

Design and Verification of Arduino Uno-Based Analog and Digital Trainers as Student Worksheets on Microprocessor and Microcontroller Programming Technique

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ABSTRACT

Logic and programming are the primary issues that students face when learning to program microprocessors and microcontrollers. Students must have systematic practical instruction in order to comprehend the lesson. The goal of this study was to create and validate a student worksheet to ascertain the trainer's feasibility in the application of analog and digital based on the Arduino Uno for microprocessor and microcontroller courses. This study technique makes use of R&D. (R&D). This research consists of seven (seven) steps, including the following: (1) potential and issue analysis; (2) data collecting; (3) product design; (4) product validation; (5) product revision; (6) product trial; and (7) data analyzing and evaluation. The results and analysis of the trainers' validation exam revealed an overall score of 84.37 percent. Thus, analog and digital trainers based on the Arduino Uno have been classified as extremely valid, indicating that they are extremely suitable for use as tools or supporting material in microprocessor and microcontroller courses. Thus, it can be concluded that the use of digital and analogue trainers based on validation verification has a number of advantages and benefits as student worksheets, learning material, and trainers for the use of digital and analogue microprocessors and microcontrollers based on Arduino Uno. Thus, it is quite practical to utilize it as a tool or supporting media in courses on microprocessors and microcontrollers. As a result, it can be concluded that the use of analog and digital trainers based on validation verification has a number of benefits and advantages as student worksheets, learning media, and trainers for the application of digital and analogue microprocessors and microcontrollers based on Arduino Uno. Thus, it is highly feasible to use as a tool or supporting media in microprocessor and microcontroller courses. Thus, it can be concluded that the use of digital and analogue trainers based on validation verification has a number of advantages and benefits as student worksheets, learning material, and trainers for the use of digital and analogue microprocessors and microcontrollers based on Arduino Uno.

Keywords: *Learning Media, Analog and Digital Arduino-based deployment Trainer, R&D.*

1. INTRODUCTION

Vocational school students, especially the expertise program. Learning media in the world media and comes from Latin which is the plural form of "Medium" [3]. Media Education but useful only for teaching and learning activities tools and materials. Quoting Briggs'

statement, the notion of learning media is a physical means to convey content or it can also be said that learning materials such as videos, films, books, and so on [2]. While the quote from the National Education Association says that learning media is a means of communication in the form of print or which can be seen

or heard and can also include hardware technology, types of learning media, including [5]:

- a. Visual media: graphs, charts, posters, cartoons, diagrams, comics, charts.
- b. Audio media: tape recorders, language laboratories, radio, and the like.
- c. Projected still media: slide: overhead projector (OHP), in focus, and the like.
- d. Projected motion media: video (VCD, DVD, VTR), film, television, computer, and the like.

Learning media that are often used because they are interesting and easy to use, for example, are computer-based interactive multimedia learning media, and by utilizing computers as tools. The use of computer-based interactive multimedia includes the presentation of illustrated videos, learning materials, and learning practice questions.

Learning media, in general, are facilities or intermediaries that are used in the process of a mutual action that occurs between teachers and students as a driver of the process of acquiring knowledge which aims to gain knowledge, skills and can strengthen what is learned and

This Arduino Uno-based analog and digital trainer is very useful and useful as material that can be researched, because after being reviewed the media does not yet have additional media that is useful as a support for teaching and learning in the subject of Microcontroller Microprocessor Programming Engineering on the basic competencies of analog and digital input and output and programming. . And also teachers who provide a lot of theory and practice who do not use trainers so that the trainers are expected to help increase student creativity.

The advantages of analog and digital trainers based on Arduino Uno include the following: students can comprehend the genuine microcontroller circuit used on the trainer and how to utilize it. Additionally, the Arduino Uno-based analog and digital application trainer includes a worksheet to help students develop their creative thinking skills while programming analog and digital input and output devices. Additionally, the project intends to develop trainers and worksheets as viable goods.

