Super Skule Fighter A.R. Artix VII Turbo Edition

ECE532H1 S
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Project Description

Augmented Reality Fighting Game (similar to Street Fighter)

Features:

- Live HDMI video feed from camera as input (720p, 60FPS)
- Green screen background that immerses players in different environments
- Real time HDMI video output with no frame rate drop or down-scaling
- Motion detection of attacks of two players through tracking of specific colors

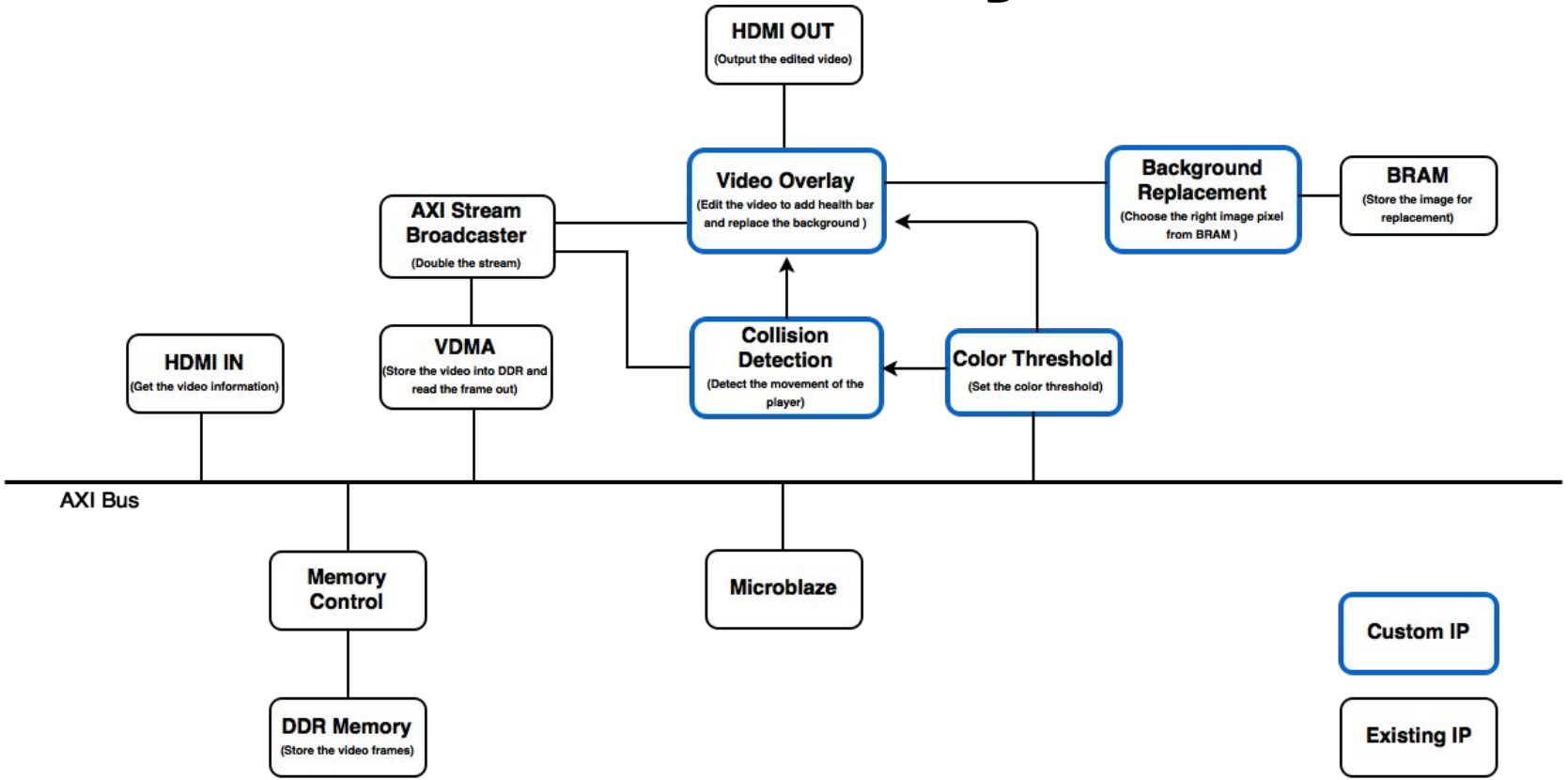
Initial Goals

- Learn about HD video signal transmission and reception on an FPGA, including buffering
- Implement basic video manipulation algorithms such as green screen replacement
- Develop hardware to detect motions and collisions of two separate players in video feed
- Create a basic augmented reality video game

