Reconfigurable Computing Architecture for Image Enhancement Processes in Night Surveillance Robot Using Hybrid Vision Neutralization Method

L.M.I. Leo Joseph

Research Scholar , Sathyabama Institute of Science and Technology

Dr. S.Rajarajan

Sri Sairam Institute of Technology

ABSTRACT

The neutralization is a technique to neutralize the image with specific resolution in order to obtain optimal vision apart from the poor resolution of image at different intensities. This technique plays a major role in balancing the resolution of images that are caused due to changes in luminance level . Luminance level variations are due to light reflections from solar system and lunar system that varies time to time and day to day. It is interesting that the light reflections from solar system is dominant than lunar system and the neutralization took a hard part when the input is image captured and to be processed during night light circumstances. This paper highlights a reconfigurable computing architecture that is designed to achieve image neutralization by means of Image Processing, which provides a better compensation in providing a better image enhancement. Reconfigurable computing architecture is designed such to provide a neutral vectors that are computed by creating a database by analyzing high resolution images that are captured at different illumination. The acquired image intensity is added to a neutral vector and the neutralized output is obtained which in turn is compared with the standard database. The resultant image having minimum intensity is again neutralizing by the neutral vector. The resultant image is the carbon of high quality image with neutralized value. This approach is a very simple approach with less computational time since the first point of neutralization will produce high quality output.

Keywords— neutralization ,neutralization vector (NV), GPS , reconfigurable computing , Luminance level ,hybrid vision neutralization method (HVNM), Configuration Logic Block (CLB).

I.INTRODUCTION

Image processing defines the picture as per our expectation which improves the visual quality of the picture. Image processing has several categories and analysis methodologies such as Image restoration, Image segmentation, Image de-noising etc. Researchers are interested in finding fathomable solution to provide to better for analyzing night vision. Researches and case studies have been adapted to improve night vision using vector values determination and evaluation[1] .

A feature vector is just a vector containing multiple elements (features). The features may represent a pixel or a whole object in an image. Examples of features are color components, length, area, circularity, gradient magnitude, gradient direction, or simply the gray-level intensity value. It depends on which features are useful for the application at hand. Some people compute special features using image processing and computer vision techniques and some people just use the original pixel intensities as features. For example: v = [R; G;

B]; is a feature vector containing color components of a pixel or an object. In a typical object recognition application, feature vector of a query object is compared with that of each object in a database to know how much the query object matches with each object in the database. There are many techniques to compare two feature vectors. One of them is just the Euclidean distance between the feature vectors of two objects [2]. A feature vector is an n-dimensional vector that represent numerical representation of some object. When representing images, the feature vector values reveal pixel information that corresponds to the pixel information of an image. Feature vectors have similarity with the vectors that are associated with variables used in linear regression like statistical procedures Feature vectors are correlated with weights in order to form a linear predictor function to determine the value for making a prediction.. Higher-level vector values can be obtained from already available data and added to the feature vector .This corresponds to vector construction.[3][4] Feature construction is the formation of a set of constructive operators to a set of available features resulting in construction of neutral vectors. Resultant vector counts the number of features in the neutral vector satisfying some condition present in the standard database [5] Neutral vector construction has been considered as a powerful tool in image enhancement especially during night vision with high quality and picture definition [6]. The paper presented was organized as follows . The reconfigurable architecture has been are discussed in section II . The details of neutral vector formation, comparison and resultant vector formation are detailed in section III. Section IV contains Experimental results. The conclusion and future works are discussed in section V.

II. RECONFIGURABLE COMPUTING ARCHITECTURE

The mechanisms described in the previous section for controlling design complexity have ramification for the physical design of the system. The processing element modules are instanced within a FPGA fabric. The structure of this fabric needs to be support variable numbers and combinations of various sized modules.

