Use of Virtual and Pocket Labs in Education

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Abstract

this demo shows exercises held at Jadavpur University using a combination of virtual labs (basically electronic circuit simulation) and pocket labs. The use of pocket labs in education enables students to follow their own time schedule and makes it possible to repeat exercises for a better understanding. Two exercises will be shown, both of them using National Instruments’ myDAQ: Basic electronic circuit design compares the simulation result of Multiuse with a real circuit on a breadboard, and computer science and programming lectures will use a Jadavpur University -designed mini System. All exercises using pocket labs are designed to be done at home by students.

Keywords: virtual lab, pocket lab, miniSystem, National Instruments, oscilloscope, circuit

I. INTRODUCTION

This demo is intended to show the experience so far at Jadavpur University with the use of pocket labs. Here, pocket labs are defined as any low-cost hardware equipment, in combination with free (or low-cost as well) software tools, that enables students to do laboratory exercises similar to those held at the campus site at home or other places and at a self-chosen pace [1].

II. EXERCISE 1: CIRCUIT DESIGN LABS

With the simulation tool “Multisim”, the pocket lab NI my DAQ, and the corresponding software suite NI ELVISmx, National Instruments offers a very good and inexpensive package for students to verify their knowledge about electric and electronic circuits, and to do specific laboratory exercises at a self-chosen time and a self-chosen place [2]. The courses in Fundamentals of Electric and Electronic Engineering at JU include basic principles and laws, network analysis under dc as well as ac conditions, component properties, and basic circuit design.

Figure 1 shows the use of a my DAQ together with a breadboard circuit and a simulation of the same circuit. The excitation and the measurement of the simulated as well as the real circuit is done by the ELVISmx instruments, which means, that it is not necessary to change instrument settings when switching from simulation to measurement and vice versa. Therefore, on instruments such as oscilloscope or bode analyzer, simulated as well as measured data can be displayed simultaneously and easily compared.

The plot of a result comparison can be seen in Figure 2; showing both measured data and simulated data in one graph.

Fig. 1: Using NI myDAQ for circuit design labs
The top plot shows the gain of the amplifier circuit; differences at lower frequencies can be caused by component tolerances or even wrong values, whereas the difference at higher frequencies which can also be seen in the bottom (phase) plot, is caused by the capacitive behavior of the breadboard, which leads to an overall low-pass characteristic of the entire system.

Exercise 2: Computer Science Lectures

The miniSystem which can be seen in Figure 3 was developed by Jadavpur University itself and provides a clean, clear, straightforward method to understand a system for learner. It includes an analog output with two analog input (potentiometer and NTC resistor) and digital outputs (LEDs) and digital inputs (switches) [3]-[5]. In computer science lectures, now the students will have the chance for the use of actual data and systems. Both are interacting with each other.

In order to ease of myDAQ in the computer science lectures, a library is used for myDAQ use. This library including of the interface functions has been developed. This is shown in the following Figure 4. By using this library, students can create sample applications for the aforementioned topic.

Since myDAQ is a pocket lab, so that students starts their homework. They will have to complete that by using the device. It is the combination with the Jadavpur University miniSystem. They will stimulate the students to use the pocket lab at home as well as at their work place [6].
III. CONCLUSIONS

Pocket labs might be the next step in the development of laboratory exercises in education, following classic campus labs (students and labs are at the same location on the university campus), and online labs (students and labs are not at the same location). Using pocket labs, students and their lab are at the same location again, but this could be anywhere. Moreover, pocket labs can combine the results of virtual labs or simulations with real-world results in a very descriptive way.

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REFERENCES