## Design of Embedded Systems – Advanced Course HT 2009

# Final Project Proposal

Arcade Game: "Spot the Squirrel"

Group Members:

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### **General Description:**

The main objective of the project is to demonstrate the concept of embedded system design involving hardware–software co-design. The project is to be implemented on Diligent NEXYS-2 board. We chose to implement an arcade game called "Spot the squirrel". The main objective and the rules of the game are as explained below.

- The vga-screen will contain 4 squares and a squirrel will pop up from each of the squares at random times and disappear after 1 sec
- The user will have to press the correct button or click on the squirrel to score
- Loses a point if a wrong square is hit or hits after the squirrel disappears
- Game ends when 3 squirrels are missed or ends automatically after 1 min.

We will implement the game graphics by using a custom VGA controller. The VGA controller will be done on the hardware and the coding will be in VHDL. The VGA controller should be able to draw a background with the squares and change the graphics as per the game. The images for the squirrels will be stored on a memory and will be fetched from the memory and displayed at random times inside the squares.

The game logic will be implemented on software and the coding will be done in C and will run on the microblaze processor. To begin with we plan to use keypad on the *digilent* board to enable the user to choose the squares. Once this is done, we plan to use a PS2 mouse controller to give user more flexibility and to make the game more fun.

The sound effects will be included later depending on the availability of time.

A block diagram of the system is shown below in Figure 1.



#### Implementation:

The VGA controller will be implemented on hardware using VHDL. It will be able to drive a 640x480 color monitor. It will be used as shown in the block diagram. The images of the squirrels will be stored in the on chip memory. The Microblaze will instruct when the VGA controller should fetch the images from the memory to be displayed and when to stop displaying the image. Also it will send the details like score and the remaining time duration to the 7-segment display.

Microblaze will be used to control the game. It will interface the user inputs to the VGA controller. It will have a random delay process which will enable us to produce squirrels on the screen at random times. It will also calculate whether the user pressed the correct button in the window when the squirrel is visible and will keep track of the score. It will also be responsible to send signals to the audio controller on the board.

Initially, the user can interact in the game via the buttons on the board. Each button will control selection of one of the squares. The user scores a point when he selects the correct square when the squirrel is visible. After completing these initial tasks, we plan to implement a mouse controller. It will be done via software interrupts and the microblaze will talk with the VGA controller to display a mouse pointer on the screen. The user will be able to select the correct square with a mouse after this is implemented.

After these tasks if we still find time, we plan to implement the audio controller for the sound effects.

#### Time Plan and work distribution:

The project plan and who will be handling the different tasks is shown in the table below.

Week	Task	Team member responsible		
2-4	VGA controller	Can		
2-4	7-segment display	Can		
3-4	Game logic		Rakesh	Balaji
3-4	Mouse controller			Balaji
4-end	Integration/Debug	Can	Rakesh	Balaji
	Report	Can	Rakesh	Balaji