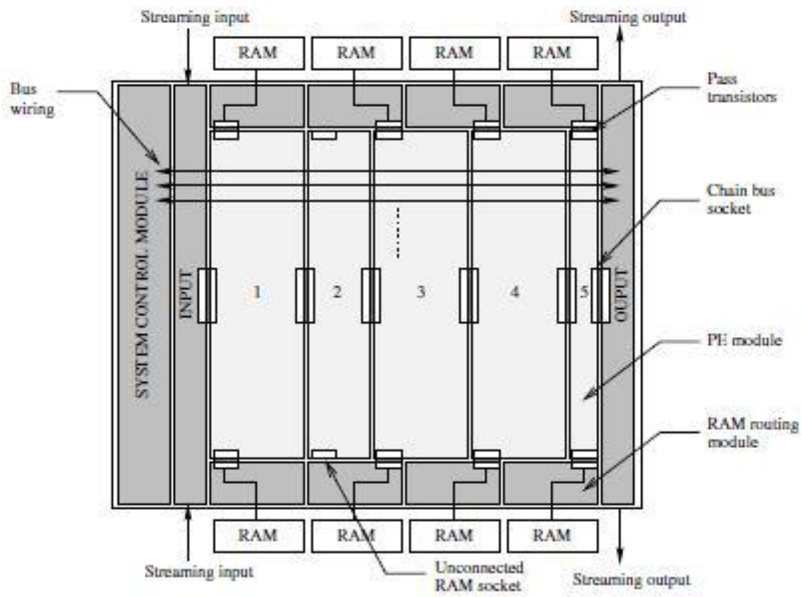

Fig 1: Proposed system with reconfigurable architecture

The physical system structure is illustrated in Fig. 1.The neutral vector elements are implemented as partial configurations within the FPGA fabric. The neutral vector elements occupy the full height of the fabric, but vary in width by discrete steps. The reconfigurable fabric is based on the Virtex-II Pro FPGA family from Xilinx; Inc. it has an exclusive wiring structure, with distinct connection points to the FPGA fabric. The advantage of this methodology is that, we can obtain optimized electrical characteristics of the global bus wiring [7, 8].Each processing element contains chain bus connections to the neighboring PEs; this is accomplished through the use of ‘virtual sockets’, implemented as hard macros. The bus signals are routed as ‘antenna’ wires to specified locations along the edges of the module. When two configurations are loaded adjacently into the array, the wires got aligned, and by configuring the pass transistors the signal path gets completed by separating the wires. Thus, each module acts as a ‘sockets’ into which other modules can be plugged in. Similar ideas are incorporated previously [9, 10], using a CLB programmed as a buffer. This is particularly advantageous when data are connected from external RAM, in which sequential access pattern overwhelms the burst mode transfer capability of standard RAM devices.

III. Neutral Vector

A) Formation of neutral vector

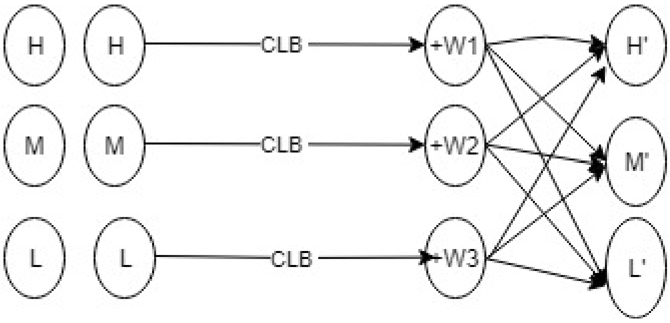

Fig 2: Neutral vector formation and enhanced vector creation

Neutral vector is an empty array formed inside the processor using CLB which posses any values according to the threshold estimated by the FPGA processor based on the resolution of the image. Fig 2. describes the formation of neutral vector in which H represents pixels with high intensity, M represents pixels with medium intensity and L represents pixels with low intensity. The logic comparator present in the proposed method computes the threshold according to the intensity level of the acquired image.

Calculation of threshold values:

For neutral vector threshold estimation, global thresholding technique [11] is used.

