Learning Objectives

- Use the Xilinx Embedded Development Kit (EDK) and the Digilent Nexys board with LCD, PMODDA2, PMODAD1 and/or other peripherals to develop an embedded system.

- Use the knowledge and skills you’ve gained in the previous labs to create an original project of your specifications.

- Complete a design project including proposal, specifications, project demonstration and final report.

Introduction and Overview

Each of the previous experiments have provided you with a majority of the steps in the standard design methodology. In this experiment, it is up to you (and your lab partner) to come up with most of these steps. In this experiment, you’ll be able to create your own design that will tie together some of the knowledge and experience you gained in CPE 329.

Final Design Project Requirements

Do something interesting and unique. This is purposefully an open ended requirement. The requirements provided for this experiment are found in the two design phases listed below.

**Phase 1-Project Proposal:** Each team shall submit a written proposal of their project of no more than two pages in length in lecture Wednesday 11/14/07. This proposal should include a description of the project, a hardware block diagram, and a software flow diagram. The proposal will be returned with comments at lecture on Friday 11/16/07.

**Phase 2-Project Design and Implementation:** Each team will make a short PowerPoint presentation to the class during our last lab session scheduled Tuesday 11/27/07. If the team has completed their project by this time, then they can present a demonstration of their completed project to the class; their presentation and demonstration should last approximately 10 minutes. If the team is not ready for a demonstration on Tuesday, then they can schedule with a signup sheet an individual demonstration with the instructor on Thursday (11/29/07) or Friday (11/30/07). A written report must be submitted at the time of the demonstration. The report should contain all pertinent information such as an introduction, design procedures, circuit schematics, circuit block diagrams, software diagrams, VHDL code, and the testing and demo results, as well as the individual conclusion paragraphs; append the original proposal to the end of the report. In addition, following the procedure in the previous labs, each team will submit their Lab 5 .zip file and .doc file to the Blackboard Assignment site by Friday 11/30/07 by 5:00pm.
Acceptable project ideas will be ones that do something that you’ve not done before or ones that extend your current knowledge. You are encouraged to add additional peripherals to your Nexys board to support your final design project. Some possible ideas include the following:

- Communication with the computer or another microcontroller using a UART Lite IP Core.
- Communication with the Nexys board with Hyperterminal; requires IP cores.
- Using the Pulse Width Modulator feature of the OPB Timer peripheral to drive a DC motor or servo. You will need an external motor driver circuit since the FPGA pin can only source a small current.
- Communicate with the VGA port.
- Communicate with an RS232 device.

**PowerPoint Presentation Format:**

On Tuesday 11/27/07 during the lab period, each group will give a PowerPoint presentation overview of their design project. The format of the presentation will be five slides, consisting of:

1. Title: project name, team members, etc
2. Requirements
3. System block diagram: hardware and software
4. Design overview: software and hardware
5. Status of integration and testing, demo

If the team is ready, then a demo will be performed for other students in the lab. The total allotted time for presentation and demo is 10 minutes per team, with the presentation assumed to last 5 minutes. Students are encouraged to ask questions during the presentation (and demo, if performed). To facilitate the presentation, please bring a USB stick with your presentation so that it can be loaded at the start of the lab. The order of presentations will be a signup on the board, with those doing demos getting priority.

**Evaluation of Design Project:**

Your final design project grade will be based on the difficulty of the project that each group selects, how well the group met their proposal requirements as defined by their proposal, your demonstration, and your oral presentation and written report. The project complexity will be assessed based on three criteria, the external circuitry required for the project, the use of new and interesting IP cores or features of IP cores not used in the previous labs, and finally the system complexity of your project. In summary, the total points for this final design project will be 20, as opposed to 10 for the previous four labs, and the points will be awarded equally in the following categories: demo (meets requirements), IP core complexity, software complexity, external circuitry complexity, communication (written report and oral presentation).

**Due Dates:**

Wednesday 11/14/07: Each group turns in proposal in lecture.
Friday 11/16/07: Commented proposal returned to groups during lecture.
Tuesday 11/20/07: Laboratory time to work on project, and seek assistance for questions.
Tuesday 11/27/07: Presentations in lab; if ready, demo after presentation to lab students and instructor.
Thursday and Friday 11/29-30/07: Sign up sheet schedule for demos to instructor.
Friday 11/30/07: Submit Lab 5 .zip file and .doc file to the Blackboard Assignment site by 5:00pm.

**Modifying Your Design**

While you work on your design you might want to add to it or change what you are doing. This is permitted as long as you submit a Design Change Proposal and have it approved by your instructor. A Design Change Proposal should include your original proposal along with all modifications you made to it. Include all Design Change Proposals in your final lab report. You will be graded by how well you met the system requirements of your Design Proposal or your most recent Design Change Proposal.