CSC258 Project Proposal

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What is the title of your project?

Volcano scientific drome operation

Provide a one-paragraph description of your project.

This project is a game of controlling planes by players to avoid obstacles along the way until they crash into obstacles. At the beginning of the game, the obstacles would show up randomly at a slow rate, and the gap allowing the plane to go through is wide. The width of the gap is decided randomly behind the scene. As the game continues, the gap will show up with an increasing speed using a speed controller.
There would be 2 types of obstacles. One is static, tube-like mountains, and the other is lava drops moving in horizontal directions coming towards the plane. The scene of the game is moving simultaneously rolling towards the left. The player can operate the plane through key0(when pressed, the plane will go up; otherwise, it will go down) on the DE1-SoC board to dodge the tubes and lava. The Hex lights on the board represents the score for the current player. The time that the player remains alive represents the score that the current player has. Each player can have 3 lives, which is represented by the purple squares shown on the top left corner of the screen. Once it crashes with a lava or a mountain, and the player will lose 1 life. When the player loses all its 3 lives, the game will end. The final score for the player represents the number of times that the player avoids crashing with a lava or a mountain.

Project Description:

(This is where you describe your project in detail. You can use the Design Case Studies slides as a reference on how to create the following components for your project. All of these components are not compulsory for you to have but most projects usually have these components. They are: high level pseudo

code, state diagram, datapath-and-control-CU block diagram, input/output block diagram [Example: https://www.nandland.com/goboard/images/project10-pong-block-diagram.png], truth tables etc. These components should be designed and described to show your understanding of your design i.e. how many bits is each input/output, what is the max number your counter can count up to, how many counters/shift registers you need to use etc. A good idea is to get an initial draft of this done and show to your TA in the next lab or during office hours to get feedback.)

Components of the Game

VGA_Controller.v->generate the active-low signals VGA-HS, VGA-VS by using the implementation introduced in MIT.

Controller.v-> draw the current scene of the game given the coordinates of each object (the coordinates represent the top left corner of each object).

draw.v -> draw objects in the game including lava(represented by a red 16×16 square), 2 mountains(represented by 2 green rectangles with width of 50 and randomly generated heights), plane(represented by a blue 16×16 square)

check_crash.v -> Use the coordinates of the plane and the obstacles to figure out whether they crash or not. When the plane just crashes with a lava or a mountain, it will lose 1 life.

Speed Controller.v-> SW[0] control the rate of screen rolling and the gap's width for lava drop coming out

ScoreDisplay.v(asynchronous) -> track current player's score, increment every time that the player avoid crashing with a lava or a mountain.

VGAFrequency.v ->change the frequency of the vgaclk to 25MHZ to slow down the frequency of the VGA-display

LEDRs -> light up the led according to the note of music

PIN Assignments (input/output)

KEY[0] -> when pressed, plane goes up; otherwise, plane goes down

KEY[1] -> resetn

SW[0] -> difficulty control(default:0 -> normal; 1->hard)
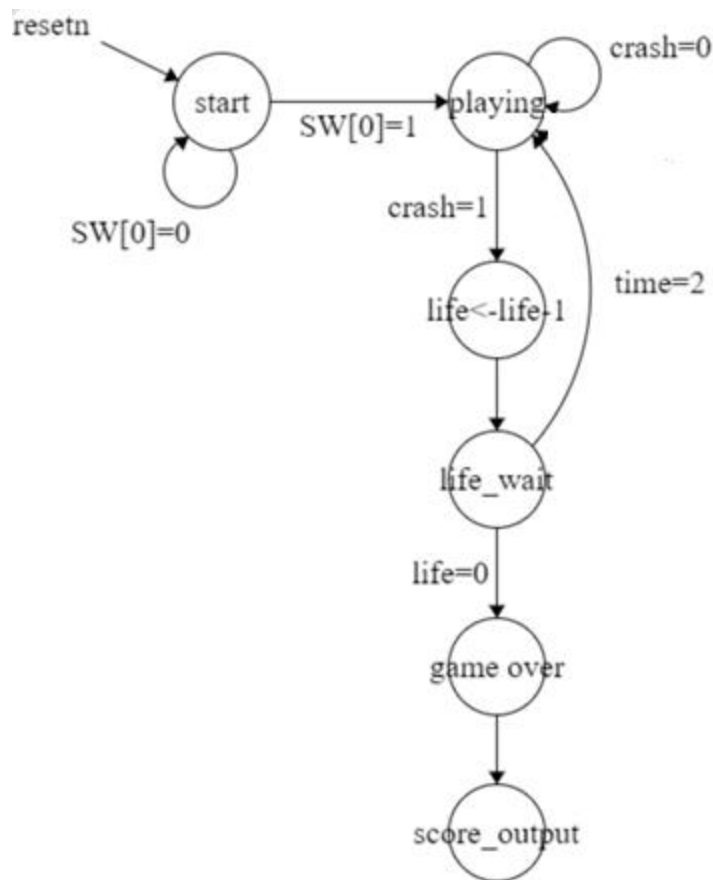
HEX0,1,2-> show score

