

# Battle tank game

Lupeng Fan If2447

Yichen zhu yz2582

Di Yang dy2266

Yinshen Wang yw2561

1.Game Introduction

2.Game Architecture and Implementation

3.Hardware Structure and Implementation

4.Software Structure and Implementation

5.Lesson Learned and Advice for Future work

# Game Introduction

- ✦ Battle city game on Sockit board
- ✦ Inspired by the classic tank game - battle city
- ✦ Rules of the game

for winning the game:

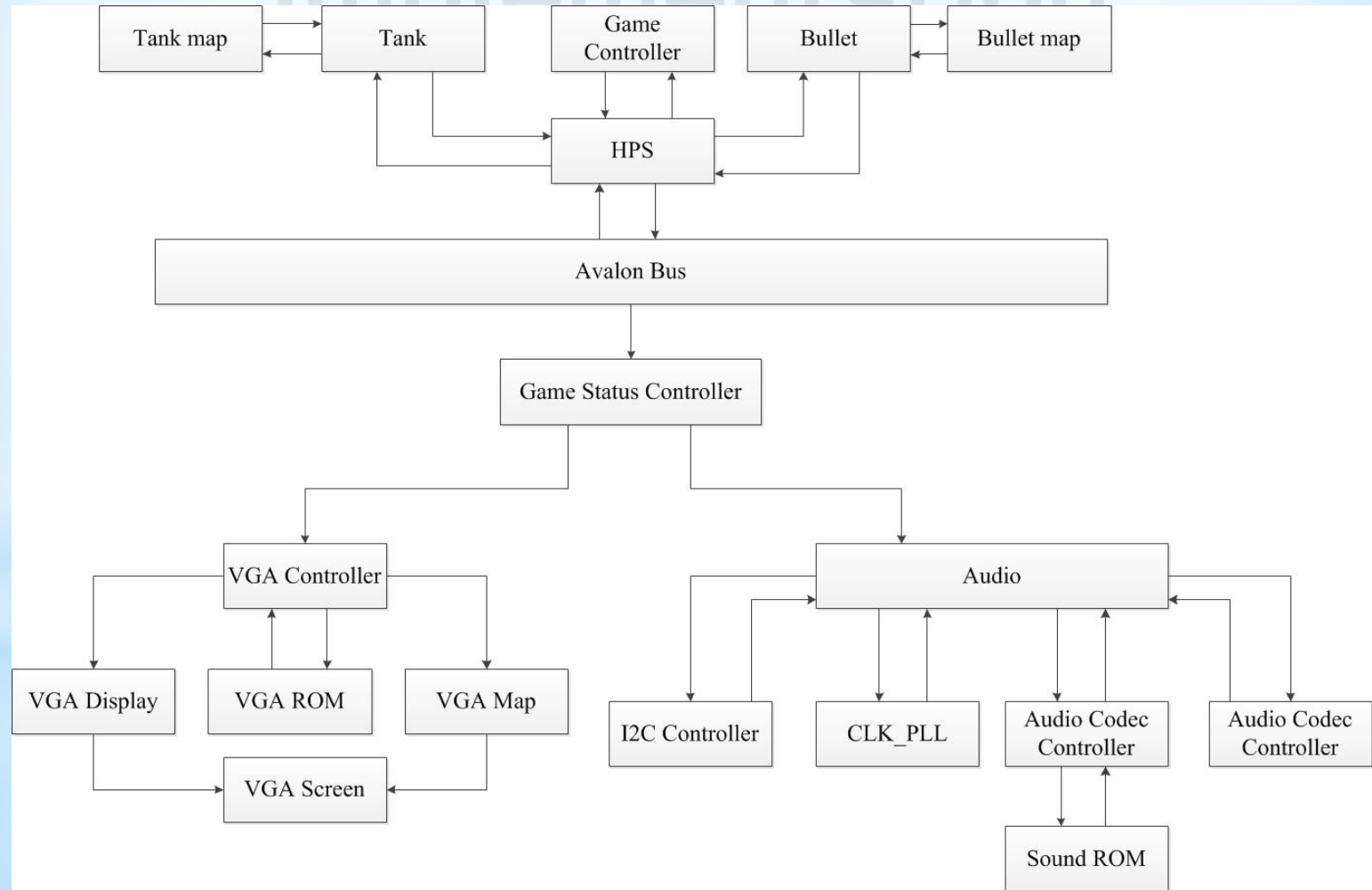
-- shot off all the enemy tanks

for losing the game:

-- Enemy tanks are not wiped off after reborn two times

-- homebase is damaged no matter who shoot it.

