International Journal of Electrical and Electronics Research ISSN 2348-6988 (online)
Vol. 8, Issue 2, pp: (50-52), Month: April - June 2020, Available at: www.researchpublish.com

DEVELOPMENT OF DC MOTOR CONTROL SIMULATOR TRAINER BASED ON ELECTROMECHANICAL RELAY

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Abstract: **The purpose of this research is for the students of engineering, especially electrical, mechanical and electronics to have a laboratory equipment that can prepare the newly graduates of the said courses. The trainer will enhance their practical skills specially using relays as substitute to PLC, which is a common skill needed in the industry. Mixed method was used in the study since the research is both qualitative and quantitative: the researchers needed to use one method (based on electromechanical relays) to inform another method (based on PLC). This study wants to elaborate, clarify, or build on findings from other methods. The results show that the research prototype got high scores of approvals in terms of functionality and reliability in both testing conducted by the researchers and evaluated by the professional and student respondents. It has a grand mean of 4.92 for functionality, and scoring 4.88 for reliability. Hence, it can be concluded that the prototype can function properly and is reliable for the students to acquire the said important skills needed in the industry. It is recommended to improve the components of the prototype such as its motors and the quantity of timer.**

Keywords: **DC Motor, Prototype, trainer and skills.**

I. INTRODUCTION

Students nowadays learn faster and are able to easily comprehend and retain their knowledge for longer period when they see the experiments being performed in front of their eyes. This is why laboratories in schools are implemented. Experts have always believed that the laboratory is an important means of instruction in education since late in the 19th century. Laboratory instruction was considered essential because it provided training in observation, supplied detailed information, and aroused pupils' interest. These same reasons are still accepted almost 100 years later.

Shulman and Tamir, in the Second Handbook of Research, listed five groups of objectives that may be achieved through the use of the laboratory in science classes:

- skills - manipulative, inquiry, investigative, organizational, communicative
- concepts - hypothesis, theoretical model
- cognitive abilities - critical thinking, problem solving, application, analysis, synthesis
- understanding the nature of science - scientific enterprise, scientists and how they work, existence of a multiplicity of scientific methods, interrelationships between science and technology and among the various disciplines of science
- attitudes - for example, curiosity, interest, risk taking, objectivity, precision, confidence, perseverance, satisfaction, responsibility, consensus, collaboration, and liking science.

II. RESULTS AND DISCUSSIONS

Evaluation of the System

The evaluation form was intentionally made by the researchers and was validated by a statistician, who also interpreted the results. The survey's objective was to evaluate the trainer's functionality and reliability. Under functionality test was the trainer's functional completeness, correctness and appropriateness. On the other hand, reliability test covers maturity, availability, fault tolerance and recoverability.

Table 2.1: Evaluation on Reliability According to the Student Respondents

Indicators on Functionality	Mean	Std. Deviation	Interpretation
1. The DC Motor Control Simulator Trainer functions properly under normal operations especially in laboratory experiments.	4.93	0.26	Strongly Agree
2. The DC Motor Control Stimulator Trainer is convenient for executing experiments during laboratory schedules. The project is made exclusively for Motor Control Related subjects.	4.93	0.26	Strongly Agree
3. The DC Motor Control Simulator Trainer tends to work under minimal failures due to wrong connections.	4.87	0.52	Strongly Agree
4. The DC Motor Control Simulator Trainer has a circuit protection and possible for future maintenance.	5.00	0.00	Strongly Agree
Overall Evaluation on Functionality	4.93	0.00	Strongly Agree

Note: 5.00 – 4.20 Strongly Agree 4.19 – 3.40 Agree 3.39 – 2.60 Slightly Agree

2.59 – 1.80 Disagree 1.79 – 1.00 Strongly Disagree

Table 2.2: Evaluation on Reliability According to the Professional Respondents

Indicators on Functionality	Mean	Std. Deviation	Interpretation
1. The DC Motor Control Simulator Trainer functions properly under normal operations especially in laboratory experiments.	4.67	0.52	Strongly Agree
2. The DC Motor Control Stimulator Trainer is convenient for executing experiments during laboratory schedules. The project is made exclusively for Motor Control Related subjects.	5.00	0.00	Strongly Agree
3. The DC Motor Control Simulator Trainer tends to work under minimal failures due to wrong connections.	4.83	0.41	Strongly Agree
4. The DC Motor Control Simulator Trainer has a circuit protection and possible for future maintenance.	4.83	0.26	Strongly Agree
Overall Evaluation on Functionality	4.83	0.12	Strongly Agree

