INTERNATIONAL JOURNAL FOR INNOVATIVE RESEARCH IN MULTIDISCIPLINARY FIELD
ISSN(O): 2455-0620 [Impact Factor: 9.47]
Monthly, Peer-Reviewed, Refereed, Indexed Journal with IC Value : 86.87
Volume - 10, Issue - 5, May - 2024

DOIs:10.2015/IJIRMF/202405018 --:-- Research Paper / Article / Review

Construction and Evaluation of Manually and Programmable Logic Controller (PLC) Operated Industrial Motor Control Trainer

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Abstract: *The main purpose of this research study is to construct and evaluate a* Manually and Programmable *Logic Controller (PLC) Operated Industrial Motor Control Trainer to address the dearth of electrical equipment in Electrical Technology under the program of BS Industrial Technology and followed an orderly process of designing, constructing, testing and evaluation. A manually – operated and PLC ready motor control trainer can be designed and constructed out of resources and locally available materials. The level of acceptability of the trainer in terms of design and durability, functionality, safety and maintenance, and economy and cost as perceived by the two groups of respondent was Strongly Agree. The developmental and descriptive methods of research were used with the survey questionnaire as the main gathering instrument. The study used the Five-Point Likert rating scale. Instructor/professor and electrical engineer/electricians respondents evaluated the acceptability of Manually and Programmable Logic Controller (PLC) Operated Industrial Motor Control Trainer. The statistical tools used in the study were weighted mean. The activities that can be conducted on the trainer includes connecting, installing and troubleshooting manual and semi-automatic motor controller of industrial controls. Also includes designing of programmable logic controllers for various motor control operation, installation of discreet input and output, analog input and output and programming.*

Key Words: *Programmable Logic Controller, Motor Control, Trainer, Electrical Technology*

1. INTRODUCTION:

The Philippines together with other countries belief that the most effective agent for social change and national development is education. Through a quality education, a country is provided with productive manpower that carries out transformation and progress. Schools at all levels are tasked to provide students with the necessary knowledge, right skills and attitudes that will make them as contributors for national growth and development.

In education sector, technology is one of the important dimension that is being explored. It is related to the use of *Instructional Materials* along with the right laboratory equipment/apparatus, Manual of Activities, and many others specifically for those teaching Technology courses. To achieve a more effective and meaningful teaching-learning activities, the students should be exposed to practical activities. This for the fact that laboratory facilities enhance, ease, and make teaching-learning processes easy, lively, and realistic. Instructional materials are devices being developed or acquired to help or to facilitate in transmitting an organized knowledge, skills and attitudes to the learners within an instructional situation. These are educational resources used for instruction, thereby making learning experiences more tangible, realistic, effective, and meaningful. Instructional materials are precisely necessary. The sequence in which learners encounter materials has a direct effect on the achievement of the desired activity. In providing a closer experience to real situations, instructional materials enhance the acquisition and retention of factual information. Instructional materials not only give the necessary concrete experience but also help the student integrate the meaningful experience.

It is a fact that quality education is relying on the availability of training equipment which forms collectively as facilities in any learning institutions. For those schools offering different technology courses, like electrical technology, electronics technology, etc these training equipment are very important for today's period. The school need to produce

competent graduates equipped with necessary standard skills that suit the demand of the work industry. So, these technical vocational schools, colleges, and universities should provide adequate laboratory facilities and equipment which serve as a replica in real industry situation/ setting/ environment.

The goal of every competent, committed, compassionate and dedicated teacher/faculty is to impart technical knowledge, skills, and training that will last. One major reason for the realization of this goal is the presence and use of functional/operational instructional equipment and its accessories. However, in reality, some of the technical schools, colleges, and universities offering technology courses are faced with the problems on the lack of tools, equipment, and other facilities required in the teaching-learning process. Shortage of instructional materials/devices and equipment can greatly affect the quality of education in different technology courses. As a result of this, the learning that the graduates possess, in terms of technical knowledge and technical skills, do not match the standard competencies needed by the industry because of inadequate training facilities/ materials.

In order to produce quality graduates, adequate / functional equipment is needed to produce the required skills. Otherwise, teachers / trainers will only resort to chalk and board activities which give a very limited learning experiences to their students. The practice creates a feeling of guilt and ineffectiveness on the part of the instructor. Thus, the needed equipment must be available and operational. Otherwise, any vision and mission will just become hallucination!

