



VLSI BASED COLOR INTERPOLATION ALGORITHM FOR REAL TIME IMAGE APPLICATIONS

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ABSTRACT

Applications of Digital Image Processing (DIP) have become common in our day to day life. Exploitation of digital image processing systems for real time applications indeed requires efficient computing techniques., the proposed algorithm mainly focuses on Very Large Scale Integration (VLSI) chip based implementation of digital image processing applications since it suits better for real time processing. The proposed method VLSI implementation for interesting applications such as identification the pest affected or not affected crops in the agriculture field. But farmers used fertilizer at certain period of time at field crops growth. These crops are purchased by the customers without any knowledge. All the fertilizers are made from chemicals. These chemicals affect the human health. To overcome all the problems mentioned above, a system is proposed with high computation speed in this research work. This will help the customers as well as farmers in the agriculture field. The equipment for this purpose should be portable, and the measurement method should be quick, capable of providing test results within a very short time. High Quality Interpolation Algorithm (HQIA), Edge Matching Algorithm, Edge detection, anisotropic weighting model and filter based compensated methods is used. The design is based on VLSI for the hardware implementation using Mathematical Laboratory Matlab and Modelsim software. Field Programmable Gate Array (FPGA) Cyclone III kit is used for the hardware implementation.

Keywords: color interpolation algorithm, color filter array, charge coupled device.

1. INTRODUCTION

Recently, human beings get affected by hazardous diseases which could not be diagnosed. In agriculture field Crops and leaves with affect by pests or without affected crops it cannot be found out manually. But farmers used fertilizer at certain period of time at field crops growth. All the fertilizers are made from chemicals. These chemicals affect the human health. The crops are purchased by the customers without any knowledge. Digital Image Processing has been used to identify these problems. But this is a time-consuming process. To overcome all the problems, a system is proposed with high speed and high accuracy in this project work. This will help the farmers to identify the disease crops in the agriculture field using Very Large Scale Integration (VLSI).

2. SYSTEM IMPLEMENTATION

Designed to identify the pest affected crops in the agriculture field. In certain period of time farmers apply the fertilizer in the crops. Now a day's some chemical tests also involved, namely PH level test used to determine the affected of crops [3]. The crops samples are adulterated by pest and insects. The harmful effects are human beings cancer and nervous problem.

A gradient-base scheme with a Gaussian low-pass filter to enhance the performance of the color interpolation was proposed [6]. An effective scheme to enhance state-of-the-art demosaicking methods using image spatial and spectral correlation was presented a wavelet-based classifier. This method produced a high-

quality color interpolation. A high-quality full RGB color images from the mosaic sensor were adopted the full color images by filtering the luminance components [9].

An edge estimation method using variance of the different colors was invented In addition; an iterative K-SVD based algorithm successfully improved the quality of interpolated images through iteration technique [10]. Prior knowledge was used to improve the performance of demosaicking images [4]. The high-quality color interpolation algorithms, mentioned above made great contributions in CFA images correction. However, these high-quality color interpolation algorithms have the characteristics of high complexity and high memory requirement [2]. Furthermore, these algorithms are not easy to be realized using VLSI technique.

For this reason, previous studies, concerning the VLSI architecture of low-complexity and low-memory-requirement color interpolation algorithms were conducted. Implemented a high speed image processor by VLSI technique [8]. The throughput achieves a real-time process of 30 frames per second. Although this study proposed a high-quality and high-throughput color interpolation processor, the chip area and power consumption of this design are quite few. Moreover, it demands a frame memory to buffer the input CFA image. An efficient color interpolation processor based on edge-direction weighting and local gain approach techniques [4].

3. PROPOSED METHOD

The proposed novel color interpolation algorithm is composed of low-complexity edge detection, a green



color interpolation, and red-blue color interpolation techniques. Each color is interpolated by different methodologies according to the relative locations and reference neighboring samples as shown in which the $BRg(i, j)$ and $RBg(i, j)$ represent that the green color pixel $g(i, j)$ was interpolated and prepared when it interpolates $R(i, j)$ and $B(i, j)$.

