Squash Yourself...

Presented by
Sumit Khatod
Azadeh Moini
Will Fotsch
Introduction

- The purpose of our project is to create a two player interactive racquetball game.

- This project was motivated by Nintendo Wii’s innovative approach towards making gaming more realistic.

- We wanted to create a game that we could appreciate and enjoy playing ourselves. Since sports are something of interest to us and we find using a real paddle more interactive than pressing buttons; we thought this would be fun.
Division of Labor

- There are three main components
  - User Controls (Sumit Khatod)
  - Game Logic (Azadeh Moini)
  - Video and Audio Output (Will Fotsch)
User Interface
Summary

- The users use a ping-pong racquet with an LED placed in the center to play the game.
- Both movements and swings are registered by a camera that tracks the movement of the LEDs.
- Users can change paddle size using buttons and a switch to select which paddle is being changed.
- Why not accelerometers?
Video Processing

- The camera sends out a YCrCb.
- Using modules provided by the 6.111 staff modified to convert the camera input into RGB, the camera input is stored as a 18 bit color data in a ZBT.
- The data is then processed in a video processing unit to detect:
  - Location
    - center of mass of LED
  - Acceleration
    - change in location of led over last few frames
  - Direction of the swing
    - change in location of led over last few frames
Game Logic
Game Physics

- Determines:
  - Paddle location
  - Ball movement

- Collision detection (ball & paddle; ball & ground)
  - Current hitter

- Ball heat
  - Paddle power and ball speed
  - Ball movement with respect to angle
Scorekeeper

- Whether point awarded or point over:
  - Based on hitter, server, and groundball
- Tracks points:
  - Based on point and server
  - “Rally” for one-player
- Changes server:
  - Based on previous server and point over
Outputs
Display

- On The Screen
  - Court
  - Ball with appropriate size according to the Game Physics
  - Paddle(s) with appropriate size and coordinates according to the Game Physics
  - Scoreboard
    - Player 1 Score, Player 2 Score
    - Rally Score (Hits per point)
    - Ball Heat
  - Frame Buffer will store the display on ZBT Memory
Audio

- Audio clips will be added to make the game more fun and interactive
- Audio clips for
  - Server Change (Player 1 or Player 2)
  - Hit
  - End of a Point
  - End of a Game
  - Power Hits
- Audio clips will be stored into BRAM
  - The samples will be stored using the microphone and selecting the correct BRAM through 3 switches on the FPGA. A button will be used to indicate record mode.
  - BRAM will be split up into 6 different sound bytes on 32K x 8 BRAMs
Project Roadmap

- Phase 1 – Thanksgiving break
  - Basic ball and paddle movements with court graphics

- Phase 2 – December 2\textsuperscript{nd}
  - Full one player mode
  - Major enhancements to the graphics (scoreboard)
  - Ball heat and acceleration calculations

- Phase 3 – December 9\textsuperscript{th}
  - Two player game
  - Sound effects
  - Added graphic detail