The Application of MIOT Trainer in Teaching and Learning in Higher Institution

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Abstract

The Multi Interface Iot Trainer (MIOT)'' is a multi-DC voltage level switching or controlling trainer using IoT (Internet of Things) concepts and multi switching devices. In this paper, an IoT trainer has been developed for the purpose of teaching and learning process for electronic engineering students. The trainer is equipped with various level DC and AC electromechanical switching devices which facilitates the instructor to demonstrate clearly the concepts of interfacing and activating larger and more powerful devices using high power DC relay and AC contactor to students. Moreover, hands on experience on interfacing of electronic and electrical switching methods equips the students with the skills and knowledge to apply IoT controlling method in the industries for lower to higher power switching management system. The application of the IoT device in teaching and learning not only enhances the understanding and skills of the students, it enables students to be more conversant with new technologies which bridges the gap between academic institution and industrial requirements.

Keywords: IoT trainer, switching devices, teaching and learning.

1. Introduction

Teaching aid is a tool or method used in the teaching and learning process to facilitate and assist students to understand the subject more deeply. Learning is a complex process involving all the senses of a student. Students find it difficult to understand certain concepts, tools and their use in real situations if they only learn them in conventional ways and methods. This is an experience that can be demotivating and loss of interest among the students in teaching and learning process. One of the biggest challenge that the engineering students facing in class or in laboratory is to visualize the working concept of an engineering set up for testing and experiments. In conventional teaching and learning process, power point presentations using LCD, white or black board are used as teaching aids to convey the subject matter. In the process of learning technical subjects, simple teaching aid in the form of a combinational electronic or electrical component being used to demonstrate the concept in teaching and learning process. In this new era, the advancement of science and technology are evolving fast and academicians are facing many challenges to cope with this changes in their teaching syllabus and methods and to deliver the subject matter effectively to students. There is a crucial need of different and diverse approaches need to be used to strengthen the

teaching and learning process. A new trend of teaching and learning in academic institutions is the integration of Internet of Things (IoT) concepts in some syllabus or courses to adapt to the industrial 4.0 needs which are moving towards digitalization, IoT and AI (artificial intelligence). By utilizing the IoT into teaching practices especially in the technical subjects, it helps to accelerate students' understanding of the subject and promotes students interest and creativity in technical subjects. Furthermore, this approach allows students to have hands on learning experiences by touching, seeing, feeling, experimenting engineering to the closes as possibly as being applied in the industries.

2. Literature Review

According to [1], visualization skills are closely related to success in engineering and mathematics in general. Popular technical skills and knowledge can be acquired through TVET programs which can produce specialized skilled workers who are able to compete in the competitive job market [2]. Some of the teachers today are still practising the popular Teacher-centered teaching and learning [3], [4], [5]. The conventional teacher-centered teaching method like explanative, demonstrative and one-way makes the students bored and less enthusiastic in learning process. These makes the students passive and the learning environment become less enjoyable [6], [7]. As such the students won't engage actively in this kind of teaching and learning environment [8]. The hands on real life experiment enhances students' knowledge and enable them to apply relevant techniques which is practiced in industries [9]. To increase their employment chances in the labour market, labourers must be equipped with the necessary ICT skills and technical knowledge to keep pace with the changing needs of the industry. IoT is essential innovation tool in the transformational solution for intelligently and autonomously managing and controlling various types of hardware and software for users [10]. The most difficult part for the students are the interfacing part of the IoT wifi modules to various hardware, such as sensor, load, electromechanical devices, students often find it challenging to activate eternal devices. IoT is becoming the future of design tools for fast development of hardware and software interfacing around the world which creates excitement and anxiety around the world [11]. The importance of developing good teaching aids for students to improve students' skills and ensure graduate readiness for job in future is emphasized in [12]. Besides, the implementation of IoT in teaching aid provides a sense of practicality in science subjects which could make learning more interesting [13].

