AN EFFICIENT COLOR SPACE CONVERSION USING XILINX SYSTEM GENERATOR

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Abstract : In modern era the trend of 3D movies and 3D projection took a very intensive attention.Stereoscopic 3D images are elementarily obtained by overlapping left and right eye images in different color planes of a single image for successive viewing through colored glasses.Here we present a novel FPGA based reconfigurable architecture for 3D image color space conversion RGB to YCbCr using Xilinx System Generator (XSG) for MATLAB.The CSC design is implemented which is realized using the Xilinx Block Sets presented in Simulink.

***Keywords*-- CSC, FPGA, XSG, Simulink, MATLAB**

I. INTRODUCTION

In today's world there is enormous increase in 3D demand which is quite natural, as market is growing rapidly due to huge requirement of electronics media Humans will discern the depth illusion in a 3D image from two non-identical perspectives. The two viewpoints are from both the eyes provides an excellent immersive vision. The two different images are collectively called as a stereoscopic image and the whole process is called stereo image method.As the bandwidth requirement is very high when transmitting images in RGB color space there is a need to convert images into different color spaces such as YUV, YIQ and YCbCr and then transmitted.Depending upon the application and requirements the choice of the color space is chosen.In this paper we present a novel architectural module for efficient implementation of RGB to YCbCr color space conversion using an FPGA based system. Due to their low power dissipation per unit computation, high performance and reconfigurability FPGAs are an attractive choice to implement in the system hardware. Xilinx System Generator provides a set of Simulink blocks (models) for several hardware operations that could be implemented on various Xilinx FPGAs. These blocks can be used to simulate the functionality of the hardware system using Simulink environment.System Generator is used as a high level suited design tool in order to create a custom data path in FPGA.Designs are captured in the DSP friendly Simulink modeling environment using a Xilinx specific blockset.

II.PROPOSED WORK

Anaglyph 3d image

Stereoscopic 3D illusion accomplished by concealing each eye's image using filters of dissimilar colours, usually red and cyan. The two differently filtered coloured images in anaglyph 3D image maps one for each eye. Having two photos capturing at an instant is the vital part in creating an anaglyph image. Both photos must be focused on the same object, sliding the camera horizontally between 3 and 5 cm for the next picture. Anaglyph delivers a marginally distinct perspective to individual eyes. From the variance between the two viewpoints and other visual indications, the human optical system can provoke the stereoscopic depiction of spatial correlation in the scene. To generate an anaglyph image, the left and right images of a stereo image pair are superimposed in discrete colour planes. The two images will be isolated from the amalgamated picture by colour filtering and fed to each eye. The red channel of the left image and the blue and green channel of the right image are fused to produce a red cyan colour anaglyph image. It is essential to have coloured glasses which is devised by two unlike colours red and cyan. These glasses act as filters and permit each eye to see only what it deserves, thus, creating an illusion

COLORSPACE CONVERSION

Color Space Conversion (CSC) [6] is the mathematical translation of the numerical representation of a color from one color cube definition to the other. In most of the videos there is a full bandwidth of RGB signals that were not determined to be to be economically efficient enough as a means for storage and broadcasting. That's why RGB signals are encoded to YCbCr , where primary colors red,blue, green are proceesed into images that closely resemble the original RGB image , but at a much lower bandwidth for transmission. In YCbCr space, an image is represented by one luma (Y) and two chroma (Cb, Cr) components. The luma channel contains brightness information; it is essentially a grey scale version of the image and the chroma values are color offsets. In YCbCr space, the bandwidth of an image tends to be concentrated in the Y Channel. This leaves the Cb and Cr channels with less information, so they can be represented with fewer bits.The human eye doesn't actually see equally well in the different color bands with our human vision [9] system optimized for the red, green bands but not quite as sensitive to changes in blues.Scientist and engineers looking for ways to reduce the bandwidth and/or bit rate of a video system have created other color spaces (and sampling spaces) that reduce the amount of blue information in a system while maintaining a subjectively high picture quality. Therefore, many video systems sub sample the color information [9] (chrominance) while transmitting the black and white (luminance) in full resolution. This subsampling is often applied to luminance chrominance color space systems such as YCbCr where Y re presents the luminance information and Cr and Cb are color difference signals that represent the chrominance information. In these systems all of the Y samples are used but every other color sample is dropped. These systems are referred to as 4:2:0 sampling. The 4:2:2 nomenclatures signify that for every 4 Y samples only 2 Cr and 2 Cb samples are saved. Owing to the bandwidth saving benefits of these different image formats different video equipment will adopt different color space encodings. Interoperability between such equipment often requires a device to convert the output of one video device in a given color space to the color space needed as input for the downstream device. YCbCr Color Space was developed as part of the Recommendation ITU R BT.601 [1] (InternationalTelecommunication Union) for worldwide digital component video standard and is used in television transmissions. In this color model, the luminance component is separated from the color components.Component (Y) represents luminance, and chrominance information is stored as two color difference components. Color component Cb represent the difference between the blue component and a reference value and the color component Cr represents the difference between the red component and a reference value [1]. The basic equations to convert between RGB and YCbCr are:

$$Y = 0.299R + 0.587G + 0.114B + 16$$
$$Cb =-0.169R-0.331G + 0.5B + 128$$
$$Cr = 0.5R-0.419G-0.081B + 128$$

Among all the color models found, YCbCr seems to be better because humans are sensitive to brightness information than color information which is more in luminance (Y channel) when compared to chrominance

(Cb and Cr channels). During video processing thec luminance can be removed by converting the image from RGB color model to the Y CbCr color model [1].

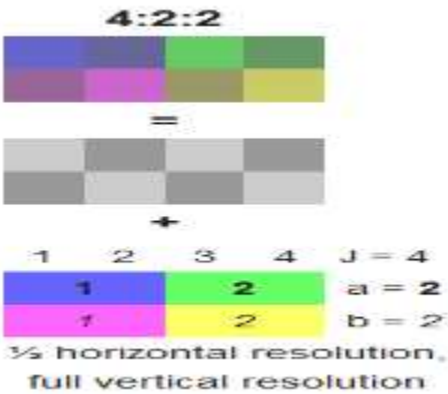
Chroma subsampling

Chroma subsampling is the practice of encoding images by implementing less resolution for chroma information than for lumainformation, taking advantage of the human visual system's lower acuity for color differences than for luminance. Because the human visual syatem is less sensitive to the position and motion of color than luminance, bandwidth can be optimized by storing more luminance detail than color detail. At normal viewing distances, there is no perceptible loss incurred by sampling the color detail at a lower rate .In video systems, this is achieved through the use of color difference components. The signal is divided into a luma (Y') component and two color difference components (chroma).

Sampling systems and ratios

The subsampling scheme is commonly expressed as a three part ratio J:a:b (e.g. 4:2:2) , that describe the number of luminance and chrominance samples in a conceptual region that is J pixels wide, and 2 pixels high. The parts are (in their respective order):

- *J*: horizontal sampling reference (width of the conceptual region). Usually, 4.
- *a*: number of chrominance samples (Cr, Cb) in the first row of *J* pixels.
- *b*: number of changes of chrominance samples
- (Cr, Cb) between first and second rowof *J pixel*



CONCLUSION

The design is implemented using XSG and Simulink IDE.By this colour space conversion image size will reduces auotomatically storage capacity wiil becomes low .The development time is less. It is less complex and highly flexible for prototyping and modifications. It is implemented with MatLab13.2 version and Xilinx ISE 14.1. The implementation of CSC design of 3DAnaglyph image is very high in terms of accuracy and performance.

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