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DEVELOPMENT OF VIRTUAL LABORATORY TOUCHSCREEN BASED FOR THE STUDENT OF VOCATIONAL HIGH SCHOOL IN ORDER TO SUPPORT THE PRACTICE LEARNING Hendra Jaya, Sapto Haryoko, & Indah Mauliana Makassar State University Abstract: The students interact directly in virtual laboratory with a simulator or remote equipment, and it is desirable that the experience will be similar to a real lab.

There are many ways by which a student could attain this experience - through real experimental activities or through computer generated interactions. These computer based multimedia environment could be collections of images, animations, simulations, authoring tools, games or virtual reality. These environments offer students a means to explore, experience and express themselves.

In a Digital Electronics virtual environment, the students can posit hypotheses about a engineering concept, conduct as many experiments as they want start AND gates until aplication of digital gates circuit, observe and record data and draw conclusions. This might not always be possible in real laboratory because of many reasons. In this paper the virtual laboratory design based on macromedia flash and J2ME touchscreen media with the framework of android.

Have implemented a virtual lab for the user especially vocational students (SMK), making practices more interesting through user interaction using a mobile with touchscreen facility that provides flexibility in operating. Combination of real and virtual lab which is integrated into the syllabus, can enrich the learg rceandieastudnt'iest a ioy Introduction Technological developments in the current profoundly changing the way the information on daily life. It more efficient because now can do anything with just a small device.

As it is now developing a smart phone. In a small electronic device that we can obtain unlimited information and can do anything anywhere that normally only be carried out on a place. Especially with the development of such media are more interactive touchscreen for the user.

It is not fully utilized in the field of education, especially in the field of teaching. Until finally the development of electronic media is only used for the benefit of others, sometimes also abused by their owners. Increasingly lagging educational system not using existing technology developments.

Unpredictable world of teaching at the vocational school students in particular will be abandoned or become unattractive to students. Due to the ancient method of teaching that can not attract students to undertake vocational school whose name practicum. They will be interested to follow development of technology rather than lesson.

Moreover, if students are facing in the field of teaching digital Electronics, which includes digital electronics as a heavy field of practice. It takes patience and understanding to be able to study these subjects, especially at the beginning of the semester, digital electronics is a new teaching field. They need to adapt to these lessons, sometimes teachers use teaching system often makes them very hard adaptation.

So they gave up in the face, and the field of teaching has become an area of teaching that they do not like. For that developed a flash-based virtual labs that can be integrated with technologies that have been developed at this time using the android operating system in a mobile package (e.g handphone, PDA, PC Tablet, etc) that can be more mobile, can be used anywhere and anytime.

Virtual Laboratory A virtual laboratory provides a way to perform experiments with equipment that is not physically present in the same place as the user (Joler, 2001). There are two types of virtual labs: (i) remote and (ii) simulated. A simulated lab has a computer model of the equipment and its environment, and the user interacts with these models to perform experiments (Richard L, 1999).

Simuled or espond o he udentacons o end st'underandiofhi actions in the context of specific situations. It allows a training phase in a safe environment also. If we couple an intelligent tutor with a virtual laboratory, we can extend the free exploration in the virtual laboratory capabilities with the tutoring labor based on the student performance follow up, task planning, and providing help (Noguez J., 2003).

In a virtual laboratory, the students interact directly with a simulator or remote equipment, and it is desirable that the experience will be similar to a real lab. So if we couple a tutor to the virtual lab, it should be transparent to the user when she/he does an experiment, thus avoiding repetitive interruptions. With this interaction information, the tutor infers the state of the student, and decides the best pedagogical action.

Given the uncertainty inherent in this task, a student model that can represent and reason with uncertainty is required. Figure 1. High-level view of the general architecture for Integrating an intelligent tutoring system with a Virtual laboratory Main features of the Virtual Lab If we analyse the common activity of a student during his practical work, we will identify the following steps: 1) Understand the concept of the experiment and calculate the parameters of the circuit; 2) Choose the components; 3) Place and interconnect the components in order to constitute the desired circuit; 4) Analyse the results.

Except the first step which is mainly a reflection activity, the three others could be realized virtually. Models are introduced and justified in lectures to facilitate the understanding and the calculation. As the fourth step is very important, the analysis suggests different models presented during the lectures.

