ENHANCING THE HAND ON EXPERIENCE OF *UOH* STUDENTS BY ORGANIZING PRACTICAL COURSES

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ABSTRAC: *The main objective of this paper is to illustrate the requirements for enhancing the hand on experience of both the under graduate and fresh graduate students of the Computer Science and Engineering College (CCSE) at University of Hail (UOH). This can be done by organizing non curriculum courses related to the practical implementation of electronic circuits. It is so effective to organize such courses related to the practical implementation of analog and digital circuits. Also, it is important to have practical laboratories at which the practical implementation can be carried out. Such labs are already existed in the CCSE at UOH. During each semester, many basic circuits are designed, simulated, implemented and tested in such labs. A sample of the hardware projects as an output of the CCSE hardware laboratories is presented. In addition, it is important for the students to gain certified certificates for the non curriculum courses which they pass. Thus a collaboration has to be held with a well know company enjoying good reputation in the Middle East. Such company has to be specialized in the training on the practical implementation of electronic circuits. This collaboration permits the students to gain certified certificates for the training which they pass.*

Keywords— Practical implementation, CCSE hardware laboratories, Non curriculum courses, Hand on experience

INTRODUCTION

It is highly important to graduate students who have a hand on experience in the field of electronic circuits [1, 2]. Such experience enables the students from satisfying the overall design flow. Thus they can firstly design the circuit, simulate it, and make its practical implementation. Finally they can test the practically implemented circuit [3, 4]. Gaining the hand on experience enables graduate student to not just compete with their competitors in the market, they will also dominate them [5, 6]. There are some requirements which have to be available for enhancing the hand on experience of our CCSE students. Firstly, there must be available laboratories at which the practical implementation can be carried out. Such laboratories are already existed in the computer science and engineering college of UOH. With the existence of such laboratories, it is available to organize non curriculum courses. These courses are specialized in the practical implementation of electronic circuits, both analog and digital. During each semester, many basic circuits are designed, simulated, implemented and tested in such labs. Such circuits are related to the course which is served by each lab. A sample of the hardware projects which came out of the CCSE hardware laboratories is presented. Also, it is important to hold collaboration with a well-known company which is responsible of giving training on the practical implementation of electronic circuits. Thus, students can gain certified certificates in the field of the training courses.

II. THE LABORATORIES OF COMPUTER SCIENCE AND ENGINEERING COLLEAGE AT UOH

The computer science and engineering college in UOH has nine Laboratories. Table 1 summarizes the name of each lab and its location in CCSE at UOH.

Table (1): Name of the laboratories of CCSE department at UOH with its locations

Lab Name	Location
Digital Logic Lab	11C – 004
Electric and Electronic Circuits Lab	11C – 105
EMC² Lab	11C – 106
Oracle Lab	11C – 107
CISCO Network Lab	11C – 108
Microsoft Lab	11C – 109
Microprocessor Lab	11C – 206
Printed Circuit Board Lab	11C – 207
Robotics Lab	11C – 209

Table 2 contains the name of the courses with its course code which can be served by each lab.

There are three labs concern with the practical implementation of digital and analog electronics circuits. These labs are the Electric and Electronic Circuits Lab (11C – 105), the Printed Circuit Board Lab (11C – 207) and the Microprocessor Lab (11C – 206).

Both of Lab 11C – 105 and 11C – 206 contain all the requirements for the practical implementation of digital and analog electronic circuits. It contains the required powering instruments, function generator and the power supply. Also, it contains the required measuring instruments, digital oscilloscope and digital multi-meter. In addition, it contains both the test board and the electronic components required for implementing the electronic circuits. Figures 1, 2, 3, 4, and 5 shows pictures for the powering instruments, the measuring instruments and the test board which are included in Labs 11C – 105 and 11C –206 of CCSE.

