

## **Control Structure Programming language (CPro) Trainer**

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DOI: <https://doi.org/10.30880/mari.2023.04.01.021>

Received 15 October 2022; Accepted 30 November 2022; Available online 15 January 2023

**Abstract** : Basic electrical circuit has been covered in most engineering field especially electrical and electronic engineering students. However, students in information technology fields only concentrated on theory part of programming language such as Visual Basic, Object Oriented Programming, C language and Python without using component of hardware devices. Control Structure Programming language (CPro) Trainer is attempt to bridge the gap between theory and real time hands-on for the circuit connection for engineering students and information technology students. CPro Trainer is a learning kit to help students and allow students directly learn programming language concepts that combine hardware and software by using an open source electronic prototyping platform which is an Arduino. Arduino consists of both a physical programmable circuit board and a piece of software that runs on a computer, used to write and upload computer code to the physical board. The main purpose of developed are to design a multipurpose function of Printed Circuit Board (PCB) that can be relate with internal and external module, provide a platform for students and lecturer to enable combine hardware and software in teaching and learning session such as Visual Basic Programming, Programming Fundamental, Object Oriented Programming, Python and Integrated Project courses. The methodology uses to build this application is using ADDIE model that involves five phases (Analysis, Design, Development, Implement and Evaluation). Arduino Nano has been used as the microcontroller that accepts input from Variable Resistor, Finger Print, Light Dependent Resistors (LDR), Individual Temperature Control (ITC), Digital Humidity and Temperature (DHT11/22) then processed the information from the inputs and produces corresponding outputs via LCD, buzzer, LEDs, Servo Motor and DC Motor. The result after implemented CPro Trainer during teaching and learning session shown that students can see the application of the program produced more clearly and effectively, Course Learning Outcomes (CLO) set in the Polytechnic curriculum are achieved and the use of visualization tools are able to increase students' interest and understanding while performing programming experiments.

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**Keywords:** Variable Resistor, Finger Print, Light Dependent Resistors (LDR), Individual Temperature Control (ITC), Digital Humidity, Temperature (DHT11/22), LCD, buzzer, LEDs, Servo Motor

## 1. Introduction

Control Structure Programming language (CPro) Trainer (**Figure 1**) is attempt to bridge the gap between theory and real time hands-on for the circuit connection for engineering students and information technology students. CPro Trainer is a learning kit to help students and allow students directly learn programming language concepts that combine hardware and software by using an open source electronic prototyping platform which is an Arduino. CPro Trainer is using Arduino Nano as a microcontroller. The microcontroller in this project, has been used as a digital system that has been widely applied in electronics industrial and technology. Microcontrollers (Arduino Nano) is chosen because of the affordable prices and it has Dicimila/Duemilanove has (electrically) with more analog input pins and onboard +5V AREF jumper [1]. Physically, it is missing power jack.

The Nano is automatically sense and switch to the higher potential source of power, there is no need for the power select jumper. Microcontrollers are usually used as control systems, signal processing, instrumentation, and others [2]. CPro trainer have been developed for multipurpose PCB that can handle more than one module and controlling by using software (Arduino). It combine internal and external module in input and output device. Arduino Nano has been used as the microcontroller that accepts input from Variable Resistor, Finger Print, Light Dependent Resistors (LDR), Individual Temperature Control (ITC), Digital Humidity and Temperature (DHT11/22) then processed the information from the inputs and produces corresponding outputs via LCD, buzzer, LEDs, Servo Motor and DC Motor. The purpose for developed this product is to to design a multipurpose function of Printed Circuit Board (PCB) that can be relate with internal and external module, provide a platform for students and lecturer to combine hardware and software in teaching and learning session such as Visual Basic Programming, Programming Fundamental, Object Oriented Programming, Python and Integrated Project courses.

This courses are available in Polytechnic Malaysia for Department of Information Technology and communication and Department of Electrical Engineering. Programming is core subject for information technology students. Most of programming students only concentrated on theory part of programming language without using component of hardware devices. However despite being important course for students, programming is a challenging course for both student and lecturer. Factors that contribute to students performance can be generally divided into two which are internal and external factor [3]. Internal factor that are inherent in a student such as motivation and capability [4]. External factors are factors that are indirectly attributed to the student and the student has no control over such as the learning environment, method and tools [5]. Based on this statement, CPro trainer is attempt to bridge the gap between theory and real time hands-on for the circuit connection. This method, will help students to build creativity, increased motivation, gain experience in hardware components where they can see output in real time, improves logical thinking in coding and also can help students to develop resilience through troubleshooting hardware and software in order to find a correct output or solution.

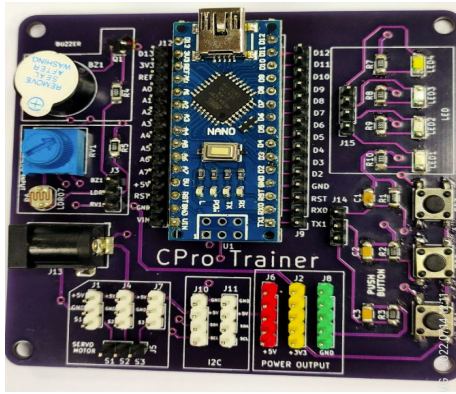


Figure 1: Control Structure Programming language (CPro) Trainer

## 2. Materials and Methods

Arduino Nano has been used as the microcontroller that accepts input from Variable Resistor, Finger Print Light Dependent Resistors (LDR), Individual Temperature Control (ITC), DHT11/22 Digital Humidity and Temperature. Microcontroller produce corresponding output via Liquid Crystal Display (LCD), Buzzer, Light Emitting Diode (LED), Servo Motor and DC Motor. **Figure 2** show the schematic diagram of the CPro Trainer which was drawn using Proteus 8 Profesional. **Figure 3** show the 2 layer PCB layout of CPro Trainer. 2 layer PCB is chosen to get high level engineering tool for board and increase functionality of CPro Trainer board. It will provide high capacity and high speed in a smaller footprint. **Figure 4** show 3D view (front) of CPro Trainer that have been developed. Software use to control input and output devices are Arduino. Arduino is an open source microcontroller which can be easily programmed, erased and reprogrammed at any time [6]. Control structure and looping that have been used by CPro Trainer have been programmed by Arduino. **Figure 5** show the program code (sketch) of CPro Trainer.