In order to enhance the students critical mind and to understand the limitation of each model, the experiments file allowing the simulation of the circuit. We propose both electrical schemas and virtual circuits represented by real images of the components. This aspect places the student in the same situation as in the reality where the calculations in the first phase are realized,through the electric schemas, before the experiment executed with virtual circuits (Zysman, 1997). In fact, the future engineer will have to deal more with electrical schemas than handling real components.

Quickly, the virtual approach turns out a spectacular artifice more than a very useful techniques. The: application provides three levels of help: 1) The justification of the experiment; 2) The substitution of the guide (teacher) when theory is ecessary to provide some phenomenological explainations, including animation. The study of semiconductor components (diode, transistor bipolar or MOS, etc...)

needs frequently this approach; 3) The explaination of the model and the algorithm used to develop the experiment. It is interesting for the students to develop their own environment. Today, this is possible with new author systems, easy to use and cheap. Using Virtual Lab There are 3 factor of using the virtual labs such as (Harina, 2011): 1) Virtual lab as a substitute of Real lab; 2) Virtual lab as a complement of Real lab; and 3) Virtual lab as a supplement of Real lab.

Virtual lab as a substitute of Real lab Can be used in the following condition: a) School does not have physical lab at all so Insufficient fund and land; b) There is physical lab but Experiments require dangerous, rare and expensive substance, Lab materials too abstract and difficult to implement; c) School does not have lab technician but have IT technician.

Virtual lab as a complement of Real lab can be used in the following condition: There is physical lab but: a) Experiments require dangerous, rare and expensive substance; b) Lab materials too abstract and difficult to implement; c) As a guide and introduction to the materials that will be experimented later; d) Inadequate quantity and quality of lab technician but have competent IT technician.

Virtual lab as a supplement of Real lab, can be used in the following condition: 1) School already have real science lab according / above required standard with sufficient IT facility; 2) The content of virtual lab: a) Explain abstract and complex concept; b) Microscopic process that is difficult to observe; c) Real world application; d) Provide reinforcement and flexibility to explore; e) Prove of a theory; f) Polished the conclusion; 3) Science teacher and lab technician have sufficient IT knowledge. Touch Screen Technology A touch screen is a computer display screen that is also an input device.

The screens are sensitive to pressure; a user interacts with the computer by touching pictures or words on the screen. There are three types of touch screen technology: a) Resistive: A resistive touch screen panel is coated with a thin metallic electrically conductive and resistive layer that causes a change in the electrical current which is registered as a touch event and sent to the controller for processing.

Resistive touch screen panels are generally more affordable but offer only 75% clarity and the layer can be damaged by sharp objects. Resistive touch screen panels are not affected by outside elements such as dust or water; b) Surface wave: Surface wave technology uses ultrasonic waves that pass over the touch screen panel. When the panel is touched, a portion of the wave is absorbed.

This change in the ultrasonic waves registers the position of the touch event and sends this information to the controller for processing. Surface wave touch screen panels are the most advanced of the three types, but they can be damaged by outside elements; c) Capacitive: A capacitive touch screen panel is coated with a material that stores electrical charges. When the panel is touched, a small amount of charge is drawn to the point of contact.

Circuits located at each corner of the panel measure the charge and send the information to the controller for processing. Capacitive touch screen panels must be touched with a finger unlike resistive and surface wave panels that can use fingers and stylus. Capacitive touch screens are not affected by outside elements and have high clarity (Manik Junja, 2000).

There are three components used in touch screen technology: a) The touch sensor is a panel with a touch responsive surface. Systems are built based on different types of sensors: resistive (most common), surface acoustic wave, and capacitive (most smart phones). However, in general sensors have an electrical current running through them and touching the screen causes a voltage change.

The voltage change signals the location of the touching; b) The controller, is the hardware that converts the voltage changes on the sensor into signals the computer or other device can receive (can see Figure 1); c) Software tells the computer, smartphone, game device, etc, what's happening on the sensor and the information coming from the controller. Who's touching what where; and allows the computer or smart phone to react accordingly.