In this paper, a Multi Interface Iot Trainer (MIOT) has been developed which is equipped with various level DC and AC electromechanical switching devices to facilitate the instructor to enhance the teaching and learning for the electrical and electronic engineering students. This paper is organized as follows: The problem statement and a case study is presented in next section. This is followed by the methodology section. Next section briefly discusses the feedback of the students and lastly is the Conclusion section.

3. Problem Statement

The motivation behind this study is that many students face difficulties to understand the techniques of interfacing microcontrollers to other electronic and electrical components as being applied in the real world industries. Therefore, a MIOT trainer has been developed to address these issues. As a case study, the MIOT trainer has been applied as a teaching aid in learning the microcontroller interfacing to 30 final year project students in a polytechnic

institution. Earlier on, these students lack the understanding of how an IoT based microcontroller is able to output a small signal and how that signal can be used to control higher power devices. They only learned to assemble microcontrollers input and output on a breadboard provided by the microcontroller kits. Any additional output devices are in the module form and it made easy with "plug and play "concept. The outputs of the devices can only be observed via LEDs where students are unable to apply the microcontrollers output signal to a "real world load" when they are working on their final year projects. This is less practical as what they learned is not the same "Load" in the field of electricity and electronics in the industries.

4. Methodology

This section explains how the MIOT trainer is developed. An IoT based Arduino microcontroller is used to develop the MIOT prototype consist of various parts like power supply, regulators, electronic components and electromechanical switching devices. The IoT uses the power of the internet to connect physical real life devices in real-time. So any physical object connected through the internet can be converted into an IoT device. The IoT can be activated and used by merely a hotspot wifi from an android device. This devise can also be used one or two way communications devises. These types of controller are cheap and ready available for students and lecturers to be incorporated in their projects. The trainer can be wired in many different ways to suit the application in need. In conventional laboratory, in practical work student will wire the circuit's input and output (IO) using breadboard , jumper ,resistors and the output will be LEDs as the output indicator as shown in Figure 1.

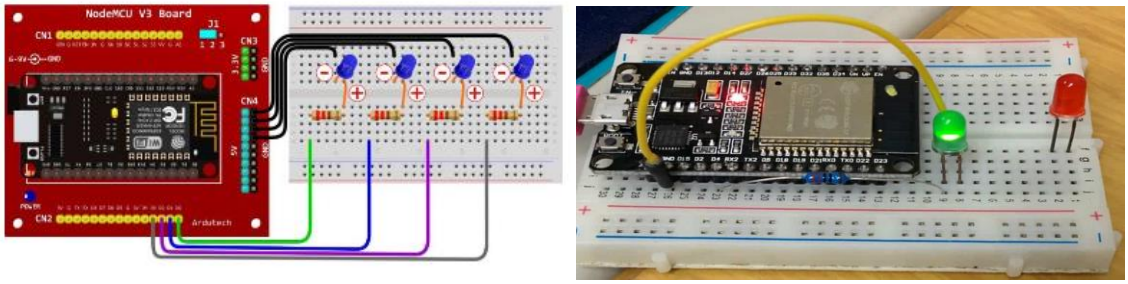

Figure 1: Conventional Wired IO

MIOT trainer is a multilevel interface trainer using Arduino ESP8266 wifi controller. Figure 2 shows the IO of all the ports.

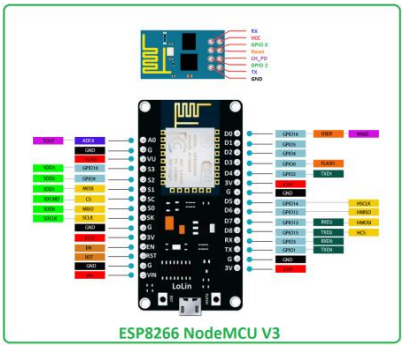

Figure 2: Conventional uController IO

It has development features of plug and play design that makes it easy for connections and helps students, hobbyists, enthusiasts and professionals to focus more on Program/application

development. It also equipped with on board IO's, communication interfaces & peripherals. This controller is easy to design, experiment with and test circuits by just using jumper wire without any soldering connection. The device can be easily connected with readily available wifi either from a nearby router or hotspot tethering for just a hand phone. It's suitable for educational purposes and is used in many educational institutions and R&D LAB across the world. The prototype MIOT is developed using this Arduino ESP8266 wifi module as the main controller of the trainer as shown in Figure 3.