In Isabela State University-Ilagan City Campus, one of the problems faced by the school is the lack or absence of laboratory equipment, tools, apparatuses and trainers in most shop laboratories due to cost-cutting of budget intended for laboratory equipment, gadgets and apparatuses. As such, it is difficult to both students and instructors to develop the desired skills and competencies to meet its program objectives.

As a consequence of this, instructors of Electrical Technology and other instructors in the different specializations are challenged in trying to address these problems for the improvement of the trainings that needs to be acquired by the students. The situation could be improved through improvisation of equipment, with the initiative and resourcefulness of the instructors in teaching different field of specialization, they have to make an improvise laboratory or training equipment as part of their initiatives, that are made from locally-available materials within the market as a less expensive alternative equipment.

With this concern at hand and in response to the vision of the university, the researcher, who was an alumnus and presently an electrical instructor of the University under the program of Bachelor of Science in Industrial Technology (BSINDT), come up with the idea of constructing a Manually-Operated and PLC Ready Motor Control Trainer that may help to improve the training conditions in electrical technology; to accelerate skills in installing, connecting, programming, interfacing, troubleshooting; and to introduce new meaningful learning experiences in the course; and to eventually sustain the student's interest to pursue their chosen field/ endeavor.

The Manually and Programmable Logic Controller (PLC) Operated Industrial Motor Control Trainer will help to provide practical or hands-on activities for skills development based on the topics in the curriculum guides for 3rd year electrical courses under the program of BS Industrial Technology. It will enable to offer opportunities for the students to be equipped and trained in different necessary laboratory activities that would help them to enhance their understanding and prove themselves the working theory, principles, function, connection and the application of different manually and PLC operated Motor Controls that will bring them in industry setting. It would also enrich their knowledge and skills for them to pass the Electrical Installation and maintenance assessment NC III and NC IV of the Technical Education and Skills Development Authority (TESDA) and have the competence and skill to undergo Industry Immersion in preparation for their future career.

2. LITERATURE REVIEW:

Instructional Technology

Learning is a continuous process gained by man through study and experiences in life. It is the key to success that gives a snug life to mankind. Learning opens the portal of advanced technology. It leads man to create and develop devices that make life easier. Theory alone is not enough to develop skills among students. The shortage of instructional devices becomes an obstacle for hands-on training of the learners.

Using technological devices in teaching had been proven to be an efficient tool in conceptualizing ideas through demonstration of the particular process. Learning in class is more comparable with the important work situation but with the help of instructional technology, the application and performance become just like the important world of labour. With the introduction of this technological equipment, students' knowledge and skills could be enhanced.

Education to be simpler and productive it must transcend traditional lectures and tests for learning and training. Outcomes-Based Education (OBE) learning must be imposed and adopted to alter education policy worldwide. This approach makes both teaching and learning together for the teachers to facilitate. This includes a comprehensive strategy

to show both knowledge and required skills including thinking analysis and problem solving, collaboration, communication, creativity and innovation. Students should learn and master the desired technical skills in industry by means of getting industrial equipment/apparatus to imitate the industrial situation.

The use of mock-up trainer as an instructional material is very important in the part of teaching-learning process. Developing desired technical skills and exercises is a guarantee to the learner's quality education in an industrial-like scenario. With the present of instructional equipment in the shop-laboratory, learners can easily develop their expertise by accomplishing such tasks because it is along-side the real situation.

Siemens S7-200

Getting Started with Siemens S7 PLC's" said that Siemens S7-200 is a very popular choice when you start PLC programming. It is the most affordable PLC from Siemens, and it is very easy to start basic programming. The Siemens S7-200 encompasses a limited form of functions, but it certainly includes a lot of benefits. He added some of the explanations why it should start PLC programming with the Siemens S7-200 PLC. First, though this relatively small PLC is the cheapest one from Siemens has a limited amount of built-in functions, this PLC has some clear advantages over other cheap PLC's. It is user-friendly especially to the beginners, easily build programs, connect to, configure, program, and debug your programs.

Figure 1. S7 200 CPU222 PLC

A PLC is an industrial-grade digital computer designed to perform control functions—especially for industrial applications. PLC is composed of a few basic parts. These include a power supply; a central processing unit, or CPU; input/output cards; and a backplane, carrier, or rack that these parts are mounted.