2. METHODS

The Research and Development (R&D) method will be used for this research. Quoting a statement according to Sugiyono (2010:407) that the method used for research is to produce certain products and to test the practicality of products that are beneficial to the community.

The Research and Development process can be categorized into ten stages: 1) the possibility and issue

phase, 2) data collection, 3) design process phase, 4) validation phase, 5) usage testing phase, 6) product modification phase, 7) product trial stage, 8) concept revision phase, 9) product revision phase, and 10) mass production stage.



Figure 1 Stages of ADDIE method development (Analysis, Design, Develop, Implement, and Evaluate).

In this study, the Research and Development process was implemented through stage 7 (seven), with analysis and reporting being the last stage. Because this is scholarly study with a certain amount of time. This stage is characterized as follows: 1) potential and issue analysis, 2) data gathering, 3) product design, 4) product validation, 5) product revision, 6) trial stage product, and 7) data analysis and reporting.

Research conducted will occur in the process of data collection. Several methods will be used in this process, one type of method that is determined and used at the data collection stage is also adjusted to the circumstances and character of the research. For data collection, validation methods are used, namely trainer validation sheets and job sheet validation sheets. in this study using data analysis techniques, namely by analyzing data from the results of the validation by the validator and the results of student responses.

3. RESULTS AND DISCUSSION

The results and discussion sections will detail the study findings from the data presentation phase. The data supplied will include the findings of the verification of the media trainer and the validation of the job sheet. While the conversation will cover everything from developing a media trainer and creating a task sheet to evaluating research data and discussing how it works, as well as a series of input and output coding in five experiments and proof of online data retrieval techniques. This research results in the creation of a worksheet and an Arduino-based digital and analogue application trainer. The trainer is composed of the following components: a push button, a 16 x 2 LCD (Liquid Crystal Display), an ultrasonic sensor, an LM35 sensor, a potentiometer, an LED, a buzzer, a DC motor, and an Arduino Uno. This is a representation of the trainer product's outcomes.



Figure 2 Guesttrainer plan.

On the task sheet, there are five alternatives for practical experimentation, including programming and building a potentiometer input with an LED output, programming and creating a push-button input with an LED output, and programming and building an ultrasonic sensor input with an LED output.

Trainers who passed the validation exam made up 84.37% of the total. It may be claimed that the Arduino Uno-based analogue and digital application trainer can be employed as a teaching tool or enabling medium for competency in analogue input and output programming digital. Illustration, content, and presentation are all taken into account when approving a task sheet.

An overall assessment score of 81.6 percent was given to job sheet validation. In order to use the Arduino Uno-based analogue and digital application worksheet to educate students digital-analog input and output coding, it is necessary to select the correct category for the task sheet.

Here's a visual representation of the circuit and the five experiments it powers:

3.1. Experiment with Programming Ultrasonic Sensor Input With Buzzer Output

- Arrange the circuit as shown in.
- After this, connect the Arduino to the laptop/computer using a serial cable.
- Open the Arduino IDE software, click the "create a new file" icon (CTRL + N) on the Arduino software.
- Write this program listing on the Arduino worksheet.
- Set the Arduino board and port by clicking tools > board > Arduino Uno, and port clicking tools > port > COM 18.
- Click the verify sign first to find out if there is an error or not.
- Click upload on Arduino program

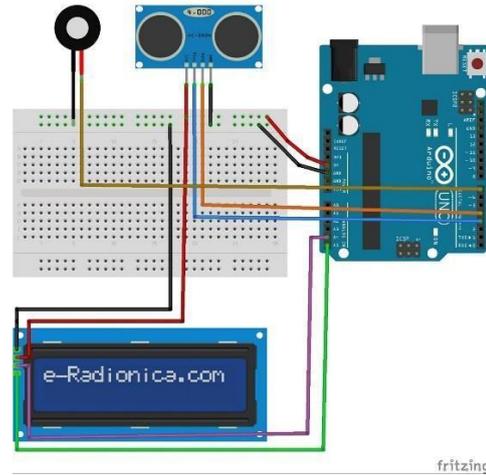


Figure 3 Ultrasonic sensor input with buzzer output.

