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INTERACTIVE VIRTUALIZATION IN THE PROGRAM DELPHY ENVIRONMENT OF ALGORITHMS AND PHENOMENA OF THE SECTION OF PHYSICS OF "ELECTRICITY", FOR HIGHLY EFFECTIVE TUTORING

Abstract. The training program assumes not only studying of theoretical material, but also performance of laboratory works. They are necessary for development of skills of measurement of physical quantities, performance of physical experiences, ability to draw the correct conclusions from the observations. Modern computer technologies allow to add this traditional scheme of training. The training programs modeling physical processes and the phenomena which not always manage to be shown "in live" in the training conditions can provide to pupil's substantial assistance [1,2,3,7]. Processes the phenomenon of the section of physics "Electricity" are visualized and online virtualized by means of the computer program Delphy environments. The made, laboratory work on a research of processes the phenomenon of the section of physics "Electricity" are very effective at development of this course, and the technology of creation of the virtual and interactive laboratory described in this article is very relevant for creation of the similar virtual and interactive laboratories (VIL) in other objects. This virtual interactive laboratory development is introduced in educational process of the Eurasian technological university and is successfully applied in training.

Keywords: Algorithm, virtual interaktivization, virtual and interactive laboratory (VIL), electricity, multimeter, two-channel oscillograph, capacity, inductance, electrical circuit, computer program Delphy, Pascal.

Introduction. Physics - science experimental. Therefore, the training program assumes not only studying of theoretical material, but also performance of laboratory works. They are necessary for development of skills of measurement of physical quantities, performance of physical experiences, ability to draw the correct conclusions from the observations.

Modern computer technologies allow to add this traditional scheme of training. The training programs modeling physical processes and the phenomena which not always manage to be shown "in live" in classroom conditions can provide to pupil's substantial assistance. The value of such programs, however, should not be exaggerated. It is necessary to remember - nothing can replace a real physical experiment in which a part a natural phenomenon, but not the copy of "virtual reality" simulated by the person talks to the researcher!

The "Virtual and Interactive Laboratory of the Section of Physics "Electricity"" program can be used in the course of training differently.

First, with its help it is possible to show demonstrations during an explanation of new material. Such demonstrations are very evident, improve perception and awaken interest in a subject. Advantage of such demonstrations, in comparison with usual videos, also that the teacher can quickly, changing parameters in the program, to answer questions of pupils: "And what will be if …?" The answer is simple - let's make and we will look!

Secondly, the program can be used as a "laboratory" practical work. It is the best of all to give these classes in a computer class. In this case each pupil will be able to perform the laboratory work

independently. Preliminary preparation is usually necessary for such occupation - when the theory of the phenomenon is already known, then intelligent work with experimental installations can bring benefit in deeper understanding of a subject. A set of laboratory works and demonstrations offered by us far does not exhaust all opportunities of the program, and the teacher can always complement this list with own developments.

In the third, on the basis of the program it is possible to perform research works and projects. Within the opportunities, the program allows to conduct researches enough difficult electric processes and the phenomena which theory is beyond the program of training. Inquisitive pupils could open, for example, for themselves laws of Ohm, Kirchhoff for a branched chain, the law of Joule Lenz, etc. if to think over the scheme of an experiment and to take the corresponding measurements. Below examples of laboratory works and demonstrations which can be used in the program are given. It must be kept in mind that the calculations which are carried out by our program for model of real electrical circuits have qualitative character. The list of laboratory works the physics offered for performance on the computer according to the section "Electricity".

Laboratory work № 1 - Studying of dependence of resistance of real conductors on their geometrical parameters and specific resistance of materials.

Laboratory work № 2- Research of resistance of conductors at parallel and consecutive connection.

Laboratory work № 3- EMF and internal resistance of DC power sources. The law of Ohm for a complete chain.

Laboratory work № 4 - Research of difficult chains of direct electric current. Laboratory work № 5- Power in a chain of a direct current.

Laboratory work № 6- The principles of operation of fuses in electrical circuits.

Laboratory work № 7- Elements of chains of alternating current. Capacitive and inductive resistance, their dependence on the frequency of alternating current and parameters of elements. Laboratory work № 8- The resonance phenomenon in a chain of alternating current.

Realization virtual-interaktivization stages of works in the program environment Delphi-7.

The present requirement of time, visualization and interaktivization, including animation images in movements physical the phenomenon and work with them demands the convenient software for realization. The modern visual programming system of Delphi-7 provides convenient means for creation of the environment of modeling of any physical task. We use the Delphi programming language and its Delphi development environment [5.6]. This environment was created by the Borland company with use of the Object Pascal language. Now development of Delphi it is carried out by the Embarcadero company, and the environment supports several languages: Delphi, C, C, C#. The Delphi environment allows to compile the same codes of the program for Windows, Mac OS, iPhone, Android, etc. For reduction of capacity of use of memory for virtual – interaktivization of Delphi-7 technologies is very effective. Delphi is the system of visual object-oriented programming in the Object Pascal language for the Windows operating system. The programs written for Windows are called applications. The technology of visual programming gives to the user an opportunity to create applications by means of a mouse and to observe on the screen results of work in the course of application programming. By the way, the Delphi environment is written to Delphi. [4].