Festo Didactic is that the world-leading provider of equipment and solutions for technical education. With Headquarters in Denkendorf (Germany) with two other core locations: Eatontown, New Jersey (USA) and Québec (Canada). The company acquired Lab-Volt Systems in June 2014 integrating the all system modular into "LabVolt Series" into their industrial and commercial products. The company is known worldwide in the commercial production of modular equipment.

Industrial Controls

A lab volt series designed to teach the theory and techniques of electric motor controllers. They allow students to select and mount control devices to form typical control circuits, and to troubleshoot them once a fault is inserted. The systems offer unique controls training possibilities, are modular, and include insertable faults. The Industrial Controls Training Systems comprise four basic systems, each covering a particular topic that deals with various aspects of industrial controls equipment operation. One of this system is Basic Controls, Model 8036-1, provides students with a complete basic training in motor controls.

"Electric Motor and Control System", it is a magnetically actuated electrical device for repeatedly establishing or interrupting an electric power circuit. The magnetic contactor is an actuator similar in operation to a typical electromechanical relay. They have the same feature: contacts operate when the coil is energized. Unlike relays, contactors are designed to energize and de-energize the power circuit loads in excess of 15 A without being damaged.

In relation to the power contacts, one open contacts auxiliary hold-in contact is provided to accommodate three-wire pushbutton control. Two circuits are involved in the operation of a magnetic contactor: the control circuit and the power circuit. The control circuit is for the coil, and the power circuit is connected to the main power contacts. The principle of operation of a three-pole magnetic contactor is illustrated in figure 1. When voltage is present to the terminals of the coil, the current draws through the coil, creating a magnetic field on the circuit. The coil, in turn,

magnetizes the stationary iron frame, turning it into an electromagnet. Toward to the amateur it draws electromagnet pulling together the movable contacts. Power then flows through the contactor from the line side to the load side.

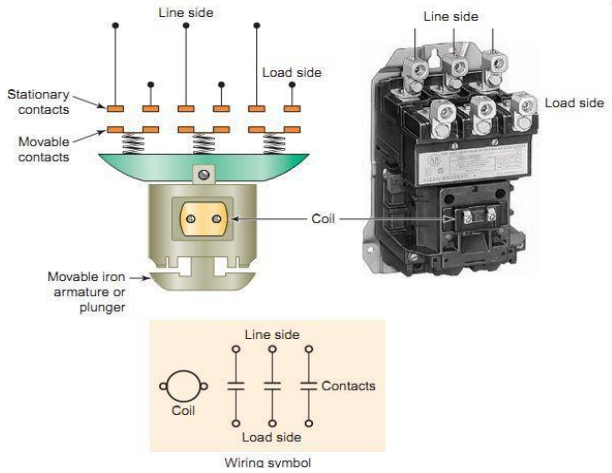


Figure 2. Typical appearance of 3 pole Magnetic contactor

3. MATERIALS:

A. Tools and Equipment

Table 1 shows the list of different tools and equipment that was used in the construction of the proposed project. The function of every tool and equipment is also described.

Table 1. Tools and Equipment and Their Function

Tools	**Functions**
Wrench	This is used to tighten and loosen nuts and bolts.
Hacksaw	Used for cutting pieces of metal based on the desired measurements.
Steel rule	This is used to measure the dimension of parts to be cut and fabricated.
Tri- Square	This is used to test the straightness and squareness and the 45° and 90° degrees angle of the project.
Pliers	It is used to hold and twist wires
Vise Grip	It is used to provide an extremely high gripping power particularly in joining two pieces of metals.
Ball Pen Hammer	It is used tin pounding metals.
Center Punch	It is used in punching the piece of work before drilling operation
electrical pliers	It tightens bolts and nuts
long-nose pliers	It holds electronic components
diagonal side cutter	It cuts wires and excess terminal connections
screw driver set	It tightens and loosens bolts and screws
paint brush	It applies paint on steel frame, cabinet and panel
soldering iron	It solders terminal leads, pins and connectors
Scissor	It cuts stickers
Machines/ Equipment	**Functions**
Bench Vise	It is used for gripping and holding bigger parts together
Welding Machine	It is an electro-operated machine for welding or joining pieces of metal.

