Virtual Board Breaking

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Project Description

• Overview
  – Simulates board breaking with input provided by the user’s punch
  – Provide feedback to the user on force magnitude and final state of the board

• Potential Enhancements
  – Expand use to kicks and head breaks
  – Include difficulty level selection to adjust thickness of the board
Module Overview

Hardware Module → Signal Processing Module

<table>
<thead>
<tr>
<th>Graphics Module</th>
</tr>
</thead>
<tbody>
<tr>
<td>Audio Module</td>
</tr>
</tbody>
</table>

ADC Control Module

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<table>
<thead>
<tr>
<th>channel_address</th>
</tr>
</thead>
<tbody>
<tr>
<td>clock</td>
</tr>
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<td>board_orientation int_low</td>
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<tr>
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</tr>
<tr>
<td>channel_address</td>
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<td>cs_bar</td>
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Signal Processing Module

- Keeps track of the maximum acceleration detected
- Integrate the acceleration over a set window of time to determine if the force is large enough to break the board

Board Module

- Displays the image of the board in one of three axes
- Iterates through images to display a board broken
- Store images in BRAM
  - 128 x 256 images (x axis, one for each half)
  - 128 x 32 images (y and z axes, rotated)
  - 4 of each size for animation
  - 4 color bits for each pixel (boards have few colors)
**Force Gauge Module**

- Implemented as a sprite
- Changes length depending on magnitude of acceleration
- Color gradient: dark -> light

```
clock  force_gauge  x  y  hcount  vcount

               15  11  10  11  10
```

**Audio Module**

- Uses AC97 module to play back the sound the board break in conjunction with the image for the board break.
- Store audio data in BRAM
  - Length 0.5 seconds, down sampled to 6 kHz

```
clock  start_audio

               8
```

```to_ac97_data```
Testing

- Sensor: visually, with an oscilloscope
- Signal processing: input sample acceleration waveforms with ModelSim
- Sound playback, image display, and force gauge magnitude: input sample signal values with ModelSim
Timeline

• Week of 11/15
  – Board image module complete
  – ADC control module complete
• Week of 11/22
  – Signal processing module and sensor mount complete
  – Force gauge and audio modules complete
• Week of 11/29
  – Cross-testing and module integration
  – Add enhancements, time permitting
• Week of 12/6
  – Prepare for checkoff & write report