



Experimental kit control sensors by PLC

メタデータ	言語: English 出版者: 公開日: 2020-10-28 キーワード (Ja): キーワード (En): Lab Sheet, Sensors, PLC 作成者: Bunjittum, T., Toosrithong, T., Promsaranee, S., Chuenkul, C., Ngamlamai, S. メールアドレス: 所属:
URL	http://hdl.handle.net/10458/00010055

Experimental kit control sensors by PLC

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Abstract

This research presents the construction and efficacy of experimental kit control sensors by PLC. The research instruments were as follows: 1) Experimental kit and worksheet 2) Test to measure academic achievement 3) Questionnaire of the student opinions. 20 people were sampled from undergraduate students. Electronics Engineering, Faculty of Industrial Education and Technology. They take exams before and after practice. To compare it with pre-test and post-test scores by t-test and to determine the efficacy of the experimental kit by $E1 / E2$. Has higher post-test scores than pre-test, 0.05. The efficacy of the experimental kit was 84.50 / 82.25. This means that the experimental kit was more effective and the learner performed higher.

Keywords: Lab Sheet, Sensors, PLC

1. Introduction

In present day, industrial plants use a control system for production of conveyor belts. By using an automatic control machine, PLC [1] In industrial applications, sensors are a key factor in the development of control systems because they can be set and modify quickly. It is also possible to increase the number of inputs or outputs such as photoelectric sensors and inductive proximity sensors. In the teaching and practice of PLCs. Teaching materials are an important [2]. Currently, the teaching and practice materials of PLCs in some educational institutions are not still used together between PLC and sensors For this reason, the concept was to create experimental kit control sensors by PLC as a teaching medium for learners to learn the whole diagram ladder writing theory for controlling sensors through PLC.

2. Related Theory and Research

In this study, researchers study the theory and principles, including relevant documents. Learning and

the development of learning media. Participants in the meeting provided a detailed introduction and the following topics.

2.1 Laboratory Sheet

Chusak Plengphu [3] Laboratory Sheet refers to the document used as an order to perform work. Or as a suggestion for the learner to be able to carry out the experiment according to the specified objectives There are no limitations in size and content. Depending on the content used in the experiment, a work may be small, less lengthy, or a large worksheet that is 10 or more pages long. Depending on the content of the experiment The behavior that needs to be improved And basic information that is necessary for learners to perform experiments.

2.2 Quality

Sittichai Inmang [4] Tests are a tool to measure the behavior of learners. If the test is of good quality, it will result in a quality study as well. The quality of the test involves key components such as Validity, Reliability, Difficulty and Discrimination.

2.3 Experimental efficiency

Saowanee Sikkha Bundit [5], Chaiyong Phromwong [6] Determination of the Efficiency of Educational Innovation. This examines whether the innovations created, whether media, devices, or methodologies can be used effectively or not. It consists of 2 main parts: Process efficiency (E_1) and outcome efficiency (E_2)

2.4 Content used to create experiment kit

Basic Programmable logic controller (PLC)

Nowadays, PLCs has replaced relay circuits because PLCs are easier to use and can be connected directly to input / output devices [7]. Besides that, just write a driver, Ladder diagram [8]. It can be used immediately. If you want to change the conditions, you can change the program only. The PLC can also be used with other

devices such as barcode readers, printers and REIF systems, etc. [9].

Sensors

1. Inductive Proximity Sensor is a sensor that works based on the principle of changing the inductance of the coil. Which such changes will only affect workpieces or metal objects [10].

2. Photoelectric Sensor is a sensor that uses a beam of light to detect an object without having to touch it. There is a special feature. There is a quick response. Long detecting distance.

Direct Current Motor is any of a class of rotary electrical motors that converts direct current electrical energy into mechanical energy. The most common types rely on the forces produced by magnetic fields. Nearly all types of DC motors have some internal mechanism, either electromechanical or electronic, to periodically change the direction of current in part of the motor [11].

Solenoid is an electromagnetic device that converts electrical energy into kinetic energy. The

solenoid is a coil that is wrapped around a cylindrical core. Within the core there is an iron core that can move, when electric current passes through the coil, it forms a magnetic state [12].

The Conveyor Belt System consists of two or more pulleys with a closed loop of carrying medium. One or both of the pulleys are powered, moving the belt and the material on the belt forward. Industrial classes of belt conveyors; in general material handling such as those moving boxes along inside a factory and bulk material handling [13].

2.5 Measurement and evaluation tools

Measurement refers to the attribute measurement of a person from the results of answering questions in a test form according to the rules [14]. Evaluation is systematic process that draws data from measurements to evaluate and judge the student's value. Measurement and evaluation is a continuous process [15] [16].

2.6 Research model

In this research, we will discuss the details of the One Group Pretest- Posttest Design, which has the advantages of convenience and ease of control through pre-canal testing [17].

2.7 Related Research

From the study of research related to the experimental set of sensor control via PLC. The researcher has summarized the research results as follows.