The program in Delphi consists, at least, of four types of files:

1. *.dpr – the file project (for example, Project1.dpr) connects other files in the uniform program. Project options (settings kompilyator, names of office catalogs …) are stored in the file *.dof;

2. *.pas – descriptions and the operators trained by the programmer for what decision - or parts of a programmable task contain files of modules (for example, Unit1.pas). The compiled module is a file *.dcu;

3. *.res – the binary file of resources (for example, Project1.res) stores the Delphi resources used in the program – pictograms, the image of the cursor of a mouse, etc. It is created automatically during creation of the project.

4. *.dfm – *.res is similar, keeps properties of setting up the interface

(forms) of the program. [4,5,6].

After compilation we receive one executable *.exe the file, for example, Project1.exe which comprises the *.res and *.dfm files.

The program of the project has the following sections:

-**program**< program heading (coincides with a name of the file of the project)>;

(* The section of announcements (to the first begin): *)

-**uses** < the list of the used modules >;

[Announcements of tags; constants; types; variables; procedures and functions]

-begin

(* Section of operators: *)

<operator1>; <operator2>; <…>;

<operatorN>

end.   *// End of the project*

The first **Begin** means the end of announcements and the beginning algorithmic part of the program which consists of the operators divided by a symbol ";". The program comes to an end with the word end. (with a point). When the new project opens, its text (code) is created automatically and looks as follows:

program Project1;

uses

    Forms,

    Unit1 **in** 'Unit1.pas' *{Form1}*;

{$R *.RES}

begin

    Application.Initialize;   *// initialization of the application* Application.CreateForm(TForm1, Form1); *// creation of a form* Application.Run;   *// application launch*

    end.

The body of the project consists of three operators: preparation of initial data of the program (initialization), creation of the interface on the basis of the main Form1 form and, at last, application launch.

Appointment and general features of the program.

The product is intended for the aid to pupils (and to teachers) average and also average special educational institutions for studying of sections of a course of physics "Electricity". It naturally supplements the classical scheme of training consisting of digestion of theoretical material and development of practical skills of experimenting in physical laboratory.

The program represents the electronic designer allowing to imitate on the monitor screen processes of assembly of electric circuits, to investigate features of their work, to take measurements of electrical quantities as it becomes in a real physical experiment. By means of the designer it is possible:

• to study dependence of resistance of conductors on the specific resistance of its material, length and cross section;

• to study laws of a direct current - Ohm's law for sub circuit and the law of Ohm for a complete chain;

• to study laws of consecutive and parallel connection of conductors, condensers and coils;

• to study the principles of use of safety locks in electronic schemes;

• to study laws of allocation of thermal energy in electric and lighting fixtures, the principles of coordination of sources of current with loading;

• to study the principles of carrying out measurements of current and tension in electronic schemes by means of modern measuring devices (a multimeter, a two-channel oscillography), to observe a type of alternating current on separate details, shift of phases between current and tension in chains of alternating current;

• to study manifestation of capacitive and inductive resistance in chains of alternating current, their dependence on the frequency of the generator of alternating current and face values of details;

• to study allocation of power in chains of alternating current;

• to investigate the resonance phenomenon in chains with a consecutive and parallel oscillatory contour;

• to determine parameters of an unknown detail;

to investigate the principles of creation of electric filters for chains of alternating current. The designer it is also possible to use within his opportunities and for other tasks in independent creative work of pupils.

One of the main features of a complex is the greatest possible imitation of real physical process. For this purpose, following is provided, for example:

• images of details of the designer and measuring devices are provided not schematically, and in such look as "actually";

• at excess of rated power of the electric current proceeding through resistance the last "burns down" and takes a form of the turned black detail;

• the bulb and the electric heater at the rated power begin to shine and "fuse" if the power disseminated on them exceeds working value;

• at excess of operating voltage on the condenser, the last also "fails";

• at excess of rated working current via the safety lock, it "fuses";

• the majority of operations and their results are followed by sound effects.

It becomes in order that the pupil visually saw consequences of the mistakes, learned to understand the reasons of this or that unsuccessful experiment and developed necessary skills of the preliminary analysis of the scheme.

For use of the program enough initial skills of work in the Windows system.

Maintenance of a working window and basic principles of work with a complex.

At start of the program, the monitor of the computer is displayed:

• the bench with contact platforms on which it is possible to collect and analyze work of electric circuits (in the center of the screen);

• the panel of details containing a set of electric elements (in the right part of the screen);

• "recycle bin" where the fused and unnecessary details are thrown out (it is located in the left bottom corner of the screen);

• the control panel of the program with buttons for a call of auxiliary tools (it is located in the top part of the screen);

• the panel of comments (in the lower part of the screen).