Electric grinder	It is used to grind, smoothen and cut metals and welded surfaces.
Electric Drill & Drill Bit	It is used to bore holes for bolts and other parts.
Lathe Machine	It is used to bore, thread, polish and resurface metals
Air Compressor	It is used to produce and stored pressurized air.
Spray Gun	It is used to spray paint onto a surface.

B. Parts and Functions

The parts and functions of the Manually and Programmable Logic Controller (PLC) Operated Industrial Motor Control Trainer and its function are listed and discussed below.

Table 2. The following paragraphs discuss the parts and function, interrelationship of the parts and capabilities of the project.

Built-in features and Components	Description
Panel Board	This is the main activity board made of acrylic plastic and PB board material mounted on a tubular frame. All components and devices needed in performing various laboratory activities and interconnecting them are mounted in front. PLC modules and other devices are detachable to avoid moisture or dust. Terminals for these components and devices are accessed only through its corresponding banana jacks. The back panel is covered with a white board for better lectures.
AC and DC Power Supply	These circuits provide the needed varying amount of AC and DC voltages for the various laboratory activities in the project. The AC power supply has a single phase and three phase supply. Similarly, the DC power supply produces a varying amount of 24V DC to energize the PLC module and terminal relay.
Component Modules and Assembly	The components used in the project are all found on the panel board and individually labeled. Schematic symbols and diagrams are also shown to help the user of the project identify the correct terminal of components and devices.
Test Equipment	Digital and analog multitesters are available on the trainer to be used in voltage and resistance reading, component testing and comparing voltage readings. Clamp ammeter for measuring the current and additional tachometer is also available to measure the rpm of the motor.
Main AC Panel Control	This is located at the upper portion of the trainer wherein instruments for controlling and monitoring the 3 phase 220-VAC line are performed. As a safety feature, the project is equipped with a circuit breaker and a main switch to switch on and shut down the main AC power line. Additional emergency stop was provided to control the main supply.

4. METHOD:

This research used developmental method, wherein it involves systematic drawing on existing knowledge gained from practical experience that is directed to producing new materials, products, and devices (Catane 1998). In other words, this type of research is applied to the present study wherein the researcher had conceptualized the design and specifications of the construction of the Manually and Programmable Logic Controller (PLC) Operated Industrial Motor Control Trainer. In this study, the trainer was designed, constructed, and assembled in conformity with the design.

Then, revisions followed for any defect and reassembled until it will be found functional. The following are the processes involved in the Construction of the Manually and Programmable Logic Controller (PLC) Operated Industrial Motor Control Trainer:

1. Preparing the necessary supplies, materials, tools and equipment
2. Constructing the Steel Frame. Materials such as, steel tubular and other materials were provided. Dimensions were based on the drawing of the project.
3. Cut the acrylic sheet together with the PB board to the specified dimension using an acrylic cutter tool
4. Prepare the motor control devices.
5. Assembling all the parts and components in the panel trainer board.
6. Assemble all the control modules to be mounted in the panel trainer
7. PLC Module Assembly
8. Testing

Using a questionnaire- checklist, respondents evaluated the constructed Manually and Programmable Logic Controller (PLC) Operated Industrial Motor Control Trainer based on the following criteria: design and durability, functionality, safety and maintenance, economy/cost. There were 60 respondents ranging from various end users such as industry experts and faculty listed in Figure 3.

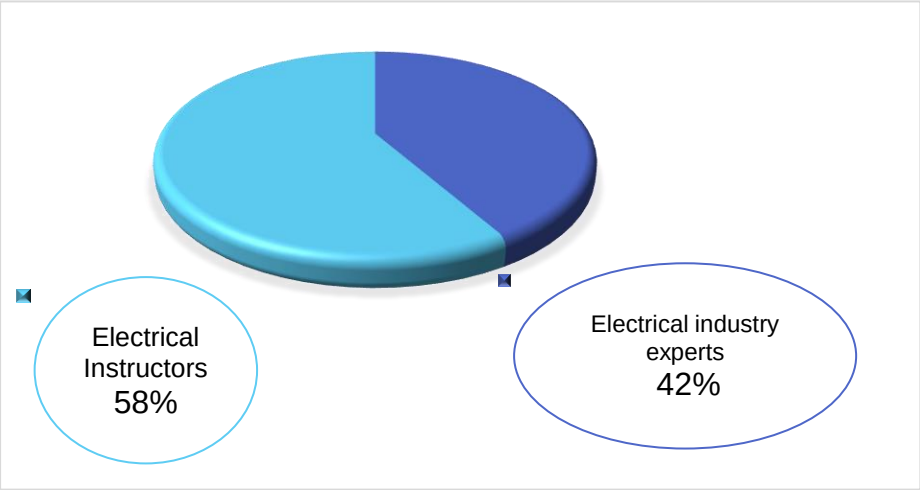


Figure 3. Pie Chart for the Composition of Evaluators

The criteria were used to evaluate is listed in Table 3.