Arthit Kongna and team [18] conducted research on the PLC experiment set. This is to create and study the

efficacy of PLC experiments.

Kittipong SudAnurak and team [19] researched the design of experimental set of machine control with PLC system.

Kusuma Sibmaetae [20] has done research on the experimental set of PLC motor control. For students at the vocational certificate in power electrician This research presents the construction of a PLC motor control experiment.

Tevinta Wongsawat [21] has conducted research on the development of a preliminary PLC experimental kit. And touch screen. By bringing content related to basic PLC applications and touch screen such as basic Ladder Diagram writing, PLC control

Kantaphon Pliewthaisong [22] has conducted research on conveyor belt automatic sorting machine. It is the invention of the automatic object sorting machine based on the conveyor belt.

3. Research Operations

Population and sample are undergraduate students. King Mongkut's University of Technology Thonburi, Faculty of Industrial Education and Technology. Department of Electrical Technology Education in Electronics Engineering Registered in course Electronic Technology Laboratory 2 (ECE386), 20 people.

In the design of the experimental series that will be associated with the content of the research. Install the prepared equipment on the base of the prepared trial kit. [23]



Fig. 1. when the equipment is installed

Write ladder diagram through a program on your computer. After that, apply the trial set to the sample group for the trial set performance. [24]

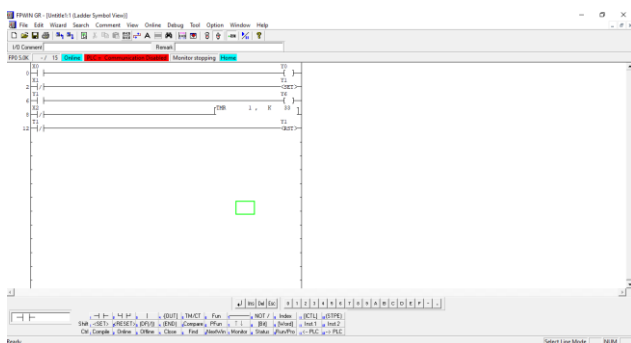


Fig. 2. Ladder diagram circuit design through a program on a computer

I. RESEARCH RESULTS

4. Research Results

Analysis of test results based on expert opinions.

The expert opinion was between 0.00-1, standard deviation (SD) 0.09 with mean score of (X) 0.97, indicating that the expert opinion of the test was consistent with the objective.

Analysis of the exam corresponds to the desirable competencies of the experts.

Table 1: Shows the Difficulty (P), Discrimination (D) and Reliability (r)

Difficulty) P)	Discrimination) D)	Reliability) r)
0.82	0.13	0.29

Analysis for student achievement.

Table 2: Shows Analysis of The Effectiveness of Experimental Kits

Items	Number of learners	Total score	Average score	Percentage
Score from the test at the end of worksheet	20	1690	84.50	84.50
Post-study test scores	20	329	16.45	82.25

Analysis for student achievement.

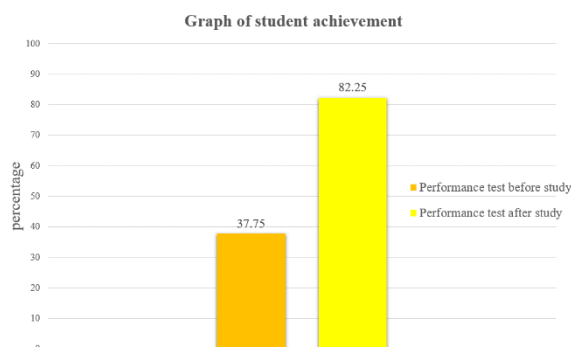


Fig. 3. Shows the Learning Achievement of Learners

Form fig 3, it was found that the sample group who took the pre-study test got a total score of 151, the learning achievement before the study process (E-pre) was 37.75, and the sample group who did the test after the study had a total score of 329. The achievement after the study process (E-post) was 82.25 and when the results were obtained to find the learning achievement of the sample. Had an academic achievement of 44.50 indicating that the students had higher academic achievement.

5. conclusion

The results of the development of experimental kit control sensors by PLC, including the development of experimental worksheets for the practice of controlling sensors by PLC. By analyzing the content from the course description and select the content to be used in teaching experiments, the number of 3 worksheets are 1) Boolean Diagram instruction set program 2) Program set program SET, RESET 3) Timer and Counter instruction set program. The efficiency (E1) was 84.50 and the score of the achievement test (E2) was 82.25, so the efficiency of the trial (E1 / E2) was 84.50 / 82.25 Which is higher than the 80/80 standard set out in the hypothesis.

The results of creating a test to measure academic achievement and found that the test had an average difficulty (P) of 0.82. Which shows that the test There is an easy difficulty value. The average classification factor (D) was 0.13, indicating that the test had a good level of classification power. This test was able to separate learners with different knowledge and the confidence (r) of the whole test was 0.29, indicating that this test had a moderate level of confidence. Therefore, overall, this set of academic achievement tests is appropriate to be used to measure the learning performance of the sample.