# Game Architecture and Implementation



# Hardware Implementation

## ✦ VGA display

--VGA controller

--VGA map

--VGA display

## ✦ Audio

-- I<sup>2</sup>C Bus Controller

--Audio Codec Controller

--Audio Data Controller

# Hardware Implementation

## 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.

# Hardware Implementation

## 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.

# Hardware Implementation

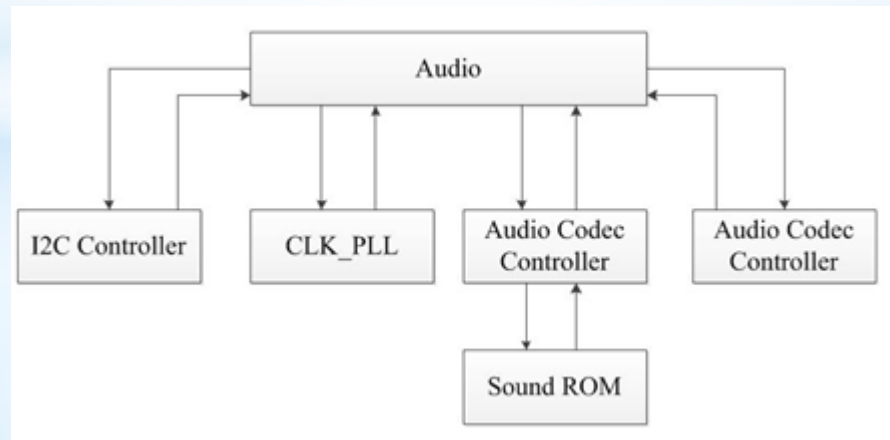
## Audio

-- 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





# Hardware Implementation

## Audio

### ✦ I<sup>2</sup>C Controller

- Configure the entire audio system like left and right channel playing and recording

