Physics Experiment and Evaluation Method Based Microcontroller Atmega and Microsoft Visual Studio

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Abstract—**Activities practicum is one of the methods that is in a process learning that can train student's ability of cognitive, psychomotor, and affective. A long with the development of science and technology there are various media come that can amenable a learning process. Currently, most of educational institutions do the practicum is still using a conventional method. This article is designed by using the study literature method which aims to introduce a practicum method with media. Hopefully, the media are able to improve accuracy and conscientiousness in the process of observation. To support the learning process, the evaluation method used is also used the same media. Media are used in the form of a set of the electronic devices that is based microcontroller. Microcontroller is a chip in the form of IC that can receive input signals, process it and give output signals based on a program loaded into it. The function of microcontroller is as a microprocessor that read analogue data that is in practicum activities, translate it into digital data and then displayed on LCD screen computer until produce observation data effectively and efficiently. So do the evaluation process.**

Index Terms—**microcontroller, practicum, evaluation**

I. INTRODUCTION

ICT is a technology that supports a kinds of activities involve information, such as collecting, processing, saving, and presenting of data. ICT covers products that can save, take, manipulate, transfer or receive information by electronic in digital form, such as a computer, television, email, and robot.

According to Daniels, in a short time, ICT will be one of the basis of development modern society [1]. It can be seen from Information and Communication Technology (ICT) user which is used in various aspects, one of them is education [2]. Many countries think that understanding, skills and concept of ICT as the essence of education [1]. Several products of ICT have relevance with education and used in different purposes [3]-[5]. The use of ICT in teaching and learning process will be able to improve the education quality if they are supported with a good pedagogic skill [6]-[7]. Some educators feel that technology is a key to extend knowledge and promote learning [8]. Learning process can hone the cognitive,

psychomotor, and affective students, and one of the way to train psychomotor abilities through practical activities.

Education oriented application and practice is important. Several research about active learning and cooperative in solving the problem is showed that students will learn faster and develop communication skills, leadership and team work [9]. ICT is expected to advance cognitive skill as understanding, reasoning, problem solving, creative, and increase the education result and repair the quality and effectiveness of teaching and learning [10]- [11].

One of ICT applications is the use of microcontroller as a medium for supports practicum activities. Microcontroller is a chip in the form of IC (Integrated Circuit) that can receive input signals, process it and give output signals according to a program loaded into it, and the microcontroller only can scan one program. Before the use of microcontroller be inevitable in almost each sector [12]. Microcontroller (MCUs) is used as controller in almost every sector of science and engineering [13], for example at sector robotics is a Design of the UItah/MIT Dexterous Hand [14], the Salisbury hand [15], five- digit hand at the University of Belgrade [16]-[17], grasping device is designed by the University of Pennsylvania [18]. A Microcontroller Based Four Fingered Robotic Hand (FFRH) [19], another example microcontroller-based wireless accelerometer for analysis kinematic [20].

This article is intended to realize the use of a practicum that integrated with microcontroller and connected with Personal Computer (PC) as the visual output as one of the way to help the student in obtained data correctly and accurately, so the learning activities in the laboratory can more efficient and effective because it happened during some of the students have difficulties in observation like detect many swings occur in static pendulum in a certain time and so on.

In addition, the purpose of this article to realize the use of microcontroller and microsoft visual studio in the evaluation of learning in educational institutions in Indonesia. The aplication of microcontroller can increase creativity of teachers in welcoming the advances of technology, as well as facilitate teachers in conducting the evaluation and processing results of the evaluation, so that evaluation can be run more efficiently. This media

was chosen because they could conform the standard of media including a device that used should were classified as can be developed, sophisticated and cheap [21].

II. LITERATURE REVIEW

A. ICT

ICT (Information and Communications Technology - or Technologies) is an umbrella term that includes any communication device or application, encompassing: radio, television, cellular phones, computer and network hardware and software, satellite systems and so on, as well as the various services and applications associated with them, such as video conferencing and distance learning. ICT is often spoken of in a particular context, such as ICT in education, health care, or libraries. The term is somewhat more common outside of the United States [22].

