

Jumpers

Embedded Systems

CSEE 4840

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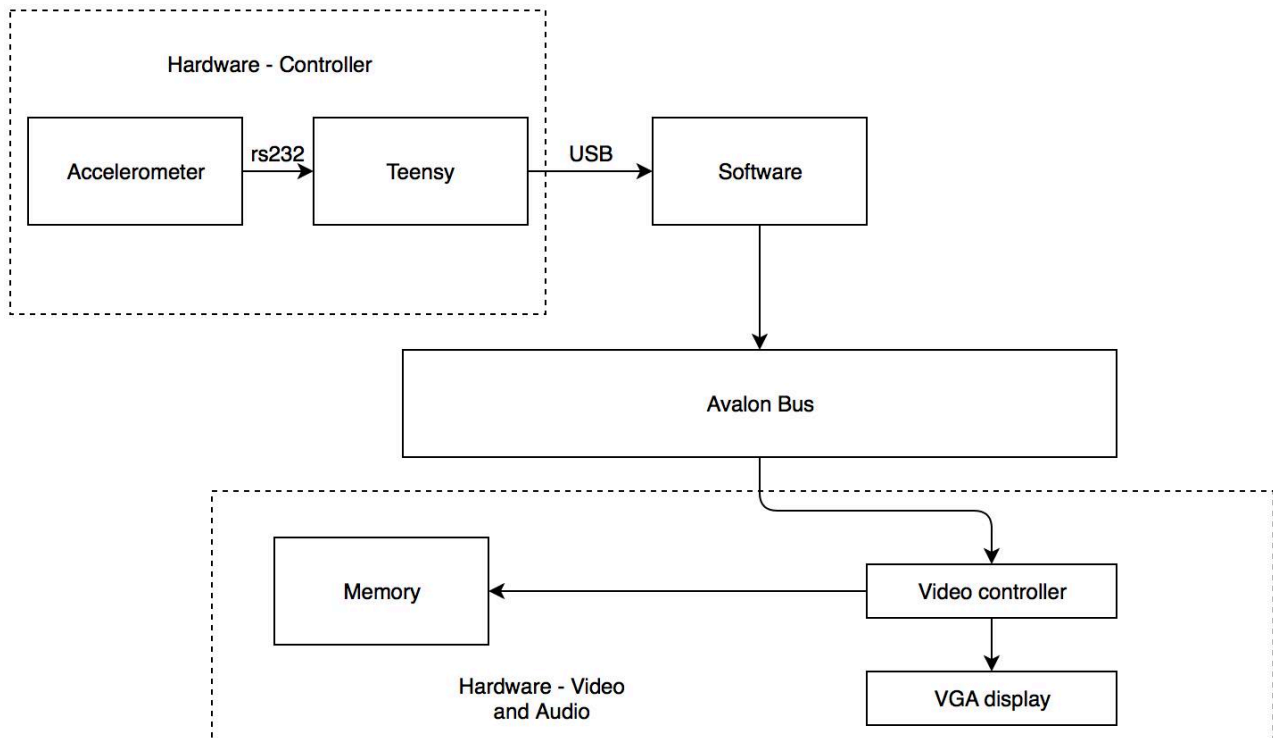
Design Overview

The purpose of this project is to develop a game called “Jumpers” using synthesizable System Verilog and C language on a FPGA board. The user input is obtained through a triple axis accelerometer. In the game, two players compete against each other playing simultaneously. The hardware developed in System Verilog will generate the image for the VGA and exchange information with the C program. The C program will calculate the characters’ and platforms positions for sprites to be printed and apply the game rules.

Game Rules

The game consists of a screen shared by two characters. The characters must jump through platforms distributed vertically across the screen, that follows the character in a higher position. The character which is first touched by the bottom border of the screen, dies and loses the game. When the game ends the total height reached by the winner is showed in the screen.

Diagram



Hardware

ADXL335 - triple-axis accelerometer

The accelerometer will work as the controller for the game, it has 3 axes but we will use only one axis to this project. This piece of hardware will control the position of the player on the frame. The movement will take in consideration the position of the hand, trying to be smoothly as possible.

The accelerometer will be plugged to the Teensy to have a USB connection with the FPGA board. This allow us to work with the accelerometer as if it was a simple keyboard, making this part of the project simpler.

Teensy (ATmega32u4 USB dev board)

This board is an Arduino compatible board that is equipped with an ATmega32u4 and uses USB to communicate with other devices. This board will have some simple algorithm to read the data from the accelerometer and send it to the FPGA via USB.

Software

The software part of this project is developed in C and is responsible for all the logic control in the game.

Sprite Positions

The software will calculate the characters' and platforms positions that are used in the graphic generation process, when they're going to be matched with sprites stored in memory. The characters start in a fixed position and jump continuously through the screen. The platforms are runtime generated, in order to present themselves in a more random distribution.

Collisions

Through the calculated positions, the software will determine whether or not the character successfully reached a platform in order to perform the next jump. The collision handling also guarantees that both characters won't occupy the same space in screen. Moreover, it is also a collision that tells when a player has lost the game, i.e. a collision with the bottom border of the screen.

Milestones

03/31

- Image generation on VGA working
- Sprites being stored in memory and printed

04/12

- Game logic working
- Positions for sprites being calculated
- Collisions handled

04/26

- Peripheral integrated to project
- User input being received and controlling characters

References

- Teensy (ATmega32u4 USB dev board) 2.0 [ATmega32u4] ID: 199 - \$15.95 : Adafruit Industries, Unique & fun DIY electronics and kits.
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