CENG3430 Rapid Prototyping of Digital Systems
Free Project

Objective

1) To learn and practice how to employ Hardware Description Language (VHDL) to implement complicated architectures on FPGA.
2) To learn and practice how to use and interface different embedded systems efficiently.

Aim

This project allows you to fully utilize your creativity to solve some practical problems in the world and implement your solution with the hardware you learn from this course.

Requirement

1) Design your project based on Zedboard.
2) In your project, the following parts should be included: Input(s), output(s), main core unit, control unit (FSM).
3) **Two students in one group. There will be no bonus if even you complete the project individually.**

Marking scheme

1) **Demonstration / Presentation (60 %)**
   Each group will be given 5-10 minutes to demonstrate your project to us. The project will be evaluated based on:
   a) The techniques used in the project (20 %)
   b) Completeness of the project (10 %)
   c) Creativity of your project (10%)
   d) Presentation performance (20 %)
2) **The Report (40 %)**

The whole project carries 40% of the coursework marks.

Deadline

1) Demonstration:
   Time: 19-Apr-2016 (Tue) 16:30 – 19:30
   Venue: SHB 102
2) Report: 24-Apr-2016 23:59

Please zip the report and all source code together and submit to E-learning system (for source code, please submit whole project folder)

Late demonstration: 33% mark deduction per day

(If you can't finish your project in the prescribed times, you must negotiate the demonstrate time with tutors first)

Short report

Your report should be typed on A4 papers. **(max. 8 pages including appendices, figures, etc., 1 inch margins, 12pt., single-line spacing, no title page)**

You are encouraged to include reasonable number of pictures of your project.

Please follow the following report structure.

Abstract

- About 100 words, this summarizes the whole report – from Introduction to Conclusion. Since in some research document databases the reader can only access the abstract but not the rest of the report, so the purpose is to give the reader a brief summary of what you have done in this project and the significance of it.
- You may rephrase some contents used in the introduction and conclusion here.
- Abstract is an independent passage, it has no chapter index.

1. Introduction

This is the real beginning of your report. Since the abstract only presents a brief summary to readers, therefore you may repeat what you have written in the abstract here.

An introduction can be a chapter containing the answers of the following questions:

- What is the problem you want to solve? (Problem definition)
- Why the problem is important? (Motivation)
- What are the previous solutions by yourselves or others? (Review, include cross references)
- What have you achieved in this project? And how good the result is compared with other approaches? (Contribution)
- What is the structure of this report? (Content of the report; Chapter 3 is the description of the theory and design etc.)

2. Theory and design

1. Overview: describe the architecture and overview of your project. Use flowcharts, block diagrams, for better presentation.
2. **<u>Important : Draw the FSM of your system. (if any)</u>**
3. Always remember to tell readers what is the input of your system (e.g. using switch / buttons etc.), and what is the output (e.g. model, pose, motor speed, output voltage etc).
4. Module descriptions: discuss each module of the system clearly and the interactions among them. The guidelines are as follows.
    i. Justify the selection and applications of the modules (the mechanical parts, hardware parts and software).
    ii. Give name/model numbers of the components. Insert diagrams if possible,
    iii. Circuits (if any): Block diagrams are preferable, detailed circuits should be placed in the appendix. Explain the operations of the circuit and explain why such circuits are necessary.
    iv. Software: Describe the key program or algorithms by using flow diagrams or pseudo code, explain why these algorithms are necessary.

3. Implementation and experimental result

- Implementation: describe how the system was integrated to become the final product. Use past tense to write this part.
- Experimental result: Any system built should be tested to evaluate its performances. State the procedures of the experiments (past tense) and show the results.
    i. Use tables or graphs: For example, for a temperature control system, you can plot a graph showing the temperature change against time.

You can consider adding some photo to show how your system works.

4. Discussions

i. Expectations: Have you realized the preset goals and how good it is?
ii. Discussion of the evaluation results in the section of "implementation and experimental results".
iii. Difficulties encountered during the implementation, limitations.
iv. Others: e.g. trade-off of the system (like memory-time trade-off), cost of production (is the design suitable for massive production)……
v. Further improvement and possibilities.

5. Conclusion

State clearly what you have achieved in this project.

- What is the problem you want to solve? (problem definition)
- What have you achieved in this project? And how good the result is compared with other approaches? (contribution)

6. References (optional, may use web links as references)

7. **Appendix (optional**)