International Journal of Advance Research in Science and Engineering
Vol. No.6, Issue No. 04, April 2017
www.ijarse.com
IJARSE
ISSN (O) 2319 - 8354
ISSN (P) 2319 - 8346

MEDICAL IMAGE ENHANCEMENT USING HARDWARE DESCRIPTION LANGUAGE

K.Surya Anusha[1], B Likhita[2], I Rohini[3], D.Chiranjeevulu[4]

[1,2,3]*Electronics and Communications, Sri Sivani College of Engineering, (India)*

[4]*Associate Prof, Dept of ECE, Sri Sivani College of Engineering (India)*

ABSTRACT

This project presents the enhancement of X-ray images which helps medical specialists for diagnosis. Sometimes the x-ray images are distorted by noise, illumination variations which may occur during acquisition. The medical image enhancement is achieved with the development of new series of filters edge detection, sharpening, brightness adjustment and contrast enhancement. These operations all together improve the quality of images and intern it helps to analyze the Images for disease diagnosis. These image enhancement techniques are simulated using Hardware description language.

Keywords: Brightness adjustment, Contrast enhancement, Edge detection, Hardware description language, sharpening.

I. INTRODUCTION

Digital image processing (DIP) is used in various fields of modern society and especially in medical imaging and, recently, occupies a fundamental role in assisted diagnosis of diseases, developing as a multidisciplinary field [1]. DIP is a very broad field based on rigorous mathematical theory [2] and implementations of DIP on different computing machines are resources consuming [3], especially if we consider the real-time processing of the information extracted from images. Nowadays, the image processing is an emerging biomedical tool contributing to the improvement of healthcare sector. Recent image processing tools can perform image analysis, image enhancement, noise reduction, image segmentation, geometric transformations, and image restoration.

Biomedical imaging focuses on the capture and display of the medical images for diagnostic, rehabilitation and treatment patient and often these images are distorted by noise or other defects which may occur during acquisition [4]. The image purposes. The development of more efficient equipment for medical imaging is closely linked to the research results of the processing and analysis of medical images, or more generally multidimensional signals with applications in medical imaging [4]. Modern imaging technology is digital due to the use of smart sensors, computer technology, advanced medical equipment, portable medical devices connected in an Internet of Things (IoT) network [4]. In most medical applications, images are acquired directly from the enhancement techniques and noise suppression are useful, especially in imaging pre-processing level. The image acquisition techniques used in the medical field are: ultrasound (ultrasound and

IJARSE
ISSN (O) 2319 - 8354
ISSN (P) 2319 - 8346

ultrasound tomography - the physical principle of reflection at tissues interfaces), X-rays (radiology, X tomography - the principle of radiation absorption or attenuation depending on the tissues density),chemical factors (specifictracers,radioactive pharmaceuticals) that are mounted to the investigated tissue and emit ionizing radiation (scintigraphy, Single Photon Emission Computed Tomography - SPECT) electromagnetic field (MRI CT – the principle of nuclear magnetic resonance of protons in a magnetic field) [4]. These technologies can be used to assess the current condition of the patient's organ or tissue and can monitor the patient over time for diagnosis and treatment evaluation [5].

Medical equipment perform processing of acquired images through filtering or removing background noise or artifacts, correction of in homogeneity, distortion of images, numerical evaluation of features, visualization of areas of interest etc. Image processing software and hardware applications can provide temporal and spatial analysis and help to automatically identify and analyze images in order to detect patterns or characteristics indicative of tumors. The image processing and analysis can be used in medical applications to determine, for example, "the diameter, volume and vasculature of a tumor or organ, flow parameters of blood or other fluids and microscopic changes" [4].

Image processing is "one of the best suited applications for FPGAs, due to the parallel architectures, the logic density and the generous memory capacity" [6]. "The FPGAs are capable to boost the performance of all the fast imaging algorithms: image construction, enhancement and restoration, image analysis and pattern recognition, image and data compression, color space conversion, etc". Implementing these applications on reconfigurable hardware offers much greater speed than a software implementation [7]. Hardware implementation has become an attractive alternative for image processing,
especially for real time processing due to the advances in very large scale integration (VLSI) technologies [8].

