ELEX 7660: Digital System Design
Composite Video Encoder with SPI Interface Proposal

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Introduction

In the simplest of terms, our project is making video driver for composite video. But what differentiates us from other video drivers is that we plan on implementing a majority hardware solution. When this project was first brought up, we knew whatever project we choice had to meet our own personal requirements. It had to be challenging, useful, and have a hardware and software component. Although this already exists in the market they can be over priced. We plan on trying to make the same product for cheaper.

Main Objective

The main objective of this project is to generate a black and white composite video signal that will drive a Cathode Ray Tube (CRT) television. To accomplish this, we will develop a video card with a serial interface that can generate a composite video signal. We will be able to achieve a resolution of 240 x 320 pixels on the screen.

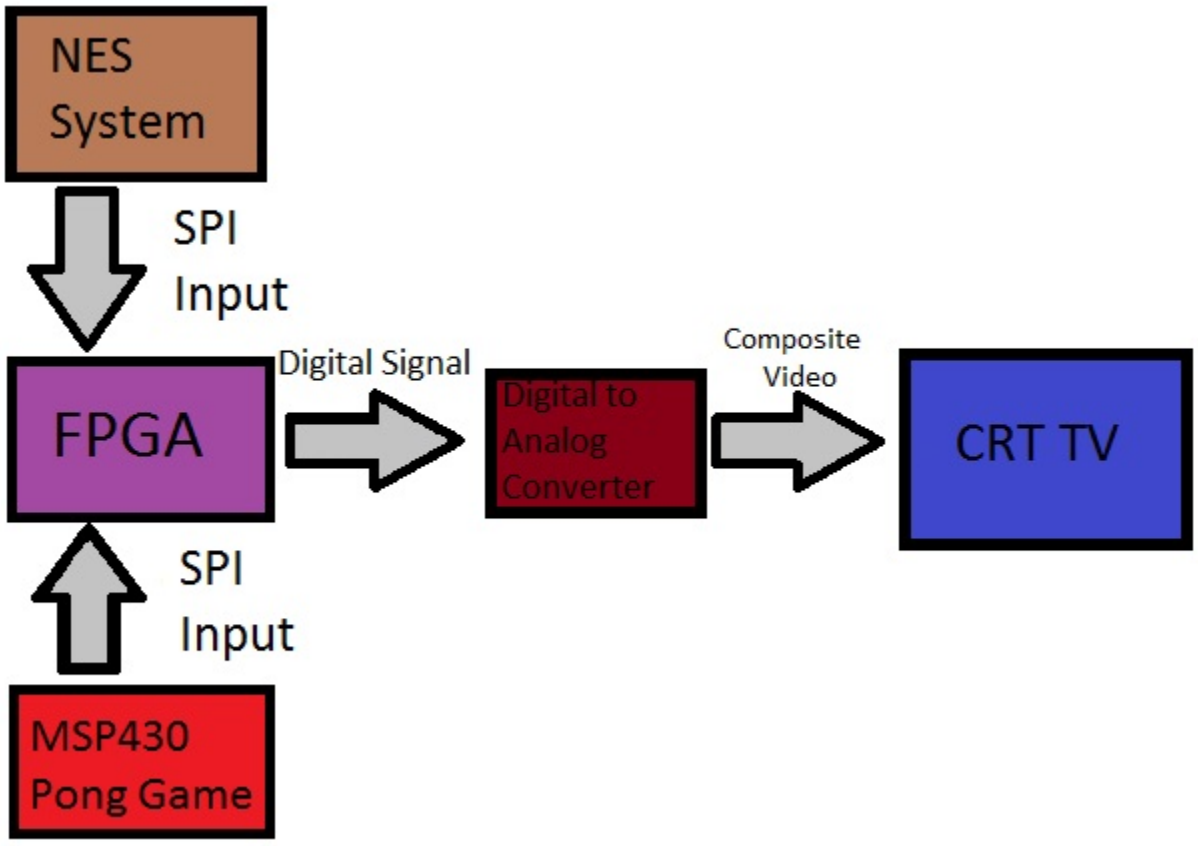

Figure 1: System Overview

Secondary Objectives

Framerate Control

The framerate for a CRT is roughly 30Hz while the shutter rate for most video cameras is 24Hz. When filming a CRT screen, slightly more than one frame will be displayed in the time that the image is captured on the camera, this results in a sweeping, white bar that will appear on the television when viewing the film. This is undesireable.

Many prosumer and professional cameras have an output signal called HSYNC. This signal will be used to trigger the composite video encoder so that only one frame is written to the television during one shutter period. In theory this will remove any erronous artifacts that would normally be seen in the video.

Sound Synthesizer

Adding to the SPI interface, we could add commands that trigger pre-generated sound "bites" which would play in conjunction with pong. These sounds could either be programmed to the encoder through SPI, and saved into RAM or hardcoded into ROM. A DAC would then be needed to drive a speaker. Sound information and playing would be modeled after some standard, possibly something like WAV.

Open MSP430 Synthesis

On Opencores.com an open source IP of the MSP430 core can be downloaded for synthesis in an FPGA. To cut back on the hardware used in the project, we can put this core on our FPGA and program pong onto it. This also adds some complexity as the ADC on the evaluation board would need to be interfaced to the system.

Colour

The colour component of a composite signal is transmitted through the phase and angle modulation of a 3.58MHz carrier. In order to generate this signal we would need to employ a parallel DAC instead of our cheap, lopsided, but inexpensive resistor divider DAC. Another project within our class is to create a Ninstendo Entertainment System on an FPGA, and so we will base our colour output on the NES.

Hardware

To be able to complete this project we will need more hardware than what we currently have. We have a MSP430 microcontroller, the FPGA board, and a mini black and white TV. We need an 8-bit parallel, single channel DAC. We will use the AD9748 from Analog Devices Inc. which can be ordered from Digikey, and we will also need a breakout board for the 32-QFN package which can also be picked up from Digikey. Any hardware we may need, such as parts for filtering will be provided by us.

Parts List

To be able to complete this project we will need more hardware that what we currently have. We have a MSP430 microcontroller, the FPGA board, and a mini black and white TV. We will need to use the 50 dollar funding from BCIT to order an 8 bit analog to digital converter. When our project progresses we will need to find will need to find a colour television (Most likly find get for free).

Milestones

1. Completeing our test bench code
2. Geting our CTR TV to display in black and white
3. Displaying our Pong Game onto the CRT TV
4. Geting our CTR TV to display in Colour
5. Displaying the other groups NES system
6. Improving quality of display

Schedule

1. February 14
    (a) Submitting the proposal
2. February 17
    (a) Project meeting to plan and divide work
3. February 24
    (a) Progress report
4. March 3
    (a) Testing our basic Verilog test bench code
    (b) Testing our CTR TV with our digital to analog converter and basic test bench code
    (c) Progress report and analysis on current progress.
5. March 10
    (a) Testing our improved test bench code
    (b) Testing our CTR TV with our improved test bench code
    (c) Progress report and proposed solutions to bugs
6. March 24
    (a) Confirm our CRT TV works with in black and white
    (b) Connect and test SPI input using Pong Game from MSP430
    (c) Progress report and proposed solutions to bugs
7. March 31
    (a) Confirm our CRT TV works with in black and white and colour.
    (b) Confirm the SPI input works
    (c) Progress report and proposed solutions to bugs
    (d) Test other groups NES system (if available) for compatibility
8. April 7
    (a) Confirm and demonstrate our CRT TV works with in black and white and colour.
    (b) Confirm and demonstrate the SPI input works with pong game and NES system
    (c) Party if the project works according to schedule