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Making an Arduino Uno R3 Trainer as A Learning Support Tool in The Electronics Study Program

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Abstract

Microcontroller technology is increasingly developing, so studying it requires a real device. The learning process for microcontroller practice at the Piksi Ganesha Indonesia Polytechnic Campus does not yet have sufficient tools, especially for Arduino Uno practice. The research aims to create a tool or trainer about Arduino Uno so that it can be used to support microcontroller learning in the Electronics Engineering Study Program. The research method uses Research & Development with stages including potential and problems, information gathering, product design, design validation, design improvement, product testing, and product revision. The research results are an Arduino Uno trainer with three inputs and three outputs. It is hoped that users can more easily understand the basics of microcontrollers with the media created.

Keywords: Trainer, Arduino, Microcontroller

Abstrak

Teknologi mikrokontroler semakin berkembang sehingga untuk mempelajarinya dibutuhkan suatu piranti yang nyata. Proses pembelajaran praktik mikrokontroler di Kampus Politeknik Piksi Ganesha Indonesia belum mempunyai alat yang cukup khususnya dalam praktek arduino uno. Tujuan penelitian yaitu membuat suatu alat atau trainer tentang arduino uno sehingga dapat digunakan sebagai sarana penunjang pembelajaran mikrokontroler di Program Studi Teknik Elektronika. Metode penelitian menggunakan Research & Development dengan tahapannya meliputi potensi dan masalah, pengumpulan informasi, desain produk, validasi desain, perbaikan desain, uji coba produk, dan revisi produk. Hasil penelitian berupa trainer Arduino Uno dengan tiga masukan dan tiga keluaran. Diharapkan pengguna dapat lebih mudah memahami dasar mikrokontroler dengan media yang dibuat.

***Kata-kata kunci**: Trainer, Arduino, Mikrokontroler*

1. Introduction

The world of electronics technology, especially microcontrollers, is developing rapidly over time. Almost all electronic devices that use automatic systems will use microcontrollers **[1] [2]**. For example, household electronic equipment often found in everyday life is household electronic equipment. For example, television, air conditioner (AC), automatic doors, and other household appliances that use remote control. By pressing the remote-control button, all the desired tools can work automatically and save human energy. A more recent development in the field of electronics is the creation of the smart home. All household equipment and the condition of the room can be controlled using a cellphone or computer, even remotely **[3]** . As contained in the research of Dedi Irawan Saputro, Isti Maulani Fajrin, Yuda Bakti Zainal regarding the Design of a Household Appliance Monitoring and Controlling System Using an MCU Node, a type of microcontroller device that is integrated with sensors [4]**.**

The increasingly sophisticated equipment used requires users to learn about it. It is possible that after the user learns about microcontrollers, they have the innovation to create a useful tool. For example, I Made Agus Mahardiananta and his friends created a microcontroller-based automatic switch to reduce electrical energy use **[5]**. Egg Incubator Machine Using Arduino Based ATMega328 Microcontroller made by Iwan Purnama, Ambiyar Ambiyar, Fahmi Rizal, and Unung Verawardina [6]**.**

Material about microcontrollers at the Piksi Ganesha Indonesia Polytechnic campus is mandatory for students in semester five (5). Considering the very importance of microcontrollers in electronics engineering **[7] [8]**. The implementation of teaching and learning activities in the microcontroller practicum in the electronics engineering study program is hampered by the lack of learning media or tools for studying microcontrollers, especially the Arduino Uno **[9].** According to Amelia Putri Wulandari and her friends, learning media can help teachers in conveying material so that students can be interested and interested in learning it; in research entitled The Importance of Learning Media in the Teaching and Learning Process, the researchers intend to create a learning tool about microcontrollers, especially learning about Arduino Uno **[10]**.

2. Method

The learning media that will be created is a sensor trainer consisting of a microcontroller, input components in the form of several sensors, and various output components. The research method used in the research is the Research and Development (R&D) research method. The stages of Research & Development are potential and problems, gathering information, product design, design improvement, product testing, and product revision. **Figure 1** is a process of cutting acrylic, drilling acrylic, and soldering component feet.

