Analysis of The use of Proteus Software as a Practical Learning Support

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ABSTRACT

This research aims to increase understanding of electronics and control systems practicum using Proteus software and practicum directly using electronic components. Proteus software is used to complement the limited equipment in the electrical laboratory and control laboratory. Data was collected using the success rateof cadets in increasing their practical understanding of electronics and control systems courses using Proteus software to complete the practicum using electronic components and simulators in learning from 16 meetings and added with UTS and UAS. The use of Proteus software for practical activities is based on the need to improve cadet skills which is based on the fact that around 76% of cadets who take part in electronics and control systems practicum do not understand electronic circuits because the practicum only uses a simulator board so it needs to be combined with Proteus software to better understand the material involved. given. Apart from the limitations of electronic component equipment, Proteus software is used. The results showed that using Proteus software, 97% of cadets were able to take part in this learning, which had a positive impact on learning outcomes and cadet activities.

KEYWORDS
Plumbing
Hot Water
Clean Water

1. Introduction

Proteus software is often used by electronic designers to assist in designing electronic circuits and then simulating them so that they can reduce errors or damage to electronic devices and components as a result of wrong connections or short circuits. The use of Proteus software is very helpful for lecturers and students in classroom learning for electronics courses in making electronic circuits that can be simulated using a computer or laptop and can be run on Windows 7 or 10. Proteus 8 software can be downloaded on the web with a file size that is not too large. about 157 MB large, then installed and the crack needs to be added [1], [2]. The ease of obtaining it can be used for learning at vocational campuses which focus more on practical activities. Along with the advancement of digital technology,computer software-based learning is no longer foreign to the world of education. Practical activities using Proteus software in the engineering department of the Indonesian State Maritime Polytechnic can be applied to control systems and electronics practicum courses. The Engineering Study Program at Polimarin is a study program in the field of engineering that focuses on electrical systems, operation and maintenance of machines used on ships. This study program provides educational provisions for cadets to become experts in the field of electrical engineering and ship machinery and can work in the shipbuilding and shipping industries. To carry out practical work on electronics and control systems, you don't have to use hardware, but you can also simulate electronic circuits using Proteus software with pictures and at the same time calculating the current flow and voltage. By simulating electronic circuits carried out on a computer, we can manipulate component values freely, we are also not afraid of component damage or equipment limitations, for example the unavailability of components or measuring instruments. In practical activities on electronics

and control systems, learning with simulations is very helpful. With the simulation in Proteus software, it can help educators overcome the shortage of electronic equipment and components in electronics laboratories and control laboratories by carrying out practicums with software for material where electronic components are not available so that practicums can be carried out directly in the laboratory and by using the software. proteus.

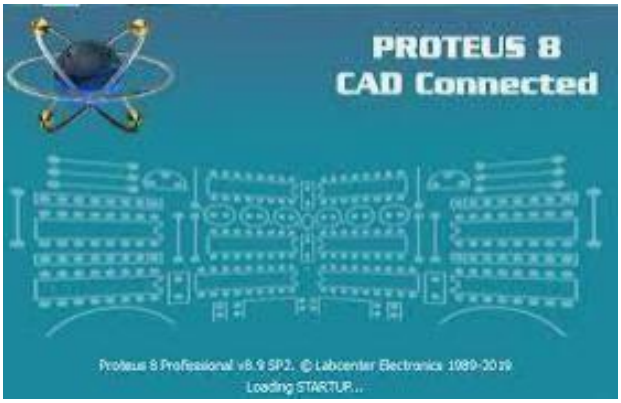

Fig. 1. Proteus 8 software [3]

Learning media using Proteus software has been widely applied in education as a means of improving the quality of education which is very important in the learning process. Practical learning activities for practical electrical circuits such as Ohm's law or Kirchofft's law are hampered by limited facilities and infrastructure, time and laboratory equipment. The limited equipment caused the practicum activities do not run well. Learning using a virtual laboratory is learning assisted by Proteus 8 professional software, which is a group of electronic simulation software used to assist educators in designing andsimulating electronic circuits. Directly, this software can be used on electronic circuit material with complete electronic components, thereby reducing deficiencies in the completeness of practical equipment in the laboratory, and this software can also be a learning medium in virtual laboratories without using external equipment, simply using a computer or laptop [4].

