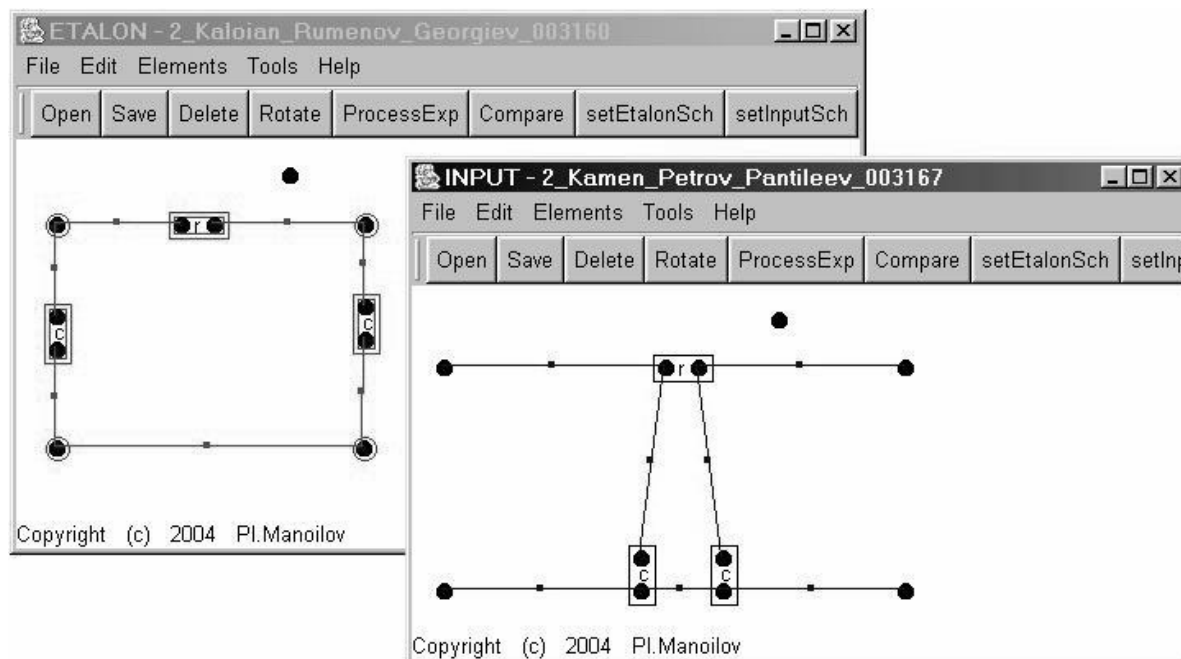

Fig. 3. Screenshot of a П - low frequency RC filter

CONCLUSIONS AND FUTURE WORK

A frame of reference of an AI system (tool), that could be used in the distance education is proposed.

An original solution of a GUI, that could be used for drawing of electronic circuit schemes.

An object oriented approach is used that makes the system omnipurpose and easy to extend.

Work in the future:
- add more building elements to the library;
- work on the elements look;
- make experiments with the system;

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