H': H/W1 …… Hn/ W1

M': H'/W2 ……. Hn'/W2

L' :H'/W3 ………Hn'/W3

The pixels are divided into three classes as low level pixels [1,…. t] , medium level pixels [t+1 to t2] and high level pixels [t2+1 ---- L]

$where\ W1 = \sum_{t2+1}^{L} H_i$

$W2 = \sum_{t+1}^{t2} H_i$

$W3 = \sum_{1}^{t} H_i$

$\mu 1 = \sum_{1}^{t} H_i/W3$

$\mu 2 = \sum_{t+1}^{t2} H_i/W2$

$\mu 3 = \sum_{t2+1}^{L} H_i/W1$

The main advantage of this method from previous method [11] is only higher concentration pixels are considered for neutralization instead of considering low and medium intensity pixels. This decreases the computational time and complexity in hardware such that the hardware utilization factor is very much reduced. This in turn decreases the power consumption.

b) Resultant Vector analysis

The resultant vector is obtained by routing the estimated threshold values to the entire pixels present in the acquired image irrespective of their original intensity. As the high intensity is taken into consideration dividing by the considerable weights will results in the enhancement of image to the better extend with nullified blurring effect.

IV Experimental Results

Comparison of original image intensity with resultant image intensity

The results obtained shows the enhancement level between original image and image after neutralization

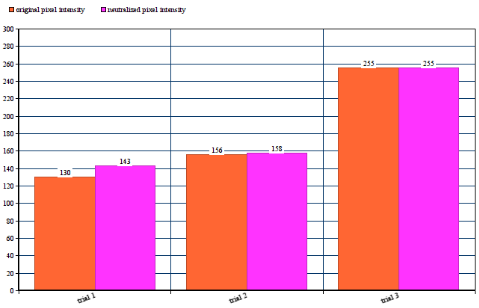

Fig 3. Comparison of original image intensity with neutral image

From the graph, it is evident that lower the pixel level greater the enhancement but the enhancement level is confined within the limit to avoid blurring. when the images are having high intensity pixel in nature then the need of unnecessary computation is avoided in this approach. Similarly pixels with medium intensity require minimal computation to achieve enhancement. The graph is arrived by taking three images with three different intensities.

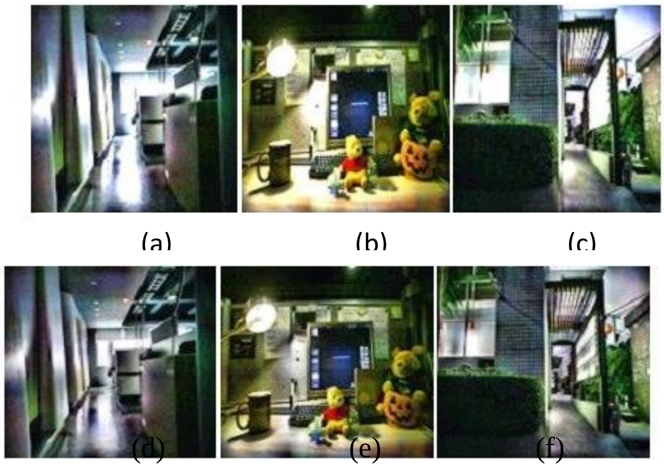

Fig 4. (a) original image with low intensity (b) original image with medium intensity (c) original image with high intensity (d) low pixel neutralized image (e) medium pixel neutralized image (f) High pixel neutralized image

Fig 4 gives the resultant vector results for images having low medium and high intensities , as discussed in the graph the computational time required for high intensity pixel is reduced and medium intensity is lesser this can be justified by means the simulation graph of FPGA