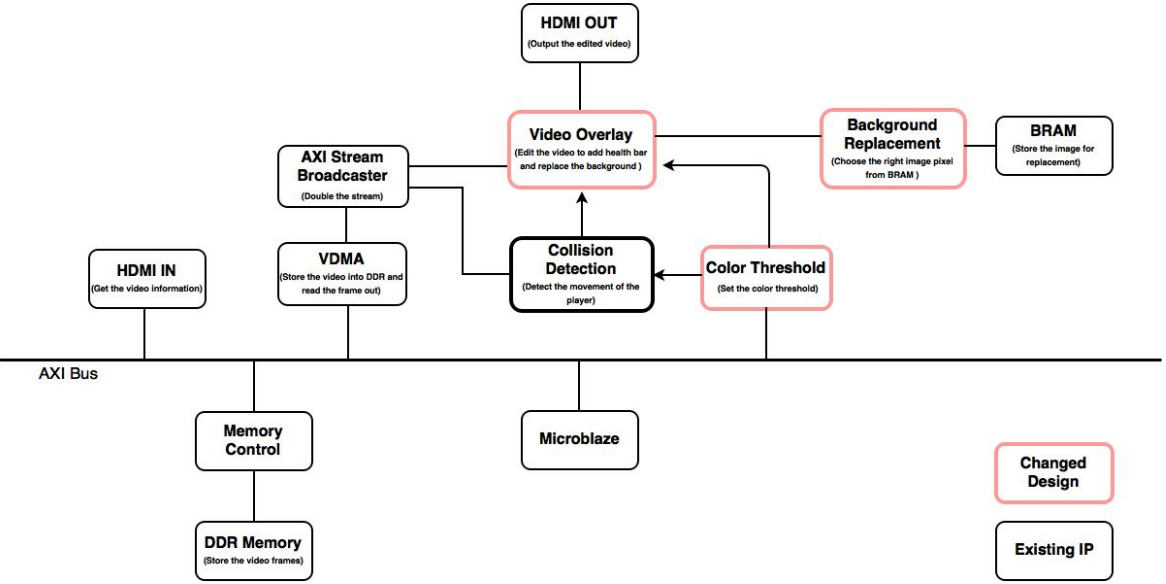
Problems We Encountered

1. Modifying 720p video in software is not possible without reducing frame rate from 60FPS
2. Learning VDMA/SDK setup of the HDMI demo
3. Creating an IP with an AXI-Stream Interface
4. Setting colour detection thresholds for red/blue gloves and green-screen background
5. Synchronizing augmented version of video stream from VDMA with the video timing control signals to get a working video output

