

REALIZATION OF THE VIRTUAL LABORATORY FOR PHYSIC EDUCATION SUPPORT

Ing. Petr SADOVSKÝ, Doctoral Degree Programme (5)
Dept. of Biomedical Engineering, FEEC, BUT
E-mail: petsad@feec.vutbr.cz

Ing. Rostislav STRÁNÍK, Doctoral Degree Programme (1)
Dept. of Physics, FEEC, BUT
E-mail: xstran03@stud.feec.vutbr.cz

Supervised by: Dr. Jiří Rozman, Dr. Karel Liedermann

ABSTRACT

This article itemizes basic demands setting to virtual laboratories, which are involved in education. In the second part is described our virtual laboratory realization - Electro-optical components characteristic measurement, which is focused to simulated classical laboratory measurement.

1 INTRODUCTION

New information technologies still offer new possibilities, which could be used in education. One of these possibilities is a virtual laboratory. Virtual laboratories are able to simulate some physical phenomenon, but they mostly operate only with mathematical models. Virtual laboratories, which contain real measured data, are rare.

There are many virtual laboratories at the Internet, but not all of them are simple possible to use in education, especially for studying without teacher. Many laboratories contain only heart of physical phenomenon and texts, which contain theory of physical phenomenon, tasks, measuring descriptions, help, etc. are not available.

When we prepare experimental virtual laboratory realization, our goal was to prepare a laboratory for student experiments without any teacher support. We had a try at definition of the most important virtual laboratory demands.

2 VIRTUAL LABORATORY STRUCTURE

The virtual laboratory must contain some important parts. Without these parts it is not able to sufficiently achieve the intention for which was created. The most important part

is not only the heart of virtual laboratory (measuring algorithms or simulation algorithms), but also some texts. For example:

- Theoretical introduction and analysis of physical phenomenon, which is demonstrated in virtual laboratory,
- Tasks, which students must execute,
- Detailed measuring process description and
- The measuring or simulation part.

2.1 THEORETICAL INTRODUCTION

Theoretical introduction and analysis of physical phenomenon is a very important part of virtual laboratory. A bibliographic references and hyperlinks to websites are not acquit oneself. We have not assurance that students will search out these references and will read it. The external hyperlinks are not dependable too. External web pages can be removed or canceled without any warning. When student do not know the theory of physical phenomenon, shown in virtual experiment, will be only a computer game.

One-way how to solve it is placing of all the texts on local website. The texts of theoretical introduction and analysis must be very short and brief. A complete comprehensive theory including mathematical proofs is not advisable for this type of education. Students must be very quickly introduced to the basics of physical phenomenon, because they usually do not hold enough concentration and are not patient when working at Internet.

Still the problem remains, that neither short and brief theoretical introduction and analysis texts nor however good created virtual laboratory do not guarantee, that this type of education won't become only a computer game for some students.

2.2 TASKS

Every virtual laboratory contains one or more experiments. It is advisable to briefly and accurately describe the tasks, to let students know what are they expected to reach in virtual laboratory.

2.3 MEASURING DESCRIPTION

After the reading of measurement description it must be absolutely obvious, how to proceed to obtain correct results. It is advisable to explain the real measurement proceed of this part and to add some photographic or video file of this experiment. This makes possible to create an image of real experiment in student's mind.

It is important to learn that in virtual laboratory is no teacher, which will be able to help when student has some problem with measurement. This situation can be solved some ways. Firstly is possible to show example measurement description step by step. The next method is to program automatics software robot, which will be able to help student. The next interesting, but only additional solution, is a discussion ring - conference room

in virtual laboratory where students can ask a question or see the older questions and responses. And also ask another students or quests in the virtual laboratory, so the help is not dependent only on virtual laboratory supervisor.

2.4 MEASURING

The measurement or simulation area of virtual laboratory must be transparently arranged and contain a few control components. Concrete face of this area however depends on concrete virtual experiment.

2.5 DATA EXPORT

If virtual laboratory is not focused only to mathematical simulation of some physical phenomenon, but if it offers some measured data, then it is advisable to provide data export. It is possible to use some common formats, for example MS Excel, HTML, text file, LaTeX, etc.

3 THE REALIZATION OF VIRTUAL LABORATORY

The virtual laboratory, which was created on Department of Physic, Faculty of Electrical Engineering and Communication, Brno University of Technology, is focused on electro-optical components characteristic measurement. It is used to measure this experiment in real laboratory for a many years as a semi-automatic computer supported experiment. We tried to expand this experiment as virtual laboratory. The virtual laboratory realization uses real measured data. It is possible to measure:

- Volt-ampere characteristic of luminance diode,
- Lux-ampere characteristic of luminance diode,
- Emitting direction characteristic of luminance diode for two position of luminance diode and
- Transmission characteristic of luminance diode.

