Low Cost Electro Pneumatic Automation Trainer Kit

Dr. Marilyn B. Castillo
Professor III, Campus Director, Caraga State University, Cabadbaran Campus ,Philippines ,
email: engrmarbcas@yahoo.com

Abstract: The purpose of this study is to develop a Low Cost Electro Pneumatic Automation Trainer to be used as an instructional device. Study is limited only to the design and construction of trainer kit and to assess its uses in the laboratory by user. This utilizes both descriptive normative research design. An average mean rating of 4.67 was rated by the students respondents on the performance of the kit, which means that they "strongly agree" that the trainer kit is user friendly, its learning objectives is easy to understand, it is easy and convenient to use, the device has a multiple applications and follows the industry standard. While experts respondents rated it 4.69 which means that they "strongly agree" that the low cost electro pneumatic automation trainer kit is very efficient on its operation.

Keywords:Electro Pneumatics, Innovation ,Mock up device, Trainer kit

INTRODUCTION

The main rationale for the creation and maintenance of State Universities and Colleges (SUCs) in the Philippines is to ensure the equity of access of all to a good quality and affordable higher education [1] . The increase in the number of SUCs, however, resulted in inequitable distribution of higher education services, proliferation of campuses and programs, inefficient utilization of government resources and unsatisfactory quality of education [2].

Challenge comes across on maintaining a good delivery of education amidst the increasing beneficiaries over an undermine funding. In effect, the provision of state of the art laboratories and equipment across SUC's to support and strengthen instruction has been evidently scarce. It is but evident however that in engineering sciences and other related fields, most instruction took place in the educational laboratories in the quest for gaining knowledge beyond theory [3]. Hence, the lack or absence thereof is detrimental to the attainment of quality education.

A young University like Caraga State University, Cabadbaran Campus is not exempted to the uneven and thin spread of resources to SUC's and is largely dependent on its incomeenough for payment to its personnel. Therefore, for most times .allocation to the purchase of laboratory equipment is given of least priority.

Invention, innovations and development of devices are very helpful in the transfer of technology. Recent development of technology encourages instructors to engage on using improvised devices and instructional devices in their day to day activity especially in the laboratory work of their students. The use of instructional device /material instructional are those which a teacher puts into use to promote the effectiveness of instructions and which also helps him/her to communicate more effectively to the learners [4].

This study designed and developed a Low Cost Electro Pneumatic Automation Trainer Kit to be used as an instructional device in teaching industrial control in engineering and electrical courses.The

Low Cost Electro Pneumatic Automation Trainer Kit could be a very viable equipment to be used in the industrial control laboratory courses since it acts as a mock up device to simulate the actual work of the students.

This research aimed to address the problem of inadequate training facilities in SUCs, especially in industrial control courses because of the very expensive laboratory equipment.The Low Cost Electro Pneumatic Automation Trainer Kit provides quality instructions in the industrial control laboratory courses without the use of capital intensive and commercially available equipment in this courses. Electro pneumatics is commonly used in many areas of low cost automation. Control of Electro Pneumatic system is carried out either using combination of Relays and Contactors or with the help of Programmable Logic Controllers [PLC]. A Relay is often is used to convert signal input from sensors and switches to number of output signals (either normally closed or normally open) .Signal processing can be easily achieved using relay and contactor combinations A Programmable Logic Controller can be conveniently used to obtain the outputs as per the required logic, time delay and sequential operation as stated by Academic Services .

This study offered range of benefits and advantage to theCaraga State University, Cabadbaran Campus in the effective training of students. It further benefit the administrator and instructors to make an improvised equipment to be used as instructional material and to improve the physical facilities of the school. Most importantly it offer the students for the competence in their application of this equipment.

This study is limited only to the designing, construction and development of Low Cost Electro Pneumatic Automation Trainer Kit. This further assessed and evaluated the uses of the Low Cost Electro Pneumatic Automation Trainer Kit in the laboratory by the students and instructors of engineering and industrial laboratory courses.

METHODOLOGY

Design Stage

The design was the idea of the author with the help of engineering instructors of the college which give the specifications and all the accessories and materials to be use for the project. The design of Electro Pneumatic Automation Trainer kit is to enable it to run in actual the program from the LOGOSOFT software or the loader. After the program is being loaded to the PLC, following inputs are now has specific outputs to the loads. Push buttons are used for the start, stop, and reset of the working program. The push buttons are connected in the PLC in its load side function. The loads are connected in the output of the kit which is the knotted bolts from here the desired function of the load will be sent. The bolts are also connected to the relays that will amplify the contact capability and or multiply the functions of the device or loads. The bolts are classified with normally closed and normally open contact which has different functions like the interlocking functions.

