Networked Air Hockey Video Game

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OVERVIEW

- **Game Play**
  - Two players
  - Paddle control using mouse
  - First player to 8 points wins!

- **Players on separate terminals**
  - Communication through Ethernet directly connected network
OBJECTIVES

Build the game from scratch that features:

- Fully integrated system (hardware and software)
- Clean, intuitive design
- Fun game play
DESIGN ARCHITECTURE

- Altera Cyclone II FPGA
- NIOS processor
  - CPU
  - SRAM

- Peripherals
  - VGA
  - Mouse
  - Ethernet
VIDEO DISPLAY
Drawing circles require computing the square of the x,y coordinates as well as the radius

Multiplication is toxic!

It is possible to generate circles using only lookups and addition:
- Created array which contains pre-computed squares
- Lookup into the array to get the square based on the index
- Use these values as constant for computing the equation of a square
Point to point ethernet connection established between the players.

Master – Slave configuration.

IP packets transmitted.

Paddle coordinates from slave to master and vice versa transmitted over the ethernet.

Puck coordinates transmitted only from master to slave.
**PS2 MOUSE INTERFACE**

<table>
<thead>
<tr>
<th></th>
<th>Bit 7</th>
<th>Bit 6</th>
<th>Bit 5</th>
<th>Bit 4</th>
<th>Bit 3</th>
<th>Bit 2</th>
<th>Bit 1</th>
<th>Bit 0</th>
</tr>
</thead>
<tbody>
<tr>
<td>Byte 1</td>
<td>Y overflow</td>
<td>X overflow</td>
<td>Y sign bit</td>
<td>X sign bit</td>
<td>Always 1</td>
<td>Middle Btn</td>
<td>Right Btn</td>
<td>Left Btn</td>
</tr>
<tr>
<td>Byte 2</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>X movement</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Byte 3</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Y movement</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

- 3 byte serial transmission from the PS2 mouse.
- Data captured continuously from the data register
- Used Altera `alt_up_ps2_port.c` functions to capture the mouse data
- Created `ps2_mouse.c` file from scratch! to handle the directions and positions of the paddles.
SCORE KEEPING

- Bit maps created for PLAYER: 1, 2.

- Bit maps created for score from 0 -8.

- Every time a goal is scored by a player, the appropriate bit map location is chosen based on the new score and displayed on the VGA.

- Scores are also transmitted over the ethernet to the other player’s display.
Physics simulation
PROJECT EXPERIENCE

- Worked in parallel
- Lots of collaboration
- Learned to work in distracting environment
SUMMARY

• Lessons Learned
  ○ Important to understand the details of each component
  ○ Make use each member’s individual strengths
  ○ Always leave space for adjustments or additions