

Project proposal,
Design of Embedded Systems Advanced Course,
EDA385

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1 Introduction

The purpose of the project is to implement the Space Invaders game from 1978 on a Diligent Nexys-3, Spartan 6, FPGA. The implementation will include design of both software and hardware.

Figure 1 is a screenshot of the original game. The goal for the player, at the bottom of the picture, is to shoot all the enemies before they reach the player. A keyboard will be used to control the player. The enemies will be able to shoot back at the player. The shots has to be dodged or absorbed by the green shields.

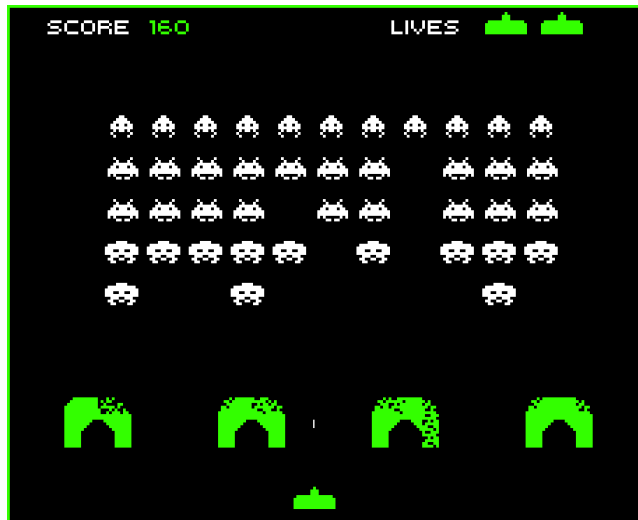


Figure 1: Screenshot of the Space Invader game.

2 Implementation

Figure 2 shows how the implementation of the system will be divided in to several modules.

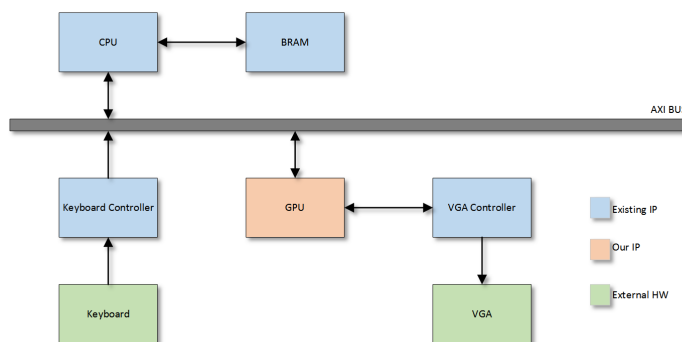


Figure 2: Block diagram of the implementation.

2.1 Software

The software will be implemented on a MicroBlaze CPU on the FPGA-board, using a 32 KB BRAM should be enough. The software will be used to control all movement and actions made by all sprites. Such as keyboard presses and enemy/player movement. The information will be sent to the GPU for processing and later displayed on the screen.

2.2 GPU and BRAM

The GPU will be used to process the image which is to be displayed on the screen. This will be done by having sprite information hard coded in the logic. The GPU will receive information from the CPU about which sprites should be active and where they should be located. The GPU will send the pixel information to the VGA controller.

2.3 VGA controller

The VGA controller will be used to display the processed image of the GPU. The GPU will only send information about what color the pixels should have. The controller will iterate through the pixels horizontally and will send control signals back to the GPU to request the following pixels. Both vertical and horizontal synchronization signals will be used. The goal is to have an output of 640x480 at 60 Hz.

2.4 Keyboard controller

A keyboard controller will be used to decode and handle the input from a keyboard. The available keys is planned to be the left and right arrow keys, space and ESC.

3 Schedule

The proposed schedule can be seen in Table 1. During design specification all in and out signals are specified in the different blocks to be able to split up the work in the implementation stage.

Table 1: Schedule

	1	2	3	4	5	6	7	8	Week
Project Planing	■								
Design Specification		■							
Implementation			■	■	■	■	■		
Verification			■	■	■	■	■		
Final design							■		
Rapport								■	