II. HDL BASED SYSTEM

The main purpose of this project is to improve the quality of the medical image by using a new series of filters for the better diagnosis of any disease. Here we are using four filters those filters are image enhancement, edge detection, brightness and contrast adjustment, sharpening. These filters are arranged in a series and we are acquiring the image from the patients body directly and we are passing that image through the series of filters to get a better quality image as an output.

This project is to improve and simulate the hardware architecture of the real-time configurable system for digital image processing using Verilog HDL and reconfigurable architecture. The configurable system for real time image processing was described in [10] and [11]. Some point operations for medical image enhancement were described and tested in reference [12].

In order to achieve the simulation using ISIM simulator component that requires a digital image and involves vectors in numerical form to be applied to the Verilog based system, an application in C # was developed. This application allows loading the image in "bit map" or "jpeg" format and generates a file which contains the digital image (RGB vectors for each pixel).

Filtering principles of image enhancement techniques were analyzed mathematically and then transcribed into a source code written in Verilog hardware description language. The filters were described at register transfer

IJARSE
ISSN (O) 2319 - 8354
ISSN (P) 2319 - 8346

level (RTL) using Verilog continuous assignments. The images were processed by switching the order of filters; using a single command and without the reconfiguration of the FPGA in order to improve the original image.

In our project we are using MATLAB software to verify whether we are getting the improved image as output or not.

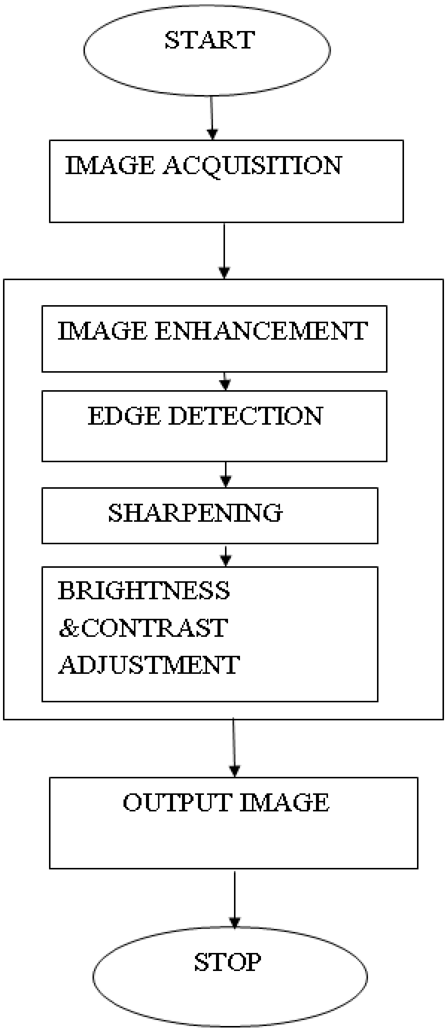
Here the order of the filters may be interchanged.

1. Enhance contrast operation, brightness adjustment, sharpen operation and edge detection
2. Enhance contrast operation, edge detection, sharpen operation and brightness adjustment
3. Sharpen operation, brightness adjustment, enhance contrast operation and edge detection
4. Sharpen operation, edge detection, enhance contrast operation and brightness adjustment

