Whistle Pongbat

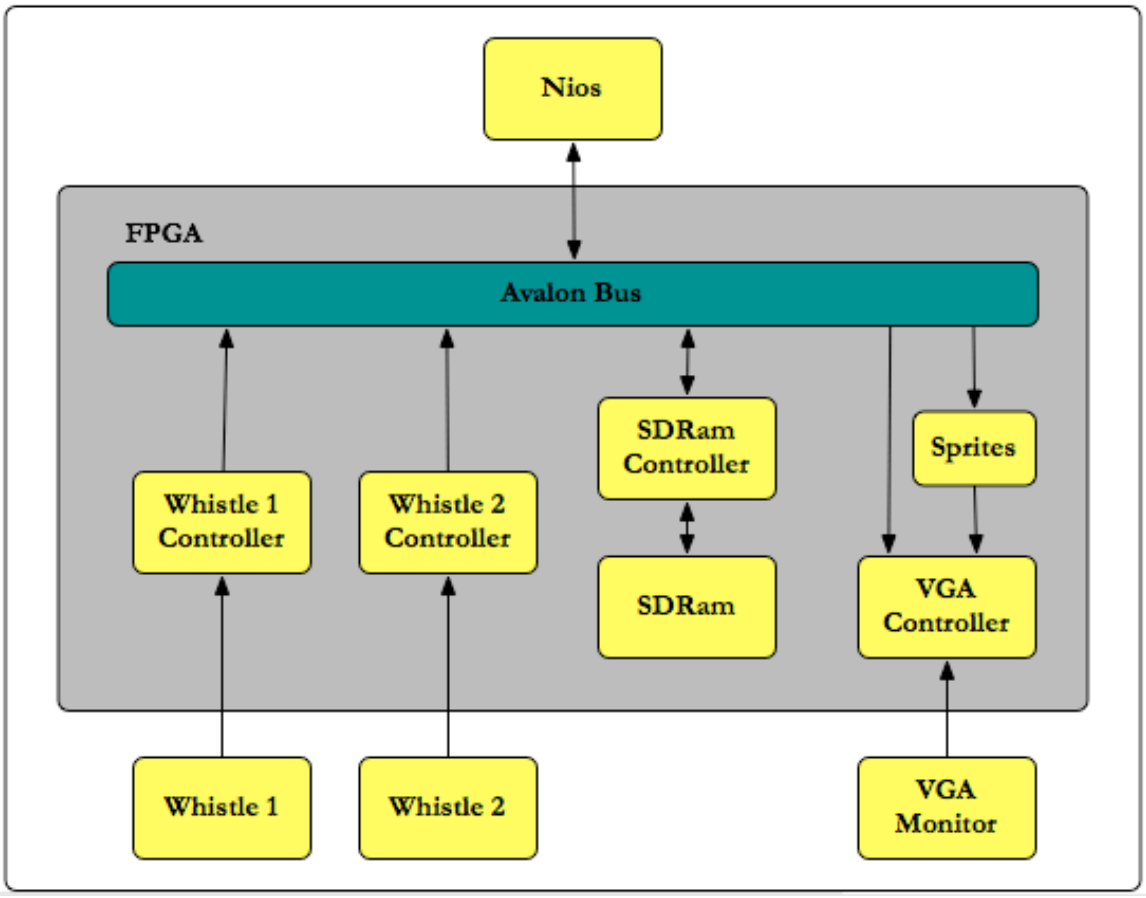
Peter Capraro
Michael Hankin
Anand Rajeswaran