In the pneumatic load the two cylinders has function depending on the designed program that is being load to the PLC. The force that a cylinder can act will be controlled from the way spring return valve. Having also a limit switch as to control the cylinder actions, used for safety interlocking or to count the actions made by the cylinder.

Development stage of the project

This part concerns with the construction and assembly of the Low Cost Electro Pneumatic Automation trainer kit. First is the painting of the installation board, the ply board serve as the house of all the other components. After the painting is the drilling of the box according to the design on where to put its parts and then it was followed by the installation of its parts and soldering of wires then it was followed by electrical wiring and pneumatic piping and finishing installation of its parts.

Implementation of the project

This is the testing of the project if it is operational. This includes also performance test and pilot testing it to prospective users of the Low Cost Electro Pneumatic Automation Trainer Kit. Utilization of these Trainer Kit for longer time to the users, test its capability and safety features and identifying the low cost electro pneumatic automation trainer kit problems and lapses.

Evaluation and Assessment of the Students and Experts on the Low Cost Electro Pneumatic Automation Trainer Kit

After making the Low Cost Electro Pneumatic Automation Trainer Kit, its operation was tested and evaluated by the expert electrical engineering instructors and their students in their laboratory classes.

The project

Figure 1. Logic Relay Kit

Figure 2. Pneumatic Load

RESULTS AND DISCUSSIONS

The necessity of laboratory equipment for quality instruction has encouraged researchers to develop this trainer. This study is limited only to the : a.) designing and construction of Low Cost Electro Pneumatic Automation Trainer Kit. b.) assess and evaluate the uses of the Low Cost Electro Pneumatic Automation Trainer Kit in the laboratory by the students and instructors of engineering and industrial laboratory courses.

Using statistical mean, the results revealed that the trainer is acceptable based on the criteria set; thus, it is essential tool, and ready for use to facilitate actual learning experiences. The model was accepted and

validated by the respondents. The developed trainer kit is more affordable than a commercial trainer, a big savings without sacrificing quality of training for students.

The results of the testing and evaluation on the performance of the Low Cost Electro Pneumatic Automation Trainer kit revealed the following results where the response value description of the students and experts respondents were: The instruments used in this study were adopted from the work of Monoy&Castillo (2007).

5 - Strongly agree
4 - Agree
3 - Slightly agree
2 - Less Agree
1 - No agreement at all