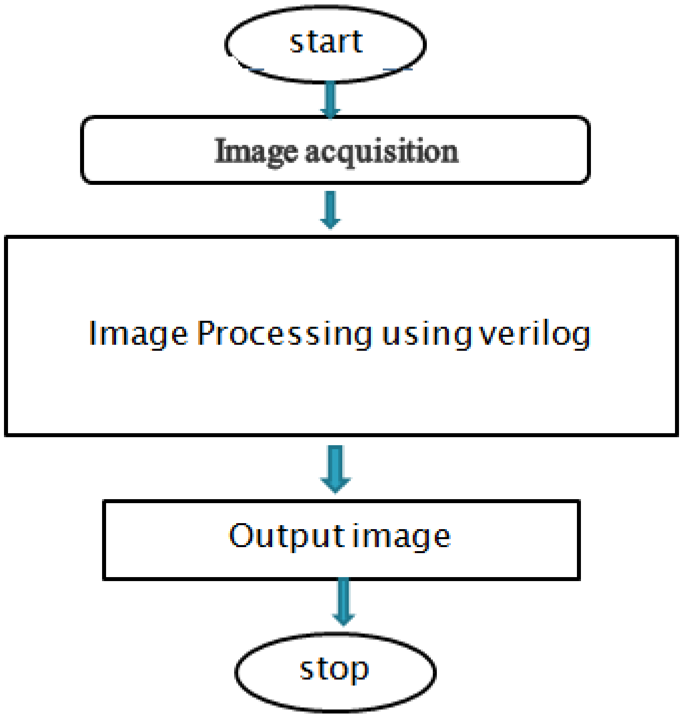
III. FLOW CHART

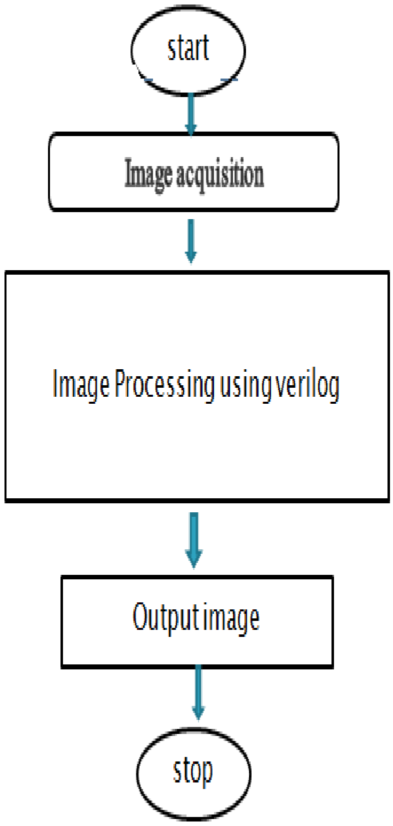
The following flow chart will describe the entire process of our project. First step is image acquisition i.e acquiring image from the patient's body.

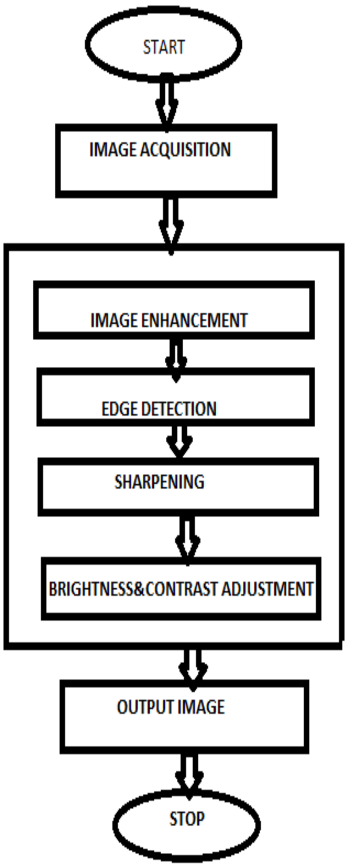
In our project we are taking an X-ray image from the patient's body. Generally all images will be in the form of pixels. Now we are converting that image into digital form and that image is passed through these series of filters and the image will be processed image that is better quality of image.

