Project Proposal, Design of Embedded Systems Advanced Course, EDA385

Anton Norell - ada10ano@student.lu.se
Erik Nilsson - fys07eni@student.lu.se
Louise Hauzenberger - ada10lha@student.lu.se

September 12, 2014

1 Introduction

The purpose of this project is to design and implement an arcade game similar to the old mobile phone game 'Space Impact', as seen in figure 1, but with a color enhanced graphics engine. The player will use a standard keyboard as a game controller which is connected to the Digilent Nexys 3 FPGA board.
During gameplay enemies will come from the right of the screen and move towards the player. The players goal is then to shoot down the enemies in order to avoid being shot down or let anyone of the enemy planes get past the player.

Figure 1: A picture of the game Space Impact

2 Functionality

The figure 2 shows how the components of the design should be connected. The modules should be connected via the FSL bus.
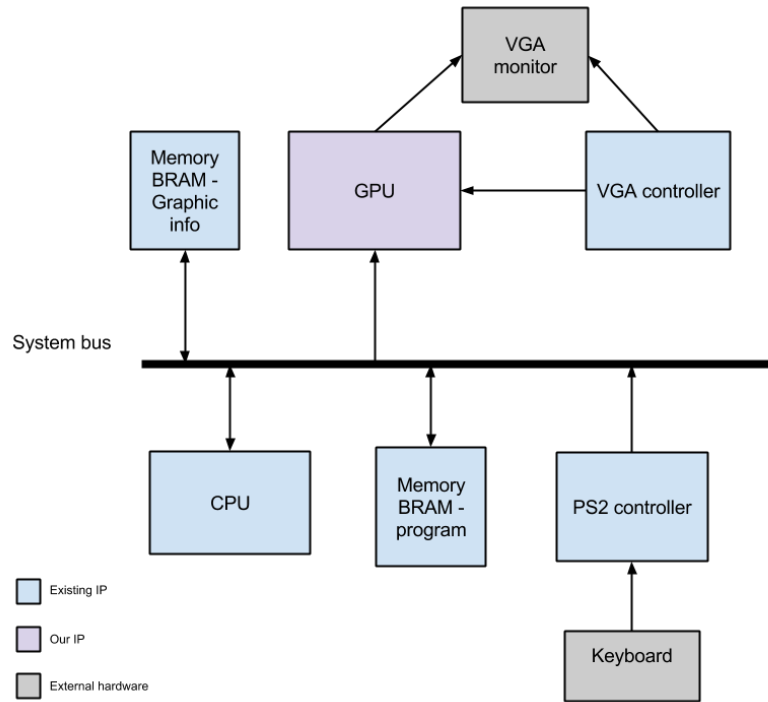

Figure 2: Block diagram over our design

2.1 GPU - Graphics Renderer

The 'GPU' is responsible for drawing (rendering) all the graphics on the screen connected to the Nexys 3 development board. The graphics of this game includes player object, enemies, projectiles and a scrolling background.

2.2 Output - VGA monitor

The graphics of the game is to be displayed on a standard VGA compatible monitor. Custom hardware implemented on the FPGA handles the responsibility of drawing the graphics to the display. The VGA timing generator could be separate from the GPU module in order to create some low level hardware abstraction. The VGA controller is commonly implemented which should allow for code reuse.

2.3 Input - Keyboard

To be able to move the spaceship, a keyboard will be used where the direction buttons moves the ship in the corresponding direction and spacebar to shoot. The keyboard controller handles player input and triggers hardware interrupts in order to recalculate the posistion of objects on the screen.

2.4 Memory

Graphics sprites should be stored in the Block RAM (BRAM) available onboard the FPGA. 32 KB BRAM should suffice for this purpose. This will also avoid having to implement a SDRAM controller for the external RAM on the Nexys 3 board.

2.5 Software

The game software is running on the Microblaze softcore CPU implemented on the FPGA. The responsibility of the software is to keep track of the various states available to the application. This includes position of objects, score, player damage and sending draw commands to the GPU. The software will write the different positions of objects on the the screen to registers that the GPU can access.

3 Possible Improvements

If the time allows us, we will try to implement more advanced game logic and animations. We will also try to implement sound effects.

4 Time plan

Week:	1	2	3	4	5	6	7	8
Project planning	X							
Design		X						
Project proposal		X						
CPU and Memory			X					
VGA controller			X	X				
Keyboard controller			X					
GPU accelerator				X	X	X		
Game logic					X	X		
Integrate						X	X	
Test			X	X	X	X	X	
Presentation							X	
Report							X	X