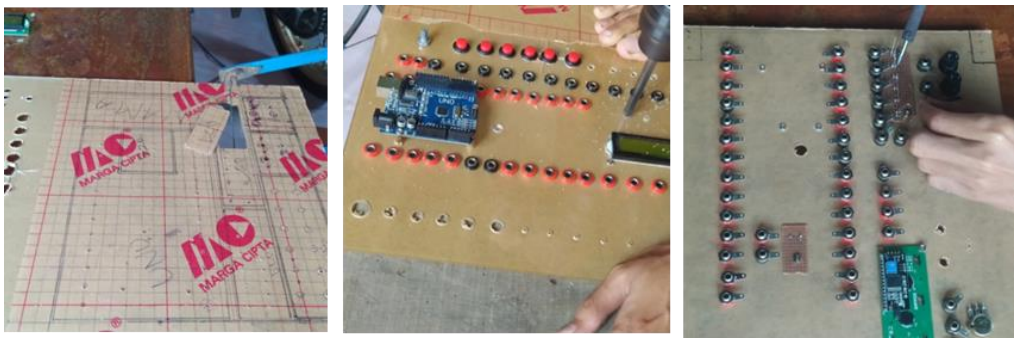

Figure 1. Process of Cutting Acrylic, Drilling Acrylic, and Soldering Component Feet

The product manufacturing process is made using acrylic material. Cutting the material using an electric grinder, then making holes for the components using an electric drill and acrylic saw. Acrylic cutting process according to design. The component slot maker uses an acrylic saw. The components that have been prepared are installed on the acrylic according to the design that has been made. Then the component legs are soldered and connected to the banana jack.

3. Results and Discussion

a. Results

The design and arrangement of components are done manually. Following are the design results of the trainer that was built. **Figure 2** presents the trainer design.

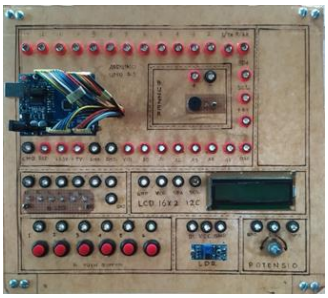

Figure 2. Trainer Design

The way the Arduino UNO R3 trainer works is that users can determine input and output within the limits of using existing components. Users can choose the cable installation route on the Arduino output pin by plugging the jumper cable into the jack hole provided. Next, the user performs programming in the Arduino IDE software then transfers the program data to the Arduino using USB Serial. To create another program and select other inputs and outputs, press the RESET button in the corner of the Arduino to avoid overlapping the program with the previous program. The component test is presented in **Table 1.**

Table 1. Component Test Table

No	Component Name	Function
1.	Arduino UNO	Arduino works well when transferring program data without any problems.
2.	*Push Button*	The push button functions in combination testing with the LED.
3.	Potentiometer	Potentio worked well when experimenting with adjusting the brightness level of the lit LED.
4.	LDR	The function in LDR testing works well by making the LDR an automatic switch for the LED.
5.	LCD	The LCD can light up and display displays according to the program.
6.	LED	All LEDs light up brightly following program commands.
7.	*Buzzer*	The buzzer can make sounds according to the program.

b. Discussion

Making the Arduino UNO R3 trainer using microcontroller components, sensors, Arduino UNO, push button, potentiometer, LDR, LCD, LED, and buzzer. Testing that the Arduino UNO can work well when transferring program data without problems. The push button functions in combination testing with the LED. The potentiometer worked well when experimenting to adjust the brightness level of the lit LED. The function in LDR testing works well by making the LDR an automatic switch for the LED. The LCD can light up and display displays according to the program. The buzzer can make sounds according to the program. Success in testing the components that make up the Arduino UNO R3 trainer proves that the tool can function and can serve as a learning media tool in microcontroller courses.

4. Conclusion

Based on observations and testing of the tool as a whole and in parts, it can be concluded that the Arduino Uno R3 Trainer is intended for students and beginners with limited

input push buttons, potentiometers, LDRs and LED LCD and buzzer outputs. Users can combine the limited components available on the trainer. Obstacles that often arise in using trainers are program errors and component damage.

The development of the Arduino Uno R3 Trainer is a valuable learning aid in the Electronics Study Program. It enhances hands-on learning experiences for students and facilitates practical experimentation with Arduino-based projects. The trainer contributes to improving students' understanding of electronics principles and Arduino programming concepts. Students can deepen their knowledge and skills in electronics and embedded systems through guided exercises and practical applications. Additionally, the development process of the Arduino Uno R3 Trainer involves considerations of functionality, usability, and educational effectiveness. The design and features of the trainer are tailored to meet the specific needs of the Electronics Study Program curriculum, providing a comprehensive learning platform for students.

Overall, the implementation of the Arduino Uno R3 Trainer represents a significant advancement in teaching and learning practices within the Electronics Study Program. It offers students valuable opportunities for hands-on learning, skill development, and practical experimentation, ultimately enhancing their educational experience and preparing them for future careers in the field of electronics.

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