Table 3. Level of acceptability

CRITERIA
A. Design and Durability
1. The trainer has a unique design and durable.
2. The trainer can be easily reproduced for students' use.
3. The trainer has component parts that are well-assembled and visible for easy understanding.
4. The trainer has component parts that are tough and can resist tension.
5. The trainer can stay strong and in good condition for a long time
B. Functionality
1. The trainer shows the actual operation of motor control circuits.
2. The trainer can serve its purpose efficiently and effectively
3. The trainer is easy to operate and maintain.
4. The trainer can be manipulated by students for easy understanding of concepts.
5. All components of the trainer work well.
C. Safety and Maintenance
1. The trainer is equipped with safety and protective devices
2. Connectors are insulated to minimize short circuits and electrocution

3. The trainer is easy to maintain
4. The trainer has movable parts which are properly mounted for safety
5. Components are mounted on a non-conductor material.
D. Economy and Cost
1. The trainer has components which are locally available and are low cost and affordable.
2. The trainer can be assembled by the Electricity instructors/professors and students.
3. The trainer has components which can be replaced
4. The trainer has a total cost lower than the commercial trainer.
5. The stand frame can be created using locally available materials.

5. DISCUSSION:

Project Perspective Design

Shown in Figure 4 are the major components of the developed trainer which are labelled accordingly. Moreover, the drawing plans are described in Figure 5

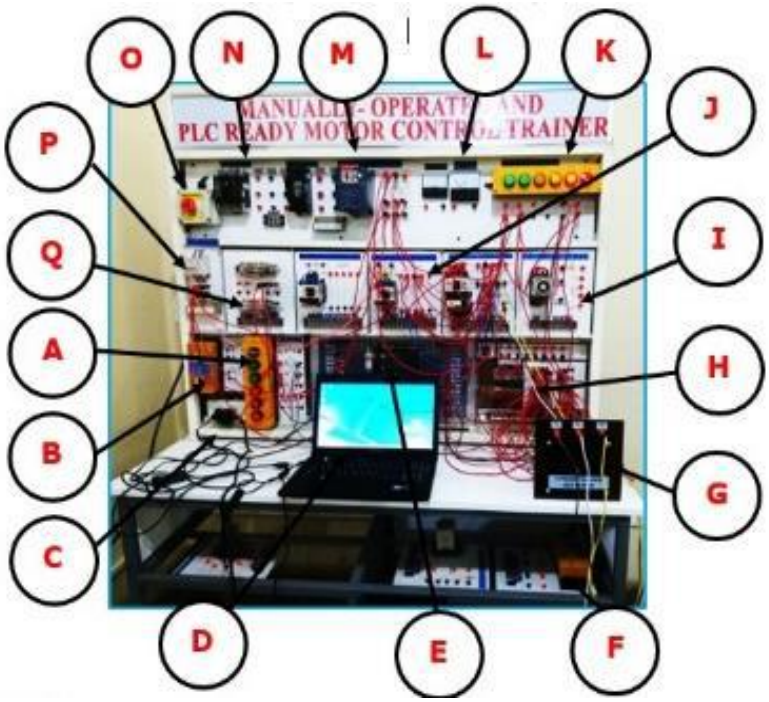
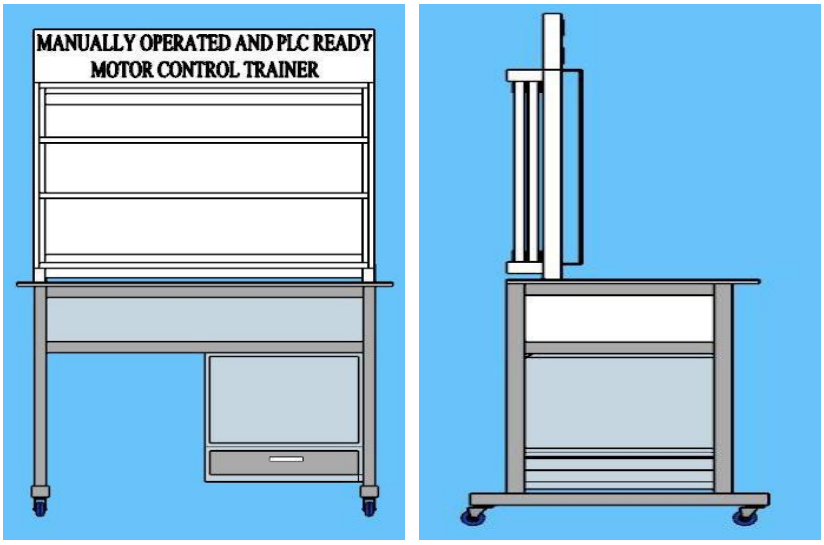