Table (2): Name and code of the courses which can be served by CCSE labs

Lab Name	Course Name	Course Code
Digital Logic Lab	Fundamentals of computer engineering	COE200
Electric and Electronic Circuits Lab	Electric Circuit, Electronics I	EE201, EE203
EMC^2 Lab	Cloud computing	ICS490
Oracle Lab	Data base systems	ICS334
Cisco Network Lab	Computer networks	COE344
Microsoft Lab	Introduction to computer	
Microprocessor Lab	Computer organization and assembly programming, Microcomputer system design	ICS232, COE305
Printed Circuit Board Lab	COOP training	COE351
Robotics Lab	System design lab	COE400

During each semester, many basic circuits [7] are designed, simulated, implemented and tested in such labs. Such circuits are related to the course which is served by each lab. For example, for electronics 1 (EE203) course which is instructed by the author, all of the diode applications such as a half wave rectifier, full wave rectifier, clipper circuits, clamper circuits and voltage doublers are designed, simulated, implemented and tested in lab 11C-206. The bipolar junction transistors (BJTs) basic circuits are also designed, simulated, implemented and tested.

Finally, at the end of the semester, the author as the instructor of the course asks the students to present a simple project at which they combine all of the experience which they gained during the semester. For example, they are asked to design, simulate, implement and test a DC power supply. Thus the students gained the experience of applying the overall design flow. Also, they become more confident concerning the hand on experience which they gained during the semester.

Figure 1: Power Supply

Figure 2: Function Generator

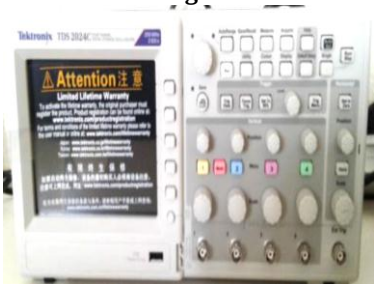


Figure 3: Digital Oscilloscope **Figure 4: Digital Oscilloscope**

Figure 5: Test boards

For lab 11C – 207, it is related to fabricating the printed circuit board (PCB). This step is carried out after the design, simulation, the practical implementation and the testing of the circuit on the test board. It is important to completely check the circuit operation in the phase of the test board before its implementation on the PCB [8]. This lab is important. It seems like a small factory for fabricating the PCBs. Figure 6, shows the machine which is used to fabricate the PCB. Figure 7 shows the soldering devices. Figure 8 shows the soldering guns.

Figure 6: Machine used for fabricating the PCB

Figure 7: The soldering devices

Figure 8: Soldering guns

III. A SAMPLE OF THE HARDWARE PROJECTS CAME OUT OF CCSE HARDWARE LABS

The labs of Computer Science and Engineering College at UOH support the practical implementation of the basic core courses for the undergraduate student, mentioned in table 2. Also, it supports the cooperative training (COOP) students who are in their final year. There are too many COOP projects supervised by the author which was carried out in CCSE labs. For each project, the designed flow was completely fulfilled. It means that for each project, the COOP students under the supervision of the author carried out the design, simulation, practical implementation and testing for their project. All of these projects were carried out in lab 11C – 206. These projects were implemented at the level of the test board (white). Figure 9 shows the hardware for the stair lamb system. Figure 10 and 11 show the hardware for the light sensor project. As shown in figure 10, the LED glows when there is light, in figure 11, when the light gone, the led turned off.