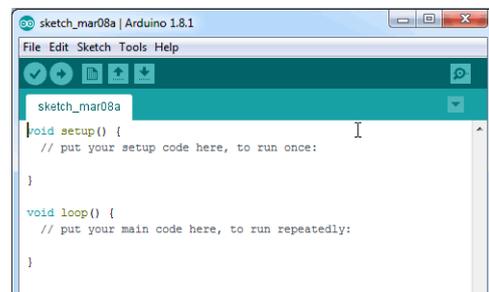


Figure 4 Arduino program display.

3.2. Experiment with Programming Temperature Sensor Input with DC Motor Output

- Arrange the circuit as shown below.

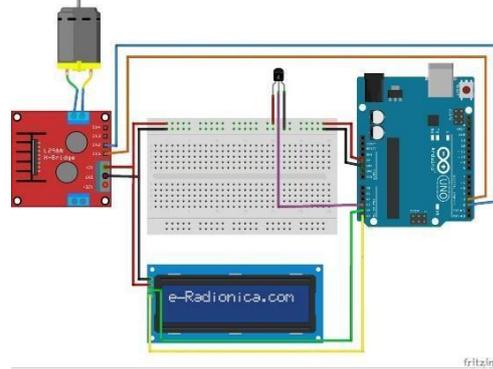


Figure 5 Temperature sensor input with DC motor output.

- After this, connect the Arduino to the laptop/computer using a serial cable.
- Open the Arduino IDE software, click the "create a new file" icon (CTRL + N) on the Arduino software.

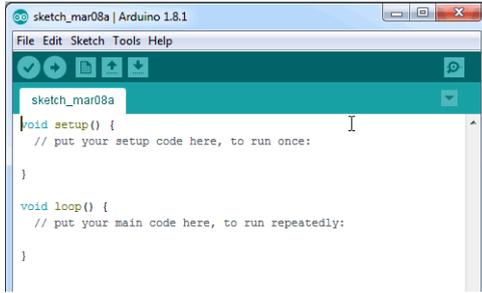


Figure 6 Arduino program display.

- d. Write this program listing on the Arduino worksheet.
- e. Set the Arduino board and port by clicking tools > board > Arduino Uno, and port clicking tools > port > COM 18
- f. Click the verify sign first to find out if there is an error or not.
- g. Click upload on the Arduino program.

3.3. Experiment With Programming Push Button Input With LED Output

- a. Arrange the circuit as shown below.

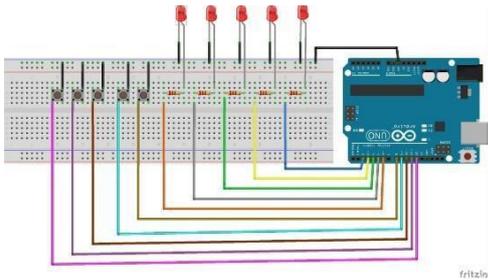


Figure 7 Push button input with LED output.

- b. After this, connect the Arduino to the laptop/computer using a serial cable.
- c. Open the Arduino IDE software, click the "create a new file" icon.
- d. new file" (CTRL+N) in the Arduino software.
- e. Write this program listing on the Arduino worksheet.

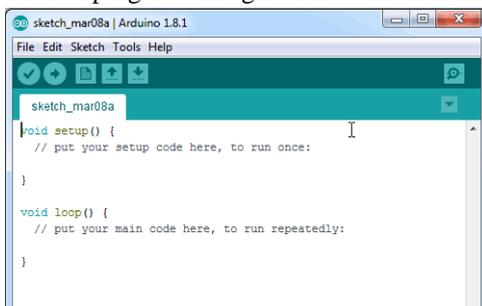


Figure 8 Arduino program display.