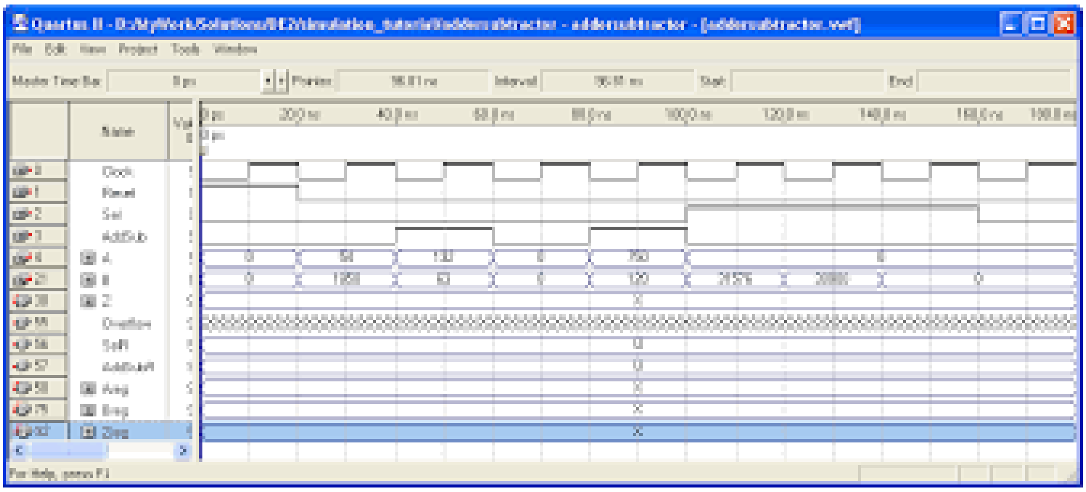

Fig 5. Simulation time analysis of different image intensities

V Conclusion and Future Scope

Hybrid neutralization vector method is a simple and effective method for image enhancement which overcomes the earlier approach by taking higher pixel intensity into account that overwhelms the computational time required for the analysis by pixel neighborhood technique. This approach is followed for statistical analysis of real time data, the same approach is used for analyzing the pixel intensities and found to be a good interpretation technique. This work can be further extended to compute a universal neutral value required to compute any type of images eliminating the threshold value estimation.

REFERENCES

[1] Pablo a. Arbelaez and laurent d. Cohen, International Journal of Computer Vision 69(1), 119–126, 2006 Reasoning about naming systems.

[2] Faqiang Wang, Hongzhi Zhang, Kuanquan Wang, Wangmeng Zuo, "Fast neighbourhood component analysis with spatially smooth regulariser for robust noisy face recognition", Biometrics IET, vol. 3, no. 4, pp. 278-290, 2014..

[3] Liu, H., Motoda H. (1998) Feature Selection for Knowledge Discovery and Data Mining., Kluwer Academic Publishers. Norwell, MA, USA. 1998.

[4] Piramuthu, S., Sikora R. T. Iterative feature construction for improving inductive learning algorithms. In Journal of Expert Systems with Applications. Vol. 36 , Iss. 2 (March 2009), pp. 3401-3406, 2009

[5] Breiman, L. Friedman, T., Olshen, R., Stone, C. (1984) Classification and regression trees, WadsworthSannella, 2003.

[6] Sidorova, J., Badia T. Syntactic learning for ESEDA.1, tool for enhanced speech emotion detection and analysis. Internet Technology and Secured Transactions Conference 2009 (ICITST-2009.

[7] Benini, L., De Micheli, G.: Networks on chips: A new SoC paradigm IEEE Computer 35 (2002) 70–78

[8] Dally, W.J., Towles, B.: Route packets, not wires: On-chip interconnection networks.In: Design Automation Conference.

[9] Dyer, M., Plessl, C., Platzner, and M.: Partially reconfigurable cores for Xilinx Virtex In: Field–Programmable Logic and Applications. (2002).

[10] Horta, E.L., Lockwood, J.W., Taylor, D.E., Parlour, D.:Dynamic hardware plugins in an FPGA with partial runtime reconfiguration. In: Design Automation Conference.(2002).

[11] Devi, H.K.A., 2006. Thresholding: A Pixel-Level Image Processing Methodology Preprocessing Technique for an OCR System for the Brahmi Script.Ancient Asia, 1, pp.161–165