Proteus software is also used for practicum in interface engineering courses which teach about creating program designs and tool circuits with the Arduino UNOmicrocontroller and students are required to be able to analyze in making certain projects related to microcontrollers [5], [6]. Learning interface engineering courses using Proteus software can increase motivation and provide practical experience. By using Proteus software, you can reduce the potential for damage due to errors in assembling electronic circuits, thereby extending the life of electronic equipment used for practical work in the laboratory. Proteussoftware is easy for educators and students to learn to carry out microcontroller circuit simulation activities. Proteus software makes it easy to design a circuit in PCB form so thatit can be implemented into a system to minimize the occurrence of errors [7]. There are components that make up the minimum microcontroller circuit using Proteus software and the Arduino UNO microcontroller to form a control system [8].

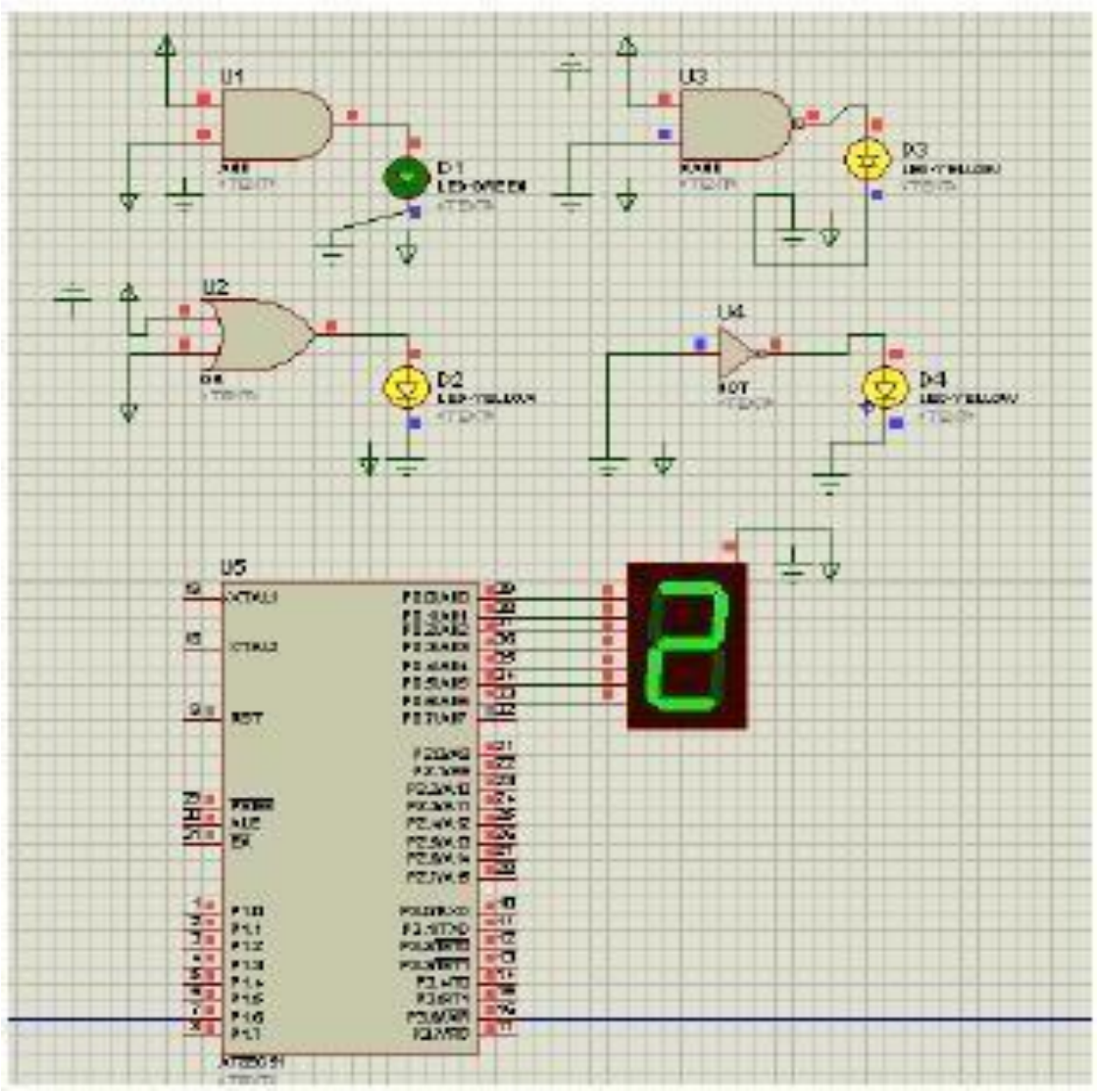

Fig. 2. Logic gate simulation [9]

Proteus software is very good for simulating electronic circuits because it is equipped with electronic components such as transformers, transistors, diodes, FETs, buttons, relays and contactors, digital ICs, amplifier ICs, Arduno as well as various measuring instruments such as voltmeters, ammeters, oscilloscopes, signals. analyzers, as well as frequency generators [10]. Monitoring solar panels can also be simulated using Proteus software which contains solar panels connected to a microcontroller. Components used include solar panels that are used to capture sunlight, batteries to store power, voltage sensors to detect the amount of voltage, LCD displays to display the current and voltage resulting from sensor readings, potentiometers to regulate the voltage, current sensors to measure the amount of current produced. , and Arduino as circuit control [11]. Proteus software is also used in learning digital systems material using NOT, OR, AND and NAND logic gates [6]. Meanwhile, with the seven segment display using the writer application, the truth table proof using the binary digital command can be proven directly with the display results via Proteus using the binary digital number commands 0 and 1.