- f. Set the Arduino board and port by clicking tools > board > Arduino Uno, and port clicking tools > port > COM 18.

- g. Click the verify sign first to find out if there is an error or not.
- h. Click upload on the Arduino program.

3.4. Experiment with Programming Potentiometer Input With LED Output

- a. Arrange the circuit as shown below.

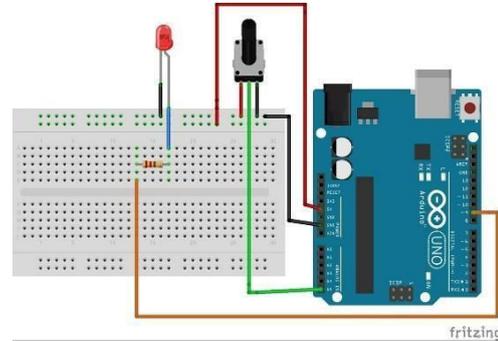


Figure 9 Potentiometer input with LED output.

- b. After this, connect the Arduino to the laptop/computer using a serial cable.
- c. Open the Arduino IDE software, click the "create a new file" icon (CTRL+N) on the Arduino software.

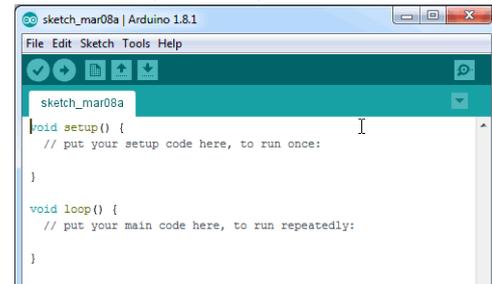


Figure 10 Arduino program display.

- d. Set the Arduino board and port by clicking on tools > board > arduino uno, and clicking on ports > tools > port > COM 18.
- e. Click the verify sign first to find out if there is an error or not.
- f. Click upload on Arduino program.

4. CONCLUSION

Analog and Digital Application Trainers Based on Arduino Uno as a Student Worksheet on Microcontroller Microprocessor Programming Techniques may be deduced from this study, based on the validation findings produced in this research.

The final average percentage derived from the examination of the validity of the analog and digital application trainers based on Arduino Uno is 84.37%. The presentation was 93.75 percent based on the content aspect, which includes the media trainer following the teaching material, the making of the trainer helps to

understand the material to be delivered, the trainer is very helpful in practicum learning, and the trainer can be used for group learning as well as individuals in the category of analog and digital application trainers based on Arduino. a presentation of 75 percent is achieved in the display and quality of media, which includes characteristics of the look and quality of the media such as the trainer model, the circuit layout on the trainer, and

The final average percentage derived from the examination of the validity of the analog and digital application trainer work sheets based on the Arduino Uno is 81.6 percent. According to three factors, namely the jobsheet cover's attractiveness, the jobsheet cover protects the jobsheet from dirt, the jobsheet cover contains elements of the jobsheet title and the author's name and/or the university's name or logo, and the suitability of the cover image clearly and accurately describes the contents. In the illustration, a percentage of 79.17 percent is achieved, which means that the illustrations that include the jobsheet text can be read, the jobsheet material on learning objectives is appropriate, and that the contents of practical activities are consistent with the subjects presented. Using the Arduino Uno-based analog and digital a category, the content of the job sheet is obtained by a percentage of 87.50 percent, which means that the contents of the job sheet, which include materials and assignments, and practical instructions, are well structured, writing and using language that is easy to understand, language according to ES (Enhanced Spelling).

Arduino Uno-based analog and digital application trainers had an average response rate of 88.49 percent from students, according to data collected. The student response results are excellent, and it can be concluded that the Arduino Uno-based analog and digital application trainer may be used.

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