


New VGA Driver Tutorial

Introduction

This tutorial provides a method for using the VGA video output from the DE1-SoC.

 Note that the provided VGA driver here is *different* from the one provided in the Display Interface lab. The key differences are outlined below. You are welcome to use/modify whichever driver you prefer to start from.

Using the New VGA Video Driver

The video driver included with this tutorial is designed to offer a very simple interface for common video needs. The driver module contained in `vi_deo_dri_ver. sv` is parameterized with `WI DTH` and `HEI GHT`. Any resolution up to the native resolution of the interface, 640 pixels wide by 480 pixels high, may be specified by the user. The driver provides the user with x- and y-coordinates of the current pixel (origin is the upper-left corner), and the user provides the driver with a color to draw at that pixel, which must be valid within two clock cycles of the coordinates changing. Colors are expressed as three 8-bit, unsigned integers, each specifying the light intensity in its respective color channel, red, green, or blue.

- Parameters
 - `WI DTH` – the number of pixels wide
 - `HEI GHT` – the number of pixels high
- User Inputs
 - `CLOCK_50` – 50MHz clock
 - `reset` – an active high synchronous reset
 - `r, g, b` – 8-bit unsigned integer color channels
- Driver Outputs
 - `x` – 10-bit unsigned integer x-coordinate
 - `y` – 9-bit unsigned integer y-coordinate

All other ports are used to drive the VGA and should be connected to top-level pins of the same name.

Details of Video Resolution

The VGA interface implemented only supports 640x480 resolution, so user specified resolutions are emulated by creating large user pixels from several pixels in the native resolution. The driver achieves this by selecting an integer that specifies both the width and height in native resolution pixels of each user pixel. This integer is chosen such that the user pixels are as large as possible without any of the display being cropped out. The region which the user draws in is centered on the display and any margins to the top and bottom or left and right are colored black. This scheme is optimal in that it provides the largest display with uniform pixels sizes and no stretching or non-square pixels.

Differences from Display Interface Lab Driver

- **Color:** Supports RGB color values instead of defaulting to only black and white pixels
- **Window size:** Can specify display width and height as parameters instead of using the fixed max size of 640×480.
- **Pixel specification:** Employs a “scanning” method. Instead of the user specifying the color (black or white) of an arbitrary pixel, the driver cycles through one pixel at a time (given by the *outputs* x and y) and the user supplies the RGB color for that pixel.
- **Complexity:** Uses modules from the standard library that weren’t present in the display interface lab driver.

Tutorial developed by Professor Scott Hauck and Kyle Gagner. Last updated by Cole Van Pelt.
Code for video driver adapted from tutorials supplied by Altera.