Virtual physics laboratory for distance learning developed in the frame of the VccSSe European project

W. Tłaczała[1], M. Zaremba[1], A. Zagórski[1] and G. Gorghiu[2]

[1] Faculty of Physics, Warsaw University of Technology,
Koszykowa 75, 00-662 Warsaw, Poland

[2] Automatics, Informatics and Electrical Engineering Department,
Valahia University Targoviste,
18-24 Unirii Blvd., 130082 Targoviste, Romania

Introduction

The laboratory presented in this work is a *remote laboratory* defined as a computer-controlled laboratory, which can be accessed and controlled externally through some communication medium, for example, trough the Internet. We proposed a kind of an e-laboratory, which contains simulated experiments based mainly on results obtained in real measurements performed earlier in the student laboratory, at the Faculty of Physics of the Warsaw University of Technology.

All equivalents of the real experiments are available 24 hours a day on the Internet opposite to real laboratory with remote access which is usually limited to the period of time, when the real experiments are supported by the laboratory technician staff.

VccSSe Project

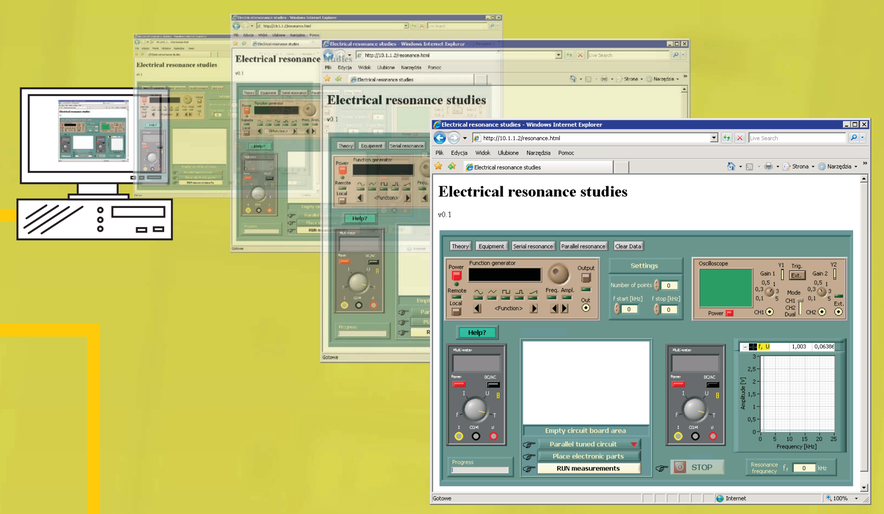
The simulated physics experiments, presented in this paper, were developed in the frame of the Socrates Comenius 2.1 European project “VccSSe - Virtual Community Collaborating Space for Science Education”. The Project was addressed to in-service teachers training on using virtual instruments in the teaching process of different Science areas and to the pupils who benefit by the implementation of the virtual instruments in the classrooms.

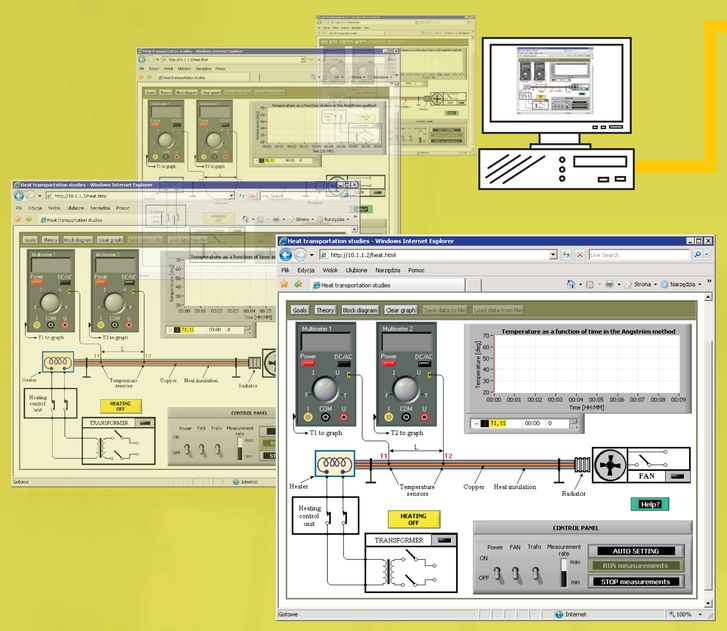
Virtual physics laboratory for distance learning

The main purpose of virtual experiments is to familiarize pupils with physical phenomena without using any special equipment. Due to simulated experiments they can work even at home at their own speed, repeating the experiment as many times as they need.