HEX5-> show the life remaining

VGA -> show the game scene

LEDR[9: 0]->some decoration lights

1. General workflow

What will you accomplish for the first milestone?

(Advice here: Pretend that you're designing Lab 8 around your project idea, in keeping with the difficulty level of the previous labs. Try to be **specific and detailed** in describing the components that you will complete. Don't say that you'll "think about" or "plan" or "design" something.

Bad example 1: We build the graphical interface.

Good example 1: We display moving spaceships on VGA.

Bad example 2: We write code for the PS2 keyboard interface.

Good example 2: We make the PS2 keyboard work and show the key inputs on the HEX display.

Assume your project can be developed in three independent parts, what you write in the space below should outline the components of the first part. Make sure to describe a full lab's worth of work, including the evidence of your work that you will provide to the TAs to justify getting the full marks for this milestone.)

1. We display the tube-like mountains without the randomized generated height in VGA and the lava drop is always coming from the topmost level on the screen.
2. We implement the VGA display with a resolution of "640×480" by method introduced in MIT.
(reference: http://web.mit.edu/6.111/www/s2004/NEWKIT/vga.shtml)

3. We can control the plane up and down by KEY[0].
4. Create Speed Controller to roll the screen of gameplay to the left at constant speed.
5. Displaying the score on hex lights on the board.
6. Implement the register to do statistics on game time
7. Complete the logic of when the plane and obstacles crash together.

What will you accomplish for the second milestone?

(similar advice as above, but for the second part of your project. Remember to specify what inputs and outputs will be used for each milestone. If your project is a visual game for example, what will appear on the screen for each milestone, for example, static colored boxes in one milestone and moving boxes in the next one etc.)

1. Implement the random number generator from 0 to 15 by using the linear feedback shift register.
2. Control the probability of appearance of lava drops and item that triggers unbeatable state
   a. if the difficulty is hard (SW[0] =1) -> the rolling speed would be changing every 30s, and the lava drop would appear more frequently (33%). On the contrary, bonus item would appear more rarely (8%)
   b. if the difficulty is normal (SW[0]=0)-> the rolling speed would be changing every 60s, and the lava drop would appear at 20% probability. On the contrary, bonus item would appear at 15% probability.
3. We will make the Speed Controller work properly. Once SW[0] is turned on, the rolling speed of the screen will be doubled.
4. HEX0-2 represents the total score that the player gets

What will you accomplish for the third milestone?

(don't say "everything" just because this is the final milestone; describe the final components instead, and exactly what the TAs should expect to see)

1. Testing the edge cases whether the gap of tubes is reasonable
2. Three pink squares on the top left corner represent 3 lives of the player. One square will disappear each time the player loses one life.
3. HEX5 represents the remaining lives of the current player.
4. The LEDRs will shine as the game begins.
5. The VGA should display the scene properly
6. The hexes would display the score in decimal (ie, just showing 0-9)
7. Show the demo to TA.

How does this project relate to material covered in CSC258?

This project covers: Shift registers, Hex display, rate divider, counters for tracking lives, time and numbers, and VGA display. These are the fundamental structures appeared in labs and lectures. On top of that, the project also involves designing concepts and ideas revealed in the lectures and labs.

What's cool about this project (to CSC258 students and non-CSC258 students)?

We would recreate our popular old-time classical game in hardware level and add some fancy new features we like to it. Besides, it is a good overall summative practice of all components and designs taught in classes and labs. Hence, we could understand the working theories and the ideas behind those components and designs deeper and better.

On the other hand, this project could attract non-CSC258 students to take this course.

Why does the idea of working on this appeal to you personally?

I(Tianjiao He) saw a movie called Ekipazh that described an internship pilot used his excellent skill to save the passengers on the plane even though they met a volcanic eruption. The exciting story motivates me to write the flight saving game where player can help the power-lost plane to fly over mountainous regions.