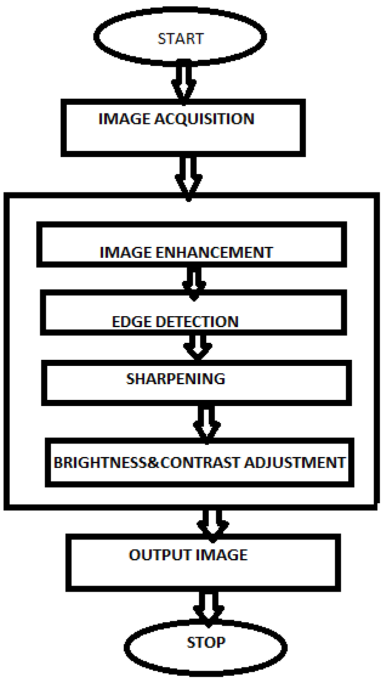


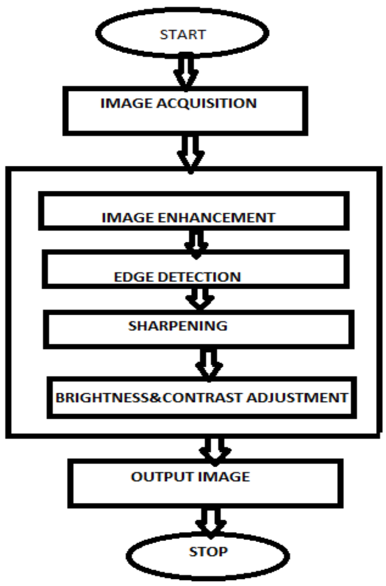
IJARSE
ISSN (O) 2319 - 8354
ISSN (P) 2319 - 8346











IJARSE
ISSN (O) 2319 - 8354
ISSN (P) 2319 - 8346

Image Acquisition:

Image Acquisition is to acquire a digital image. To do so requires an image sensor and the capability to digitize the signal produced by the sensor. The sensor could be monochrome or color TV camera that produces an entire image of the problem domain every 1/30 sec. the image sensor could also be line scan camera that produces a single image line at a time. In this case, the objects motion past the line.

Image Enhancement:

Image enhancement is among the simplest and most appealing areas of digital image processing. Basically, the idea behind enhancement techniques is bring out detail that is obscured, or simply to highlight certain features of interesting an image. A familiar example of enhancement is when we increase the contrast of an image because "it looks better." It is important to keep in mind that enhancement is a very subjective area of image processing.

Edge Detection:

Introduction to Fundamentals of Edge Detection

Edge detection refers to the process of identifying and locating sharp discontinuities in an image. The discontinuities are abrupt changes in pixel intensity which characterize boundaries of objects in a scene. Classical methods of edge detection involve convolving the image with an operator (a 2-D filter), which is constructed to be sensitive to large gradients in the image while returning values of zero in uniform regions. There is an extremely large number of edge detection operators available, each designed to be sensitive to certain types of edges.

Variables involved in the selection of an edge detection operator include:

•**Edge orientation:** The geometry of the operator determines a haracteristic direction in which it is most sensitive to edges. Operators can be optimized to look for horizontal, vertical, or diagonal edges.

•**Noise environment:** Edge detection is difficult in noisy images, since both the noise and the edges contain high-frequency content. Attempts to reduce the noise result in blurred and distorted edges. Operators used on noisy images are typically larger in scope, so they can average enough data to discount localized noisy pixels. This results in less accurate localization of the detected edges.

•**Edge structure:** Not all edges involve a step change in intensity. Effects such as refraction or poor focus can result in objects with boundaries defined by a gradual change in intensity. The operator needs to be chosen to be responsive to such a gradual change in those cases. Newer wavelet-based techniques actually characterize the nature of the transition for each edge in order to distinguish, for example, edges associated with hair from edges associated with a face.

IV. EXPERIMENTATION RESULTS

The following outputs are the MATLAB output in which the four filters are arranged in a different series.