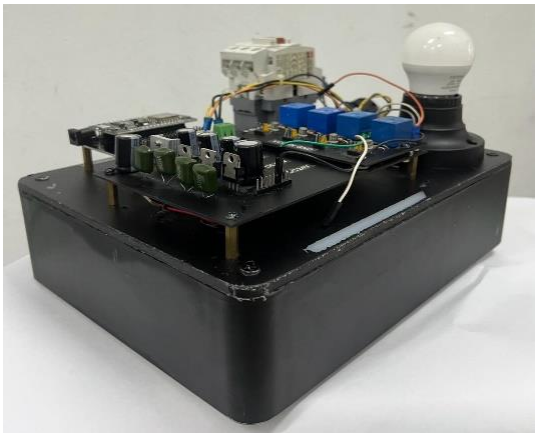

Figure 3: MIOT Trainer

The trainer is powered by AC230V (Figure 4) and consists of multilevel interfacing power and devices as in Table 1.

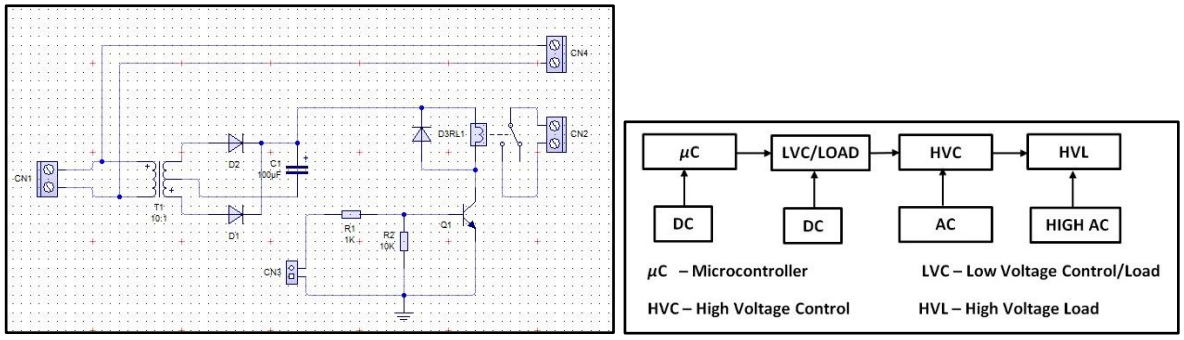

Figure 4 Power Supply Circuit

Table 1: Multilevel Interfacing Power and Devices

FEATURES	DISCRIPTION	
Main Power	AC230V	Operating Power
AC Power	230V	For230V Hardware
DC Power	5V, 9V, 12V,24V,	For uC & Relay
Relay	5V, 9V , 12V ,24 V	For Switching
Contactor	230VAC	High Power Control
Bulb	230AC	Load
Motor	DC 12V	Applience

Students can use the trainer to learn to control any combination wired to control devises through IoT to control a small IO such as a LED and as well as bigger load such as 3 phase motor can be wired using jumper wires with readily available dc and ac power supply. The

power supply for AC230V powered devises also readily available for these types of combinational control.

5. Feedback of MIOT application

In order to get the feedback in using a MIOT trainer in laboratory, students were requested to complete a survey form. This survey consists of 5 questions (Figure 5) for students' feedback on their experience before the application of MIOT trainer (Pre-Test) and after the application of MIOT trainer (Post-Test).