Bench.
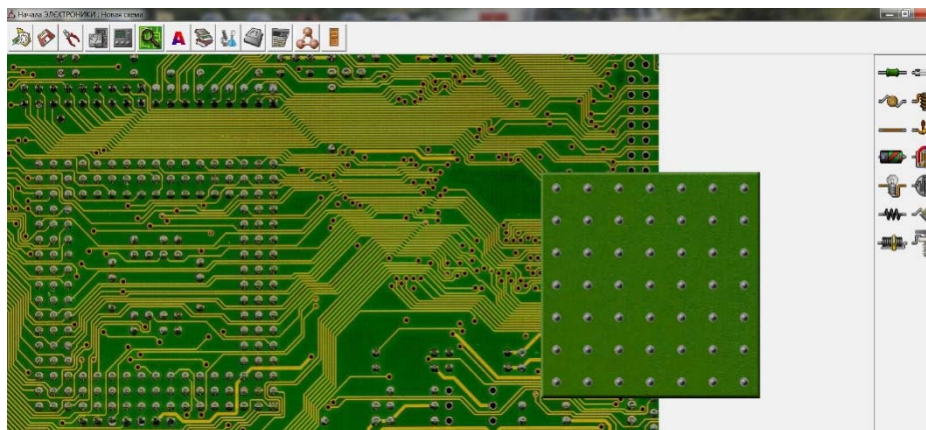
The bench is set of 7 x 7 = 49 contact platforms to which electric details, for assembly of various electric circuits "are soldered". Each detail can be located only between two next contact platforms or vertically or horizontally. In points of their connection with contact platforms, it is possible to connect probes of measuring devices to details. The choice of details from construction set and their "soldering" on a desktop is made by means of the mouse manipulator. It becomes standard for Windows – applications in the way – it is necessary to place the index of "mouse" on the necessary detail (the index takes a tweezers form), then to press the left mice button and, holding it in the pressed state, to move a

detail to the right place of the bench. After release of the left mice button, the detail will be established in the specified place. The unnecessary and "spoiled" details can be removed from a table in "recycle bin" in the same way.

It is possible to delete details from a table and other method. It is necessary "to right-click" on a detail of "mouse" – the window with the inscription "Throw Out a Detail" will appear. After confirmation (click on the button), the detail will be removed in a basket.

The details which are "thrown out" out of bench limits, but not in a basket collect in the lower part of the bench.

On a table sources of an alternating and direct current cannot be at the same time located.

Panel of details of the designer.

In the designer it is possible to use the following details:

- the resistor (it is characterized by resistance in Ohms and power in Watts, "burns down" at its excess);

- the safety lock (it is characterized by the maximum working current, "burns down" at its excess);

- the condenser (it is characterized by capacity in Farads and operating voltage, fails at its excess);

- the inductance coil (it is characterized by inductance in Henry, has very small active resistance);

- an assembly wire (has very small resistance);

- the switch (it is characterized by two states - "is opened" and "closed");

- a battery (it is characterized by polarity, EMF in Volts and internal resistance in Ohms);

- the generator of sinusoidal tension (it is characterized by amplitude and frequency of alternating voltage);

- a bulb (it is characterized by operating voltage in Volts, working current in milliamperes or power in Watts, "fuses" at their excess);

- the electric heater (it is characterized by the operating voltage and operating power, "fuses" at their excess);

- the real conductor (it is characterized by material, length and cross-sectional area);

- an unknown detail (can be the resistor, the condenser, the coil, the battery or the generator);

- a rheostat (it is characterized by the maximum resistance in Ohms);

- the condenser of variable capacity (it is characterized by the maximum capacity in Farads).

Panel of comments. Data on details and hints about purpose of buttons of the control panel are output to panels of comments. This information appears after installation of the index of "mouse" on the corresponding elements.

Digital multimeter.

General view and details purpose of a multimeter. Rules of work with a miltimeter.

Measurements by means of a multimeter: Measurement of tension. Measurement of force of a direct current. Measurement of resistance.

General view and details purpose of a multimeter.