International Journal of Advance Research in Science and Engineering
Vol. No.6, Issue No. 04, April 2017
www.ijarse.com
IJARSE
ISSN (O) 2319 - 8354
ISSN (P) 2319 - 8346

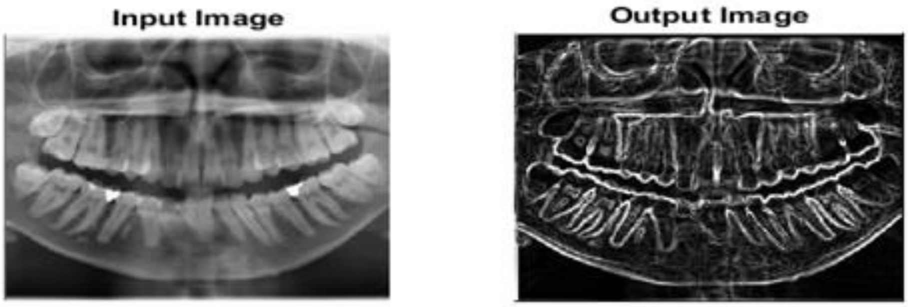


Fig.1 Enhance contrast operation, brightness adjustment, sharpen operation and edge detection.

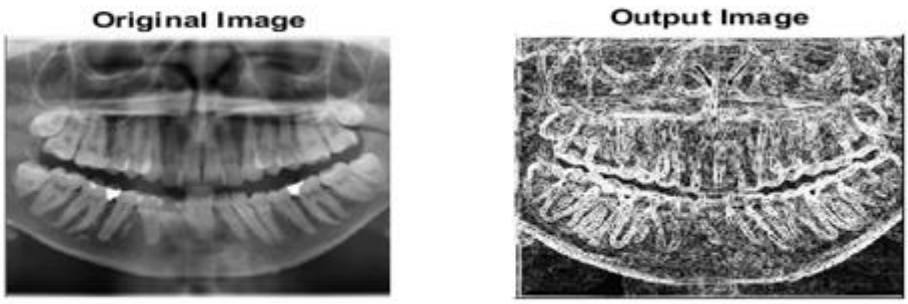


Fig.2 Enhance contrast operation, edge detection, sharpen operation and brightness adjustment.

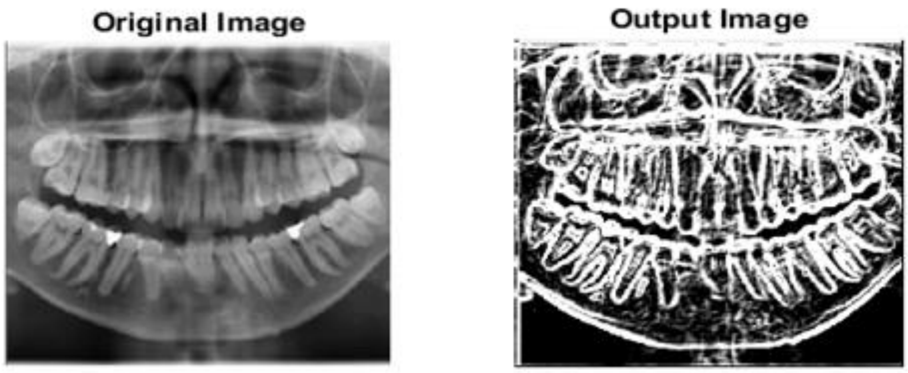


Fig.3 Sharpen operation, brightness adjustment, enhance contrast operation, edge detection.

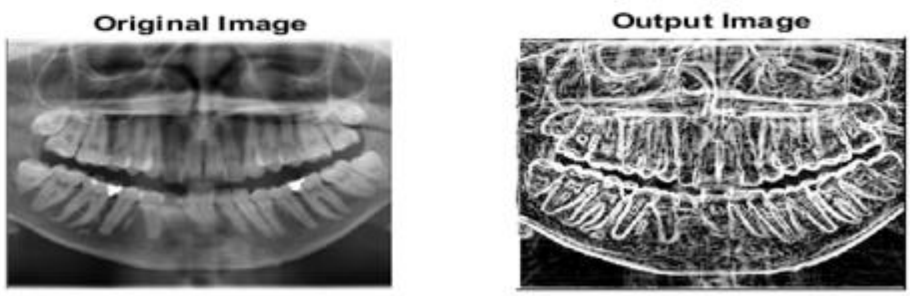


Fig.4 Sharpen operation, edge detection, enhance contrast operation and brightness adjustment.