MIOT TRAINER PRE TEST			
NO	CRITERIA	YES	NO
1	I know what is IoT ?		
2	I know how an IoT works ?		
3	I know how to activate an IoT ?		
4	I know how to activate a electrical device using IoT module.		
5	I can apply IoT concept in my final year project		

MIOT TRAINER POST TEST			
NO	CRITERIA	YES	NO
1	I know what is IoT ?		
2	I know how an IoT works ?		
3	I know how to activate an IoT ?		
4	I know how to activate a electrical device using IoT module.		
5	I can apply IoT concept in my final year project		

Figure 5 Survey for students

A total of 30 responds received and Figure 6 provides the summary of the survey done.

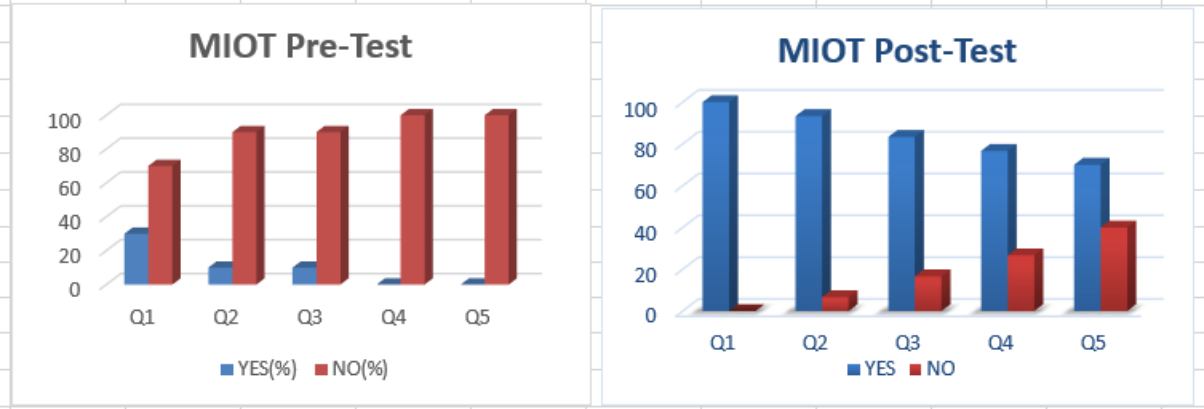

Figure 6: Summary of the survey feedback

In the MIOT Pre-Test, 0% to 30% of the students answered YES to the 5 questions. However, in the MIOT Post-Test, 70% to 100% of the students answered YES to the 5 questions. This shows that most of the students responded positively in the usage of MIOT trainer can assist in better understanding of Iot interfacing. They recommended that it should be integrated in other electronic subjects too so that other students will be familiar with the real world application. Moreover, the application of the MIOT trainer not only has enhanced their understanding in the technique of interfacing microcontrollers to other electronic and electrical components, it also sparked their interest to further explore the advantages of MIOT

for other projects. The instructors also indicated that the MIOT is a very effective teaching aid and concepts of interfacing in engineering could be easily delivered in a more efficient way.

6. Conclusion

The MIOT trainer developed in this paper enable students to learn and experience the real life application of a wireless control system through the IoT protocol. This is a simple leaning trainer to show the bigger picture of how to control real application being done in the industries. This trainer can overcome the confusion, difficulty, challenge and the fear of the of students to interfacing from a small Transistor-Transitor Logic(TTL) signal output from the controller to control higher power appliances. A practical work sheet with combinational material such software, hardware, communication can be integrated with the MIOT trainer for enhancing teaching and effective learning process. With significant positive feedback from the lectures and students of IoT interfacing in teaching and learning, the MIOT trainer is a learning medium that is an effective support tool to learn and understanding the IoT interfacing in TVET teaching, learning and application. It appears that in the hands of a trained teacher the MIOT would be an appropriate and effective leaning aid. Students can easily master the IoT interfacing which have a positive impact on the learning process, especially in improving their skill, experience the real life like application and learning perception. The hands on skills in the laboratory with this trainer can enable the students to apply the skills outside the laboratory in a real life application in various field. This in turn can definitely have a positive impact on students when they are in real life situations in the industries. The feedback from the lectures and students also found that the MIOT multi interfacing trainer has a positive impact, influence and enhance learning experience for the students.

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