The Proteus application is also widely used in electronics project simulations such as plant watering line follower robots, the aim of which is to carry out routine work of watering plants by means of the robot walking while watering the plants in its path [12]. Simulation using Proteus software on an Arduino-based automatic stadium roof using a rain sensor and LDR sensor. The LDR sensor will read bright and dark light conditions, theLDR sensor will also activate the stadium lights if conditions are dark, while the rain sensor will detect rain [13]. When it receives water droplets with a value of less than 300 RH which will be read on the LCD, the motor will activate and close stadium roof, but on the other hand, when the rain sensor receives water droplets of more than 300RH on the LCD, the stadium roof will automatically

open again [14]. Simulation usingProteus software on a robot that automatically feeds livestock to chickens, the aim of which is to carry out routine work to feed livestock chickens automatically at certain scheduled times [15]. Arduino UNO-based home security system by carrying out a simulation design on Proteus software to design and simulate the circuit and create a prototype design on the hardware implementation for analysis of the test results of the two designs. This series of home security systems uses the MQ-2 and DS18B20 sensors as fire detectors, the HC-SR501 as a movement detector indicating crime and a current sensor as an excessive current detector with buzzer, LED and relay output [16]. Proteus software learning media is used for practical work as a tool to design or describe a schematic of an electronic circuit. The Proteus software was used in accordance with the job sheet that had been created by the researcher [17].