Of course, the technology works in combination with a computer, smart phone, or other type of device. Figure 2. Capacitive touchscreen with controller (Source : Microtouch) Basic Principles Capacitive touch screens rely on conductors that are imbedded onto a sheet of glass. When the display turns on, the conductors create a electrostatic field.

Since the human body naturally holds an electrical charge, touching the display distorts the electrostatic field. From the distortion of the electrostatic field, the image processor---much like a CPU calculates where the touch occurred. Derivations of capacitive touch screens include: a) Surface Capacitance; b) Projected Capacitance; c) Mutual Capacitance; d) Self Capacitance. Figure 3.

Basic principles of a capacitive touch screen (Source: www.lorextechnology.com) Single Touch vs Multi Touch Gestures Optical touch screens recognize single and multi touch gestures. Touch gestures are available on touch-enabled DVRs. Single touch gestures require one finger (i.e. panning, dragging, flicks). Multi touch gestures require two fingers (i.e. Zoom, rotate, two finger tap). Figure 4.

Touch Screen with single and multi touch Smartphone Based The iPhone uses both Mutual Capacitance and Self Capacitance technology to achieve multi touch gestures. Mutual Capacitance requires two layers of material: one layer for the Driving Lines, one layer for the Sensing Lines. Driving Lines provide current for the touch screen. Sensing

Lines detect the current for the electric node layer.

When the finger touches the screen, the Sensing Lines determine the location of where the touch occurred. Every point on the grid generates its own si. tgrd, ouch nfmatiirelback nttipr. he Phone's processor is integral in how the system interprets a touch on the screen. The Sensing Lines and Driving Lines creates a coordinate grid for the iPhone CPU. This allows the phone to locate the specific area where the touch occurred.

Because iPhone relies on a capacitive touch screen, the screen operates only when a bare finger touches the screen. A gloved hand, or stylus will not activate a capacitive touch screen. Figure 5. The simplified explanation above explains the key concepts of a multi-touch platform like the iPhone.

Touch screens may interpret touch data in a different way (Source: www.lorextechnology.com) Here is the Android Architecture Diagram Figure 6. Block Diagram of Android Basically Android has the following layers (http://elinux.org): ? applications (written in java, executing in Dalvik) ? framework services and libraries (written mostly in java), applications and most framework code executes in a virtual machine ? native libraries, daemons and services (written in C or C++) ? the Linux kernel, which includes drivers for hardware, networking, file system access and inter-process-communication Discussion Real experience aids in better understanding.

There are many ways by which a student could attain this experience - through real experimental activities or through computer generated interactions. These computer based multimedia environment could be collections of images, animations, simulations, authoring tools, games or virtual reality. These environments offer students a means to explore, experience and express themselves.

In a Digital Electronics virtual environment, the students can posit hypotheses about a engineering concept, conduct as many experiments as they want start AND gates until aplication of digital gates circuit, observe and record data and draw conclusions. This might not always be possible in real laboratory because of many reasons. The physical phenomenon could itself be complicated to observe or the experiment setup could be time consuming.

For example, let us say the student wants to know how the current electricity flow. Now looking the current electricity flow in a real lab is very difficult. However in a virtual environment, it would be just the click of a button. This ease of setting up an experiment can let them conduct many experiments and view the results in many perspectives. (a)

(b) Figure 7.

In virtual lab (a) just the click of a button; (b) electricity flow There is no doubt that experiments with real materials would provide students with a more realistic and arguably more exciting appreciation of the physics. The disadvantages of using real materials are often managerial and cost-related. The materials themselves may be expensive to buy or collect, the laboratories have to be maintained and teaching staff must be provided.

In addition, experiments dangerous or too expensive to conduct in an actual laboratory can be simulated with the use of virtual lab. In this paper design of virtual laboratory based on macromedia flash and J2ME touchscreen media, sistem design is used (see the Figure bellow) (a) (b) (c) Figure 8. Sistem Design (a) user; (b) Touchscreen media (HP Samsung, O.S Android); (c) Integration with android and flash player Figure 9.

Block Diagram Design Sistem virtual laboratory touchscreen based There are many ways to build Android applications. One of them uses software called Eclipse using the Java programming language. This software is equipped a wide range of plugins to PROSES Virtual Environment Virtual Laboratory Simulasi Modul Praktikum (Perc.

