WMT – “Whac-A-Mole” Like Game
Overview

- “Whac-A-Mole” like game system
Basic Game Logic

- Nine holes, Three initial lives, Two minutes
- Different items
  - Get: Good! Add life Deduct life
  - Miss: Deduct life Nothing happen Nothing happen
- Different levels
Basic Game Logic Cont.
System Architecture
Hardware Implementation

- Work with ADC to get the touch position x and y coordinates and read it out in Nios II
- Figure out how to display image correctly on a 800x480 screen
- Turn the x,y coordinates into useful data for software processing.
- Set up the interrupt for touching
- Figure out how to store all the data on board, basically using SDRAM and SRAM together. Using SRAM MUX.
Hardware Implementation Cont.

- Map all the peripherals onto Avalon bus and get rid of the ELF error
- Image conversion
- Create the state machine for the game
- Redesign a LED clock on the touch screen.
Lessons Learned About Hardware

- ELF error is usually due to wiring mistake in the top level connection of NIOS.

- Every time you copy an entire project, remember to recreate the nios project. Otherwise the BSP package is mapped to the old SOPC.

- Should have design the interface more easy to use. Should split all the variables instead of putting all of them together

- Build the design using small modules.
Display Dynamic Items

- Image -> Matrix -> Calculate the edge of the item -> SRAM
- Get the signal from the software: when, where, what
- Layers implementation
Software

- Get touch signal from hardware and identify the corresponding action
- Control the difficulty level
- Implement of the main game logic
- Keep track of the lives left, points earned and the action user take
- Send signal back to the hardware
Audio

+ Audio

Diagram showing the connection between SDRAM, CPU, Avalon Bus, Nios System, Music controller, Ear plugs, De2_WM8731_audio, and WM8731 Audio CODEC.
Design Key Issues

1. Understand how WM8731 works
2. Tried to synthesis music. - Too simple
3. Sample rates. 22050Hz. - killed 6000hz
4. Store music in ROM. - slow compilation
Design Key Issues

4. Data transfer

Through Avalon Bus using interrupt request.

Using buffer to buffer data transfer between clock domains
Design Key Issues

5. Structure Optimize

- Music writing logic
- Buffer 256-2bytes
- Buffer 256-2bytes
- Music Play
Design Key Issues

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6. Merge music and sound effect

\[ \text{Audio} = \frac{\text{Music} + \text{Sound}}{2} \]

\[ \downarrow \]

\[ \text{Audio} = \text{Music} \times \frac{1}{4} + \text{Sound} \times \frac{3}{4} \]
Lessons learned

- Hands on experience of embedded system – interesting but time consuming
- Debug skill (both hardware and software)
- Always prepare a back up plan for big events.😊
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- At last, we really appreciate the hard work of the TAs.

Thank you so much!
Demonstration

- Watch the video or play the game???