2. Method

This research was carried out at the Indonesian State Maritime Polytechnic using computerlaboratory facilities to run Proteus software using quantitative research methods becausethe research data is in the form of numbers and analysis uses questionnaires. Careful observations were carried out to obtain research results that were in accordance with the panel's objectives, namely to obtain the success rate of using Proteus software for one semester for electronics and control systems courses in the Indonesian State Maritime Polytechnic engineering study program. The experiment carried out was a direct experiment by simulating electronic circuits using Proteus and Arduino in the application using a computer [18]. The sequence of research activities can be seen according to the chart below

Fig. 3. Research Flow

everal steps that must be carried out in the practical learning research stage using Proteus software include

1) Observation

This stage is the initial stage of research by carrying out an analysis of practical learning models that are suitable for control systems and electronics courses for Indonesian State Maritime Polytechnic cadets. Limited equipment such as Arduino, 16x2 LCD, timers and counters and other electronic components are obstacles that must be resolved so that cadets can understand the development of electronic components. Meanwhile, existing tools such as PLCs, resistors, automatics and hydraulics are already available in the laboratory so that practicums can be carried out in the control laboratory. Meanwhile, in the previous year, the Covid pandemic was also the background for this research, so practicum using softwarewas needed in online learning.

2) Literature Study

At this stage what is done is to look for journal reference sources and previous research that are relevant to previous research to dig up information and make comparisons with previous studies related to the use of Proteus software for electronics simulation.

3) Concept Determination

The steps at this stage include selecting media or looking for learning media that suits the needs of the subject matter and students. The media selected should increase student engagement and retention. Courses, topics, and student analysis inform changes to the media selected. This is useful for ensuring that students acquire the necessary skills. Format selection is done so that the format chosen is appropriate to the learning material. The presentation method is adapted to the teaching media.

4) Practical Design

The choice of format in developing electronics and control systems practicum is intended by designing the content of learning materials, selecting materials, designing electronic circuit simulations using Proteus software.

5) Implementation of Learning

During the practicum learning, the researcher carried out observation activities and documented them in the form of photos of the activities.

Fig. 4. Computer Laboratory

6) Data Processing

Data collection means recording data collection according to the assessment results in order to collect data, draw conclusions from test results, and analyze deficiencies in the framework that still need improvement so that it meets expectations.

7) Journal Publication

The final stage is the publication of research results in the form of a research journal.

3. Results and Discussion

3.1 Authors and Affiliations

Based on the analysis of the need for using Proteus software for practicums, it was found that there was a shortage of equipment and electronic components to support practicums for electronics and control systems courses. Proteus software helps to complete the shortage of electronic components so that practicums can be carried out in electronics laboratories and control systems laboratories using available electronic equipment or in computer laboratories using Proteus software [19], [20]. Based on the survey results, it was foundthat 22 cadets out of 29 cadets or 76% of cadets majoring in engineering who tookelectronics and control systems practicum did not understand certain materials such as adapter circuits and so on using simulators because they only took measurements while thecadets did not assemble the adapter circuit themselves. Due to the lack of existing equipment, the appropriate solution is to use Proteus software which can be combined withpracticum using an adapter simulator. According to cadet respondents, the practical use of PLC is clear enough that it does not need to be combined with using software.

