ECE 540 Final Project Proposal
Invaders From Space (WIP)

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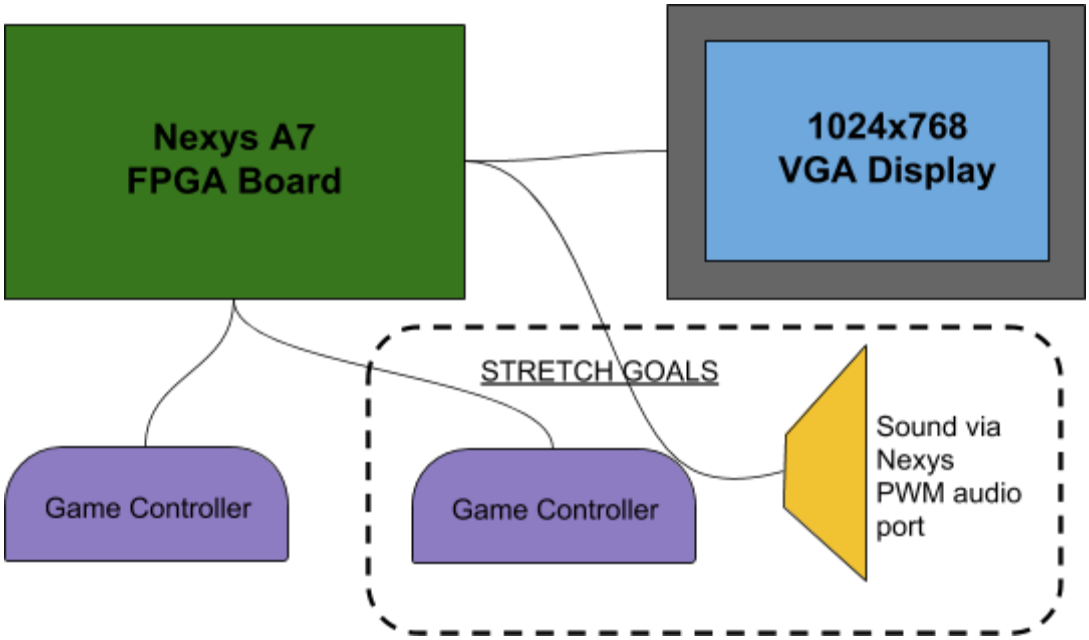
Project Description [what are you going to build? What component(s) will you use? **Include a block diagram of your design as you envision it**]:

We will be doing a recreation (and embellishment) of the classic arcade game, Space Invaders. We will be first be replicating the base functionality of the game on the Nexys A7 board. We intend to use external game controllers, interfaced with the Nexys board, to control the game, and we will use the VGA display of the board to output the graphics to a screen. We would also like, if we have enough time, to add music and/or sound effects to the game via the Nexys' built-in PWM audio output.

Block diagram of hardware:



Design Approach How are you going to build it? how will you demonstrate success on the FPGA Development Board? what are your options if you start running out of time?]:

We envision the final game to have the following features:

- A Space Invaders style game, where moving swarms of enemies are shot by the player as they progress downwards
- The game will be run on the Nexys A7, using the standard MIPSfpga IP core
- Game controller(s) as the player input (either "paddle controllers" or traditional NES controllers)
- 1024x768 VGA display output of the game: including the player, the enemies, and game progress information (e.g. score, lives, level, etc)
- Score calculation and display during the game (On VGA display and/or seven seg display)

- Game options (if any) would be selected via the switches on the Nexys 4 board

And, as stretch goals, we would like to include:

- Optional multiplayer mode, using a second controller of the same type
- Audio (music and/or sound effects) output from the Nexys A7 PWM audio port
- A start menu with game options
- Additional game modes (e.g. endless mode, or different difficulties)
- Upgraded graphics and animations (compared to the original game)
- Ability to pause and resume the game
- Power-ups or ability to upgrade ship weapons
- Different or more powerful enemies

To demonstrate the success of our project, we would show that we have the basic game running on the Nexys 4 with game controller as the primary input, and a full VGA display of the game. The game should emulate the traditional arcade game, with swarms of aliens coming down towards the bottom of the screen, while the player moves along the bottom of the screen trying to shoot them.

If we run out of time, or if we fail to integrate the external controller, we can run the game from the buttons on the Nexys board. However, we believe that we can get the base game running in time, and hope to have some bonus features added to the game (see stretch goals above) by the time of the demo.

Milestones/Deliverables (How are you going to demonstrate that you're making progress):

Week of 24-Feb:

- Divide work up into parallel parts and assigned to team members
- Determine black box interactions between various project parts (purpose, inputs, outputs)

Week of 03-Mar:

- Get hardware controller working with Nexys board
- Outline basic game logic/create a full algorithm, start coding
- Create basic graphics elements and get base VGA output working (adapted from Project 2)
- Feasibility of stretch goals has been researched, a few are chosen and planned for

Week of 10-Mar:

- Finish base game logic, work on score calculation and stretch goals
- Finish basic form of game, make playable (controller, graphics, game logic integration)
- Debug base game, fine-tune/tweak difficulty/game elements
- Start integrating code from stretch goals into the base game
- Create presentation for progress report

Week of 17-Mar : Demonstration and Final Deliverables

- Clean up code and check that it's properly documented
- Debug/test any added features/stretch goals
- Write up final reports and documents
- Create presentation for final demo, practice/check that it will work/time check
- If time, add last-minute features/stretch goals
- If time, update select features from base game (graphics, exact score calculation, etc)