"A Review on Design and Implementation of Image Enhancement for Underwater Image"

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***Abstract* —** For the Underwater image, currently the gathered images have different grades of distortion and wrong information due to the influence of underwater special environment. There are two basic process for light propagation in the sea water; Absorption and disperses .The process of the light in water can affect the overall performance of underwater imaging system. The above characteristics lead to uneven illumination, low contrast of image and poor quality of the image. For underwater images de noising, a new method based on adaptive wavelet is proposed. Finally the simulation results show that the proposed work not only eliminate the noise effectively but also improves image output peak signal-to-noise ratio (PSNR).Then after Enhancement algorithms which is generally interactive and application dependent is to bring out detail that is hidden part in an image is covered up in a picture or to increases contrast in a low contrast picture. Image enhancement is useful in feature information, image study and visual information display. It simply emphasizes certain specified image characteristics. In this paper an efficient image enhancement algorithm i.e., pre processing, thresholding, contrast adjustment, power law transform is implemented on Spartan -3 FPGA.

Keywords- *FPGA, DSP, Image Processing, Image Enhancement, MATLAB*

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I. INTRODUCTION

For a modern computer, media information such as audio, images, and video have come to be necessary for business tasks and daily life. In this paper, we study digital images processing and its processing techniques. Underwater photography is challenging due to its noisiness & poor illumination as well as varying environment condition. This paper emphasis on DSD & DIP which consists of combination of hardware and software respectively to create image enhancement simulation for under water images. Technique for DIP goes like this, first of all de-noising image then image enhancement using enhancement algorithm with the help of Field Programmable Gate Arrays (FPGA) and Various spatial domain techniques for image enhancement techniques such as contrast stretching, thresholding, Histogram Equalization, Histogram Stretching, power law transform, Negative transformation are used to preprocess an underwater image.

The new application based on image processing is Xilinx System Generator. It provide a well conditions for the image processing because of processing units which is created by blocks. Xilinx System Generator tool support software simulation and FPGAs hardware. The important task of image processing is to enhance the image for many purposes. For Hardware Descriptive Language (HDL) design, Xilinx Integrated Software Environment (ISE) is a software tool which is developed by Xilinx Corporation. By using level software languages like Matlab, Simulink and C, system are generated which define the algorithms. For the implementation of algorithm, the Xilinx's System Generator comes with a predefined block set. In these, Matlab Simulink software packet is present which is used to verify the infallibility of the algorithms. Xilinx System Generator is a system-level modeling tool from Xilinx that accessible FPGA hardware design. It spread Simulink in many ways to provide a modeling environment which is allowable for hardware design. This software automatically translate block diagram of the high level system DSP to RTL. The result can be analyzes to Xilinx FPGA technology by using ISE tools. To create an FPGA programming file, all of the downstream FPGA implementation steps are automatically performed. The design flow of XSG is given below:

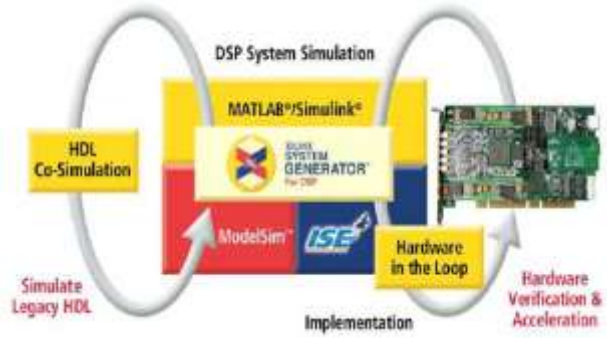

Fig-I .Design flow of XSG system

More developed and complicated Spartan board is Spartan-3E Starter Kit board. It gives unique features of the Spartan-3E FPGA family.For embedded processing algorithm,it gives convenient development board.
The features are:

A. Spartan-3E specific features

- Parallel NOR Flash configuration
- Multi Boot FPGA configuration from parallel NOR Flash PROM
- SPI serial Flash configuration

B. Embedded development

- Micro Blaze™ 32-bit embedded RISC processor
- Pico Blaze™ 8-bit embedded controller
- DDR memory interfaces

II. LITERATURE SURVEY

This section presents related literature concerning underwater image processing techniques.

LeiFei and Wang Yingying [1] proposed a method which is based on adaptive wavelet. In this method author combines adaptive threshold selection with adaptive output of the threshold function.Authors have suggested some pre-processing to achieve better de-noising effect on underwater image before wavelet threshold de-noising.The proposed algorithm combining adaptive threshold with adaptive output of the threshold function which not only remove noise, improve the PSNR, but also get a better visual effect .