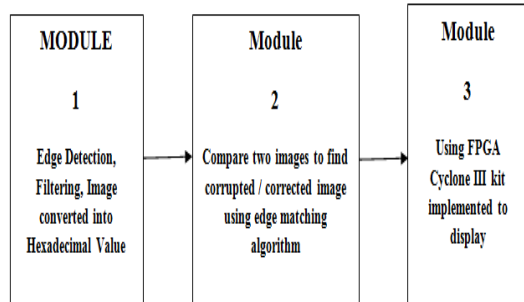


Figure-1. General block diagram of identifies the pest affected crops.

Figure-1 shows, to identify the pest affected crops in the agriculture field. There three modules are involved in the process module 1 represents edge detection , filtering, resizing and that image converted into hexadecimal value. Module 2 represents compare the two images using edge mapping algorithm to identify the corrupted image and the module 3 represents FPGA kit to implement to VLSI Design.

3.1 Module 1

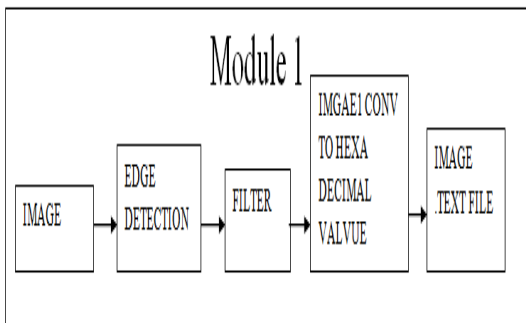


Figure-2. General block diagram for Module 1.

Figure-2 shows, the performance of this design was improved by a pipeline schedule and time-sharing techniques. Although the local gain that is obtained by the edge-direction weighting information, it can efficiently improve the quality of the interpolated images. It is necessary to use two division and three multiplication operations to obtain the edge-direction weighting and local gain information. For VLSI implementation, the chip area

was greatly increased by realizing these dividers and multipliers due to the high complexity and hardware cost.

3.2 Module 2

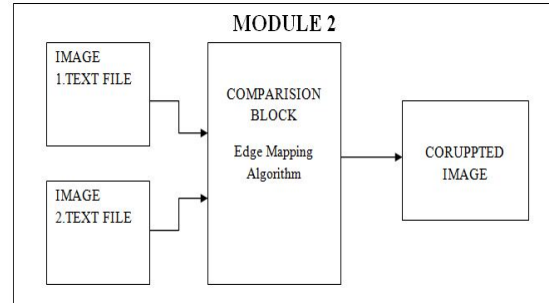


Figure-3. General block diagram for Module 2 to identify corrupted image.

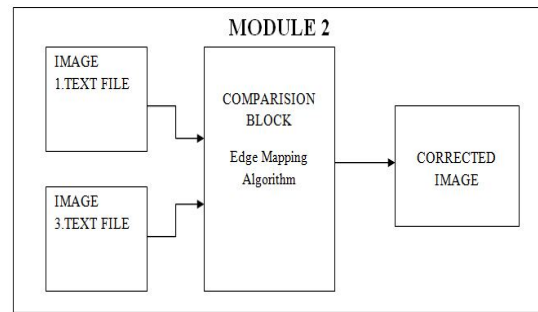


Figure-4. General block diagram for Module 2 to identify corrected image.

Figure-8 and Figure-9 shows, that identify the image is corrected or not. There loading image is sample iamge1 and the testing images are sample image 2 and sample image 3. Using edge mapping algorithm, the software tools MATLAB and MODELSIM are used to identify the image is corrupted or corrected.

3.3 Module 3

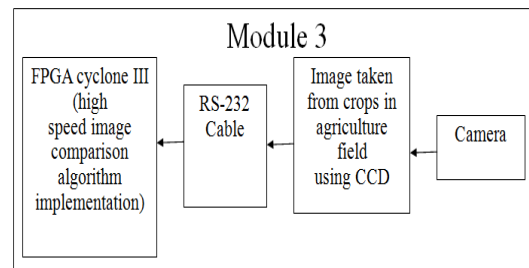


Figure-5. General block diagram for Module 3.