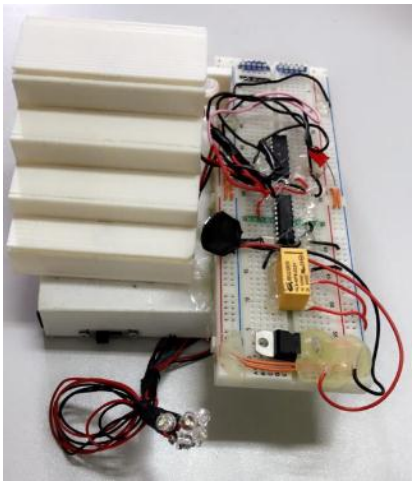


Figure 9: the hardware for the stair lamb system

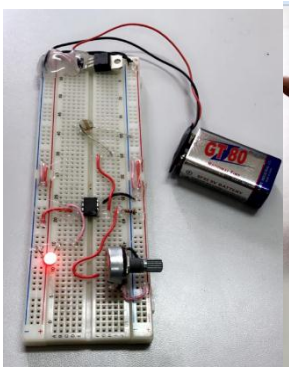


Figure 10: Light sensor in light

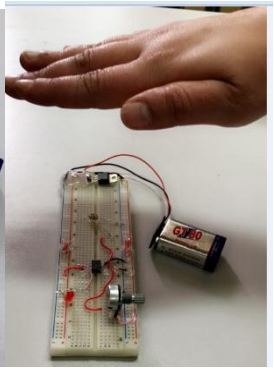


Figure 11: Light sensor in dark

One of the most outstanding COOP projects which was supervised by the author and carried out in the CCSE labs is the design, simulation, the practical implementation and testing of a function generator. This function generator generates sinusoidal, triangle, saw tooth and square waves. Also, it is designed to give the facility of frequency variation. The function generator was firstly, designed, simulated, practically implemented and tested on the test board to check that it is well functioning. All of these steps are carried out in Lab 11C – 206. After that, the well functioned function generator was implemented on a PCB board using the facility of lab 11C – 207. Thus, at the end we have a function generator product which is completely designed, simulated and implemented using the facilities of CCSE hardware labs at UOH.

Figure 12 shows the implemented function generator on the test board using lab 11C – 206 facilities. The push bottom which is responsible for changing the generator output between the four signals (sinusoidal, triangle, saw tooth and square waves) which are generated by the function generator is indicated. Also the variable resistance which is used for varying the frequency is indicated. Finally, the pins used for taking the generator output appear in figure 12.

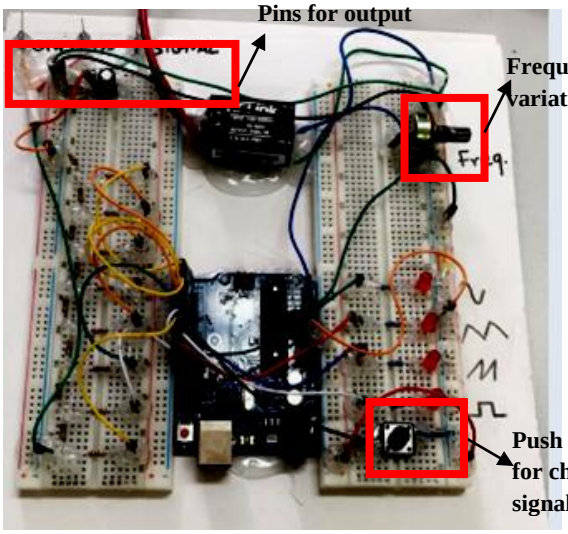


Figure 12: The implemented function generator on the test board using lab 11C-206 facilities

Figure 13a, b and c show the testing using oscilloscope of the output of the implemented tested board based function generator. It shows that it generates triangle, saw tooth and square waves.

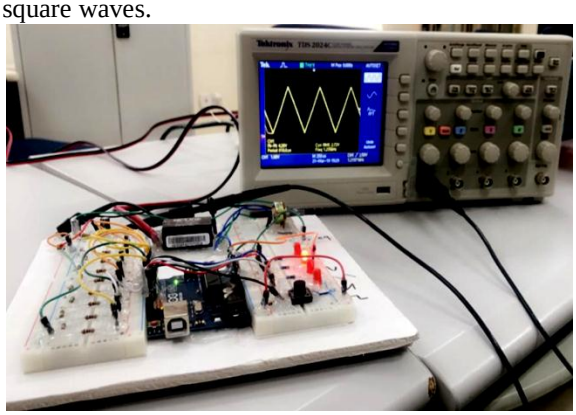


Figure 13a: Testing the output of the implemented tested board based function generator using oscilloscope. Triangle wave generation

