

Fantastic Tetris

Design Report

Benjie Tong(bt2414)

Weipeng Dang(wd2265)

Yanbo Zou(yz2839)

Yiran Tao(yt2487)

CSEE 4840 Embedded System Design

Spring 2016

Introduction:

Our Project is based on an online game called 1010! with our implementation to realize it by using FPGA board. We use the SystemVerilog for coding hardware part and C to implement the software part.

It is an easy but very interesting game. It is an optimized version of a simple Tetris. It is basically a puzzle game that player tries to fill the grid by the provided blocks. Once one row or column of grids. The picture of the game is shown:

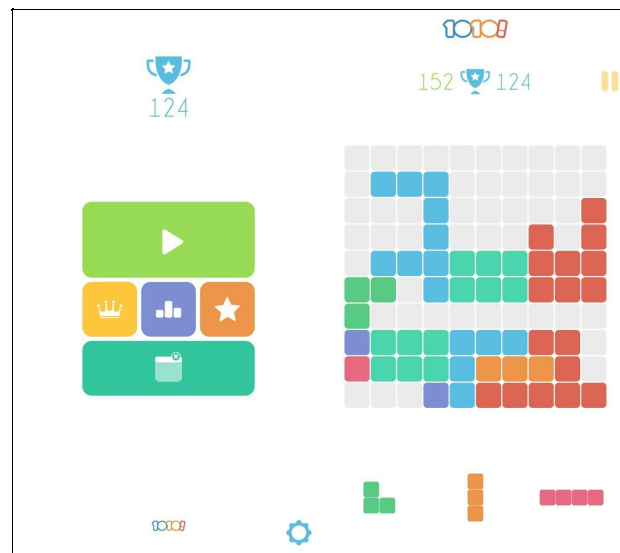


Figure 1

Players will be initially provided a 10*10 grid with three different shapes of blocks. Player must use these three blocks to fill the grids and the filled grid will not be able to fill more blocks before it is cleaned. Once one row or column of grids are fully filled, the whole row or column grids will be cleaned and is enable to fill new block. Before the player uses all of the three blocks, there will not be any new blocks provided. The game will provide three blocks in one time.

The goal of the game is to get higher score as much as possible. Once the left unused blocks can not be filled in to the grid the game is end.

There are two ways to get score in the game: every time player fill new blocks in to the grids player can get scores based on the shape of blocks; every time one (or several) row(s) or column(s) of grids are filled, player can get scores based on the number of lines that are cleaned in one time.

Hardware and Software Connections:

There are two parts for our whole system design: software and hardware. Below is an overview about all the connections:

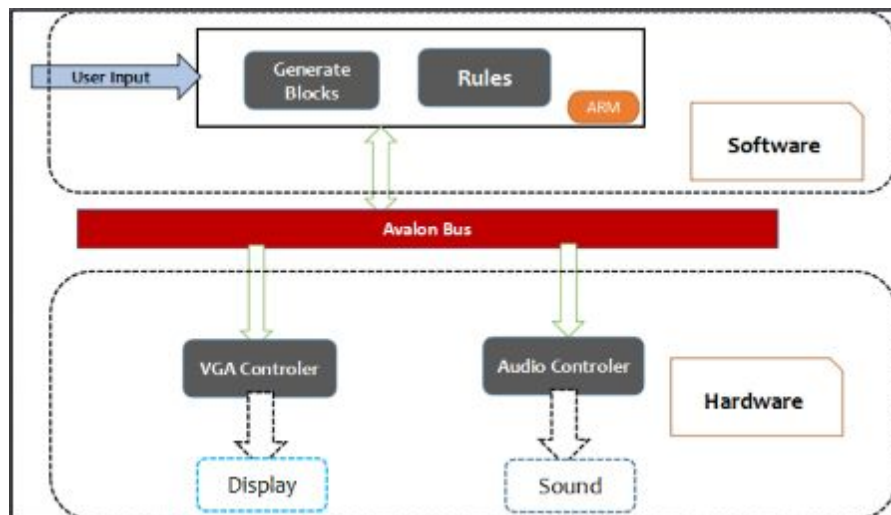


Figure 2

In software, the C language will be used to implement all the controls of the system. It first generates the three blocks in the screen and then keeps getting the user's inputs to control the screen display by using the VGA controller in the hardware part. The VGA controller we use is same as the lab3. The Audio Controller will be used to give sound if the game is over.