Note: 5.00 – 4.20 Strongly Agree 4.19 – 3.40 Agree 3.39 – 2.60 Slightly Agree

2.59 – 1.80 Disagree) 1.79 – 1.00 Strongly Disagree

III. CONCLUSION

1.The design of the Simulator Trainer were precisely measured to achieved aesthetics and provide also an educational tool to students who will use the Simulator Trainer. The Simulation of the PLC is done through comparing via Relay Logic Circuit that is known as the Ladder Logic Diagram, found out and justifies that the Simulator Trainer is adequate to be a educational tool, marking with high scores or attaining "strongly agree" through statistics gathered for evaluation procedures.

2.The Simulator Trainer runs in a 24V DC power supply with a fuse to be able to protect the components from being damage if a short circuit occurs while conducting experiments, and as part of its maintenance. The Construction of the Simulator Trainer, has undergone visual inspection check and concluded through inspection report that the Simulator Trainer have passed its inspection check and it is qualified for demonstration process for executing experiments.

3.The Testing and Evaluation for its Reliability and Functionality have undergo through inspection check and evaluation process.

4.The Resistance testing and Component Functionality Testing of the Simulator Trainer has achieved through numerous times of testing. In order for the components to work properly, the output terminals undergone continuity test and perform an energized test in which some components are situation to be supplied by a 24V DC Power Supply in order to perform its distinct function. Thus proceeding to Continuity Resistance Test as per the provision Electrical standards (IEC 60228), the results are expected to be "qualified" as a functional equipment provided that the average ohmic values are lesser than the accepted ohmic values in which results to passed the continuity resistance test and the reliability test were procured to as short circuit test, the trainer has undergone to a worst case scenario, short circuit. Conducting short circuit different types of rated fuse, the components were remain unharmed or damage during short circuiting and the power supply are still functioning as it is. Then, proceeded to determining the adequate rating for the protective device with the latest provision of PEC to ensure proper protection for the circuit as well.

5.The Evaluation for its Reliability and Functionality, the Simulator Trainer has underwent through multiple evaluation and the subjects who are able to perform experiments has given the simulator trainer high remarks for its reliability and functionality as an educational tool related to Motor Control and thus also they engages themselves to participate in doing such experiments.

6. The Laboratory Manual is design for its user-friendly and will be able to educate the students without the supervising instructor and also the experiments can be created in different wiring diagrams through the students experience and knowledge about ladder logic diagram.

REFERENCES

[1] Lloyd L. Tejano. (2018). Programmable Industrial Motor Control Trainer retrieved from International Research Journal of Engineering and Technology (IRJET) Vol. 5 Issue 7

[2] Endryansyah, Puput Wanarti Rusimamto, Adam Ridianto, Hariyadi Suglarto (2018). Development of Servo Motor Trainer for Basic Control System in Laboratory of Electrical Control System Faculty of Engineering Universitas Negeri Surabaya retrieved from IOP Conference Series: Material Science and Engineering 336

[3] Ibrahim Burhan, Rosmawati Othman, Ahmad Aftas Azman. (2016). Development of Electro Pneumatic Trainer Embbed with Programmable Integrated Circuit (PIC) and Graphic User Interface (GUI) for Educational Applications retrieved from 2016 IEEE International Conference on Automatic Control and Intelligent Systems

[4] Stephen L. Hernan (2010), Industrial Motor Control 9th Edition

[5] Vitaliy Sigarev, Tatiana Kuzmina, Alexey Krasilnikov (2016). Real Time Control System For A DC Motor

[6] Rifdian Indrianto Sudjoko, Purwadi Agus Darwito (2017). Design and Simulation of Synchronous Excitation System Using Buck Booster Converter at Motor Generator Trainer Model LEM-MGS. Retrieved from 2017 International Conference on Advanced Mechatronics, Intelligent Manufacture, and Industrial Automation.

[7] Basic of Electricity: Basic of Control Components (nd)

[8] Principle of Insulation Testing (nd)

[9] Jones and Bartlett (2015), Ugly's Electrical Reference 2014 Edition

[10] Petruzella (2010), Electric Motor and Control Systems

[11] Stephen J. Chapman (2012), Electric Machinery Fundamentals 5th Edition