Figure-5 shows, which consist of high resolution CCD camera, RS-232 cable and FPGA unit. Here, CCD camera is working as an image acquisition unit. RS-232



cable connects the FPGA system and camera. vlsi implementation of digital image processing in real time image applications.

4. RESULTS AND DISCUSSIONS

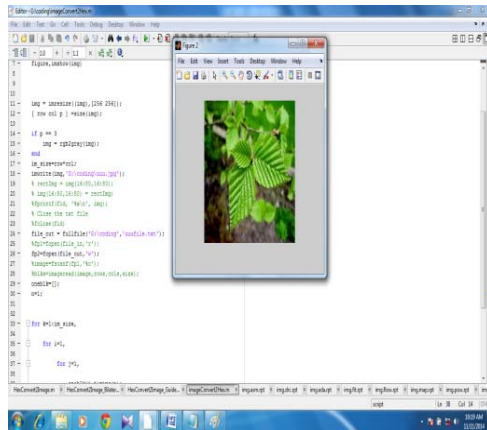


Figure-6. Sample 1 image.

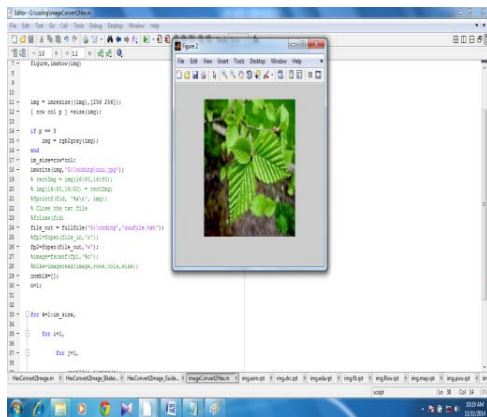


Figure-7. Sample 2 image.

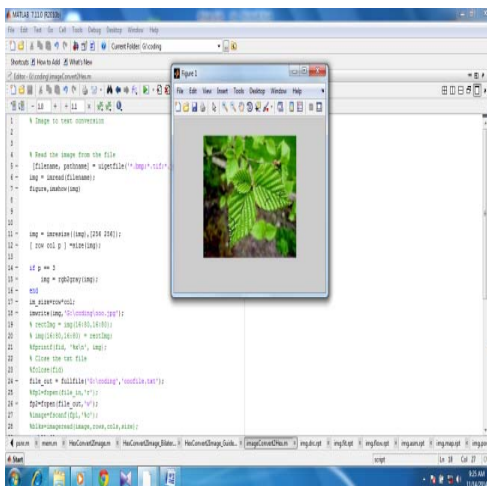


Figure-8. Sample 3 image.

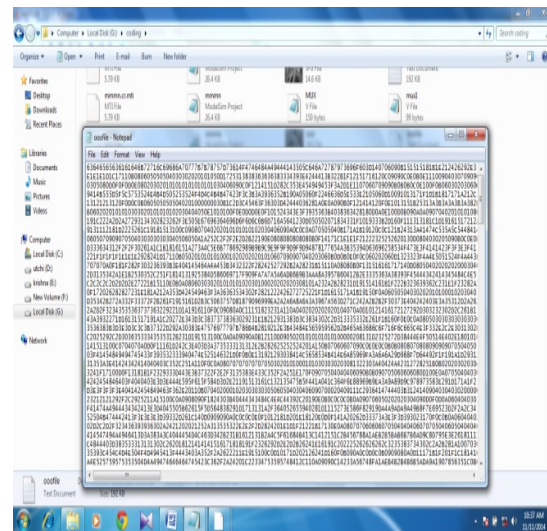


Figure-9. Sample 3 image converted into Hexadecimal value.

In sample 1 image (original image pest not affected) that's resize 256X256 pixel values. Then edge detection and the filter based compensation techniques are introduced. This process to identify the PSNR value of the sample 1 image as well as image that converted into hexadecimal value.

Sample images converted into hexadecimal value. That created a text file document in the coding folder. The text file document is used to compare the image in the modelsim software.