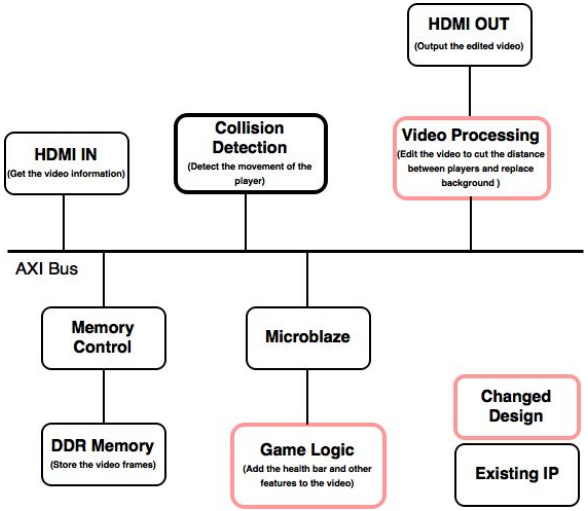
Final Product - Final Block Diagram



Changes



Final block diagram



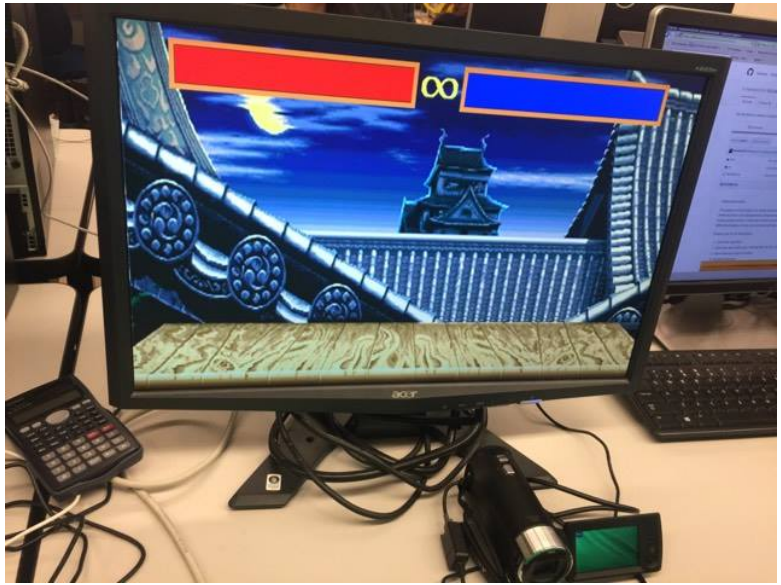
Initial block diagram

Original Modules

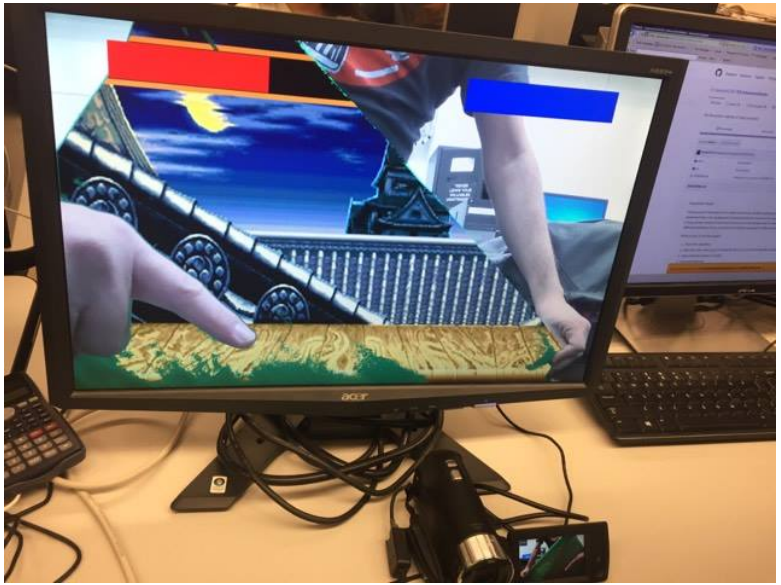
IP	Description
Collision_Detection (Original)	● Receive color of the pixel through the VDMA ● Judges whether or not there is a hit, based on flags and colors in the current and previous frame
Background_Replacement (Original)	● Upscale 640x360 image to 720p and send correct replacement pixels from the BRAM
Video_Overlay(Original)	● Edit the video output to add health bar and replace the green background
Color_Threshold (Original)	● Set threshold values, color minimums, health bar lengths, and initial health for the design
HDMI Demo	● Sample project from digilent

Sample Images of Running System

Full green-screen input w/ replacement



Partial green-screen input w/ objects behind and in front



Design Process

- Clear weekly objectives
- Progress evaluation at middle and end of each meeting

course-specific

- Dedicated a minimum of 2 days per week
- Prioritized more complex modules and performed pair/trio programming when dealing with novel concepts/interfaces
- Divided tasks whenever possible

Lessons Learned

- Debug core and testbench
- Teamwork methods
- Perseverance