- R2 & R3: 0dB volume amplification for both channel

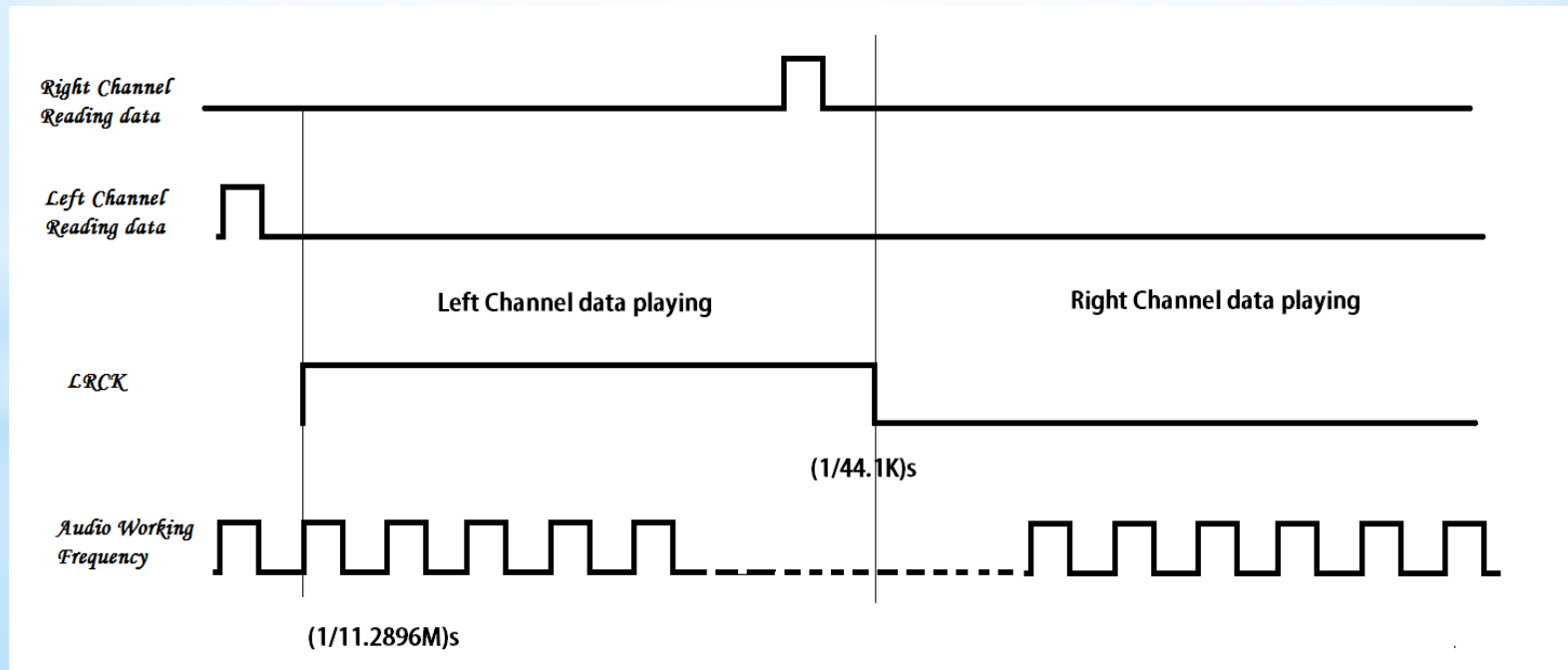
- R8: 44.1KHz Sampling Rate

# Hardware Implementation

## Audio

### ✦ Audio Codec Controller

-- Divide 11.2896MHz Working frequency to 44.1KHz  
Data reading rate (Sampling Rate)



