Final Project Proposal

March 24, 2018

Duke Community Standard

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1 Overall Idea

Our goal is to implement a 9-block grid of capacitive sensor blocks that will enable the user to perform interactive tasks and games.

2 I/O

Inputs: User touch capactive controllers, push buttons
Output: RBG LEDs, sound

3 Project Tasks

3.1 Capacitive Touch Sensor

- Description: A capacitive sensor utilizes the fact that the human body is a capacitor and can sense when it is being touched. This tech is used consumer electronics and touch screens. This task involves implementing the full sensor through hardware and software.
- Difficulty: Moderate Difficulty
- Points: 20 PTS
- Input: User touch

- Output: N/A
- CPU Use: Significant

3.2 RGB LEDs

- Description: Adds controllable colored lighting to each capacitive sensor in the controller.
- Difficulty: Non-trivial
- Points: 10 PTS
- Input: N/A
- Output: PWM
- CPU Use: Moderate

3.3 Capacitive Touch Controller With Concurrent Sensing

- Description: Implement 9 separate touch pads (each with their own LED) integrate with processor commands. Possibly optimized by having 9 mini-cores that deal with the functionality of each sensor/LED.
- Difficulty: Very Difficult!
- Points: 30 PTS
- Input: Digital I/O
- Output: Digital I/O
- CPU Use: Must implement the ability for the FPGA to handle concurrent instructions.

3.4 Random Number Generator

- Description: Using something like time or a sensor value as a seed, generates a random number for use in the Whack-A-Mole game.
- Difficulty: Moderate Difficulty
- Points: 20 PTS
- Input: N/A
- Output: A random number.
- CPU Use: Must implement a new feature into the processor's datapath.

3.5 Whack-A-Mole Game

- Description: Allows the user to play a 3x3 whack-a-mole game.
- Difficulty: Very Difficult (and cool)!
- Points: 30 PTS
- Input: Capacitive touch sensors
- Output: LEDs, seven segment display
- CPU Use: Extensive

3.6 Music Synthesizer

- Description: Play tones given user input via capacitive touch sensors.
- Difficulty: Moderate Difficulty
- Points: 20 PTS
- Input: Capacitive touch sensors
- Output: audio speakers
- CPU Use: Extensive

4 Timeline

We plan to complete the capacitive touch sensor, RGB LED, and capacitive touch controller implementation within one to two weeks. The random number generator should take at most a few days. Then we plan to implement the whack-a-mole game and music synthesizer a week before the demo in order to leave time for debugging.