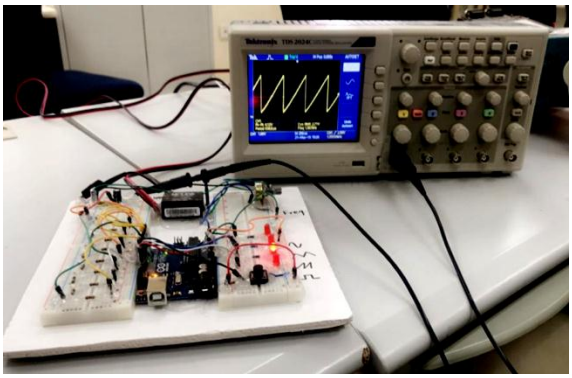


Figure 13b: Testing the output of the implemented tested board based function generator using oscilloscope. Saw tooth wave generation

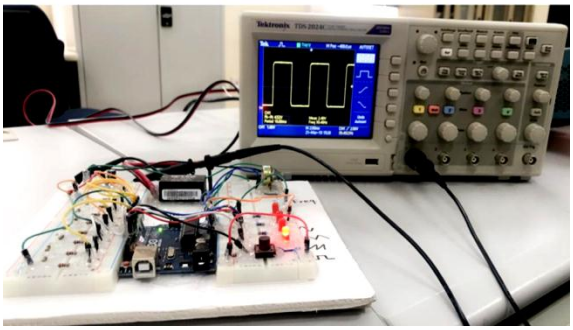
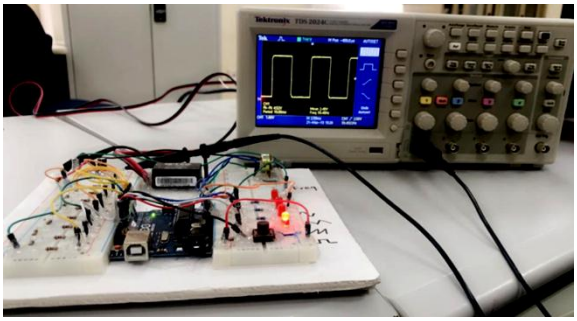
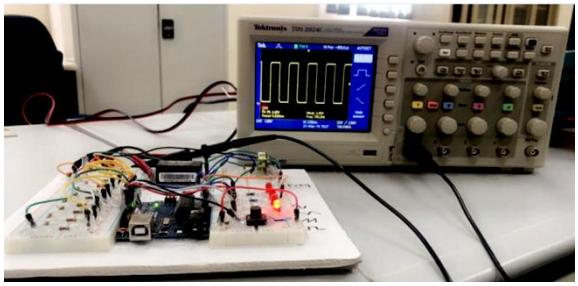


Figure 13c: Testing the output of the implemented tested board based function generator using oscilloscope. Square wave generation

Figure 14 a, b show the frequency variation using the function generator. As a demonstration, it shows the difference between the periods of two generated square waves from the same output pins of function generation. The square waves are displayed using oscilloscope. It is clear that the period is different for the same output square wave. This test can be done for the four generated waves out of the test board based function generator. But the saw tooth wave is selected as a sample.



(a)



(b)

Figure 14: Frequency variation using the function generator: 14a) shows square wave with low frequency in comparison with 14b)

Figure 15 shows the function generator which is implemented on PCB using lab 11C – 207 facilities. It is consider as a product. Similar to the tested board based function generator, As indicated in the figure, it also generates four waves (sinusoidal, triangle, saw tooth and square waves). Also it has a bottom for changing the signal. In addition it has a frequency variation bottom.