In the drawing are shown arrangement of control elements and nests for connection of a multimeter to the electronic scheme. Switching of operating modes and limits of measurement is made by "click" of the mouse manipulator on tags of the corresponding limits (at installation of the index on limits it takes a hand form).
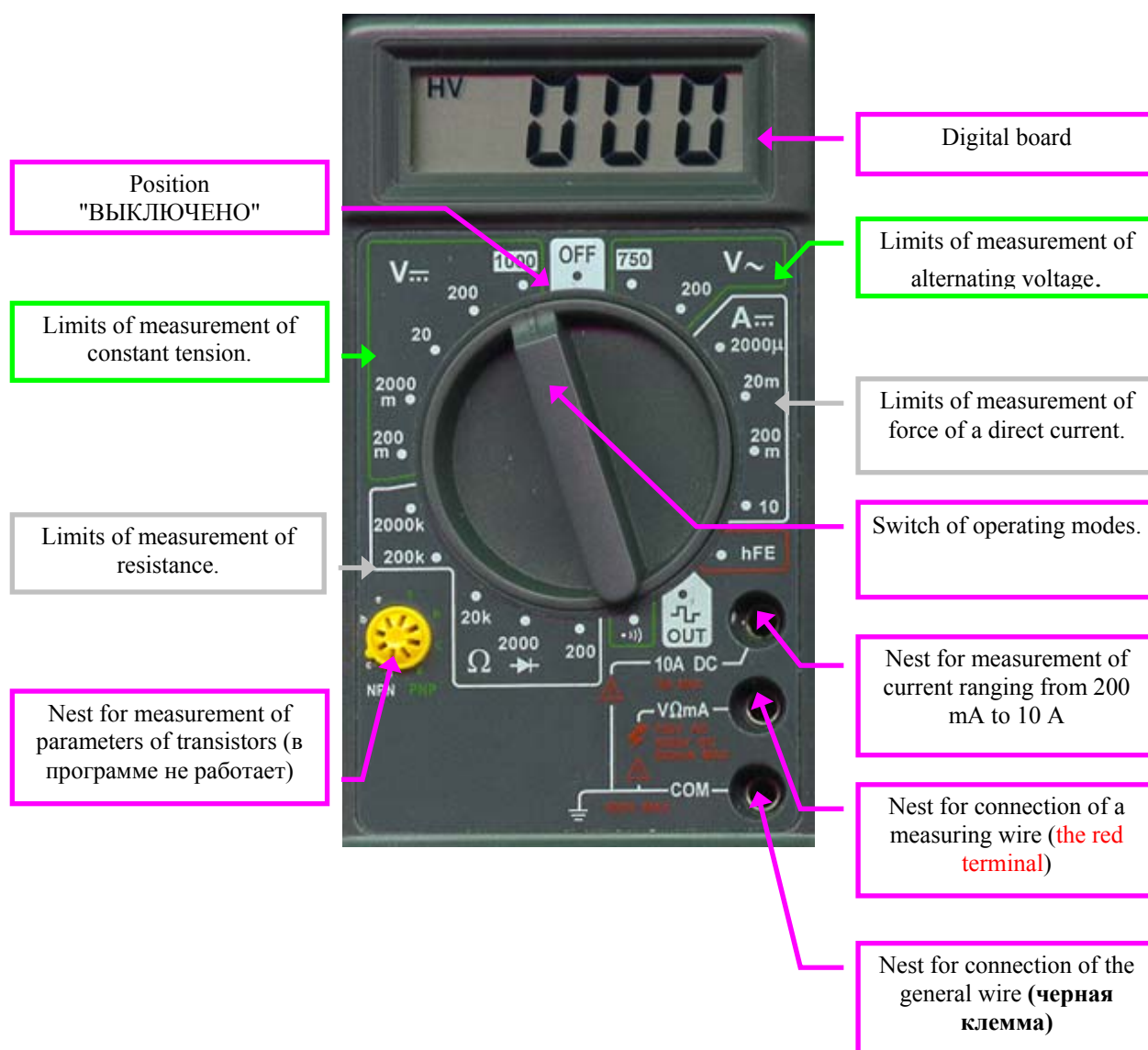
Rules of work with a multimeter.

1. The multimeter is caused on the screen (desktop) by pressing of the Receive a Multimeter button on the top panel of a window of the program. The following pressing this button calls the second device

(at the same time the button is blocked). For removal of the device it is necessary to click on the button in the right top corner of a window of a multimeter. The device together with the clips disappears from the screen.

2. Connection of a multimeter to points of the studied scheme is made by installation to the right places of the general (dark blue) and measuring (red) the clips connected to the corresponding nests of the device.

The general view of a multimeter is shown below in the drawing:

Position "ВЫКЛЮЧЕНО"	Digital board
Limits of measurement of constant tension.	Limits of measurement of alternating voltage.
Limits of measurement of resistance.	Limits of measurement of force of a direct current.
Nest for measurement of parameters of transistors (в программе не работает)	Switch of operating modes.
	Nest for measurement of current ranging from 200 mA to 10 A
	Nest for connection of a measuring wire (the red terminal)
	Nest for connection of the general wire (черная клемма)

Connecting wires of the device on the screen are not shown not to encumber the bench. It is necessary for connection of the device to the studied scheme:

- to establish the index of "mouse" on the necessary clip of the device (the index will take a hand form);

- to press and hold the left mice button:

- to drag a clip (holding the button) in the necessary point of the scheme and to release the mice button.

If in the course of work it is required to switch clips to other places of the scheme, then the same procedure is used. Transfer of a clip on area of the device brings to its automatic "parking" on the corresponding entrance nest of a multimeter.

3. Switching of operating modes of the device is carried out by installation of the index of "mouse" on the corresponding point of the panel of the device (at the same time the index changes the look) and click of the left mice button. The switch of operating modes of a multimeter turns in noted position.

4. On a digital board of the device the numerical value of the measured size (current, tension, resistance) in units specified on the chosen measurement limit is displayed. If in the left part of a board it is highlighted-1 (overflow) it means that the value of the measured size exceeds the maximum value of the chosen measurement limit. It is necessary to switch the device to other limit.

5. You can use one or two multimeters which have number 1 and 2 for work. Clips of devices also have the corresponding numbers. Devices can be used at the same time and independently. For example, it is possible to measure by the first device tension, and the second - current, in different parts of the studied scheme.

Measurements by means of a multimeter.
The multimeter allows to take measurements:
• tension of direct and alternating current;
• forces of a direct current;
• resistance of sites of a chain of a direct current.
 to check existence of contacts with use of the sound alarm system.