Around the world technological progress often applied or used into all sector for example education sector, in the education sector. ICT really change the way learning traditionally for learning more effective [23].

B. Microcontroller

In digital modern system, microcontroller is as fundamental a component as transistors and individual logic gates were 30 years ago [24]. Microcontroller is a design microprocessors that combines all features of a microprocessor that consists of functional units Arithmetic and Logical Unit (ALU), the set of register work, decoder instruction, timer and other components control. Different from microprocessors, microcontroller provide memory in flakes same with the processor (in chip). Therefore microcontroller is very ideal for in use with corrosion and chemicals aggressive. Their operating temperature is in the temperature range (4-65˚C) and pressure requirements are also low (up to 40 psi). These valves can have continuous duty cycle and require only a few milliseconds to energize. Their typical response time is 0.015-0.03 seconds from inactive to active stage and 0.005-0.01 seconds from active to inactive stage. They operate on 3V DC, 0.4 a and their typical power consumption is 1.2 W which is very low [25].

In outline a microcontroller is a computer small in an integrated circuit that contains the core processor, memory, and programmed input peripherals or output that can become an electronic service [26]. For example microcontroller AT89S52 [27], microcontroller atmega128 [28]. ATmega128 features an internal bandgap reference. This reference is used for brown-out detection, and it can be used as an input to the Analog Comparator or the ADC. The reference 2.56V to the ADC is generated from the internal bandgap reference [28].

C. Analog to Digital Converter (ADC)

Analog to digital Converter is used as a medium that converts analogue signals of light censors into digital signals to be read by microcontroller [25]. The input to an Analog-to-Digital Converter (ADC) consists of a voltage that varies among a theoretically infinite number of values [29]. Analog digital converter can be desain by converter based on spatial wave function switched field effect transistor (SWSFET). The SWSFET can be fabricated using conventional CMOS process [30].

D. Microsoft Visual Studio

Microsoft visual studio is a collection comprehensive tools and services developers to help you make application for platform microsoft and the other [31].

III. METHODS

This paper designed in the form of study leteratur. The method for designing the system learning physics experimentally and evaluation based microcontroller atmega and microsoft visual studio are 1) identify microcontroller atmega and microsoft visual studio, 2) investigation of the development and enthusiastic learning, 3) Apply the use of microcontroller and microsoft visual studio in learning physics that learning becomes effective and efficient. Futrher descriptions are presented in Fig. 1.
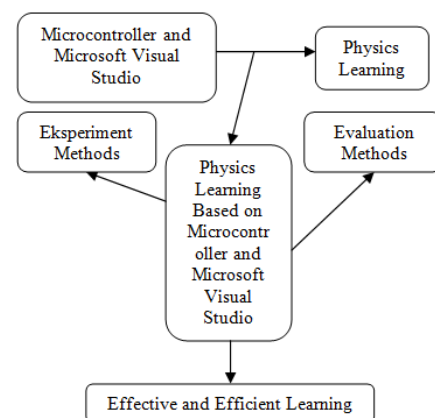

Figure 1. The conceptual thinking of physics eksperiment and evalution method base microcontroller atmega dan microsoft visual studio.