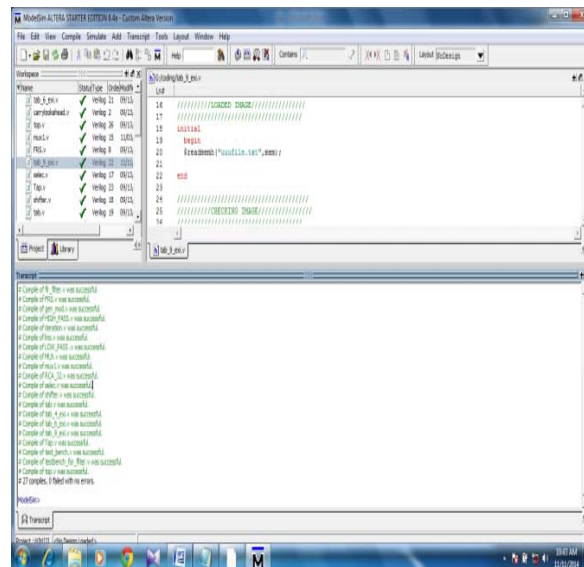


Figure-10. Compile the process of proposed system.

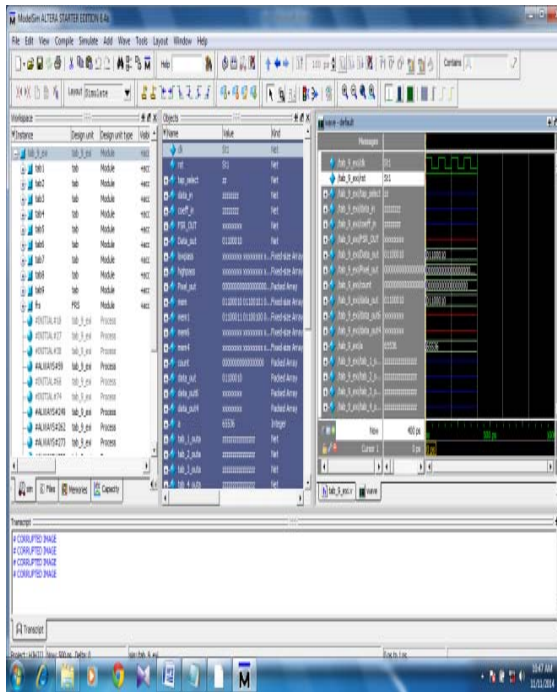


Figure-11. Output of corrupted image.

To compare the loading image and checking image. Then identify the checking image is corrupted image. Using the Modelsim (Mentor Graphics) software.

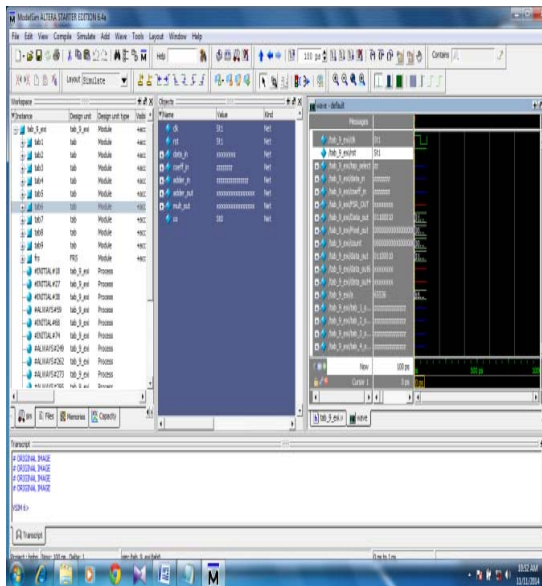


Figure-12. Output of corrected image.

To compare the loading image and checking image. Then identify the checking image is corrected image. Using the Modelsim (Mentor Graphics) software.