The better order in the above following series is simulated by using Xilinx ISE simulator. The following is the simulated output of the medical image.

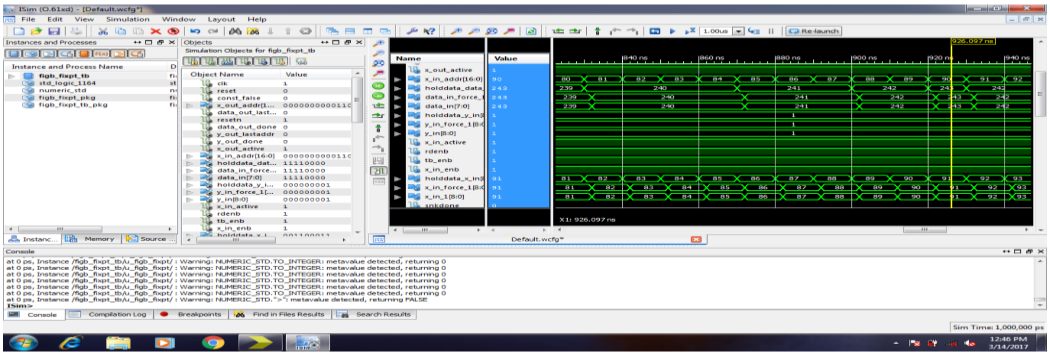


Fig.5 Simulation result using ISE simulator. (enhance contrast operation ,edge detection, sharpen operation and brightness contrast adjustment)

V. CONCLUSION

This paper presents the improvement of the Verilog-based system for image processing previously described. New series of filters were developed at the hardware level for image processing (edges detection, sharpen operation, enhance contrast operation and brightness-adjustment), in order to improve the quality of images and to assist in diagnosis the medical specialists. The advantage of this approach is that the implementation at the hardware level of our system can lead to a superior image processing speed and do not require a dedicated signal processor (DSP) in order to process the images. For modelling, optimization and simulation of image processing in Verilog HDL was used ISE Design Suite program, from Xilinx.The greater potential of this system lies in fact that it is not necessary to use an additional processor dedicated to image processing, which could slow down the flow: image acquisition → preprocessing the image → image use in order to establish a decision which can be human-type (in the case of a diagnosis based on medical images) or non-human (in the case of an industrial process).

REFERENCES

[1] J.C. Russ, The Image Processing Handbook, 6th Edition, CRC Press, 2011.

[2] W. Burger, M.J. Burge, Principles of Digital Image Processing, Fundamental Techniques, Springer Ed., 2009.

[3] D.G. Bailey, Design for Embedded Image Processing on FPGAs, John Wiley & Sons Ed., 2011.

[4] H.N. Costin, "Recent trends in Medical Image Processing," Computer Science Journal of Moldova, **22**no.2 (65), 2014.

[5] H.N. Costin, C. Rotariu, I. Alexa, et al., "TELEMON – A Complex System for Real Time Medical Telemonitoring," Proceedings of the World Congress on Medical Physics and Biomedical Engineering,Munich, Germany, **25**, pp. 92-95, 2009.

[6] Y. Said, T. Saidani, M. Atri, "FPGA-based Architectures for Image Processing using High-Level Design", WSEAS Transactions on Signal Processing, **11**, E-ISSN: 2224-3488, 2015.

[7] Praveen Vanaparthy, G. Sahitya, Krishna Sree, C.D. Naidu, "FPGA implementation of image enhancement algorithms for biomedical image processing", International Journal of Advanced Research in Electrical, Electronics and Instrumentation Engineering, **2**(11), 2013.