

Design and Development of Experiment Devices Micro computer Based for Motion Subject Matter

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Abstract- Currently Indonesia implements 2013 curriculum which requires learning activities to be carried out with a scientific approach through observing, asking, trying, and reasoning. Physics learning activities cannot be separated from experimental activities both outside and inside the laboratory. The learning activities of students who are directly involved in real activities make it possible to give meaning to themselves. Some high school materials that require experimental activities include measuring distance, mass, time, temperature, and current strength. This study aims to produce microcomputer-based distance measuring devices that can be used by students in learning physics in class easily. This device can display measurement results from a sensor through the student's android mobile screen quickly and accurately and keep up with current technological developments. Through the tools produced, experimental activities can be well organized to support learning objectives. This study uses the Research and Development (R & D) methodology of ADDIE models namely Analysis, Design, Develop, Implementation, and Evaluation. The resulting device consists of sensors, data reader modules, and android applications. The resulting device can support the 2013 curriculum learning needs characterized by a scientific approach.

Keywords: Experiments, Microcomputers, Measurement

I. INTRODUCTION

Physics learning cannot be separated from experimental or experimental activities, both outside and inside the laboratory. The learning activities of students who are directly involved in the real world make it possible to give meaning to themselves [1]. Based on its purpose, there are experiments for practice, experiments for investigation, and experiments that provide experience [1].

The form of exercise experiments aims to develop basic abilities such as using the eyes to make microscopic observations, work safely in the laboratory, use the device appropriately and carry out experiments with true steps. The form of investigative experiments aims to develop problem-solving abilities that give students the opportunity to work like scientists that is to identify problems, formulate problems, design the best ways to solve problems, apply them in experimental activities, and analyze and evaluate the results. Experiments that give experiences that give experience aim to improve understanding of teaching materials [2].

An experiment can be realized if students have the opportunity to understand natural phenomena with all their senses[1]. Real experiment is one way that can be used in physics learning so that it can help and facilitate students in understanding and managing what they receive during learning.

Experimental activities in the teaching and learning process can help make the learning experience of students more meaningful. Computer technology is one of the information technology products that has become an important part in

human life, but it is still not implemented optimally in the world of education [3].

The attraction possessed by computer technology should be used in the world of education so that the learning process can be interesting. Computer technology has advantages such as providing an explanation of a material through various ways. Computers can present information in the form of text, graphics, images, animation, sound, and video [3].

With the availability of computer-based experimental devices, it will greatly simplify and direct students to understand the subject matter and stimulate high-level thinking, especially critical thinking skills that are able to facilitate the achievement of goals to understand and remember information or messages contained in equations, pictures or graphs [4].

Microcomputer-based experimental devices can display simulations, animations, images, photos and videos so that learning has a positive impact. The advantages of microcomputer-based experimental devices are very useful to be applied in school learning, especially learning physics.

II. METHODOLOGY

The research methodology developed was the Research and Development (R & D) ADDIE model which included 5 (five) stages of Analysis, Design, Development, Implementation, and Evaluation [5]. The device developed in the form of a distance meter that is controlled via an android mobile.

III. RESULTS AND DISCUSSION

A. Analysis

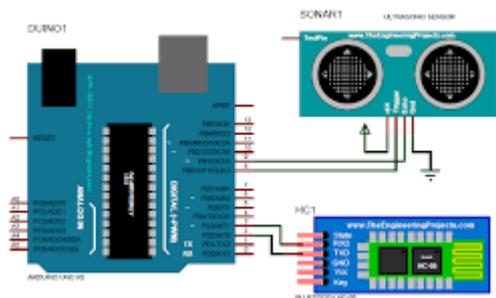
The experimental device in the distance measurement activity that is often used by students is a 30 cm ruler or ruler. In general, the ruler as a distance measuring device has two size scales, namely the main scale and the smallest scale. Units for the main scale are centimeters (cm) and units for the smallest scale are millimeters (mm). The distance between the main scale is 1 cm and the smallest scale on the ruler has a value of 1 millimeter [].

Competencies related to physics learning are applying the principles of measuring physical quantities, accuracy, accuracy, and important numbers, as well as scientific notation and presenting the results of measuring physical quantities and accuracy using appropriate tools and techniques and following important numerical rules for a scientific investigation, and analyzing physical quantities in straight motion with a constant velocity (fixed) and straight motion with constant (constant) acceleration and their application in daily life such as traffic safety [3].

B. Design and Development

The design stage produces device specifications, and a description of the software developed. The design of this application development consists of two stages, namely:

compiling the hardware circuit for the device, and designing the display layout that will be installed on the mobile [6].