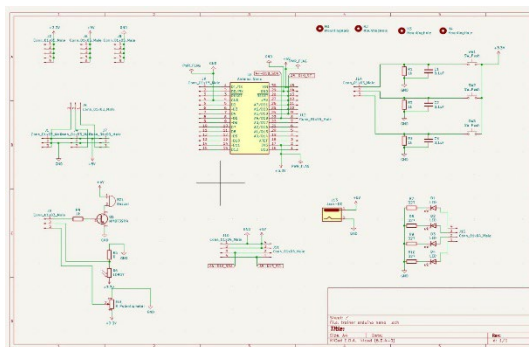


Figure 2: Schematic diagram of CPro Trainer

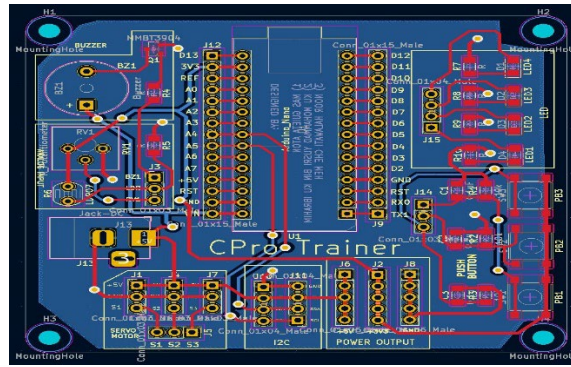


Figure 3: PCB of CPro Trainer

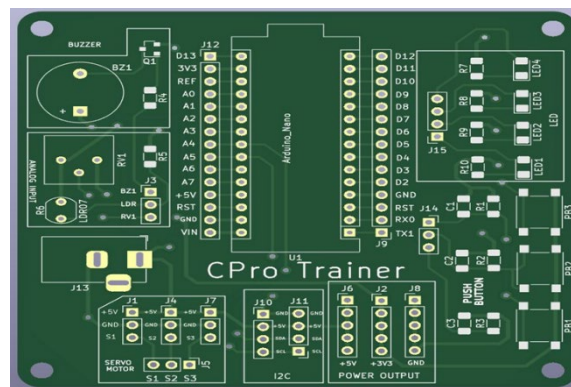


Figure 4: 3D view (front) of CPro Trainer



Figure 5: 3D view (front) of CPro Trainer

### 3. Results and Discussion

CPro Trainer was successfully assembled and implemented for Information Technology and Electronics students in Politeknik Tuanku Syed Sirajuddin as shown in **Figure 1**. **Table 1** shows the example of result obtained using fingerprint, LED, switch button, DHT 11/22, LCD and buzzer.

**Table 1: The result obtained from CPro trainer**

No	I/O devices used	Scenario	Result obtained
1	Finger print	Set more than one user for fingerprint detected.	Success and able to identified fingerprint based on user.
2	Finger print and LED	User scan the finger print and set LED is on.	Success and LED is on when button is press.
3	Switch and Buzzer	Push button on with Buzzer indication	Success and Buzzer is beeper when press the button.
4	Switch and LED	Push button on and LED is on	Success and LED is on when press the button.
5	DHT 11/22 and LCD	Show the temperature and humidity by using LCD.	Success showing the temperature and humidity at LCD.

#### 4. Conclusion

Developed and implemented of CPro Trainer during teaching and learning session shown that students can see the application of the program produced more clearly and effectively, Course Learning Outcomes (CLO) set in the Polytechnic curriculum are achieved and the use of visualization tools are able to increase students' interest and understanding while performing programming experiments. Beside that, it is beneficial for final year students in Politeknik Tuanku Syed Sirajuddin, exposing them to get an idea on a product development to complete their diploma.

#### Acknowledgement

The authors would also like to thank the unit of It and electrical, Politeknik Tuanku Syed Sirajuddin, Malaysia for its support.

#### References

- [1] Arduino Nano. Available at: <https://www.arduino.cc/>. 2019
- [2] S. Bo and W. Li, "Shenzhen pp", in International Conference on E-Health Networking Digital Ecosystems and Technologies (EDT) Shenzhen, pp. 375–378, 2010.
- [3] H. Aris, "Improving students performance in introductory programming subject: A case study", 10th International Conference on Computer Science and Education, ICCSE 2015, (July), pp. 657–662, 2015, Available at: <https://doi.org/10.1109/ICCSE.2015.7250328>.
- [4] A. Carbone, J. Hurst, I. Mitchell, and D.G. "Volume 95, ser.", in ACE '09. Darlinghurst, Australia, Australia: Australian Computer Society, pp. 25–34, 2009.
- [5] UKEssays, Factors affecting programming anxiety amongst students education essay., UKEssays, 2013.
- [6] L. Louis, "Working Principle of Arduino and Using it as a Tool for Study and Research", International Journal of Control, Automation, Communication and Systems, 1(2), pp. 21–29, 2016, Available at: <https://doi.org/10.5121/ijcacs.2016.1203>.