# Laboratory Assignment #8

Objectives

The objective of this lab is to leverage intellectual property you have previously developed to implement a video game, using an embedded processor system in an FPGA. You are encouraged to be as creative as possible to differentiate your design from that of others and improve your grade relative to your peers. You may choose any game you wish, except for the ping-pong game shown in Figure 1, because the instructor will use it as a discussion example.
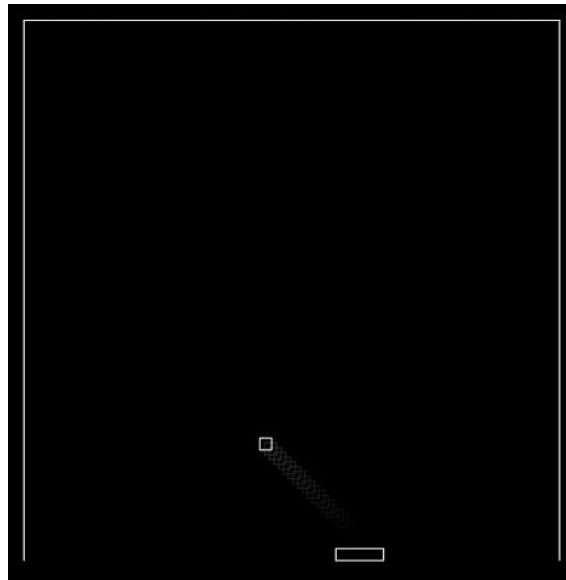
Figure 1: Any Game Except Ping-Pong

In the simplest implementation, the hardware work may be minimal – as easy as integrating your functional hardware results from previous lab assignments. The main task is then one of software – to write software in PicoBlaze assembly to implement the desired behavior.

This is a group project. Each group is responsible for a single implementation. Groups are allowed to use modules from any and all group members to complete this assignment. The development effort should be partitioned to allow group members to work in parallel, where possible.

When you successfully complete this lab, you will have completed a substantial synchronous digital system design which you might consider a small system on a chip, or SoC.

Project Specification

Watch this video on YouTube for ideas: https://www.youtube.com/watch?v=J8eZOJr5rs4

This specification is intentionally vague to provide you the most freedom. Your result will not be evaluated by comparison to any of the games in the reference video, it will be compared to the results of the other groups in the class. You must use PicoBlaze to implement the behavior.

Project Proposal

The group must generate and submit a short project proposal. The purpose of this proposal is to indicate the game you will attempt, to document your plans for the instructor, and to outline how you will approach the design challenge. You should include a rough work breakdown and task assignments, so that it is clear "who is doing what" for this project. Once your proposal is approved by the instructor, you should begin implementation in earnest.

Free Advice

Do not delay; start planning immediately. You must implement at least some form of baseline game (that is, if you turn in something that cannot be "played" you won't earn many points). Try to differentiate your implementation for a better score.

The first thing the team should do is integrate all the necessary hardware components and verify that PicoBlaze can control them properly. To confirm the hardware works as you expect, you may write multiple, simple test programs to exercise each hardware component of the system. You are not required to submit these, but you will be asked to provide them if you ask for assistance debugging some aspect of your design and the hardware correctness is in question.

With known good hardware, the project then becomes a matter of software. The instructor will provide and discuss a reference software architecture to help you get started.

Laboratory Hand-In Requirements

This lab requires a group proposal to be approved before work is started. The proposal need not look professional, but must communicate relevant project information. The proposal must be submitted in a single electronic file. The only acceptable file format for submission is PDF.

This lab also requires a group presentation. The presentation must be submitted as a professional-looking document in a single electronic file. Use of Microsoft PowerPoint is recommended. The only acceptable file format for submission is PDF. The body of the presentation must be written in English and contain the following sections:

- Title page containing group number, student names, the lab title, game name, and the date.
- Introduction containing a brief summary of the problem the group set out to solve and your final results. Please include a table or chart that shows each group member's initial work assignment and some measure of how much was completed.
- Design details documenting how the group achieved the final result. This is the most important part of the lab presentation. Illustrate understanding of the project and explain how it was implemented.
- Final results. Include information such as maximum frequency, resource usage, etc...
- Conclusion containing a brief summary and constructive criticism of the lab.

The presentation should be no more than eight pages, total. Budget four pages for the design detail and then one page for each of the other sections outlined above. The goal is to have a presentation that lasts about twelve minutes. Do not include project source code listings in the presentation. Do not waste valuable "presentation space" reproducing information that the audience already knows. For example, regurgitating information about previous lab assignments is a waste of space because everyone already knows what they were. Avoid huge "paragraphs" of text, keep it short and simple and use graphics where appropriate to illustrate.

Once your group has completed a working design and created a presentation, prepare for the presentation and demonstration process. During the scheduled final exam time, all groups will give their presentations. Following the presentations, all groups will exhibit their hardware.

__Prior to the scheduled final exam time__, your group must submit the entire project directory and presentation in the form of a compressed ZIP archive. The presentation must be in the project directory with the file name lab8_group#.pdf. Use WinZIP to archive the entire project directory, and name the archive lab8_group#.zip. For example, if I were responsible for group three, the submission name would be lab8_group3.zip and contain lab8_group3.pdf along with the entire project directory. Then email the archive to the instructor. Only WinZIP archives will be accepted.

No late submissions are accepted. You are advised to submit your archive in advance of the scheduled final exam time. If your circuit is not completely functional, you should write a presentation documenting what you have accomplished and demonstrate what you have implemented to receive partial credit.

Name: _____   Group: _____

Instructor Notes on Presentation:

Score Components for Presentation Grade (50%) _____

_____ out of __50_   Group illustrated understanding of the work and described how it was implemented. Group provided appropriate level of technical detail and used block diagrams, flow charts, tables, figures, or other forms of graphical communication.

_____ out of __25_   Quality of presentation slides. Does it look like effort was expended?

_____ out of __25_   Individual delivery. Does it look like you know what you are talking about?

Score Components for Demonstration Grade (50%) _____

_____ out of __25_   Observable individual work contribution in demonstration and submitted files.

_____ out of __25_   Cross-team evaluation: ___, ___, ___, ___, ___, ___, ___, ___, ___, ___
                              ___, ___, ___, ___, ___, ___, ___, ___, ___, ___

_____ out of __50_   Instructor evaluation of overall demonstration result.