Miniature Applications PLC for Traffic Light and Intelligent Meticulous

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Abstract. Education is an important role in facing the era of globalization. Human resources are the key to competitiveness in the era of globalization later, therefore the education system must also be upgraded in order to produce human resources that are ready and able to compete for the sake of survival in the future. This paper discusses how to create media that can be useful as a teaching material in the world of education. The goal achieved in this research is to design the build-up of an educational media in Vocational High School (SMK) using Omron CP1E PLC. The method used is Research and Development, with steps including problem analysis, data collection, product design, and product testing. The results obtained that the learning media is in accordance with the planned design system with satisfactory results, based on trial application program.

1. Introduction
The Era of globalization like now many things to be prepared one of them is the quality of education. Vocational High School (SMK) is one form of formal education units are required to be able to follow the development of technology so as to produce graduates who are competent psychomotor, cognitive, and effective.

Students of SMK especially those who take Electrical Engineering Study Program are expected to have skill in using and program Programmable Logic Control (PLC) with better. Therefore, the skills of graduates in the field of PLC needs to be improved, so that graduates are able to compete and ready to work in the industrial world. Based on the results of the observations, control systems used in the industry are also still using the PLC system.

PLC is a special form of microprocessor-based controller that uses a programmable memory to store instruction and to implement function such as logic, sequencing, timing, counting and arithmetic in order to control machines and processes and are designed to be operated by engineering with perhaps a limited knowledge of computer and computing languages. PLC was created to replace automation systems that use hundreds or thousands of relays, PLC is designed as a control tool that has many input and output lines, operating ability at higher temperatures, immunity to electrical noise, and resistance to vibration. Programs are stored in a memory that is not easily lost. To help students to improve understanding of the PLC need an interesting media. Through this media, students are expected to be more active in following the learning.

Teaching aid is a means of channeling messages or learning information to be conveyed by the source message to the target or recipient of the message. In this case, the source message is the teacher and the
recipient of the message is a student. Limited media used in the class is thought to be one of the causes of the weak understanding of student learning [8, 9]. So in facilitating the problems that exist then this paper discusses how to design, create and test instructional media on applications of PLC usage. Where the planning is done in the form of applications from a traffic light and intelligent meticulously using PLC control system that can be used as a medium in the learning process.

2. Methods
In general the application of this instructional media is the same as the working system of the traffic light and the use of intelligent meticulously as we see in general, but is created as a miniature simulator. The stages of the method used can be seen in Figure 1.

![Flowchart research method](image-url)

**Figure 1.** Flowchart research method.
This research is focused on the design, assembly, and testing. The first stage is the planning stage, which is done by doing the circuit design process hardware using Microsoft Visio. The design of the hardware circuit that is done is the design of a series of traffic light media and intelligent meticulous. Figure 2 shows the design of the series of traffic light media while the Figure 3 is a series of media intelligent meticulously. It can be seen from Figure 2, the result of wiring design of traffic light media has four intersections.

| No | Name of equipment          | Explanation         |
|----|-----------------------------|---------------------|
| 1. | PLC                         | CP1E NA-20-DR-A     |
| 2. | Personal Computer           | Acer                |
| 3. | Acrylic                     | Thick 2 mm          |
| 4. | Plat Alumunium              | Thick 1 mm          |
| 5. | Push Button                 | 6 pieces            |
| 6. | Lamp Indicator              | 5 pieces            |
| 7. | Pilot Lamp                  | 12 pieces           |

**Figure 2.** The circuit of traffic light traffic wiring.
Figure 3. The circuit wiring of intelligent meticulous media.

Figure 3 is the result of wiring design intelligent meticulous media with five group intelligent meticulous light. The second stage is the design stage of program making, This PLC programming using Ladder language. Ladder diagram is one type of programming process control using PLC.

Figure 4. Design of ladder media traffic light diagram.
Figure 4. Cont.
Figure 4. Cont.

Figure 5 illustrates the traffic light program that has outputs in the form of lights from each intersection, and input as a reset.

Figure 5. The design of ladder media intelligent meticulous diagram.
Figure 5 shows the result of the design of program intelligent meticulous, the output of this program in the form of five lights and one buzzer and input of six push buttons. The third stage is to test the performance of learning media whether it is in accordance with the program and control system.

3. Results and discussion
The media is created with the concept of mobile. There are 2 boxes, the first box is a media box application of the use of PLC, while the second box is a PLC box. Why are two made to be used in other applications or using other types of PLC. There is a banana slot that functions as a control system assembly of a media application. Where if the program has been completed then the next step is to assemble the control system using jumper cable. If the control system set made in accordance with the program then the media should run.

Programming on the application of PLC traffic light and intelligent metric is using ladder language which ladder this diagram is one way to program the control process. Programming using ladder language programming language that uses a line diagram that displays the interconnection between input devices and output devices. The use of input output is actually in accordance with the program created by the user, and the control system to be assembled on the application media also adjusts to the input output used in the ladder program. At the time of the program design problems that occur is difficult to adjust the timer for each intersection of the traffic light itself. But overall the program created has been successfully completed and runs in accordance with the work of the media application.

The results of this study are obtained from testing every part of the media that has been made. The test is performed in accordance with the media usage procedure. Hardware testing is done by performing multiple tests on each component used. After the test has been done got results that all components contained on the media work well.

Software testing is done by testing to test the program on the PLC that has been made whether in accordance with the design. From the results of experiments, it can be taken the conclusion that the ladder program runs according to the initial plan of the program.

At this stage of testing, the stages are performed that assemble the control system on the ladder program using a jumper and test whether the program and control system run according to the program command or not. However, the problems often times occur when the media is not running because there are errors in assembling a control system and wiring.

4. Conclusions
We can conclude that the design of miniature PLC application for a traffic light and intelligent meticulous match with the planned system. The results obtained are the design of the hardware has been in accordance with the initial planning. Then, the design of ladder diagram program follows the working principles of each PLC application. And finally, the whole system of applications for the PLC is already running well based on trials that have been done on a regular basis.

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