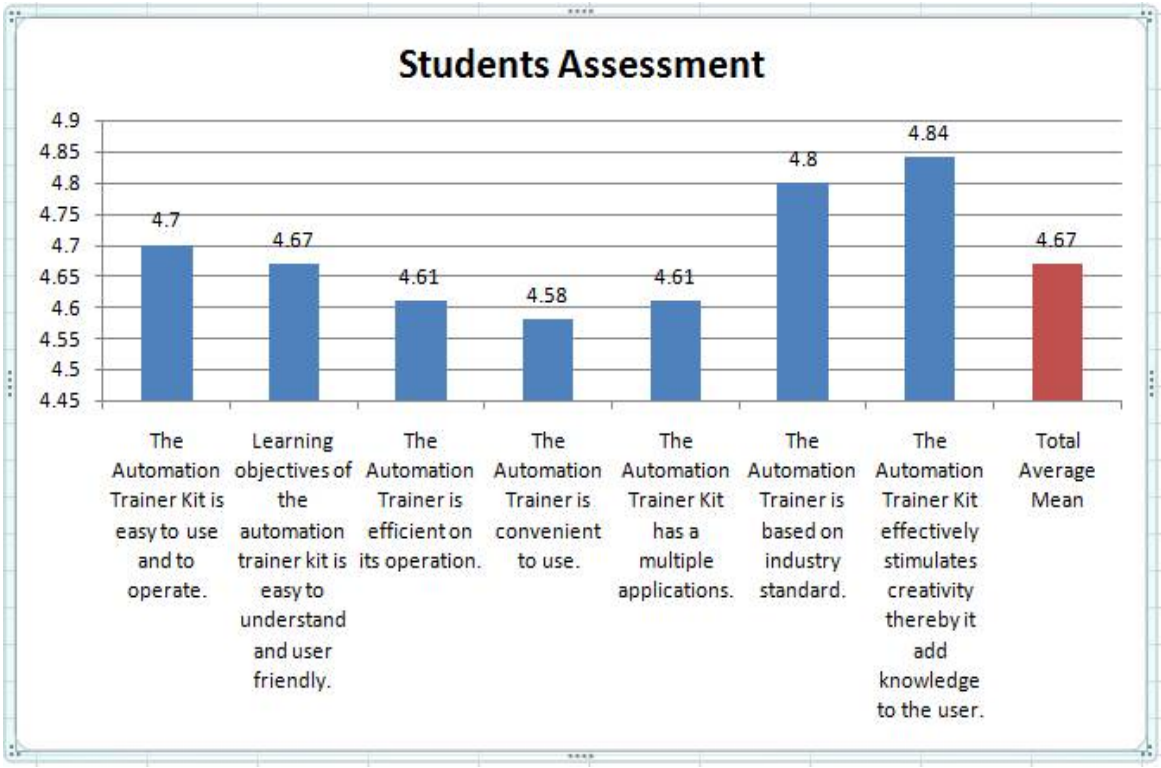

Figure 3. ***Results of the performance of the low cost electro pneumatic automation trainer kit as rated by the students user.***

As assessed by the students respondents during their laboratory activity , the Low Cost Electro Pneumatic Automation Trainer Kit stimulates creativity of the students user thereby it add knowledge to them , this is given a mean rating of 4.84 by the students respondents which means that the students strongly agree on the operation of the Automation Trainer Kit. The automation trainer kit is based on the industry standard, it is easy to use and to operate, the learning objectives of the automation kit is easy to understand and user friendly, It is efficient on its operation, and it has a multiple operation and it is convenient to use. It is rated 4.8, 4.7, 4.67,4.61,4.61 and 4.58 respectively by the students respondents which means that the students respondents strongly agree on the operation and use of the low cost electro pneumatic automation trainer kit. Overall, an average mean rating of 4.67 was rated by the students respondents, which means that the students respondents strongly agree that the low cost electro

pneumatic automation trainer kit is user friendly, its learning objectives is easy to understand, easy to use, convenient, has a multiple applications and follows the industry standard.

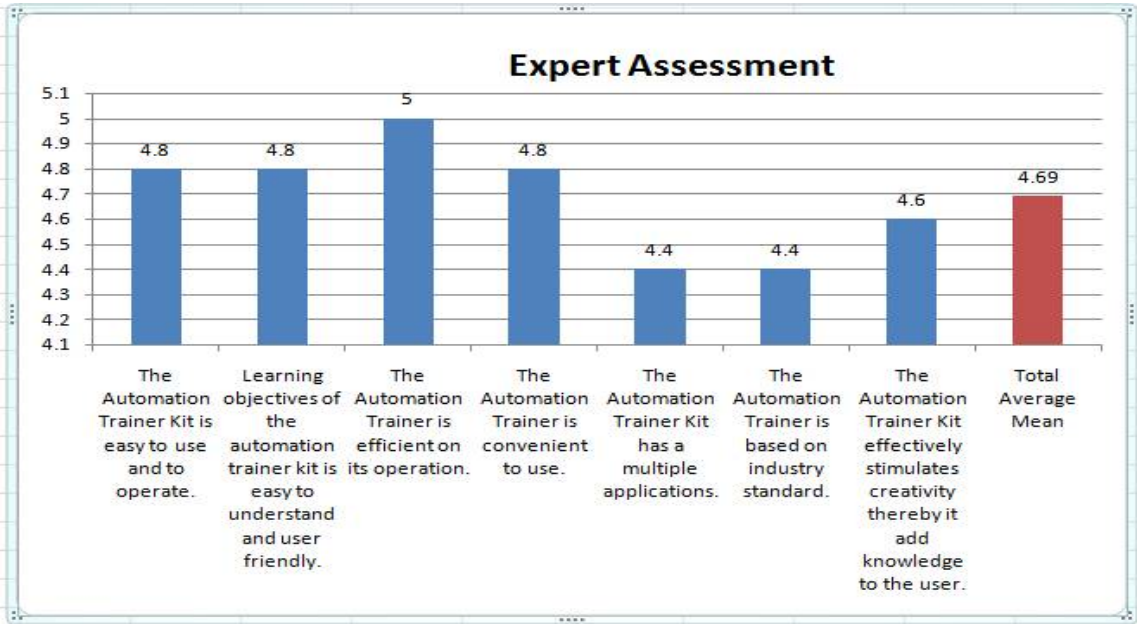

Figure 4. Results of the performance of the low cost electro pneumatic automation trainer kit as rated by the instructors user.

