Chapter XII

Enhancing Teaching and Learning Computer Hardware Fundamentals Using PIC-Based Projects

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Abstract

Computer hardware, number systems, CPU, memory and I/O (input/output) ports are topics often included in computer science, electronics, and engineering courses as fundamental concepts involved in computer hardware. We believe that students learn computer hardware fundamentals better if they are given practical learning exercises that illustrate theoretical concepts. However, only a limited range of material designed specifically to supplement the teaching of computer hardware concepts is publicly available (see http://sigcse.org/topics/, the SIGCSE Education Links page on the Special Interest Group on Computer Science Education Web site).
This chapter describes a set of PIC-based projects that give students a hands-on introduction to computer hardware concepts and are suitable for classroom use in undergraduate computer hardware courses.

Learning Objectives

After completing this chapter, you will be able to:

• Discuss the usefulness of PIC projects in teaching and learning contexts.
• Set up PIC-based projects for class demonstrations.
• Define the following key terms: RAM, ROM, LCD display, and microcontroller.
• Suggest further enhancements to PIC projects described in the chapter.

Introduction

Not infrequently, it proves difficult to motivate students to learn computer hardware fundamentals because many students appear to find the subject rather technical, dry, and boring. To overcome this problem the authors have prepared a set of projects that give students a hands-on introduction to computer hardware. They are designed around the PIC16F84, a low-cost, powerful 8-bit microcontroller chip and are suitable for classroom use in undergraduate computer hardware courses. Students have evaluated the effectiveness of these projects formally. The feedback from students indicates that the development and implementation of the projects were successful. This chapter describes the PIC-based projects, their overall effectiveness, and plans for further projects.

Background and Motivation

Computer hardware, digital systems design, number systems, CPU, memory, and I/O (input/output) ports are topics often included in computer science, electronics, and engineering courses as fundamental concepts involved in computer hardware. We believe that students learn computer hardware and
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