Figure 15: PCB implemented Function generator using lab 11C-207 facilities

Figure 16a, b, c and d show the testing using oscilloscope of the output of the implemented PCB board based function generator. It shows that it generates sinusoidal, triangle, saw tooth and square waves

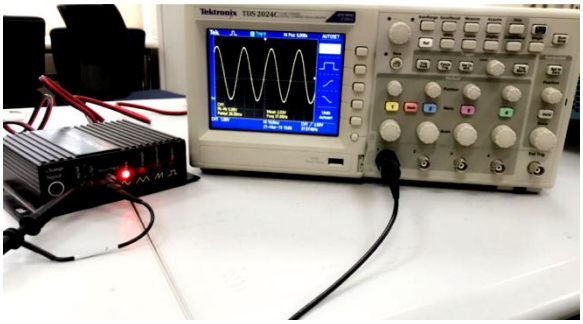


Figure 16a: Testing the output of the implemented tested board based function generator using oscilloscope. Sinusoidal wave generation

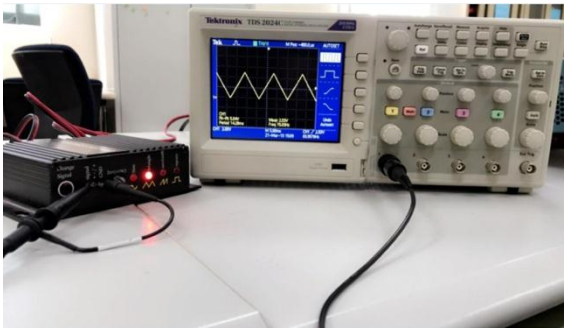


Figure 16b: Testing the output of the implemented tested board based function generator using oscilloscope. Triangle wave generation

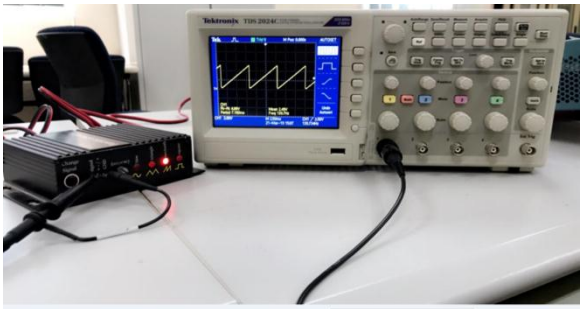


Figure 16c: Testing the output of the implemented tested board based function generator using oscilloscope. Saw tooth wave generation

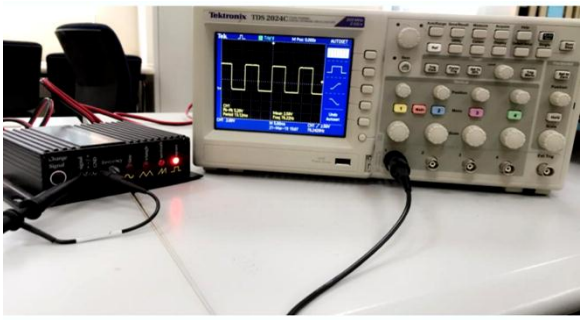
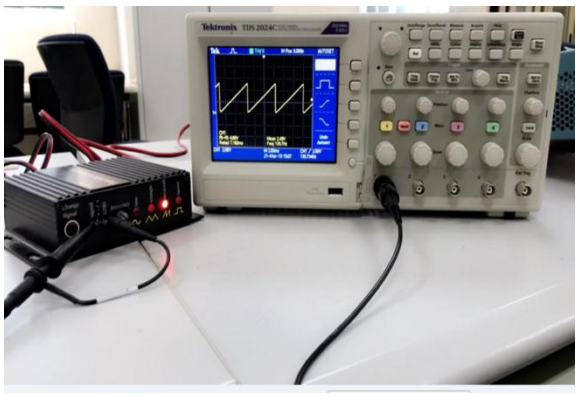
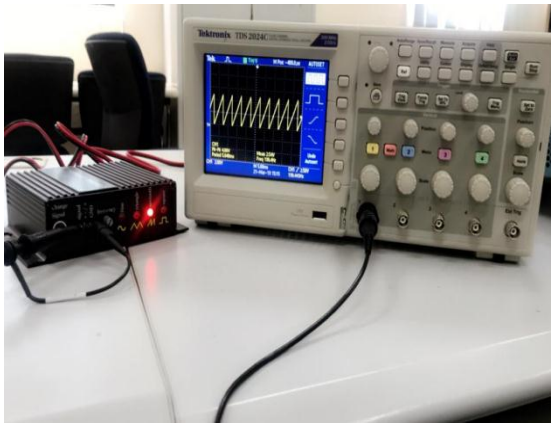