As assessed by the experts respondents during the evaluation of the device , the Low Cost Electro Pneumatic Automation Trainer Kit is very efficient on its operation given a mean rating of 5.0 which means that the expert "strongly agree" that the automation trainer kit is efficient on its operation. The low cost electro pneumatic automation trainer kit is easy to operate and use, the learning objectives of the trainer kit is easy to understand and user friendly and it is convenient to use. It stimulates creativity of the user thereby it add knowledge to the user, It has a multiple applications, and the trainer kit is based on industry standard. It is rated 4.8, 4.8, 4.8 ,4.6 ,4.4 and 4.4 respectively by the experts respondents which means that the experts respondents "strongly agree" on the operation and use of the low cost electro pneumatic automation trainer kit.

Overall, an average mean rating of 4.69 was rated by the experts respondents on the low cost electro pneumatic automation trainer kit , which means that the expert respondents strongly agree that the low cost electro pneumatic automation trainer kit is user friendly, its learning objectives is easy to understand, easy to use, convenient, it has a multiple applications and follows the industry standard.

CONCLUSIONS

This low cost electro pneumatic automation trainer kit acts as a mock up device in the laboratory to give the students a very viable instrument during their activity in the laboratory. With this device in the laboratory, students can improve their skills by performing their laboratory activities.

With this Electro Pneumatic Automation Trainer Kit, students will have actual learning experience and knowledge in industrial automation technology.

For income generating project, the institutions can mass produced this device in the future because this Electro Pneumatic Automation Trainer Kit uses cheap and reliable materials for its parts and design, It is a much cheaper alternative as compared to commercially available Electro Pneumatic Automation trainer kit.

In general, the low cost electro pneumatic automation trainer kit was found to be acceptable in terms of its design, functionality, instructional capability and safety features and operation by students and experts in industrial control courses having an average mean of 4.67 as rated by the students respondents which means that the students respondents "strongly agree" on the operations of the device and it is rated 4.69 by the experts respondents which means that the expert respondents "strongly agree" that the low cost electro pneumatic automation trainer kit is efficient on its operation.

REFERENCES

[1] CHED. 2013. Roadmap for Public Higher Education Reform. www.ched.gov.ph/wp-content/uploads/2013/07

[2] Tayag, Jean C and Charlie V. Calimlim. 2003. “HEI and Program Map of the Philippines” Proceedings of the Symposium on the Rationalization of the Philippine Higher Education System, Manila Hotel, Philippines. September 18-19, 2003.

[3] Lyle Feisel and Rosa J. Albert. 2005. The Role of the Laboratory in Undergraduate Engineering Education.Journal of Engineering Education pp. 121-130.

[4] NtasiobiC.N.Igu, Francisca N. Ogba and Iheanyi O. Igwe. 2014. Effects of Instructional Materials on Students’ Achievement in Social Studies in Lower Basic Education in Nigeria. International Conference on 21st Century Education at Dubai Knowledge Village – 2014, Vol. 2, No. 1 . ISSN: 2330-1236

Anonymous. 2014. Pneumatic_cylinder .http://en.wikipedia.org/wiki/Pneumatic_cylinder

Anonymous. 2014 Siemens LOGO! Manual http://siemens.com.logo

Petruzella , Frank. Programmable Logic Controller. Mc- Graw Hill Vol 2

BIBLIOGRAPHY

DR. MARILYN B. CASTILLO is the Campus Director of Caraga State University Cabadbaran Campus , Philippines, with an academic Rank of Professor III. She is a Chemical Engineer by profession graduated from the University of San Jose Recoletos Cebu City, Philippines last 1985. A graduate of Master of Arts in Teaching Mathematics and Doctor of Education last 2007 at Caraga State University, Philippines. She already presented several research papers in many local, national and international fora , one of which is her study on the Syllabi Information System of CSUCC, in Thailand last February 2011. Happily married to Engr. Eduardo C. Castillo and blessed with a son Paul Edward B. Castillo, BS In Management Graduate from the University of the Philippines, working now as Economic Development Specialist at National Economic and Development Authority, Caraga region Philippines