Audio Driven Laser Tetris

6.111 Final Project Presentation
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Overview

- Variant of the classic arcade game
- VGA display provides all game info
- Music drives the block movement
- Laser projects the playing field
Tetris Game Background

The seven possible Tetris pieces: I, T, O, L, J, S, and Z
(courtesy of Wikipedia)

Snapshot of a Tetris game on right
System Overview

Audio Module → Game Engine → VGA Display

Laser Display
Game Engine Unit

Randomizer

Dropping Piece

Minor FSM

Major FSM

Map Controller

drop_type [3]

pixel_clock
reset_sync
rotate
drop
left
right
coord_update

i0 [5]
i1 [5]
i2 [5]
i3 [5]

j0 [4]
j1 [4]
j2 [4]
j3 [4]

drop_type [3]

score [6]

pixel_clock
reset_sync
clean_update
game_update
score [6]

map [25][10][3]

disp_type [3]

i [5]
j [4]
Audio Processing Module

- Audio signal digitized by AC97 codec
  - Sampled at 48khz, 18 bit resolution

- Fed through FFT module

- Triggers changes in block speed upon detection of certain frequency intensities
Audio Module

AC97 Codec

Audio Supervisory FSM

Frequency Extractor Module

Event Detector

Audio data [realtime]

reset [1]

ac97_clock (12.288 MHz)

labkit_clk (27 Mhz) [1]

pixel_clk (31.5 Mhz) [1]

DCM

Audio data [255]

audio_intensity_data [255]

Laser Status LEDs [4]

Tetris Speed Output [2]
Laser Projection Module

- Laser light shines onto a 10-sided spinning mirror head assembly

- Infrared pulses synchronize the display with the labkit

- Verilog code modulates the laser accordingly
Laser Module

Debouncer / Synchronizer

Display pixel data [250]

Segment sync

Segment sync clean [1]

Head sync

Head sync clean [1]

Reset

Reset clean [1]

Pixel clk (31.5 Mhz) [1]

Laser Supervisory FSM

Laser_img_data [250]

Image Feeder

Attachment

Laser Control FSM

Laser status LEDs [4]

Laser Modulation output [1]