Bufferless Tracker for Altera DE2 Board

This is a simple tracker implemented in VHDL. It scans every odd frame for an object with an RGB colour defined by the user. It operates in real time and doesn't use any resources (ie. SRAMs) other than the FPGA and video decoder so it is best used for systems that require fast tracking or have limited resources. This system is build on top of the DE2 TV demonstration in the Altera DE2 Demonstration package so it uses a lot of the same modules and pin assignments. The tracker was successfully tested using a camera with a resolution of 720 x 480.

Algorithm:
The system first transforms the video input in YCrCb format to RGB format to increase colour selectivity and tolerance to colour fluctuations. It then scans each frame line by line for pixels whose 3 most significant bits of each colour matches the colour defined by the user. It records the coordinates of the longest unbroken line of consecutive matching bits in a frame and outputs it. The raster scanning of a camera produces 2 frames that are supposed to be superimposed on top of each other to form a complete image so there is a slight difference between consecutive frames when viewing stationary images. For this reason, we only scan every odd frame to stabilize the output the coordinates.

Setup:
1.   Plug in a camera into the video in input.
2.   Load the DE2_TV.qpf into Quartus.
3.   Compile and program the board.

How to Use:
Some configurations must be made to run the system. The colour to detect must be set by the user using the switches on the DE2 board. The controls are listed below.

Controls	Purpose
Switch 17 to 15	Sets 3 most significant bits of red to match
Switch 14 to 12	Sets 3 most significant bits of green to match
Switch 11 to 9	Sets 3 most significant bits of blue to match

This module was set to successfully to detect the colour orange with switch configuration:

value	1	1	1	1	X	X	0	0	0
switch	17	16	15	14	13	12	11	10	9

* X signifies a 1 or 0 depending on the camera used and the lighting conditions.

The coordinates of the object is displayed on the 7 segment display. The tracked_x and tracked_y signals in project_top_level.vhd can be connected to feed the coordinates to a separate module.