1-10) Work-sheet Tutorial Menganalisis dan menetapkan kompetensi dasar Mengidentifikasi standar kompetensi Mengidentifikasi karakter awal siswa (Kognitif, afektif, dan psikomotorik) Mengembangkan dan memilih materi pembelajaran praktek Menyususn strategi pembelajaran praktikum (Instructional Strategy) Analisis Kebutuhan: Studi pustaka,Literatur, Studi pendahuluan, pra-survey di SMK Macromedia ANDROID Learning Technology Situational factor INPUT Drill/ practice Animasi 3D Metode Pembelajaran Praktek (Yamin, 2005) Metode Demonstrasi Metode Experimen Metode Penampilan Metode Pembelajaran terprogram Metode praktikum Tahapan Pelaksanaan Praktek menganalisa gejala mengumpulkan informasi menyusun hipotesa meyusun rencana kerja untuk memeriksa kebenaran hipotesa mengevaluasi data- data yang diperoleh menarik kesimpulan Java2ME OUTPUT develop applications based on Android. You need to know, to run Eclipse, we do not need to install first.

if you do not have the HP Android, because we are already equipped with the Eclipse emulator. firstly you have 3 pieces of the components below: 1. Eclipse 2. ADT Plugin 3. SDK Figure 10. Eclipse Component Figure 11. ADT Component Figure 12. SDK Component Figure 13. Emulator for Android Figure 14. HP used type Samsung s583 Figure 15. Virtual lab with touchscreen In the Form of this practice is the home page to enter the lab session.

After the students press the button "PRAKTEK", then it will be brought to the lab room. Lab space can be opened by manually by pressing the door handle and can be done by entering a password automaticaly in the fields provided. Passwords are: vlab. Form of practicum consists of 13 practical topics that will be in practice in the subjects of digital electronics.

Basic electronics consisting of basic gates (AND, OR, NAND, NOR, NOT, EX-OR, and EX-NOR) and universal Gate. While advanced electronics FLIP-FLOP consists, CLOCK, REGISTER, COUNTER, and DECODER ENCODER. In the form of this experiment is equipped with a working step instructions for easy carry out practical steps.

To carry out practical work done by placing the trainer to the lab table. Trainer placement process by performing drag (touch and drag) to the desired location target in this table. After selecting an option the next gate input into the stage set up lab equipment and materials.

Determination of lab materials will be adjusted according to user or implementer practicum. Number of switches in the capture will determine the practical input. If the switch is in 2 pieces take this means in practice is that the AND gate with 2 input. However, to facilitate the students, then provided a list of ingredients listed on the sheet of tools and materials.

The "SIMULATION" is used to simulate the gate before entering the lab. Simulation will help students in understanding the process of switching between components (switches, IC, Integrated Circuit, LED). Practical work on form-Simulate is done by providing input to the gate through the switch.

If the slide switch on the left switch and LED indicator lights lit, the input logic given a positive voltage (+5 VDC) or logic 1. If the switch on the slide to the right switch and LED indicator light goes out, it means that given a logic input negative voltage (-5VDC) or logic 0. In the virtual laboratory is also equipped with an oscilloscope to measure the signal.

Conclussion From the observations during the design, software implementation is done, then the conclusion can be drawn as follows: 1. Have implemented a virtual lab for the user especially vocational students (SMK), making practices more interesting through user interaction using a mobile with touchscreen facility that provides flexibility in operating. 2.

Combination of real and virtual lab which is integrated into the syllabus, can enrich the

lniprs ieasests ntestand iy. nts e so fied from the synergies between real and virtual laboratory. 3. Synergy between real and virtual lab which supported by certain policies among them are about standardization of development procedure of virtual lab application and the proper usage of virtual lab for High School can give the following benefits: a) Provide even distribution of access to electronics lab in SMK; b) Increase the quality and competitiveness of the engineering education especially in electronic engineering; c) Upgrade the competence level of students and teachers in SMK; d) Increase the utilization of Jardiknas; e) Reduce the gap of laboratory facilities between SMK. 4. The first feed-back is very encouraging.

The students show a large interest. They are more and more attracted by the development of projects on virtual lab.

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