Introduction

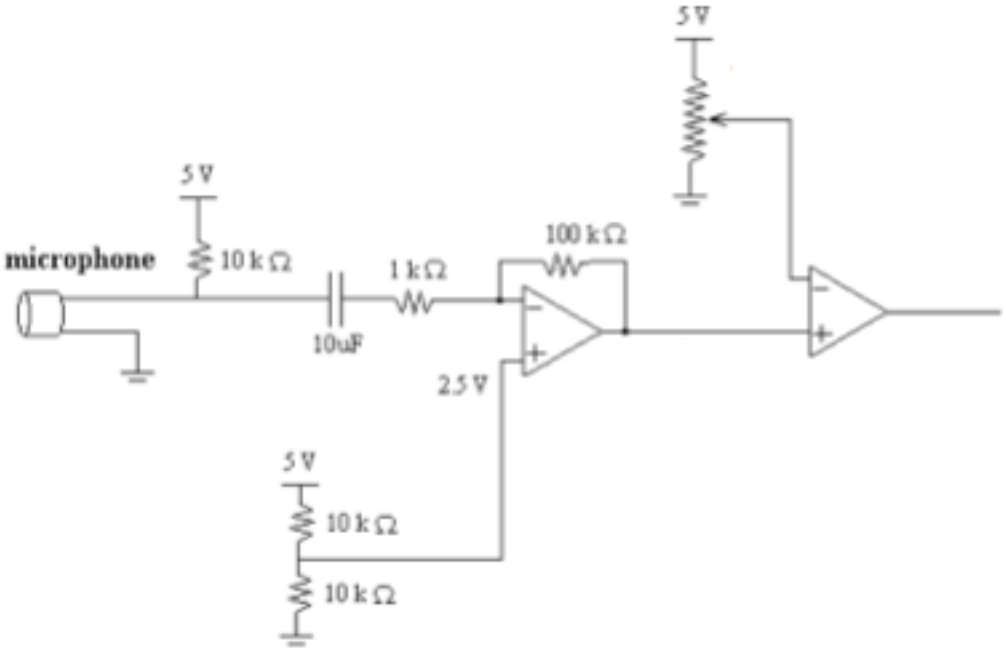
Pong is a classic table tennis arcade game where players attempt to bounce a ball back and forth by controlling the vertical position of rectangular paddles. If the ball hits a paddle, it returns on a path to the other side, but if it misses, it enters the player's goal and their opponent gets a point. The goal is to earn more points than your opponent. We intend to make a videogame that is like Pong only the position of the paddles is controlled by slide whistles, where the pitch of the note played corresponds to the height of the paddle on the screen.

