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Image Enhancement on FPGA using Verilog

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Abstract— image magnification techniques are to improving the visual quality of Image. essential objective of image enhancement is to process an image in order that end result is greater suitable than original image for specific application. This paper shows constant equipment image enhancement methods utilizing field programmable gate array (FPGA). image enhancement algorithms are brightness addition, brightness subtraction, inverting and thresholding use in this paper. FPGA is highly alternative of fast performance of digital signal processing application. These algorithms are implemented in Verilog HDL using Xilinx ISE, MATLAB.

Keywords—Matlab and Xilinx ISE software, Verilog HDL, Image Enhancement, Magnification, image Processing.

I. INTRODUCTION

Digital Image processing main role of object is to analysis and interpretation of remotely sensed data[1]. Especially data collected from camera sensor which is in the digital form, can best be used with the help of digital image processing. information extraction from image and Image enhancement are main component of Image processing. Image enhancement techniques is useful to improve quality and visibility of any part of image. Image enhancement is visually fascinating area of image processing.

Image upgrade forms have diverse methods to improve the visual appearance of a Image. In the meantime, the term picture image is mean as the improvement of a picture appearance by expanding predominance of a few highlights or then again by diminishing vagueness between various locales of the image. Image enhancement approaches fall into two broad categories:

1. Spatial domain methods
2. Frequency domain methods

In Spatial domain we are direct deal with image pixel and direct manipulation of pixel in an image. Frequency domain processing technique are based on the Fourier transform of an image. All the enhancement operations are accomplished on the Fourier transform of the image and then the inverse Fourier transform is completed to get the resultant image. 8-bit digital gray image can have pixel values in the range of 0 to 255.
Digital image processing used in very large area of application like are Remote sensing, Computerized photography, Space image processing, Industrial, Finger print/face/iris recognition and Automatic character recognition. [2]

Firstly, we need image but image file will be in .jpg file extension so this file is not readable to Xilinx software[3]. moreover, here image convert to .bmp file using MATLAB. This data is as input data processed through digital algorithms and get result data is converted to image. Block diagram is shown that in figure 1



Figure 1

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II. METHODOLOGY

We discuss the theory of most typically utilized image improvement algorithms like 1) Grayscale Transformation 2) Threshold Operation 3) Adding and Subtracting Brightness.[4]

There are so many applications of I2C protocol in real time such as micro controller, wireless communication and many more [5] [6] [7].

1) Grayscale Transformation

The Grayscale Transformation is known as a negative Transformation and These Technique used wide application. The Digital image of negative transformation will be significant part of image processing techniques. For example, in medical sector, when doctor shows X-ray in monochrome image. Monochrome image is more precise as compared to colour image in X-ray. The inverting digital image is established by using the transformation function:

J(K)=(P-1)-I(k)

Whereas assume I(k) input pixel grey level, P is the number of gray levels and J(k) is output of converged gray level. This scenario is to in reverse manner from black and white. So, we get lesser intensity at output side as compared to input side.

2)Threshold Operation

Threshold technique is easiest methods. In these techniques replaced each pixel in black and white pixels. We have fixed consent (assume as Y) when the pixel intensity is, I(ij) <= Y so it replaces by black pixel and when the pixel intensity is, I(ij) > Y so it can be white pixel.so we assume the black pixels are 0 and white pixels are 1 so we get this transformation function:

$$J(k)=\begin{cases} 0, & \text{if } I(ij) <= Y \\ 1, & \text{if } I(ij) > Y \end{cases}$$

At the resulting point of view, we get black and white image.

3) Adding and Subtracting Brightness

Controlling brightness technique plays a vital role in image improvement to search out the information that exists within low light (intensity) range of that gray level image. To enhance the quality of a digital image, it required to perform the operation like increasing and decreasing the gray value of pixel. When we clicked photo at low light so the brightness is poor so object is not clearly visible. To correct this issue, we can increase the brightness of the clicked digital image and make more prepossessing. Dark image, we can easily increase brightness by adding constant to gray value of each pixel. While this technique to increase or decrease brightness of digital image, we must choose the value of constant very wisely so that the complete range value of gray values lies between 0 to 255.if we exceed the limit of range so at result, we lose the information.so this transformation function:

$$J(k)=\begin{cases} I(k)+g, & \text{if } I(k)+r<=255 \\ 255, & \text{if } I(k)+r<=255 \end{cases}$$

r is a constant value(r>0). J(k) is output pixel after the brightness controlling process and I(k)is gray level of input pixel.

III. CONCLUSION

We conclude high speed image improvement applications using FPGA in this paper. And there are several techniques for image enhancement but we explain three major techniques like: grayscale transformation, threshold operation and controlling brightness operation on FPGA. We used Spartan-3 FPGA board for perform these algorithms. So, we get as result as images with appropriate brightness and also increase the images quality. These techniques have wide application as per requirement and need. for example, digital X-ray, CT scans, MRI, digital sonography etc.

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