Virtual physics laboratory consist of five experiments: three devoted to gases laws, one to the heat transportation and the last one to the electrical resonance. The only thing, which is required to perform a simulated experiment, is a popular personal computer with MS Windows or Linux (with web browser) and *LabVIEW Run-Tme Engine 8.6* (RTE 8.6 – browser plugin).

INTERNET





Heat transportation

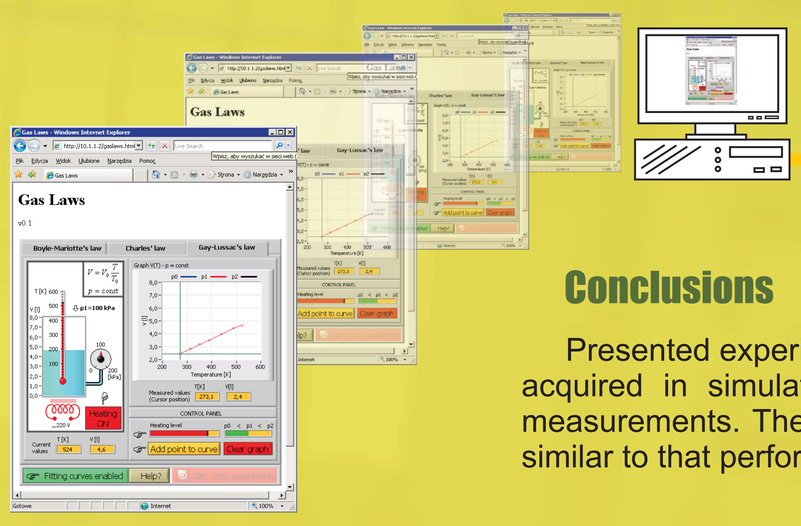
In the *Heat transportation* experiment one measures the thermal conductivity coefficient λ for a metallic rod. Main goals of this experiment performing are:

- become familiar with thermodynamics experiment
- study mechanism of heat conduction in solids
- understand the temperature gradient idea,
- become familiar with temperature measurements performed with RTDs sensors.
- become familiar with measurements, devoted to determination of the thermal conductivity coefficient λ, based on the Ängstrom method.

Gases laws

The set of three simulated experiments devoted to ideal gases laws:

- pressure (p) dependency of the volume (V) of a gas at constant temperature (T) - *Boyle-Mariotte law* - given by: $pV = p_0V_0$ for T = *const.*
- temperature (T) dependency of the volume (V) of a gas at constant pressure (p) - *Gay-Lussac law* - given by: V/T = *const.* for p = *const.*
- temperature (T) dependency of the pressure (p) of a gas at constant volume (V) - *Charles law* - given by: p/T = *const.* for V = *const.*



Electrical resonance

Experiment devoted to studies the current and voltage as a function of the frequency in the series and parallel tuned *RLC* circuits. Main goals of the experiment are as following:

- become familiar with RLC circuits
- understand the operation of the series/parallel - tuned circuit
- study voltage/current resonance observed in a series/parallel - tuned circuit
- study properties of RLC circuitsresonance frequency, phase displacement, *Q*-factor, bandwidth, loss resistance, and damping.

Conclusions

Presented experiments simulate real lab experiments performing, and data acquired in simulated experiments are similar to those obtained in real measurements. Therefore performing our simulated experiment is maximally similar to that performed in a real laboratory.

To see more visit **http://www.vccsse.ssai.valahia.ro** or **http://wlf.if.pw.edu.pl** (*Virtual Physics Laboratory – polish language*)

Acknowledgements This work was funded through the Socrates-Comenius 2.1. European project 128989-CP-1-2006-1-RO-COMENIUS-C21: “VccSSe - Virtual Community Collaborating Space for Science Education”. support offered by the Education, Audiovisual and Culture Executive Agency is gratefully acknowledged.