Measurement of tension.
For voltage measurement on the site of the studied chain it is necessary to consider the following:
 The voltmeter always turns on parallel to the site of a chain on which measure tension (the real voltmeter can fail at the wrong inclusion!).
 What type of current - constant or variable, proceeds in a chain? The switch of operating modes needs to be installed in the corresponding position.
 The voltmeter shows effective value of alternating voltage.
 At measurement of constant tension, the voltmeter shows value taking into account polarity - if potential on a measuring clip less, than on the general, on a board the sign "minus" is highlighted.
 Limits of measurement of constant tension: 1000 V, 200 V, 20 V, 2000 mV, 200 mV.
 Limits of measurement of alternating voltage: 750 V, 200 V.
 Entrance resistance of the device is equal in the mode of the voltmeter to 1 megOm.

Measurement of force of a direct current. For measurement of current on the site of the studied chain it is necessary to consider the following:
 The ampermeter always turns on consistently in the site of a chain where current is measured (the real ampermeter can fail at the wrong inclusion!).
 Our ampermeter can measure only force of a direct current.
 At measurement of current in chains, the ampermeter shows its value taking into account polarity: if current via the device flows from the general terminal to measuring, on a board the sign "minus" is highlighted.
 Limits of measurement of force of a direct current: 10 A, 200 mA, 20 mA, 2000 mA.
 Entrance resistance of the ampermeter is not enough (near 10^{-6} Om)

Measurement of resistance. For measurement of resistance it is necessary to consider the following: The ohmmeter can measure only the active resistance of elements of the scheme; Limits of measurement of resistance: 2000 kOm, 200 kOm, 20 kOm, 2000 Ohms, 200 Ohms and a special limit for definition of contacts with the sound alarm system; On the measured site of the scheme the device gives voltage of 2 V; It is possible to determine by the Device existence of contact in the scheme, at the same time, if resistance of the measured site is less than 75 Ohms, the sound signal is given. mereny forces of a direct current. For measurement of current on the site of the studied chain it is necessary to consider the following:
 The ampermeter always turns on consistently in the site of a chain where current is measured (the real ampermeter can fail at the wrong inclusion!).

Our ampermeter can measure only force of a direct current.

At measurement of current in chains, the ampermeter shows its value taking into account polarity: if current via the device flows from the general terminal to measuring, on a board the sign "minus" is highlighted.

Limits of measurement of force of a direct current: 10 A, 200 mA, 20 mA, 2000 mkA**.**

Entrance resistance of the ampermeter is not enough

Dual trace oscilloscope. General view and details purpose of an oscillograph of the Rule of work with an oscillograph: Description of governing bodies of an oscillograph. Measurements by means of an oscillograph.
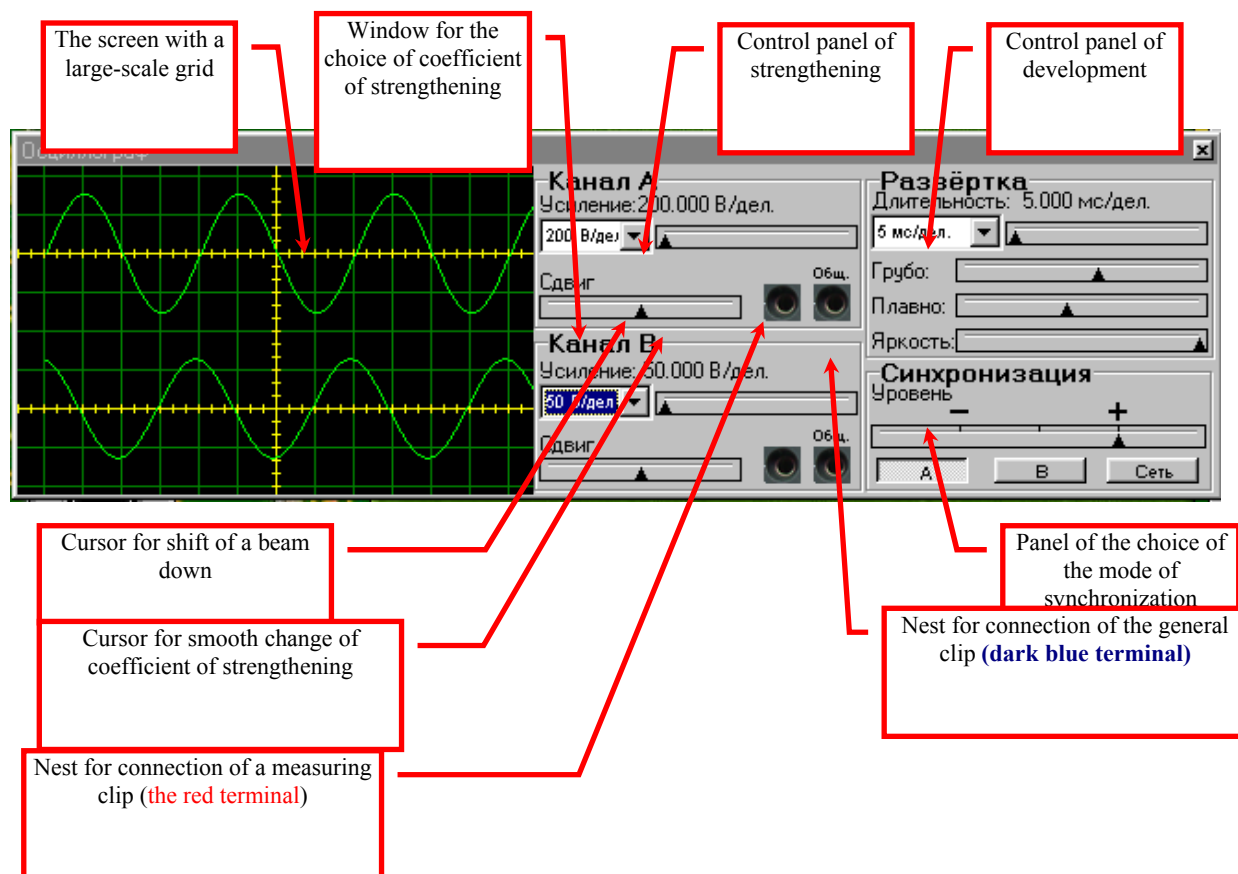
General view and details purpose of an oscillography:

