Battle tank game

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Game Introduction

♦ Battle city game on Sockit board
♦ Inspired by the classic tank game - battle city
♦ Rules of the game
  for winning the game:
  -- shot off all the enemy tanks
for losing the game:
  -- Enemy tanks are not wiped off after reborn two times
  -- homebase is damaged no matter who shoot it.
Hardware Implementation

✿ VGA display
  - VGA controller
  - VGA map
  - VGA display

✿ Audio
  - I²C Bus Controller
  - Audio Codec Controller
  - Audio Data Controller
VGA display

Image processing and storing

--All images that are stored into the ROM can be categorized into three sizes: 0.25KB, 1KB and 64KB.

--Image categories:

  Background, tank, welcome and game over screen and Display Effects.

--All images are loaded from the ROM and the position of displaying is sent from software.
VGA display

- VGA controller
  - different types of sprites have different locations and motions and they should be displayed on the screen at the same time.
  - VGA controller is designed to control the display of different sprites, including order, location, direction and changing map.
  - With VGA controller, it is easier for us to add or delete or move the sprites by software.
Audio

-- 11.2896 MHz Audio Module Working frequency (Table 30 from audio codec datasheet)
   * Creating a 11.2896MHz clock generator by Megawizard

-- Two-track 16 bit 44.1KHz sampling rate audio effects
   * Stored in on-chip memory
Audio

- I²C Controller
  - Configure the entire audio system like left and right channel playing and recording
  - R2 & R3: 0dB volume amplification for both channel
  - R8: 44.1KHz Sampling Rate
Audio Codec Controller
-- Divide 11.2896MHz Working frequency to 44.1KHz
Data reading rate (Sampling Rate)
Audio

Audio Data Controller

--Reading left and right channel data separately

left channel data right channel data
Software Implementation

- Global
- Bullet moving
- Bullet map
- Tank moving
- Tank map
- Gamecontroller
- Explosion
Software Implementation

✦ Global
  Record all macro definitions for the whole project

✦ Gamecontroller
  Record all keycodes information for different button on the joystick.
**Software Implementation**

- **Tank moving and tank map**
  - Generating our tanks and moving them according to information from joysticker.
  - Generating enemy tanks and moving them according to random information.
  - Judge whether the bullet meet a brick or not
  - Judge whether tank meets obstacles or not
  - If a bullet meet part of the brick, update the map so that tank can move over that place.
Software Implementation

 Bulld moving and bullet map
   -- Generating the bullet according to the direction of tank
     -- Judge whether the bullet meet a tank or not
     -- Judge whether two bullets meet or not
     -- If a bullet meet part of the brick, update the map

 Explosion
   If a tank is shot off, beginning the two steps of explosion
Lessons Learned

- Design architecture of hardware and software for the FPGA board to run the whole project.

- Use Qsys to help with hardware design.

- Resources allocation when designing the hardware due to the limited resources on the board.