For virtual laboratory programming was chosen the PHP language, because it is very known and used. The PHP is able to cooperate with databases (we use MySQL database).

The Java scripts were used exceptionally, because enables to switch off the properties of browser and this fact can bring on many problems.

Our virtual laboratory realization contains apart from the above-mentioned parts (theoretical introduction and experiment analysis, tasks, measurement or simulation description, measurement or simulation part, data export, etc.) also conference room, page about virtual laboratory, which is important especially for the teachers of the other universities which wants used virtual laboratory in their lessons and data erasing page. Data erasing page make possible erase measured data and start the measurement again for other operating point of diode.

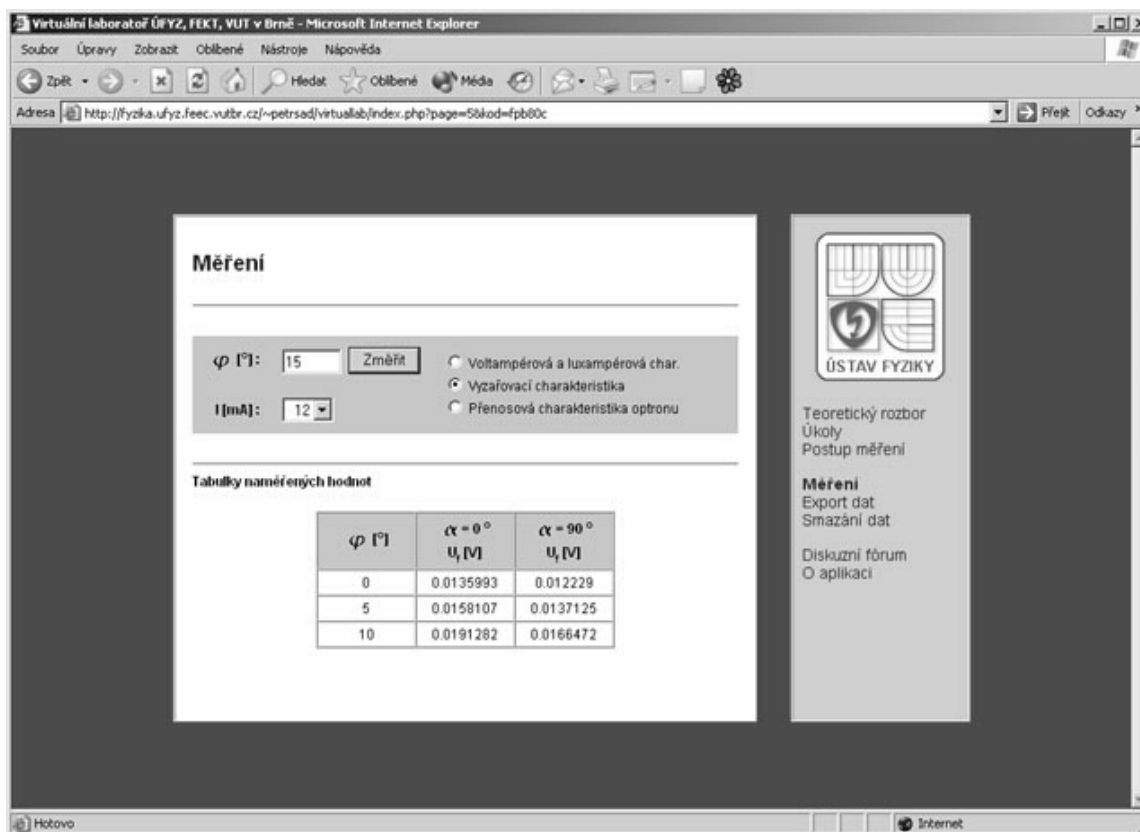


Figure 1: Measurement part of the virtual laboratory

There is shown the PHP virtual laboratory realization in Figure 1. There is shown a part of measurement in particular part of emitting direction characteristic for luminance diode measurement. In this Figures the virtual laboratory is shown in Microsoft Explorer window, but it is possible to use other compatible browser like Mozilla, Opera, etc.

CONCLUSION REMARKS

The virtual laboratories sufficiently complement traditional method of education and follow the present trends of cheap education (especially expensive laboratory education) provide to obtain measured data alike as in classical laboratory. Then this data are determined to practice the elaboration of measured data (for example graphs construct, approximations, etc.).

The virtual laboratories created at universities can be used not only at universities where they were created, but also at other universities or colleges.

Although the virtual laboratories are very good as an educational addition, they could not recompense the classical education.

REFERENCES

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