The front panel of an oscillography contains the following parts:

- The screen with a large-scale grid for observation of a form of a signal and quantitative measurements;

- Control panel of strengthening of channels and shift of beams down;

- Control panel of development, shift of beams across, choice of the modes of synchronization and some support functions.

The oscillography is intended for visual observation of a form of alternating voltage. It allows to define quantitative characteristics of a signal also: frequency and amplitude of alternating voltage, impulse duration, shift of phases between two periodic signals (for this purpose the oscillography has to be two-channel).

Entrance resistance of an oscillography is rather high (near 10 megOms).

General view and details purpose of an oscillography:

The front panel of an oscillography contains the following parts:

- The screen with a large-scale grid for observation of a form of a signal and quantitative measurements;

- Control panel of strengthening of channels and shift of beams down;
- Control panel of development, shift of beams across, choice of the modes of synchronization and some support functions.

Rules of work with an oscillography.

1. The oscillography is caused on the screen (desktop) by pressing of the Receive an Oscillography button on the top panel of a window of the program. For removal of an oscillography it is necessary to click on the button ⊠ in the right top corner of its window. The oscillography together with the clips disappears from the screen.

2. Connection of an oscillography to points of the studied scheme is made by installation to the right places of the general (dark blue) and measuring (red) the clips connected to the corresponding nests of an oscillography. Connecting wires on the screen are not shown not to encumber the bench. Clips have designations (letter A and B) corresponding to channels of an oscillography. It is necessary for connection of an oscillography to the studied scheme: to establish the index of "mouse" on the necessary clip of the device (the index will take a hand form); to press and hold the left mice button: to drag a clip (holding the button) in the necessary point of the scheme and to release the mice button. If in the course of work it is required to switch clips to other places of the scheme, then the same procedure is used. Transfer of a clip on area of the device brings to its automatic "parking" on the corresponding entrance nest of an oscillography.

3. Installation of operating modes of an oscillography is carried out by means of adjustment of coefficients of strengthening of channels, the choice of duration of development, the mode of synchronization and adjustment of support functions.

4. On the screen of an oscillography the measuring grid by means of which it is possible to take quantitative measurements of parameters of a signal is put.

5. You can use for work one or two channels at the same time. Clips of an oscillography have designations "A" and "B", according to channels "A" and "B"".

Description of governing bodies of an oscillography.
Installation of coefficient of strengthening.

In order that the image of a signal on the screen of an oscillography did not go beyond the screen or had no too small amplitude, it is necessary to choose coefficient of strengthening of the channel correctly.

The coefficient of strengthening of an oscillography is set in Volts/divisions. It means, for example, that the price of division of a scale of the screen of an oscillography will be down equal to 500 mV if value of coefficient of strengthening to choose equal 500 mV / put.

The coefficient of strengthening of an oscillography can be changed in the Strengthening window by the choice of the necessary value from the offered list. This list opens when pressing the   button located to the right of a window. Besides, it is possible to change smoothly strengthening coefficient in some limits by means of a cursor of   located more to the right of a window with the button. For this purpose, it is necessary to establish the index of "mouse" on this badge, to press the left mice button and, holding it in the pressed state to move a cursor to the necessary position.

The cursor "Shift down" allows to displace an oscillography beam up or down.

Choice of the mode of development.

For the correct display of a periodic signal it is necessary to choose the corresponding duration of development of an oscillography also.

Duration of development is set in units time/division. It means, for example, that the price of division of a scale of the screen of an oscillography will be equal to 20 ms across if value of duration of development to choose equal 20 ms / put. The numerical value of duration of development is set by the ways similar for installation of coefficient of strengthening.

The cursor "The synchronization level" determines the time point of the beginning of development of a signal corresponding to a preset value of its amplitude. This adjustment can be useful to numerical definition of phase shift between two signals. Buttons "A" and "B" choose the channel on which development synchronization is carried out. The button "Network" changes development of both channels of an oscillography from the internal generator of sinusoidal tension. This mode is used for observation of addition of perpendicular fluctuations – Lissazhu's figures.

