Slap the Ninjas!

Giovanni Reveles
Chuan Zhang
Gameplay

- Ninjas appear on screen and attempt to move towards center
- Camera detects players’ hand which tries to slap the ninjas away from center.
Design

Video Processing

hand_position [19:0]

videodataout [23:0]

analog video

hcourt, vcount, hsync, vsync

Game Module

video [23:0]

analog camera

monitor
Video Processing
Issue #1: Synchronization

- Video camera and decoder run on 27 Mhz clock
- ZBT and FPGA run on 65 Mhz clock
- Use series of flip flops to synchronize video data
Issue #2: Hand Detection

- Wear green gloves, use blue background
- Filter out pixels not in valid color range
- Average coordinates of pixels in intensity range to find center of mass of hand
Issue #3: Timing

- hcount, vcount run at 65 Mhz
- Propagation delay from hand detection
- Latency for reading from ZBT
- Total Time access frame’s pixel data < 7.5 ms
Game Module
Game issues

• Ninja Display
  – Several ROMs to represent animation.
  – A “depth” parameter will be use to determine display priority.
  – Initially simple stick figures, will try to implement more complex sprites using portable grey maps and pgm2coe.py provided online.

• To test as stand alone game
  – Generate two button controlled paddles on screen that behave the same way as if hands were detected.
  – To implement game, hand center of mass will be represented as a paddle.
Display logic

- Gives priority to game graphics.
- Essentially a MUX where if there are any game graphics, display them otherwise display the camera pixel.

```
if (time+health != 0)
  if (game pixel != 0)
```

```
if (time+health != 0)
  if (game pixel != 0)
```
Timeline

• Video
  – Dual-ZBT write/read functionality 11/17/2006
  – Live video feed 11/22/2006
  – Hand position detection 12/1/2006

• Game
  – Animated ninja graphics 11/17
  – Game FSM w/ health and time display 11/22
  – Collision logic and stand-alone game implementation 12/1

• System Integration
  – Last Week