Figure 3. Major components of the Manually and Programmable Logic Controller (PLC) Operated Industrial Motor Control Trainer.

LEGEND

A. Push button switch
B. Selector switch
C. 220v covinience outlet
D. Laptop computer
E. Plc module
F. Storage area
G. 3 phase induction motor
H. Terminal relay module
I. On-delay timer
J. Magnetic contactors
K. Pilot lights
L. Metering device
M. Vfd drive
N. 3 pole circuit breaker
O. Emergency stop
P. Circuit protection
Q. Limit switch



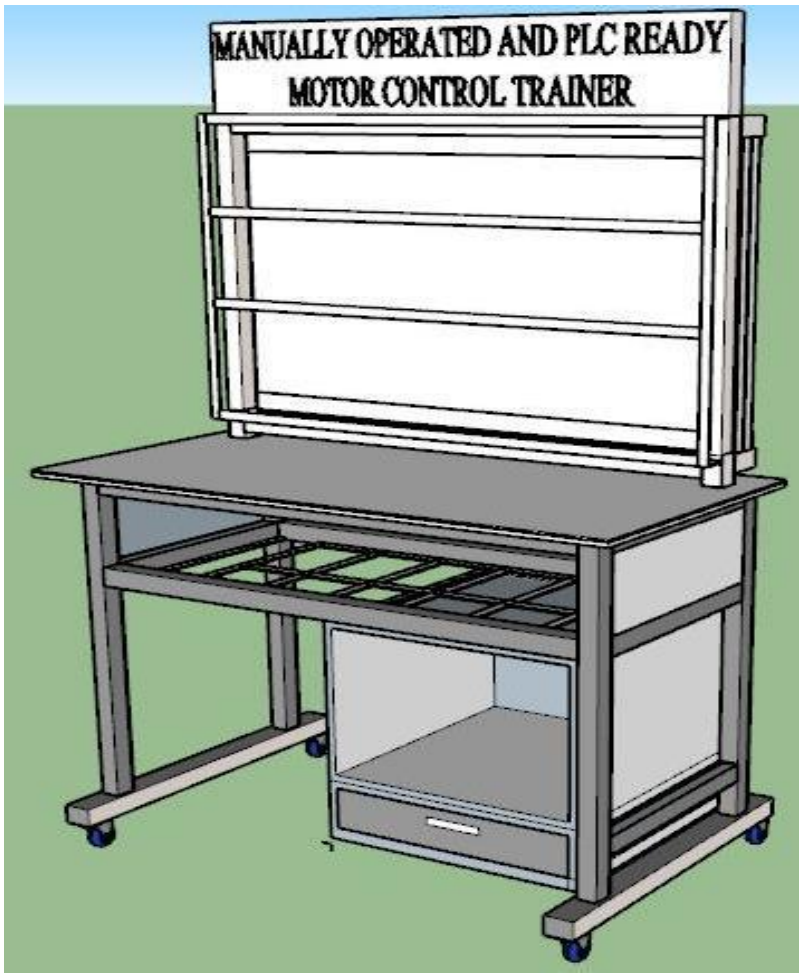


Figure 4. Front, Side, and Perspective View of the Manually and Programmable Logic Controller (PLC) Operated Industrial Motor Control Trainer

6. RESULT:

To evaluate the overall response of the respondents, the following scale:

Scale	Range	Verbal Description
5	4.50 – 5.00	Strongly Agree (SA)
4	3.50 – 4.49	Agree (A)
3	2.50 – 3.49	Moderately Agree (MA)
2	1.50 – 2.49	Disagree (D)
1	1.00 – 1.49	Strongly disagree (SD)

A. Design and Durability

Under Design and Durability, the developed Trainer was evaluated by the following criteria: Q1) The trainer has a unique design and durable. Q2) The trainer can be easily reproduced for students' use. Q3) The trainer has component parts that are well-assembled and visible for easy understanding. Q4) The trainer has component parts that are tough and can resist tension. Q5) The trainer can stay strong and in good condition for a long time.

Table 4. Respondents' Evaluation of the Constructed Manually and Programmable Logic Controller (PLC) Operated Industrial Motor Control Trainer with Respect to Design and Durability

Design & Durability	Respondents			
	Electrical Instructors		Industry Experts	
	WM	VI	WM	VI
1. The trainer has a unique design and durable.	4.94	SA	4.92	SA
2. The trainer can be easily reproduced for students' use.	4.43	A	4.44	A
3. The trainer has component parts that are well-assembled and visible for easy understanding.	4.63	SA	4.52	SA
4. The trainer has component parts that are tough and can resist tension.	4.77	SA	4.88	SA
5. The trainer can stay strong and in good condition for a long time	4.86	SA	4.84	SA
Average Weighted Mean	4.73	SA	4.72	SA
Standard Deviation	0.33		0.33	

It can be observed in Table 4 that the electrical instructors and industry expert's respondents' evaluation on the constructed Manually-Operated and PLC Ready Motor Control Trainer as regards to design and durability are 4.73 and 4.72 respectively with the same standard deviations of 0.33, and both are verbally interpreted as strongly agree. The findings show that the two groups of respondents both agreed that the constructed Manually-Operated and PLC Ready Motor Control Trainer has unique design and could last long. This finding concurred with the study of Canceran (2019) that the developed trainer was also well designed.

B. Functionality

The following functionality criteria were evaluated, Q1) The trainer shows the actual operation of motor control circuits, Q2) The trainer can serve its purpose efficiently and effectively, Q3) The trainer is easy to operate and maintain. And disassembly of parts, Q4) The trainer can be manipulated by students for easy understanding of concepts, and Q5) All components of the trainer work well.

Table 5. Respondents' Evaluation of the Constructed Manually and Programmable Logic Controller (PLC) Operated Industrial Motor Control Trainer with Respect to Functionality

Functionality	Respondents			
	Electrical Instructors		Industry Experts	
	WM	VI	WM	VI
1. The trainer shows the actual operation of motor control circuits.	4.94	SA	4.84	SA
2. The trainer can serve its purpose efficiently and effectively	4.94	SA	4.84	SA
3. The trainer is easy to operate and maintain.	4.66	SA	4.44	A
4. The trainer can be manipulated by students for easy understanding of concepts.	4.40	A	4.36	A
5. All components of the trainer work well.	4.89	SA	4.88	SA
Average Weighted Mean	4.77	SA	4.67	SA
Standard Deviation	0.26		0.34	

As seen in Table 5, the electrical instructors and industry experts rated the constructed Manually-Operated and PLC Ready Motor Control Trainer in terms of functionality with an overall weighted mean of 4.77 and 4.67 respectively, both are verbally interpreted as Strongly Agree. This goes to show that the constructed trainer shows the actual operation of motor control circuits. The findings of Corbillion (2019) and Canceran (2019) concurred with the result of the present study relative to the functionality of the developed trainers. They were able to prove that the developed trainers can serve the educational purpose in teaching the subject effectively and efficiently.

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C. Safety and Maintenance

It can be gleaned in Table 6 that the electrical instructors and industry experts rated the motor control trainer in terms of Safety & Maintenance with the average mean of 4.91 and 4.82 respectively and both were verbally interpreted as Strongly Agree. This indicates that the trainer is highly acceptable because it is safe to use and easy to maintain. Thus the trainer is user-friendly. Further, the result of the study of Corbillion (2019) relative to safety & maintenance revealed that the trainers that they developed are safe to use and user-friendly.

