6.111 Introductory Digital Systems Laboratory – Fall 2011

ImprovTetris - Checkoff List
Ray Li & Scott Bezek

Image-Processing - Scott

Verilog Modules:

- NTSC capture (to ZBT)
  - Adjust memory layout from supplied module to support color
  - Ability to save to 2 different locations (current frame and reference frame)
- Image analysis
  - Can save pixel-difference image to ZBT (for debugging/testing)
  - Use blurring to reduce noice (if time permits)
  - Calculate 4x4 pixel block differences and compare difference to threshold
  - Store thresholded bits (silhouette) in BRAM
  - Read silhouette from BRAM and quantize into 3x4 block output
  - Add hysteresis for 3x4 block output to avoid "glitchy" shapes (if necessary/time permits)
- Memory Manager
  - Manage access to ZBT based on vcount
- BRAM Silhouette display adapter
  - Calculate BRAM address based on hcount and vcount
  - Output pixel value from BRAM at appropriate clock cycle

Testing and Debugging

- Ability to adjust pixel-difference threshold using USER input pins
- Ability to adjust quantization threshold using USER input pins
- Display current frame and reference frame on-screen
- Display computed difference image on-screen
- Display 3x4 block with 12 LEDs connected to USER output pins

Game and Display Logic - Ray

Non-Verilog Tasks:

- Design Game UI frame and import the image into ROM with Matlab script.

Verilog Modules:

- Game FSM Module
  - Storing and updating falling block
  - Storing and updating playing field
    - Clearing rows
    - Simulate rows flashing animation
    - Calculate score according to playing field

- Display Module
    - Outputting UI frame pixels from ROM
    - Outputting silhouette of player
    - Calculating pixels for playing field
    - Calculate pixels for falling block
    - Calculate pixels for score/text
- Audio Module (if time permits)
    - Audio effects for clearing a row
    - Audio effects for left/right movement

Testing and Debugging

- Display Mode
    - Show the Game UI frame with the dynamic blocks (playing field, score, silhouette) as solid-colored rectangles.
- FSM Mode
    - Play the Tetris game with FPGA buttons/switches
        - Switches to indicate shape of the 3-by-4 falling block.
        - Left/right buttons for falling block movement.
- Audio Mode
    - Push buttons to hear audio effects for row clearing and left/right movements

Improvements

- Improve the Game UI to have better font, block styling, and round corners for blocks.
- Add support for a gyroscope to indicate left/right movement.
- Add support for 2-player mode.