IV. DISCUSSION AND RESULTS

Based on the fact, there are schools that each practicum activity takes a long time because of the diversity character of the students, so their ability to observations, stringing tools, process the data are also different, there are some students need some repetitions to obtain precise and accurate results. On the other side of the unavailability of tools affect to enthusiastic students, tools is available, can motivate students and increase interest in learning, and facilitate students to learn and understand the lecture being studied [32]. An example is the use of technology as a tool for practicum viscosity using atmega microcontroller. The purpose is objectives to minimize errors in the practicum, especially in recording time. The measurement of viscosity fluid can be done by a simple way using viscosimeter method the ball fell. Viscosity of the fluid is determined by filling the viscometer tube (long glass tube scale) with the fluid (liquid) to be measured viscosity and give a certain distance in the tube. Before determine viscosity fluid

must first be known about diameter the ball, a mass of type the ball, a mass of type fluid and the acceleration of gravity [33]. However, the weakness of this method is errors in observing the movement of the ball because the views is not straight and difficulties in determining the time it took the ball in a fluid with a predetermined distance previously [34]. To minimize errors in record time developed a designed up viscosimeter method the ball fell by using technology microcontroller atmega16. To compare the accuracy of the time measurement performed in the conventional data retrieval and microcontroller. The measurement result time with the distance 0.05 m between censors (see Table I) and conventional (see Table II) to be shown as follows:

TABLE I.   DATA OF MEASUREMENT USES VISCOSIMETER MICROCONTROLLER BASED

	Measure 1		Measure 2	
	Distance (m)	Time (s)	Distance (m)	Time (s)
Censor 1-2	0.05	0.162	0.07	0.209
Censor 1-3	0.10	0.347	0.14	0.481
Censor 1-4	0.15	0.550	0.21	0.770
Censor 1-5	0.20	0.743	0.28	1.040
Censor 1-6	0.25	0.952	0.35	1.326
Censor 1-7	0.30	1.153	0.42	1.605

Source: Didik Aryanto, Ernawati Saptaningrum, dan Wijayanto (2012).

TABLE II.   DATA OF MEASUREMENT CONVENSIONAL OF VISCOSIMETER

Measure 1		Measure 2	
Distance (m)	Time (s)	Distance (m)	Time (s)
0.05	0.27	0.07	0.50
0.10	0.35	0.14	0.71
0.15	0.70	0.21	0.99
0.20	0.93	0.28	1.22
0.25	1.05	0.35	1.45
0.30	1.24	0.42	1.63

Source: Didik Aryanto, Ernawati Saptaningrum, dan Wijayanto (2012)

Based on these data looked clearly differences in measurement results of measurement time conventional and automatically using a microcontroller. This difference caused by weaknesses of conventional methods is difficult to see the movement of the ball and determine the exact time when the ball falls, so that the use of the microcontroller is able to help students in the process of observation and data processing.

In this era, the availability of computers and internet has spread to various regions it is becoming a strong foundation to do exams are online [35]. Most of the educational institutions and universities to apply online exams to students. This system has become a promising alternative and become a substitute for the traditional systems [36]. Online examination systems is an example a application of technology in education, however this system having little weekness like no one can exactly observe so the student can doing test with the help of

other parties as browser, and other kinds of applications. While the traditional examination system direct control occurs during the learning process but it takes longer than the online examination system, because the process of analyzing the results of the test can still be spelled out manually. Because it appeared idea of using a microcontroller in the test were able to make the implementation of the evaluation process becomes more efficient and supervised while helping teachers in the process of evaluation results because the software microsoft visual studio is a complete software (suite) that can be used to perform application development, so the software is able to display various kinds of problems either with images and text, this application can also directly analyze the results right or wrong answer and immediately display the value of the evaluation activities. With this software, teachers can create a question bank that can later be used as a test device in the evaluation of learning, so students will gain more experience working on a wide variety of problems or cases. So in this method only required one PC as servers and microcontroller that's wired up as remote control in answer the questions (Fig. 2).
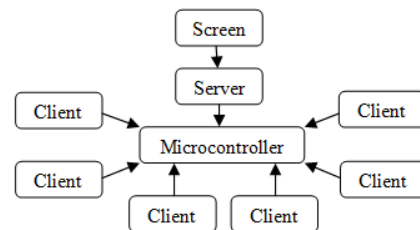

Figure 2.   Design chart evaluation

The microcontroller can also be used for 3 students with 10 exam questions and display the time with a choice of a range time, for example, for 120 seconds, 60 seconds and 45 seconds countdown to some questions, for the answer button can consist of five options, namely A, B, C, D and E, where the response speed of up to 1 second button for the tap, and the button can be pressed simultaneously by all participants (students) and no delay.