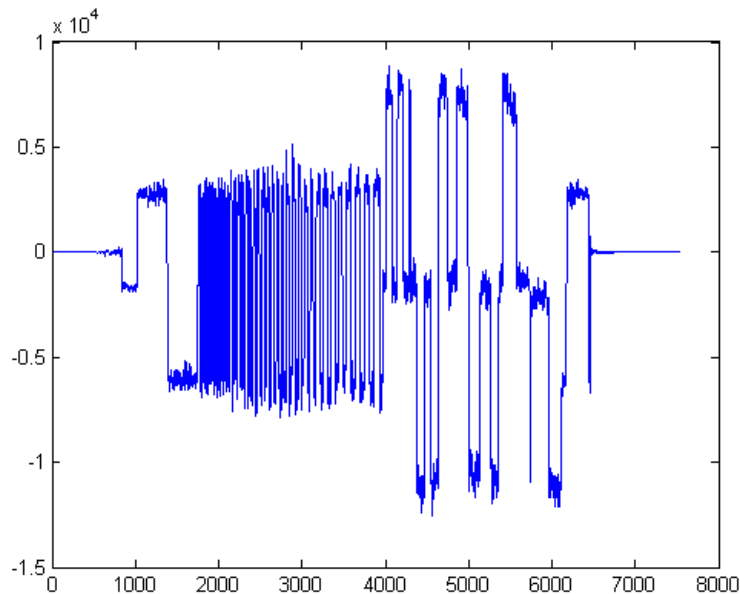
# Hardware Implementation

## Audio

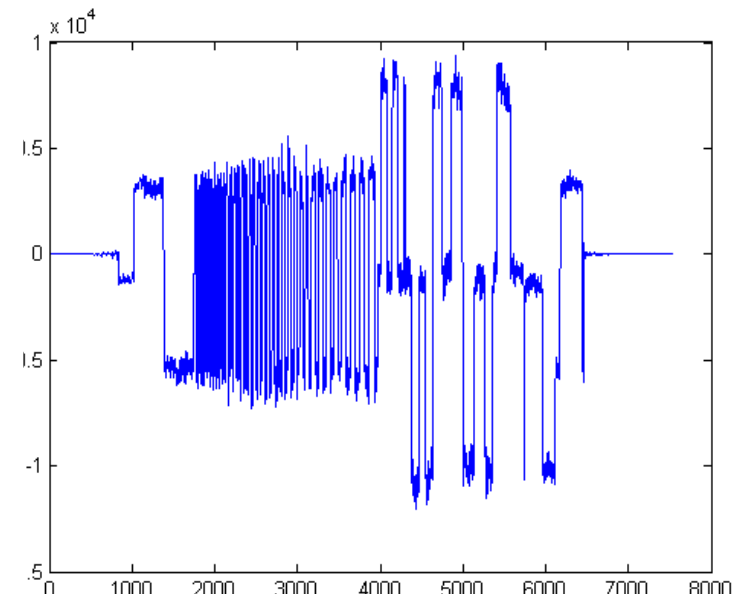
### ◆ Audio Data Controller

--Reading left and right channel data separately

left channel data

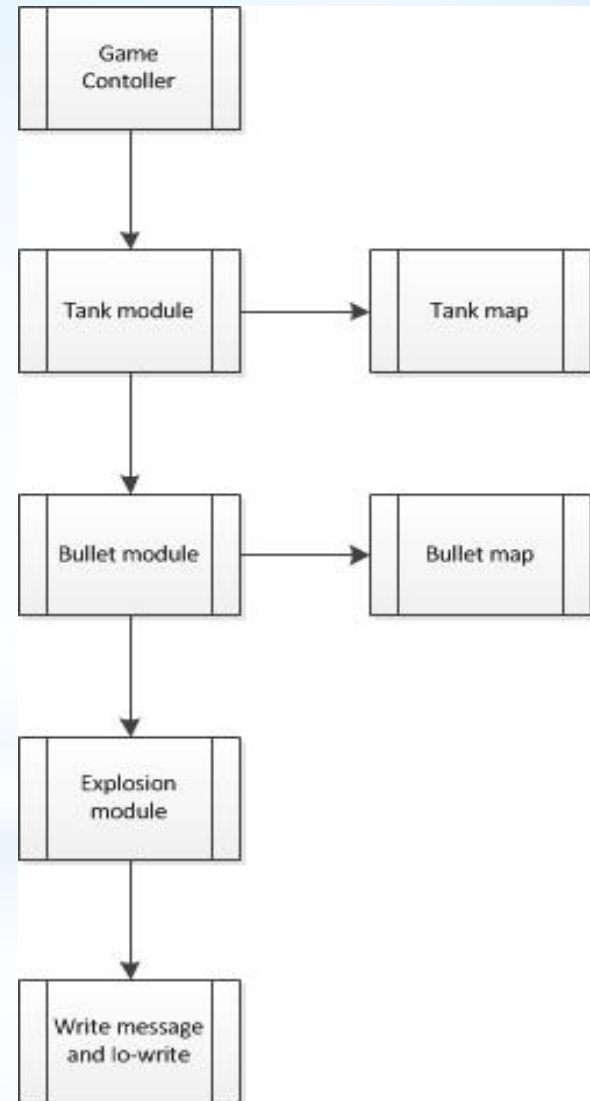


right channel data



# 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 joysticker.

# 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

## ✦ Bullet 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.