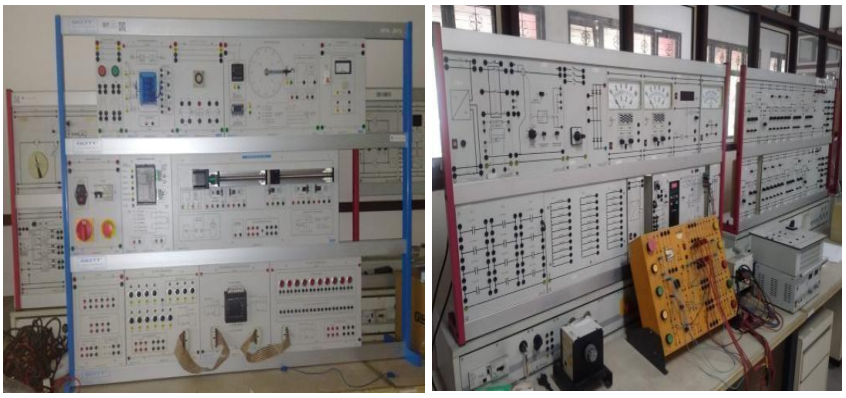

Fig. 5. Electronics and control system practicum using a simulator

Practical activities in electronics courses use electronic equipment which can be in the form of simulators which are formed from several types of electronic components and eachelectronic component has its own functions to form an electronic circuit. Competencies expected from this electronics practicum include being able to understand, assemble circuits, be able to calculate values, use multimeter and oscilloscope measuring instruments and analyze electronic circuit schemes such as transformer circuits, measuring resistor rings, analyzing series and parallel circuits, capacitors as voltage storage, diodes, transistors as amplifiers and switches, op-amps as inverting and non-inverting amplifiers, power supplies, logic gates, and so on. As technology develops, electronic components become more varied and the types are increasing. However, the basic components that make up electronic equipment such as transformers, resistors, capacitors, transistors, diodes, inductors and ICs are still used today. This electronic component consists of one or more materials that make up electronic components which consist of one or several material elements and when put together, to design an electronic circuit that is desired to function according to the function of each component, some are to regulate, strengthen current and voltage, equalizes current and voltage and many other functions.

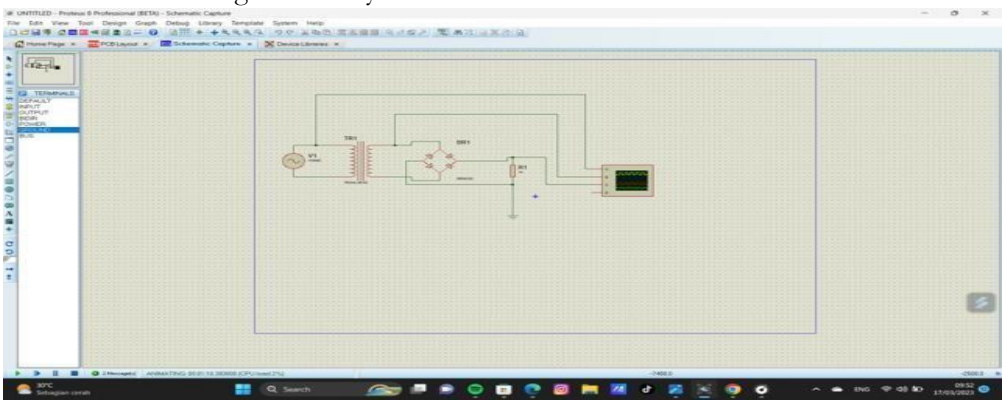

Fig. 6. Practicum using Proteus software

Introduction to sensors is needed such as thermocouple sensors, rotary encoder sensors, LDR sensors, smoke sensors, and ultrasonic sensors as basic knowledge later when working on ships. Thermocouple is a type of temperature sensor that is used to detect or measure temperature through two different types of metal conductors which are joined at the ends to create an effect [21]. Thermocouples are sensors that are commonly used in industry with various types including Type E thermocouples, Type J thermocouples, thermocouples. type K, type N thermocouple, type T thermocouple, type U thermocouple [22]. Apart from thermocouples, ultrasonic sensors are also widely used for applications to measure distance and speed of objects simultaneously by reflecting on walls or certain objects. Ultrasonic sensors are usually used to measure the depth of the sea, measure the distance to certain targets, detect an object in the sea so that ships can avoid the object. The light sensor or LDR (Light Dependent Resistor) sensor is useful for detecting the amount of light often found in street lighting so that it can save by detecting sunlight to determine. Savings on street lights can be made by sensors that work to detect the intensity level of sunlight to determine when the street lights are lit. general will be on, so that during the day the street lights will not turn on. Other sensors commonly used in industry are smoke sensors, proximity sensors and pressure sensors.