A. Design System

Hardware design includes a signal processing circuit design, circuit design interface microcontroller. Software design includes the design of the monitoring program display and design workings system.

1) The assembly stage hardware and encoding software

On the hardware made circuit power supply system, power supply is used directly use the power laptop that connected to a cable USB, the circuit signal processing of censor, circuit minimum system microcontroller, because the serial port on the computer has a voltage level TTL (Time To Live) is the time the maximum of the computer when the reply ICMP packets also called latency or delay that is often used in digital circuits with IC in general, so it takes a RS232 voltage converter. Converted data from the microcontroller is shown in the screen Personal Computer (PC) via a software bascom containing a

combination of the commands in programming languages according the standard program for the device (hardware) that is designed to work as expected.

2) Downloader module

As a medium for download program to all IC AVR which has facilities ISP (In System Programming) via the USB port on the notebook or PC. Using IC USB to serial TTL it can be used also as a channel of communication between electronic devices with a TTL-level computer through a USB port, in this case connect the microcontroller to the computer (PC).

3) Bascom

The steps that need to be done in programming microcontroller atmega as follows:

1. Typing program, typing program can be done with text editor applications such as notepad, sun and others.
2. The program that was created compiled using other programs such as ASM51.EXE resulting in a file with extension .lst and .hex.
3. Upload file with extension .hex into microcontroller by using software atmel microcontroller isp.
4. Connect the IC microcontroller to be downloaded on a socket downloader available.
5. Double click in icon microcontroller isp software.
6. Select the type IC in accordance with the microcontroller you want to download. Then do the initial target by selecting the option and initialize the target.
7. Then select load buffer, take the file name program .hex that have been made.
8. Select the Instruction, select auto program. Downlolader automatically erases the existing program on the microcontroller, and fill it with files name program .hex.
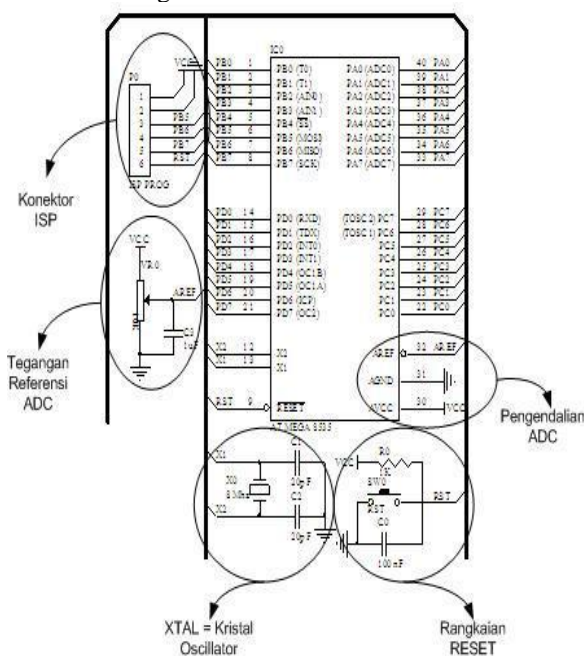9. Finally click 'ok'. Microcontroller ready for use on a tool designed.