Shiwam S. Thakare and Amit M. Sahu[2] proposed various De-noising method and divided them based on different factors, which leads to a better understanding on their operation.Also discussed the implementation details of methods including the tools used by various authors and the metrics used to measure their performance in the paper. Author also studied some preprocessing methods whose purpose was to improve color and contrast of underwater images.

Alex Raj S. M.1, Khadeeja N.1, Supriya M. H.[3] proposed various spatial domain techniques for image enhancement techniques such as power law transform, contrast stretching, Histogram Equalization, Histogram Stretching, Negative transformation are used to preprocess an underwater image. In this paper a comparative analysis of above image enhancement algorithm implemented in FPGA is done. In this paper, work aimed to implement the basic image processing algorithms for underwater images effectively in Altium Nano board 3000. Hence the result on tested images had proven that the FPGA is stipulated in the field of image processing.

Mr.Anup T.Gadre[4] proposed a wavelet-based multiscale products thresholding scheme for noise suppression of magnetic resonance images. This paper proposed a method based on image de-noising and edge enhancement of noisy multidimensional imaging data sets. For the intent of image de-noising, Adaptive Multiscale Product Thresholding based on 2-D wavelet transform is used. In this method, contiguous wavelet sub bands are multiplied to improve edge structure while reducing noise. For the edge enhancement. Canny Edge Detection Algorithm is used with scale multiplication technique. Simulation results shows that the planned technique better suppress the Poisson noise among several noises i.e. salt & pepper, speckle noise and random noise. The Performance of Image Intensification can be estimate by means of PSNR, MSE.

Praveen vanaparthy, Sahitya.G, Krishna Sree and Dr.C.D.Naidu[5] proposed implementation of image enhancement algorithms like brightness control, contrast stretching, negative transformation, thresholding, filtering techniques on FPGA that have become a competitive alternative for high performance digital signal processing applications. In these paper, algorithms successfully implemented on retinal images in verilog HDL using Xilinx ISE, MATLAB and MODELSIM.

III. PROPOSED WORK

We are going to implemented combination of hardware and software respectively. First we apply wavelet transform method to image de-noising. In this case, we select threshold and the output of the threshold function during use of wavelet threshold for de-noising of image. However, the traditional selection fixed threshold method is not allowable. This method minimizes the limitations of traditional threshold selection with increasing the peak signal to noise ratio (PSNR) of the image and we get better de-noising effect. In this paper after de-noising the image, an efficient image enhancement algorithm is implemented on Spartan -3 FPGA. The flow for proposed work is given below:

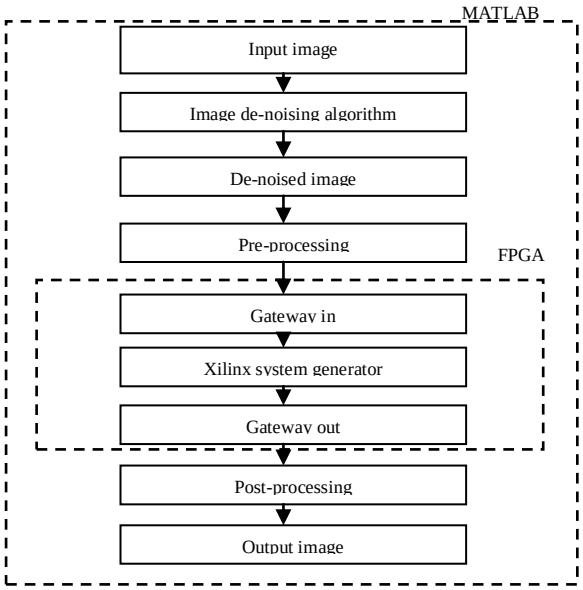

FIG.-2. PROPOSE WORK

CONCLUSIONS

Underwater photography is challenging due to its noisiness and environment condition. In above Literature survey, they show multiple techniques for de-noising and image processing by using XILINX and Spartan -3 FPGA to verify the competitive performance.

In this paper, we are going to implemented combination of hardware and software respectively to create image enhancement simulation for under water images. Xilinx System Generator is a multipurpose tool to perform both software and hardware image processing task respectively. After de-noising, here we perform Image Inverting, Thresholding, Power law transform, Contrast stretching, Histogram Equalization etc on underwater image to get better result.

ACKNOWLEDGMENT

It is our almost duty to express acknowledgement to a person who have rendered valuable guidance for preparation of project. First of all, I would like to thank my guide **Prof. Pooja Khangar** for providing her support and guidance. She guide throughout never leaving me unanswerered for any of doubts. Because of her constant support, encouragement, inspiration and guidance, I am completing project successfully.

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