The hardware used in making the application is Arduino Uno, one of Atmel's laboratory products, namely an electronic board that contains an Atmega328 or Atmega 8 microcontroller (a chip that functionally acts like a computer) [7].

This tool can be used to realize electronic circuits from simple so complex. The reading of various sensors for instrumentation needs can be implemented using a relatively small board and with the addition of certain components, this device can be used for sensor readings. Arduino Uno contains an Atmel AVR microprocessor and is equipped with a 16MHz oscillator that allows time-based operations to be carried out properly, and a 5 Volt voltage generator [7].



A number of pins are available on the board. Pins 0 through 13 are used for digital cues, which are only 0 to 1. Pin A0-A5 is used for analog signals. Arduino Uno is equipped with static random-access memory (SRAM) measuring 2KB to hold data, 32KB flash memory, and erasable programmable read-only memory (EEPROM) to store programs [7].

The tools used to make the GUI display on the android screen are MIT-made Inventor app and the layout used as a GUI on an android mobile [8]. MIT-made Inventor app is very easy and light does not burden the performance of a laptop or computer.

C. Implementation

Implementation includes installation and packaging of ape devices, coding and software installation. Followed by function and operational trials to ensure the journey of all logical operations.

The results show that the device can operate properly according to the purpose of detecting the distance of the object and the reference point automatically shown on the mobile screen. Before you begin to format your paper, first write and save the content as a separate text file. Keep your text and graphic files separate until after the text has been formatted and styled. Do not use hard tabs, and limit use of hard returns to only one return at the end of a paragraph. Do not add any kind of pagination anywhere in the paper. Do not number text heads-the template will do that for you.

D. Evaluation

Microcomputer-based experimental devices are made with hardware that has standard quality, using the clone version of the Arduino board with the Atmega328 processor, the proximity sensor uses a clone model with a 90 cm range, and this standard is more than enough.

This microcomputer-based experimental device is only limited to measuring the distance of an object. Further development can develop devices for other measurements such as temperature, mass and current strength. Other and made as attractive as possible.

The furthest distance from this module is 10 meters and is most accurate at a distance of 5 meters.

In implementation often found delay or data processing time from sensors that will be sent very long this is because the generation of microcomputers used is not the latest. Microcomputer development is now in the stage of using blue pills with a generation of processors that have 72 Mhz very far above the microcomputers used in this study.

CONCLUSION

Along with technology development, physics learning experimental devices can be developed using microcomputers with android applications. Based on the results of trials of experimental devices, motion measurement can be used as an innovation in physics learning activities. Experimental devices of measurement of motion can be used as media or experimental devices in accordance with the demands of the 2013 curriculum using scientific methods so that student learning activities can proceed accordingly.

References

- [1] Rustaman, N. Y. et al. (2003). Common Textbook on Biology Teaching and Learning Strategies. Bandung, JICA.
- [2] Arifin, M. (2003), Common Textbook Chemistry Teaching and Learning Strategies. Bandung: Department of Chemical Education FPMIPA UPI.
- [3] Wahyudi Nyoto Suseno, (2013), Effectiveness of Using Experiment Methods in Class X Physics Learning, Journal of Physical Education, ISSN: 2337-5973
- [4] Supardiyono (2009), Implementation of Experimental Methods in Physics Learning in Junior High Schools, Proceedings of the National Seminar on Research, Education and Application of Mathematics and Natural Sciences Faculty of Mathematics and Natural Sciences, Yogyakarta State University, 16 May 2009 PF-231
- [5] Srisawasdi, Niwat (2012) Student Teachers' Perceptions of Computerized Laboratory Practice for Science Teaching: A Comparative Analysis, ELSEVIER / Procedia - Social and Behavioral Sciences
- [6] Andrianto, Heri (2013). Programming ATmega16 AVR Microcontroller Using C Language (CodeVisionAVR). Bandung: Informatics Bandung
- [7] Iswanto C. Self Learning AT90S2313 Microcontroller with BASIC Compiler. Yogyakarta: ANDI
- [8] Koltun, M. M. 2010. Photoelectric Device of the Great Soviet Encyclopedia, 3rd Edition. The Gale Group, Inc. All rights reserved
- [9] Prasetya, Catur Edi Widodo (2012). USB Port Interfacing Coding Tips and Serial Port Using VB. Yogyakarta: ANDI
- [10] Setiawan, Afrie (2012). 20 ATmega 16 Microcontroller Applications Using BASCOM-AVR. Yogyakarta: ANDI
- [11] Winoto, Ardi (2010). ATmega80 / 16/32/8535 AVR microcontroller and programming with C language on WinAVR. Bandung: Informatics Bandung.