Software algorithm:

The flow chart of our software part is shown in Figure 3. The software firstly generates three blocks into the screen. These three blocks are randomly picked. Then the user gives signals to the software to pick one of the blocks to move. Then the software keeps controlling the VGA to change the display of the moving block to be placed into the frame. When a row or a column is formed in the frame. The software detects this change and deleting the whole row or column. When the three blocks are used up, the software should regenerate three blocks into the screen. It is like in the figure 3, the flow chart is just traced back to the third state.

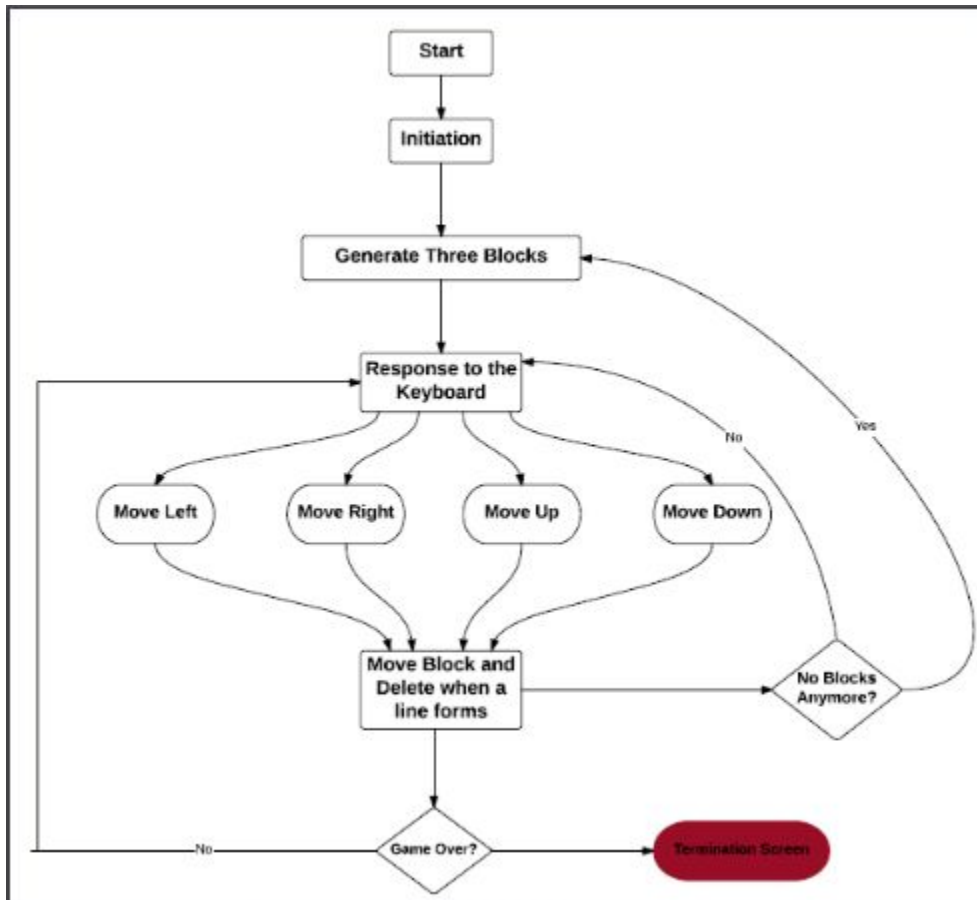


Figure 3

Moreover, our software algorithm keeps detecting if there is no space for the blocks to fill into the frame. If this case happens, the “Game Over” incidence is triggered. The screen is then changed to the termination screen.

Sprite Controller

The Sprite Controller will be used in display the “welcome” and “termination” screen. The basic connection is shown below:

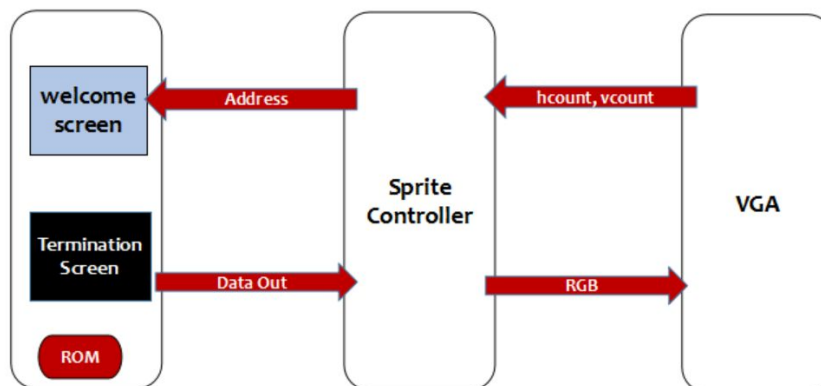


Figure 4

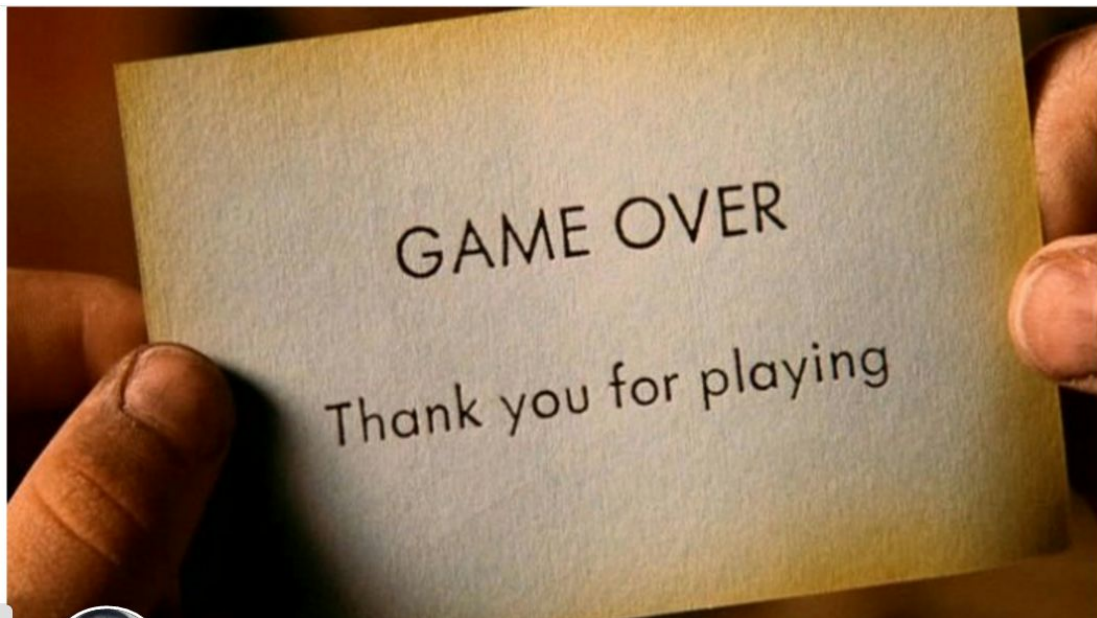
The two screens are stored in the ROM and the Sprite controller will give the address to the memory

to get the data pixel out then it forwards to the VGA for display objective.

Here is the welcome screen we could use:



And if the player lose the game, we will switch to the screen:



The size of Welcome picture is 88KB and the gameover picture is 48KB.

Audio Part:

The audio is used for giving sound when we start the game. In the welcome screen, there should be a welcome sound which is positive and make players feel confident. During the game, the sound is changed. Then in the last part, the game over part, the sound should be changed to be a negative sound.

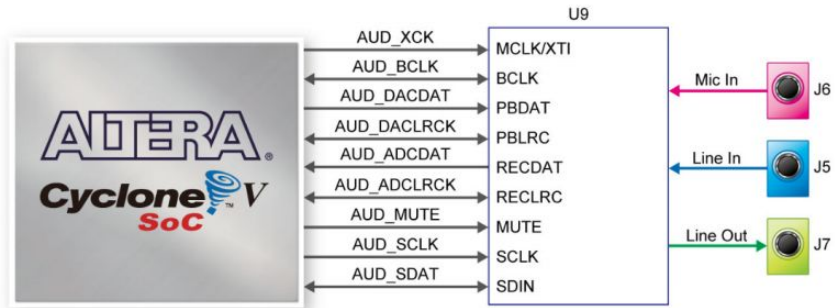


Figure 5

As showed in the figure 5, this is a possible audio device we will use: Analog Devices SSM2603 audio CODEC (Encoder/Decoder).