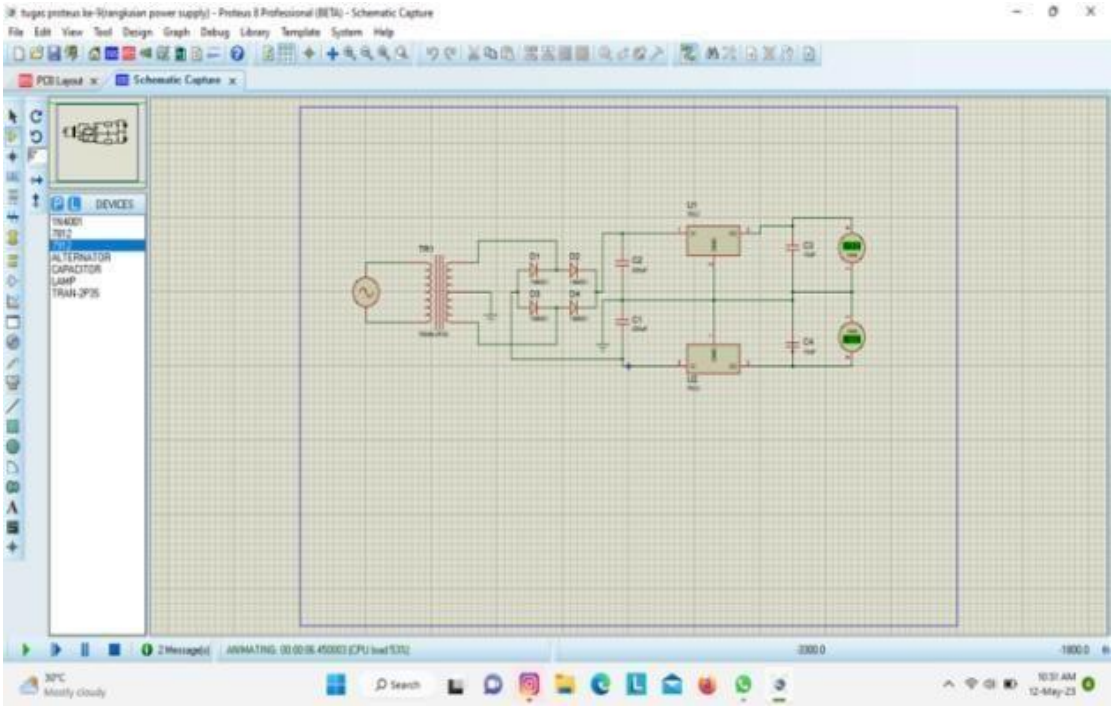

Fig. 7. Adapter circuit simulation using Proteus

The control system course is a course that studies open loop and close loop control systems,types of sensors and their applications in the system, control using relays and contactors, control and programming using Programable Logic control (PLC), control applications using the Proportional method, Integral and Derivative (PID), control using Arduino, andso on. The limited equipment available in the control laboratory and electronics laboratory means that the control practicum using a microcontroller is carried out using Proteussoftware. Due to the limitations of supporting equipment such as Arduino, control system practicum activities require control system learning innovation using professional Proteus 8 software media.

Learning about Arduino needs to be taught because many small industries use it because ofits complete function to be able to create a system to control a machine. Apart from that, it is cheap and widely available on the market. In order for this to happen, one medium that can help with Arduino learning is the Proteus 8 professional software medium. The completeness of the features in the Proteus 8 professional software makes it easier for teachers to simulate control system learning [23], [24], [25]. Along with advances in computer technology,learning based on Proteus 8 professional software technology is very suitable for learning about microcontrollers or Arduino.

The Arduino software contained in Proteus is an application that can help us in creating programs for a project. Arduino uses its own programming language which resembles C which can be written using the