The results of comparing the learning achievement of the practice, when comparing the mean score, it was found that the pre-training mean score was 7.55, standard deviation 1.96 and the mean test score after training was 16.45, standard deviation 1.50. Practice learned with a trial set and worksheets on Sensor control via PLC That



has developed with the achievement of practical training Increase which is based on hypothesis.

Acknowledge

This project was partly supported by Department of Electrical Technology Education, Faculty of Industrial Education and Technology at King Mongkut's University of Technology Thonburi (KMUTT), Thailand.

Reference

- [1] Ittipon Laoprom, 2013, Construct and efficiency study of automatic fluid filling control system by PLC, Bachelor's thesis Department of Electrical Engineering Faculty of Engineering King Mongkut's University of Technology Thonburi.
- [2] Boonlua Thonglam, 1998, Utilization of instructional media, 9th edition, Ramkhamhaeng University Press, Bangkok, page 26.
- [3] ChuSak Plianphu, 2002, "Workshop and Laboratory System Development", Teaching documents, Department of Electrical Education Faculty of Industrial Education and Technology King Mongkut's University of Technology Thonburi
- [4] Sittichai Inmung, 2015, A quad-rotor helicopter training set, Master of Industrial Education Thesis Department of Electronics Faculty of Industrial Education King Mongkut's University of Technology Ladkrabang, page 29-31.
- [5] Sowwanee Sikkhabandit, 1985, Educational technology, Bangkok: King Mongkut's Institute of Technology North Bangkok.
- [6] Chaiyong Brahmawong, 2013, "Media performance testing or teaching suite", Silpakorn Educational Research Journal, Vol5 , No 1 (January - June 2013), Page8 .
- [7] Nirut Wanyato, 2017, ADVANCE [Online], Available : <http://www.advanceelectronic.com/blog/detail/113/th/html> [14 February 2017]
- [8] Siwapong Thisopha, 2012, Electronic [Online], Available : <https://elec-thai.blogspot.com/2012/12/plc.html> [14 February 2019].
- [9] Mitsubishi electric, 2016, Learn through the Relay Sequence Your First PLC for beginners, MITSUBISHI ELECTRIC CORPORATION, Bangkok, Page 80-90.
- [10] PSP TECH, 2014, Proximity sensor [Online], Available : <http://www.psptech.co.th/proximity-sensor-17211.page> [14 February 2019].
- [11] PSP TECH, 2016, What is a motor? [Online], Available : <http://www.psptech.co.th/Motor.page> [14 February 2019].
- [12] Phansak Phutthimanitphong, et al. 2556, Industrial Electronics, Vocational Promotion Center Press, Bangkok, Page 117.
- [13] Heiphar, 2559, Belt Conveyor System [Online], Available : <http://heiphar.blogspot.com/2014/08/belt-conveyor.html>[14 February 2019].
- [14] Somchai Ratanathongkam, 2013, "Educational Measurement and Evaluation", Teaching Document, Department of Physical Therapy. Faculty of Medical Technology Khon Kaen University.
- [15] Paisan Suwannoi, 2002, "Educational Measurement and Evaluation", Instructional Development Manual, Khon Kaen University.
- [16] Santi Ngamsereth, 2017, "Building an Academic Achievement Exam", Academic Journal of the Royal Thai Naval Academy, Vol 4, No 1 (January - December 2017), pages 50-57.
- [17] Sumalee Chanchalo, 2011, "Summary of Research Methodology", Teaching Materials, King Mongkut's University of Technology Thonburi.
- [18] Athit Khongna, Amornthep Kirinpharadon, Natcha Luesamphan, 2013, Trial Set PLC, Bachelor's Thesis Electrical Technology Department Faculty of Industrial Education and Technology King Mongkut's University of Technology Thonburi.
- [19] Kittipong Suduruk, Jakaphon Jakmanon, Warut Pakkhetanang, 2012, Design of an experimental set of machine control with PLC systems, Bachelor's thesis. Department of Electrical Engineering Faculty of Engineering King Mongkut's University of Technology Thonburi.
- [20] Kusuma Sib Mae Tha, 2013, PLC Motor Control Experiment Kit For students at vocational certificate in power electrician, Bachelor thesis Department of Electrical Engineering Faculty of Industrial Education and Technology King Mongkut's University of Technology Thonburi.
- [21] Devinta Wongsawat, 2015, Development of a preliminary PLC experimental kit. And touch screen, Bachelor's thesis Department of Electrical Engineering Faculty of Industrial Education and Technology King Mongkut's University of Technology Thonburi.
- [22] Kantaphon Pliew Thaisong, 2014, "Conveyor Belt Automatic Sorting Machine", Research Journal, Vol 7, No 1 (January - June 2014), Pages 88-96.
- [23] Luan and Angkhana Saiyos, 1998, Techniques for creating and examinations for academic aptitude, Bangkok.
- [24] Boonchom srisaard, 2013, Preliminary Research, 9th edition, Suwiriyasas, Bangkok, pages 99-100.