Team Mega Men
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EC551 Final Project
Bill & Omar's Excellent Adventure

Bill & Omar's Excellent Adventure, a brand new IP developed by Team Mega Men, is a side-scroller action game which is inspired by the classics. Whether it's the platforming of Mega Man, the level design of Metroid, or the difficulty of Contra, this game heralds back to the classic arcade style of the eighties. The game is playable with an arcade controller (via JAMMA interface) and features all original artwork, from the playable characters and enemies to the backgrounds. In addition to the graphics, the game features a custom and comprehensive movement system (left, right, jump (up and down)) along with a combat system (attack) to eliminate enemies from the stage and move on. To complete a stage, the player must eliminate every enemy on the screen and proceed to the right to exit the level. If the player dies, a game over screen will display, though the game can be restarted from the menu.

The game is written in Verilog and features a series of modules that work in tandem to read memory from the DRAM of the Spartan 6 board, paint each pixel, and coordinate player input and enemy artificial intelligence to create a game. The character and background sprites are converted from .coe files, using a python script that we wrote, bincoe.py. The binaries and bitstream are then loaded onto the Nexys3 using the Adept software tool. The binaries are loaded at the following addresses:

Binary (.bin) File Name	Decimal Location
Title Screen.bin	0
Boss Room.bin	307201
New Omar Punch.bin	614401
Finished Red Ninja with Death.bin	644401
GameOver Final.bin	679401
new swamp.bin	1601001
rooftop_fix.bin	1908201
Wild Pikachu.bin	2215401
Drunk Mario.bin	2260401

The modules used are as follows:

vga_display.v

The top module in this design. Handles user inputs by accepting the movement controls as well as the combat controls, and moves the player character accordingly. This also handles the enemy sprite control and moves the enemies so they attack the player as appropriate. The top module also allows the memory controls and the vga controls to interface with one another.

vga_controller_640_60.v

This module is called by the top module and is the driver for the VGA display. It cycles through the horizontal and vertical pixel count and outputs and RGB value according to the

input. We did not write this module, but it was retrieved from Zafar Takhirov's Github page: https://github.com/zafartahirov.

masterspritectrl.v

This module receives all of the player and enemy coordinates, as well as the inputs to read from the D RAM. Depending on the level, this module loads the background and sprites from memory and checks to see if the VGA is displaying a pixel within that range. It also checks to see where the sprite and background pixels overlap, and only outputs the RGB value for the position of the player sprite.

cellular_ram_controller.v

This module to provided to use by Team Metal Squad (Street Fighter) and is used to read from the D RAM on the FPGA. We did not modify this module significantly as it reads the data in asynchronously the way we need it to be read.

Sprite Design

The sprites were designed using the online application http://www.piskelapp.com/. These sprites were downloaded as .png files (as well as .gifs) and then converted to .coe files using one of the programs created by a classmate (Img2COE.exe). The .coe files were converted to binaries using a python script that we wrote, bincoe.py. It can be executed by running 'python bincoe.py *somefile*.coe'

```
lineCount = 0
coeName = sys.argv[1]
binName = coeName.replace('.coe','.bin')

with open(binName, 'wb') as bin:
        with open(coeName, 'r') as coe:
                for line in coe:
                        if lineCount != 2:                  #number of header lines in .coe
                                lineCount = lineCount + 1
```

```
else:
        byteInt = int(line[0:len(line)-2],2)
        bin.write(struct.pack('B',byteInt))
```