Arduino IDE and then saved in the form of a .hex file for later uploading to Proteus. The Arduino programming language has been changed to make it easier for beginners to program. The use of Proteus software for learning activities is an effort to increase students' knowledge of microcontroller material by creating an Arduino application for writing on a 16x2 LCD. LCD (Liquid Crystal Display) 16x2 is a type of display media or display made from liquid crystal material as the main display. LCD 16x2 can display as many as 32 characters consisting of 2 lines with each line displaying 16 characters. On the Arduino, to control theLCD, the legs on the Arduino are connected to the LCD leg in the following order: Pin 1 of the Arduino is connected to leg 11 of the LCD or data 4, pin 2 of the Arduino is connected to leg 12 of the LCD or data 5, Pin 3 of the Arduino is connected to leg 13 LCD or data 6, Pin 4 of the Arduino is connected to leg 14 of the LCD or data 7, Pin 5 of the Arduino is connected to leg 6 of the LCD or enable leg, Pin 7 of the Arduino is connected to leg 4 of the LCD or Kali RS, and leg 5 of the LCD or RW is connected to Ground , After completing assembling the 16x2 LCD circuit, the cadets write their names and roll numbers in running text form as follows:

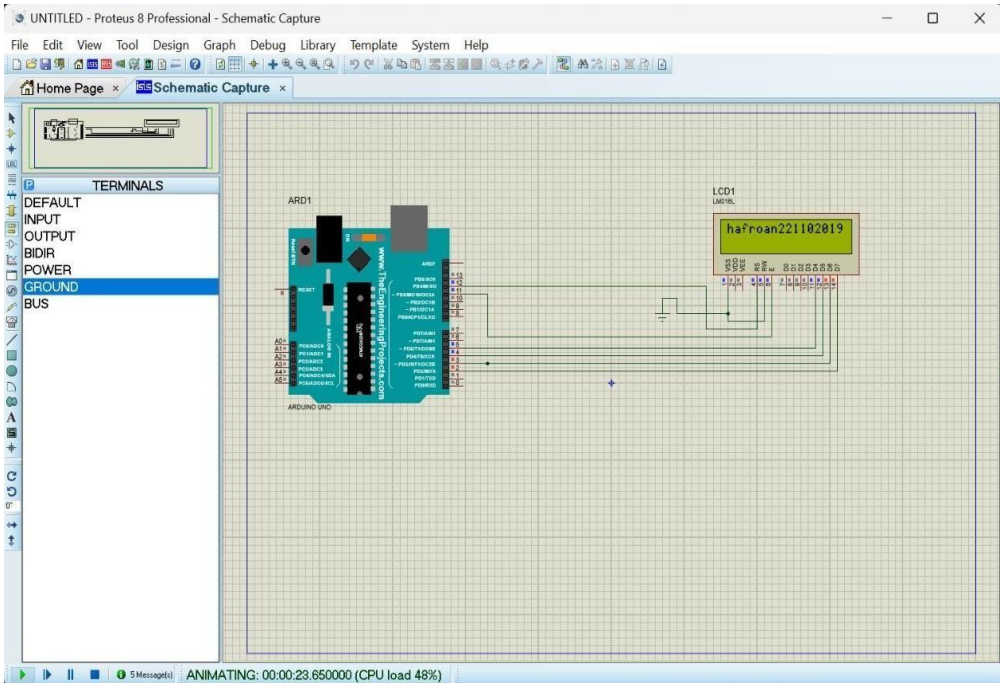

Fig. 8. Arduino simulation

Observation activities were carried out during one semester for 18 meetings consisting of 16 practicum meetings for electronics and control systems courses plus one mid-semester exam and one final semester exam. During the 18 meetings, a combination of practicum was carried out, namely using electronic components in the control laboratory and electronics laboratory as well as using Proteus software in the computer laboratory. Cadets were able to use the Proteus software to create a 16 x 2 LCD circuit using Proteus software. From the results of a survey conducted on cadets, 97% of cadets understood practicum using a combination method using Proteus software and practicum using electronic components in the laboratory.

4. Conclusion

Based on the results of the research that has been carried out, it can be concluded that the use of Proteus software is very useful for helping lecturers and students in carrying out practical learning for electronics and control systems at the Indonesian State Maritime Polytechnic, especially for material where electronic components are not available and is useful for general online learning. The practical course using the Proteus application increases cadets' understanding on the electronic equipment in the laboratory because students are not afraid to practice and assemble electronic components. Due to incorrectly assembling the components can cause short circuits.Acknowledgment

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