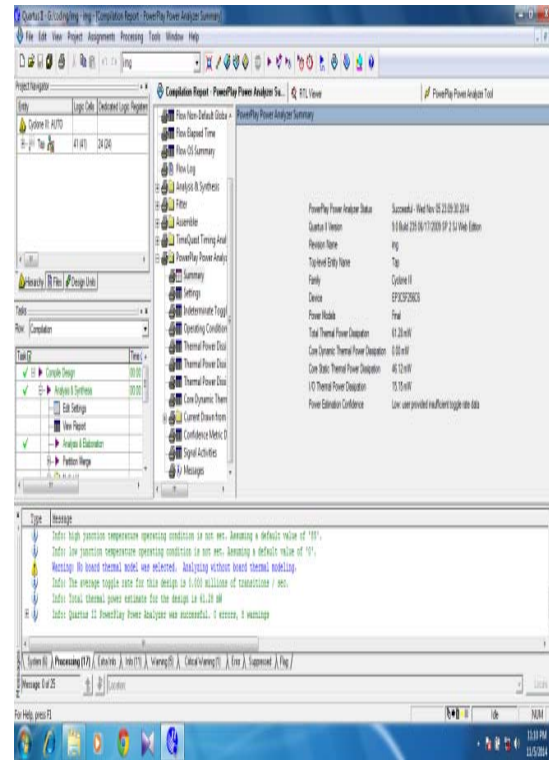


Figure-13. Power analyzer summary.

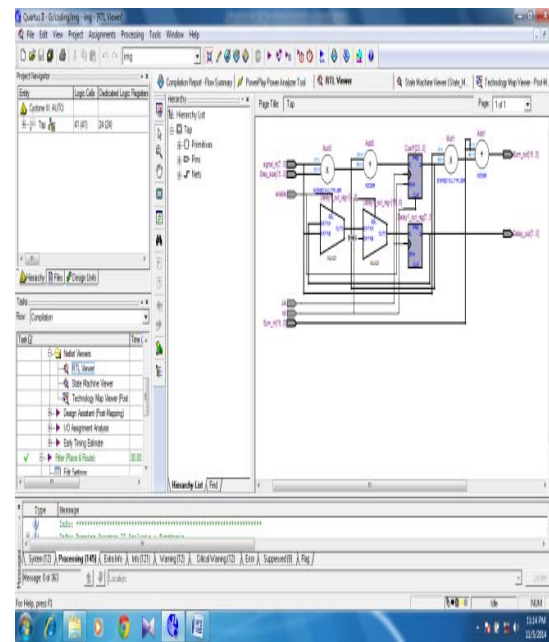


Figure-14. RTL viewer.

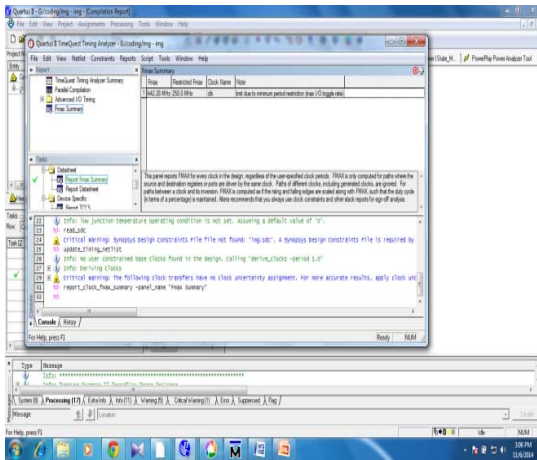


Figure-15. Timing analysis.

To determine, to analyze the Power of the given image, the power value is dependent on the device configurations and thermal power configurations. The Resistor Transfer Level of the given image. RTLviewer consists of the number of adder, number of multipliers, number of signed multipliers, the maximum frequency value of the given image. Frequency is inversely proportional to timing analysis, using the Quartus II software.

5. CONCLUSIONS

In this paper, a novel color interpolation algorithm is proposed to develop a low-power, high performance for real-time image applications. Here real time images are pest affected crops and non affected crops. An anisotropic weighting model, an edge detector, Laplacian and sharpening filters have been used to reduce the memory requirement and improve the quality of the images.

The proposed system will be implemented on Cyclone-III FPGA kit for real time implementations.

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