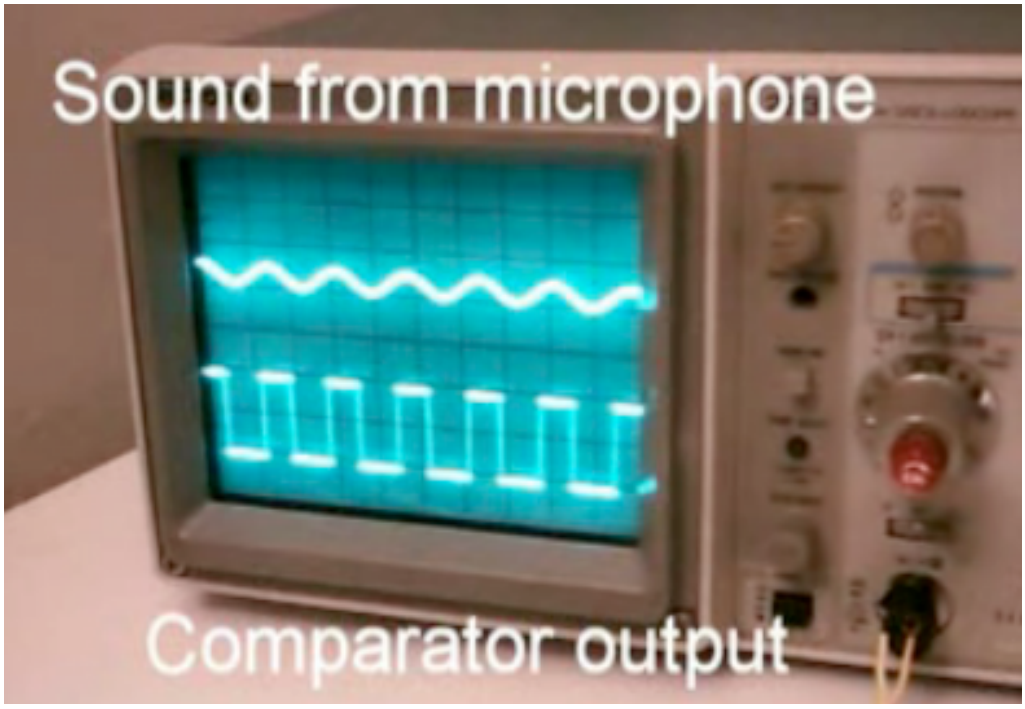
Architecture

The following shows the block diagram for our video game, which consists of input from both players, SDRam, VGA output, and an Avalon bus interface with Nios.



The whistles will be recorded by microphones, which produce a near-perfect sine wave. We will then use a comparator to simplify this into a square wave, which will be the input to the FPGA. The whistle controller will output a measurement of the frequency by simply counting the number of samples between rising and falling edges (the algorithm will account for noise as well). This concept was taken from the site http://lukeallen.org/whistleswitch.html, which provides the following circuit diagram and wave output.





The whistler controllers will also deal with the start button (handling button bounce). The additional components will be similar to the bouncing ball lab but with sprites for the paddles and ball. The hardware will interface with a C Program to control sprite motion and game play. The RAM will store the following values:

Address	Bit Range (MSB-LSB)	Description
0x00	31-16	Player 1's y-position
0x00	15-0	Player 2's y-position
0x01	31-16	Ball's x-position
0x01	15-0	Ball's x-position
0x02	31-28	Player 1's score (10's place)
0x02	27-24	Player 1's score (1's place)
0x02	23-20	Player 2's score (10's place)
0x02	19-16	Player 2's score (1's place)
0x02	15-0	Reserved
0x03	31-16	Player 1's Whistle Frequency
0x03	15-0	Player 2's Whistle Frequency
0x04	31-0	Reserved
…		
0x20	31-0	Reserved

Optional Additional Features

One feature that would enhance the experience of game play a custom controller for player use. The controller would act as a housing for the slide whistle, microphone, start button, and related circuitry. The housing would help the microphone block out sounds other than the whistle and which would be quite necessary especially for two-player play. The controller would be fabricated using the mechanical engineering department's rapid prototype machine.

Furthermore, we would like to enhance the game itself in addition to the controls. One aspect that would add a sense of combat would be if the paddles could shoot lasers to take out portions of the opponent's paddle, thus making it more difficult to return the ball. Also it would be nice to have the lasers "charge" with each successful return (i.e. shooting the laser after 5 successful returns could potentially destroy more of the opposing paddle than after 1 or 2 returns).

Milestones

Milestones listed below are for our original idea without additional features. Starred items indicate steps towards additional features if time permits.

1. a) Build and verify physical hardware aspects including slide whistle, microphone, comparator output. After unsuccessfully searching several music and toy stores in Manhattan, we have order slide whistles online. Unfortunately what we ordered were out of stock and will not arrive until later this week at the earliest.
   b) Confirm block diagrams, solidify and confirm algorithms, and plan VHDL code more specifically

   *Implement whistle controllers and verify that a relative frequency can be obtained for the range of whistle pitches.

2. a) Implement whistle controllers and verify that a relative frequency can be obtained for the range of whistle pitches.
   b) Implement paddle sprite, with position controlled by the frequency of the whistle input.

   *Finalize design of controller casing and circuitry
   *Add ball (moves continuously at 45 degree angles, bounces off paddles when encountered, otherwise passes through)

3. a) Add ball (moves continuously at 45 degree angles, bounces off paddles when encountered, otherwise passes through).
   b) Add game play features such as scoring, start screen, etc.

   *Build controller prototype
   *Implement lasers