Figure 3. DI-Smart AVR System. Source : Depokinstroment.com [37]

4) Design media of practicum

DI-Smart AVR System (Fig. 3) is an electronic module that is based on the circuit minimum system microcontroller AVR (sismin AVR) ATMEGA 8535. Specifications of DI- SMART AVR systems that can be used as the minimum system microcontroller AVR ATMEGA to type 8535 (L), equipped with interface circuit (interface) RS-232 that can be directly connected to the PORT SERIAL/COM PORT computer (Fig. 4).
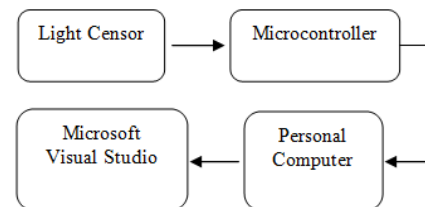

Figure 4. Censor practicum tools design

Microcontroller that serves as a controller connected to the censor made of LDR acronym of Light Dependent Resistor which resistor the resistance value change due to the intensity of the light is absorbed.

LDR is also a resistor having a negative temperature coefficient, where the resistance is influenced by the intensity of the light. So that the censor get analog data to be translated by a microcontroller which is then displayed on a computer screen through a visual basic program is a programming language which is very easy to learn, with the technique of visual programming that allows users to create better at producing a program-based visual by using microsoft visual studio.
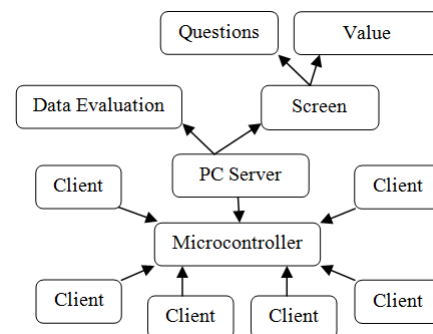

Figure 5. Design system media evaluation

5) Design media evaluation (Fig. 5)

As in the media practicum microcontroller serves as a controller, microcontroller receives input from the client through an answering machine that consists of 6 buttons that tombal answer A, B, C, D, E, and a reset button to erase an answer. Then the data are forwarded to directly processed by the server through the program visual studio by providing a value of 1 if true and the value 0 if wrong, when the result of the answers <70% of the amount of matter it did not pass, if the results of the answers ≥ 70% of the amount of lecture it is passed. After the data is processed results immediately shown on screen, and save documents the results of the test.

Visual studio program (Fig. 6) is in addition to process data is also used to create many type questions. Then screened using a projector. Types of questions can be

adapted to the needs of each educator, if you want to make two exam is enough to make two columns containing a different matter, for example, contains about one column A and another column containing about B.
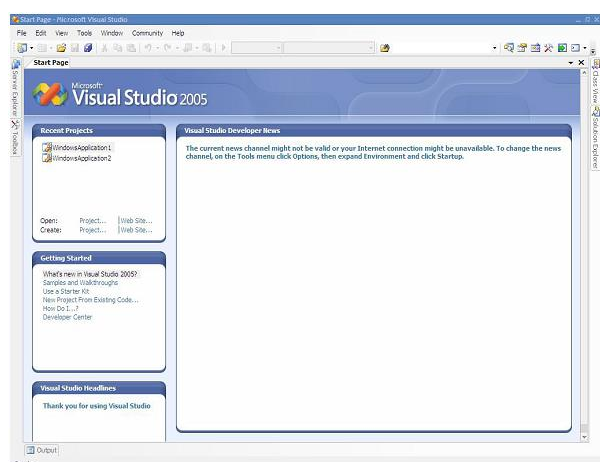

Figure 6. Start paget microsoft visual studio. Source: Fajar rahadian, 2011 [38].

V. CONCLUSION

In learning physics will not escape of the practicum, as through the experiment done, students can understand more of a lecture of physics. To cope with the development of science and technology and the needs of quality resources, the methods of teaching practicum physics in Indonesia needs to be developed further because the method the lab is one method that can establish and improve the three aspects of the ability of learners is the ability of cognitive, affective, and psychomotor. Learning practicum based microcontroller could be one alternative way to confront the development of science and technology. Using microcontroller will produce data of observation more accurate and more efficient. Similarly, in the evaluation will be more effectively, efficiently and students can also find the direct result of the evaluation. On the other side, the use of media and appropriate tool also will increase the enthusiastic learning.

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