Table 6. Respondents' Evaluation of the Constructed Manually and Programmable Logic Controller (PLC) Operated Industrial Motor Control Trainer with Respect to Safety and Maintenance

Safety & Maintenance	Respondents			
	Electrical Instructors		Industry Experts	
	WM	VI	WM	VI
1. The trainer is equipped with safety and protective devices	4.94	SA	4.84	SA
2. Connectors are insulated to minimize short circuits and electrocution	4.94	SA	4.88	SA
3. The trainer is easy to maintain	4.83	SA	4.72	SA
4. The trainer has movable parts which are properly mounted for safety	4.94	SA	4.80	SA
5. Components are mounted on a non-conductor material.	4.91	SA	4.88	SA
Average Weighted Mean	4.91	SA	4.82	SA
Standard Deviation	0.22		0.34	

D. Economy and Cost

Table 7. Respondents' Evaluation of the Constructed Manually and Programmable Logic Controller (PLC) Operated Industrial Motor Control Trainer with Respect to Economy and Cost

Economy and Cost	Respondents			
	Electrical Instructors		Industry Experts	
	WM	VI	WM	VI
1. The trainer has components which are locally available and are low cost and affordable.	4.63	SA	4.32	A
2. The trainer can be assembled by the Electricity instructors/professors and students.	4.49	A	4.52	SA
3. The trainer has components which can be replaced	4.83	SA	4.64	SA
4. The trainer has a total cost lower than the commercial trainer.	4.86	SA	4.76	SA
5. The stand frame can be created using locally available materials.	5.00	SA	4.88	SA
Average Weighted Mean	4.76	SA	4.62	SA
Standard Deviation	0.25		0.36	

Table 7 discloses the evaluation of the motor control trainer in terms of Economy and Cost. It can be seen that the electrical instructors' overall weighted mean is 4.76 while the industry experts rated 4.62. The two groups of respondents Strongly Agree that the trainer has a total cost lower than the commercial trainer. This finding on the economy and cost of the developed trainer concurred with the study of Corbillion (2019). They both agreed that the developed trainer is lower in cost compared to commercially sold trainer.

7. RECOMMENDATIONS:

The following recommendations are hereby given:

- Electrical instructors and professors from other program are encouraged to use the constructed manually – operated and PLC ready motor control trainer and to test its effectiveness to provide quality learning of the students.
- School administrators should encourage other technology instructors to develop other related instructional apparatus to further improve teaching-learning in electrical and other technology;
- We encourage collaboration between educational institutions and industry partners to develop real-world projects and scenarios for training modules. This will give students practical experience and help them develop their skills.
- To fully utilize the trainer's instructional potential, the school should offer training sessions or workshops for teachers. This can help educators maximize available resources and improve student learning experiences.
- The developed trainer should not only be used on campus, but also downloaded to the community through extension activities.

8. CONCLUSION :

The main purpose of this research study is to construct and evaluate a manually and programmable logic controller (PLC) operated Industrial Motor Control Trainer to address the problem of inadequacy of instructional equipment in the Electrical Technology at Isabela State University, Ilagan Campus. The manually and programmable logic controller (PLC) operated Industrial Motor Control Trainer was designed suited for the 3rd year electrical subjects of BS Industrial Technology and followed an orderly process of designing, constructing, testing and evaluation and can be can be constructed using available resources and locally available materials. The evaluation on the constructed manually – operated and PLC ready motor control trainer in terms of design and durability, functionality, safety and maintenance, and economy and cost as perceived by the two groups of respondent was Strongly Agree.

The constructed manually and programmable logic controller (PLC) operated Industrial Motor Control Trainer was suited to the curriculum/subjects of BS Industrial Technology major in Electrical Technology and industry experts'

level of understanding. The trainer was constructed utilizing electrical devices from different firms locally and commercially available materials and supplies. Compared to the existing similar trainers, the manually and programmable logic controller (PLC) operated Industrial Motor Control Trainer has the following salient features; 2 amperes circuit protective device, emergency stop button, variable frequency drive which can be used as phase inverter if three phase supply is not available, white board for lecture purposes, 24 volts' terminal relay and Programmable logic controllers. The activities that can be performed on the trainer are connecting, installing and troubleshooting manual and semi-automatic motor controller of industrial controls. Also includes designing of programmable logic controllers for various motor control operation, installation of discreet input and output, analog input and output and programming.

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