Figure 16d: Testing the output of the implemented tested board based function generator using oscilloscope. Square wave generation

Figure 17 a, b show the frequency variation using the function generator. As a demonstration, it shows the difference between the periods of two generated saw tooth waves from the same output pins of function generation. The saw tooth waves are displayed using oscilloscope. It is clear that the period is different for the same output saw tooth. This test can be done for the four generated waves out of the PCB based function generator. But the saw tooth wave is selected as a sample.



(a)



(b)

Figure 17: Frequency variation using function generator: 17a) shows saw tooth wave with low frequency in comparison with 17b)

As there are many students from UOH were graduated before the establishment of such powerful labs, thus it is important to organize non curriculum courses for the practical implementation of the electronic circuits using UOH labs facilities. The main objective of these courses is to transfer the hand on experience for our graduate students. Thus they will be able to not only compete with their competitors in the market, but they will also dominate them. These courses will target undergraduate students, fresh graduated students and our COOP students.

IV. NEEDS FOR PARTNERSHIP WITH TRAINING COMPANY SPECIALIZED IN PRACTICAL IMPLEMENTATION

It is important for the students to gain certified certificates in the courses which they pass. Such certificates are the evidence that they gain the required hand on experience after passing the course. Thus it is important to hold a partnership with a well-known company. Such company has to be specialized in the field of the practical implementation of the

electronic circuits. Also, the company and its certificates have to be certified from well-known international organizations. Finally, the company has to support the same courses as the organized non curriculum courses by the computer science and engineering college of UOH. Thus, it can provide our students with the certified certificates.

V. CONCLUSION

It is important to transfer the hand on experience to our CCSE undergraduate and fresh graduate UOH students. Such experience enables them from enhancing their carriers. Also, it enables them from acquiring better job opportunities in the market. One of the main requirements for enhancing the hand on experience of our UOH students is the existence of laboratories at which the practical implementation can be carried out. Such labs already exist in the computer science and engineering college at UOH. These labs benefit both of the undergraduate and fresh graduated UOH students. It also benefits the COOP projects. Based on the nature of CCSE courses, many basic electronic circuits are designed, simulated, implemented and tested in CCSE labs. Thus the students gain the hand on experience in practical implementation during their study.
Many COOP projects supervised by the author are carried out in CCSE labs. For each project, the designed flow was completely fulfilled. All of these projects were carried out in lab 11C – 206. The stair lamb system and the light sensor are samples of these projects. One of the most outstanding COOP projects which was supervised by the author and carried out in the CCSE labs is the design, simulation, the practical implementation and testing of a function generator. One of the most outstanding COOP projects which was supervised by the author and carried out in the CCSE labs is the design, simulation, the practical implementation and testing of a function generator as a product. It generates sinusoidal, triangle, saw tooth and square waves. Also, it is designed to give the facility of frequency variation. To have a product both of 11C – 206 and 11C – 207 facilities had to be used. It is important to organize non curriculum courses. Such courses target both the undergraduate and fresh graduated UOH students. The computer college in UOH is seeking for a partnership with a well-known company specialized in the training on the practical implementation of electronic circuits. Thus, our students can gain certified certificates in the courses which they pass.

VI. FUTURE WORK

Organize non curriculum courses for the practical implementation of both analog and digital circuits. These courses target both the undergraduate and fresh graduate students of UOH. Also, it is important to seek for holding a partnership with a training company specialized in the practical implementation of electronic circuits.

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