Cursor "Brightness" can be changed intensity of a luminescence of beams of an oscillography (at the same time brightness of a large-scale grid does not change).

**Measurements by means of an oscillography.**

The oscillography allows to take measurements: amplitudes of tension of alternating current; frequencies of alternating voltage; shift of a phase between two signals.

here is an assembly of the electric circuit
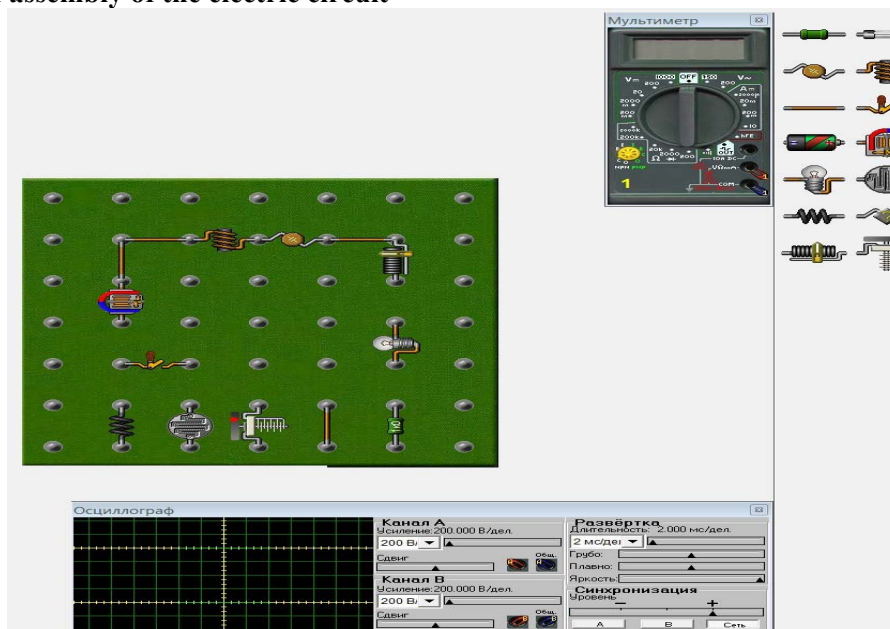
After final assembly of the scheme, there will be a process of measurement of parameters of a chain.

Performance of laboratory works on a physics course – electricity, begins with assembly of an electrical circuit, with calculation of parameters of details and half-cooking to measurements of current, tension, resistance of resistors, frequencies and amplitudes of alternating current, shift of phases electric fluctuation, the power of electroinstallations of a chain.
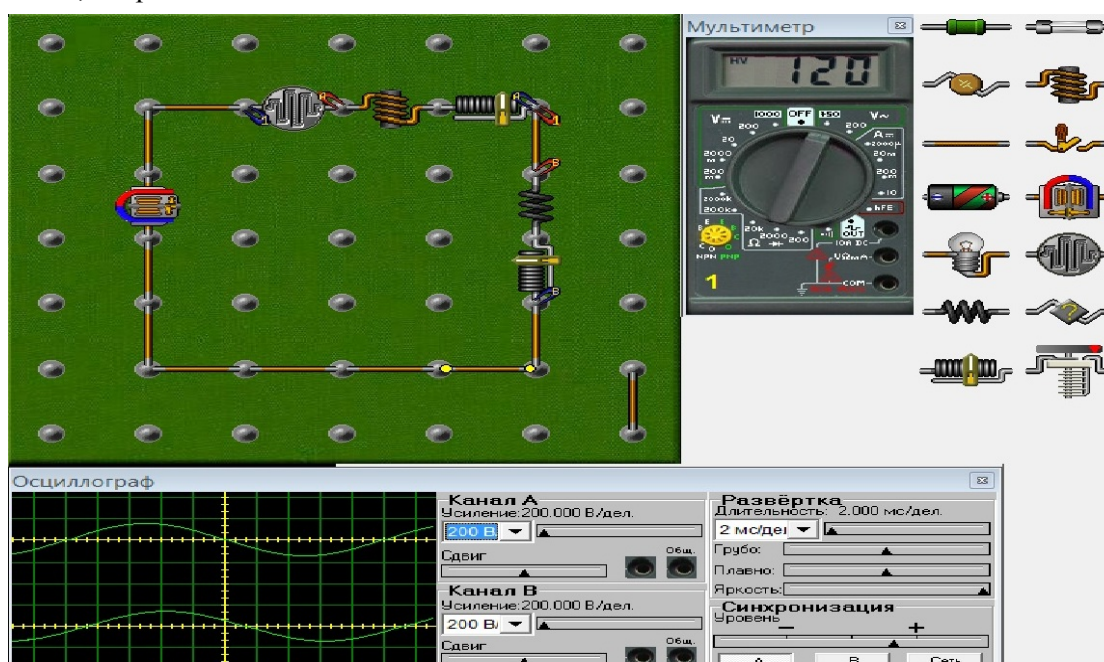
Measurement of devices and characteristic of all details of the scheme work in the real mode

Conclusion.

