

AUTOMATION OF THE EDUCATIONAL PHYSICAL EXPERIMENTS ON THE BASE OF UNIVERSAL MEASUREMENT AND CONTROL DEVICE “TECHNOLAB”

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The main difference of the proposed solution from others is the complex application of the information technology and real-time experiment for an implementation of the laboratory training in physics, chemistry, biology, and ecology. In the frame of the developed approach we propose to unify two directions of the scholarship – empirical and theoretical. At the first stage students are studying the theoretical material using multimedia resources and make the virtual modeling of the experiment with computer software. Then work is continued on real-time laboratory setup which is controlled with personal computer. On the final stage students are comparing the results of real time experiment with virtual modeling.

Laboratory trainings and demonstration experiments are based on the universal measurements and control device “TechnoLab”. This device is realized on the base of embedded microcontroller and contains analog-to-digital and digital-to-analog converters with additional digital input/output channels. The device is connected to personal computer host via USB interface, which is also used as device power source.

Special software for device control with additional sensors allows us to use “Technolab” device as a number of typical electronic devices: generator, oscilloscope, voltmeter, frequency and phase meter, spectrograph, statistical analyzer, amplitude-frequency and phase-frequency analyzer, PH-meter, gas analyzer etc.

The device is provided with special designed sensors (illumination, temperature, magnetic field strength, acceleration, pressure, force, velocity, PH, gas analyzers, etc), which convert physical and chemicals quantities to the electric signal.

The main advantages of the proposed device “TechnoLab” as training instrument and education equipment:

- Wide choice of laboratory trainings and demonstration experiments in physics, chemistry, biology, botanic, and ecology;
- Special educational and methodic materials realizing the approach of the combined study with real-time experiment and information technology are applied;
- The method of laboratory trainings is based on the creation of problems, revelation and resolution of the appearing contradictions during the comparing of the results of the real-time experiment, virtual modeling with theoretical base;
- Realization of the problem activity approach for the training;
- Optimized control software does not require special training;
- The possibility to realize at one working place several laboratory trainings allow to decrease significantly the costs of laboratory training courses;
- Optimal price/possibilities ratio.