As a part of information technologies the new industry develops - it is a virtual interaktivization and visualization of the hardly understood subjects of physics, chemistry, biology and other objects [2,3,7]. And creation is virtual – interactive laboratories in the called objects meet the operated measuring devices very seldom. Therefore the technology of creation of the virtually-interactive laboratory (VIL) for the section of physics "Electricity" given in this work will be very relevant to creators similar to VIL – at higher step in other objects of knowledge. Such VIL – on the computer are very effective for development of a certain course of knowledge and develop independent research skills and awaken to creative search of methods of a research. Given VIL according to the section of physicists Electricity, due to visuality and interactive intervention in change process an experiment condition, it is very useful to fast development of a subject of physics by students and to development of skills a research. Brought VIL – according to the section of a course section of physicists Electricity, are introduced in educational process of the Eurasian Technological University and are successfully applied.

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Казак Ұлттық Қыздар Педагогикалық Университеті. Алматы қ. Казақстан.

ФИЗИКАНЫҢ «ЭЛЕКТРЛІК» БӨЛІМІНДЕГІ ҚҰБЫЛЫСТАРДЫҢ АЛГОРИТМДЕРІН DELPHY БАҒДАРЛАМА ОРТАСЫНДА ИНТЕРАКТИВТІ ВИРТУАЛДАУ, ЖОҒАРЫ САПАЛЫ ОҚЫТУДЫҢ ҚҰРАЛЫ

Аннотация. Бұл оқыту бағдарламасы тек теориялық материалдарды үйрету ғана емес, сонымен бірге лабораториялық зертханалық жұмыстарды орындауға болады. Зертханалық жұмыстар, физикалық шамаларды өлшеу әдістерін үйренуге, физикалық тәжірибелерді орындауды меңгеруге, өзінің зерттеу нәтижелерінен дұрыс қорытынды шығаруға қажет. Қазіргі компьютерлік технологиялар дәстүрлі оқытуға қажетті қосымшаларды жасауға мүмкіндігі бар. Физикалық процестер мен құбылыстарды модельдеу арқылы жасалған оқыту бағдарламалары, оқыту кезіндегі «тірілей» көрсете алмайтын процестерді , көрсете алады және оқушыға түсіну үшін зор көмек береді.[1,2,3,7]. Физиканың «электрлік» бөліміндегі процестер мен құбылыстар Delphy компьютерлік бағдарлама ортасында көрнекілік-ке ие болды және интерактивті түрде виртуалданды. Жасалынған виртуалды-интерактивті лабораториялық жұмыстар физиканың «электрлік» бөліміндегі процестер мен құбылыс-тарды зерттеу нәтижесінде осы курсты меңгеруге өте пайдалы, ал мақаладағы келтірілген виртуалды-интерактивті лабораторияны құрудың технологиясы, басқа пәндерден осы сия-қты виртуалды-интерактивті лабораториялар (ВИЛ) құруға көмек ретінде өте актуалды. Келтірілген виртуалды-интерактивті лаборатория қондырғылары Евразия технологиялық университетінің оқыту процесіне толығынан енгізілген және оқыту барысында қолданыс-та.

Түйін сөздер: Алгоритм, виртуалды интерактивтендіру, виртуалды-интерактивті лаборатория (ВИЛ), электрлік, мультиметр, екіканалды осциллограф, сиымдылық, индук-тивтілік, электр тізбегі, компьютерлік бағдарлама, делфи, паскаль.

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ИНТЕРАКТИВНАЯ ВИРТУАЛИЗАЦИЯ В ПРОГРАММНОЙ СРЕДЕ DELPHY АЛГОРИТМОВ ЯВЛЕНИИ РАЗДЕЛА ФИЗИКИ «ЭЛЕКТРИЧЕСТВА», ДЛЯ ВЫСОКОЭФФЕКТИВНОГО ОБУЧЕНИЯ

Аннотация. Обучающая программа предполагает не только изучение теоретического материала, но и выполнение лабораторных работ. Они необходимы для выработки навыков измерения физических величин, выполнения физических опытов, умения делать правильные выводы из своих наблюдений. Современные компьютерные технологии позволяют дополнить эту традиционную схему обучения. Обучающие программы, моделирующие физические процессы и явления, которые не всегда удается показать "в живую"

в обучающих условиях, могут оказать учащимся существенную помощь.[1,2,3]. Процессы явлении раздела физики «Электричество» визуализированы и интерактивно виртуализированы с помощью компьютерных программных сред Delphy**.** Сделанная, лабораторная работа по исследованию процессов явлении раздела физики «Электричество» очень эффективны при освоении данного курса, а технология создания виртуально-интерактивной лаборатории описанной в данной статье, очень актуальна для создания аналогичных виртуально-интерактивных лаборатории(ВИЛ) по другим предметам. Данная виртуально- интерактивная лабораторная разработка внедрена в учебный процесс Евразийского технологического университета и успешно применяется в обучении.

Ключевые слова: Алгоритм, виртуальная интерактивизация, виртуально-интерактивная лаборатория(ВИЛ), электричество, мультиметр, двухканальный осциллограф, емкость, индуктивность, электрическая цепь, компьютерная программа,делфи, паскаль.

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