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Different Edge Detection Techniques using System Generator

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ABSTRACT:Edge Detection plays an important role before applying any image processing algorithm. In this paper we are going to see Sobel and Prewitt edge detection algorithms. Xilinx System generator is used to design the edge detection algorithm. Sobel edge detection is efficient and noise free. This tool is having a high level graphic interface under the environment of MATLAB tool.

KEYWORDS: Image processing, Xilinx System generator, Sobel and Prewitt edge detection algorithm

I.INTRODUCTION

Edge detection is the process of identifying and locating sharp discontinuities in an image. The edge detection is the important in the low level image processing. The edge detection is the initial step of many other image processing techniques. There are many different edge detection algorithms are there. In this paper, Sobel and Prewitt edge detection algorithms are concentrated.

The Sobeland Prewitt edge detection are the discrete differentiation operator, computing an approximation of the gradient of the image intensity function. The Sobeland Prewitt operatorsare based on convolving the image with a small, separable, and integer valued filter in horizontal and vertical direction and are relatively inexpensive in terms of computations. The result of these operator is either a the corresponding gradient vector or the norm of that vector. The magnitude calculation is reliable and easier to interpret. The gradient of a two variable function is at each image pixel a 2D vector with components given by the derivatives in the horizontal and vertical directions. At each image pixel,the gradient vector points in the direction of largest possible intensity increaseand the length of the gradient vector corresponds to the rate of change in that direction. The result of an image pixel is a zero vector and at a point on an edge is a vector which points across the edge, from darker to brighter values.

II.LITERATURE SURVEY

In the Image processing the important step is the feature extraction. Edge detect provokes great interest for the systematic community. The edge extraction is done using the respective Operator for each type of edge detection. The FIR compiler and other filters are used to find the gradient of the edge detection which takes more computational time.

The Sobeloperator considers 0°and 90°convolution kernelsorientations. The operator uses the two kernels which is convolved with original image to calculate the gradient.

$$G_x = \begin{bmatrix} -1 & -2 & -1 \\ 0 & 0 & 0 \\ 1 & 2 & 1 \end{bmatrix} * I \qquad G_y = \begin{bmatrix} -1 & 0 & 1 \\ -2 & 0 & 2 \\ -1 & 0 & 1 \end{bmatrix} * I$$

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The Prewitt Operator uses 3 x 3 kernel which are convolved with original image.

$$G_x = \begin{bmatrix} -1 & 0 & 1 \\ -1 & 0 & 1 \\ -1 & 0 & 1 \end{bmatrix} * I \qquad G_y = \begin{bmatrix} -1 & -1 & -1 \\ 0 & 0 & 0 \\ 1 & 1 & 1 \end{bmatrix} * I$$

Where I is the Original Image and * denotes it is 1D convolution operation

$$G = |G_x| + |G_y|$$

III.DESIGN METHODOLOGY

The design methodology mainly involves Image pre-processing, Colour space converter, edge detector and image post-processing.

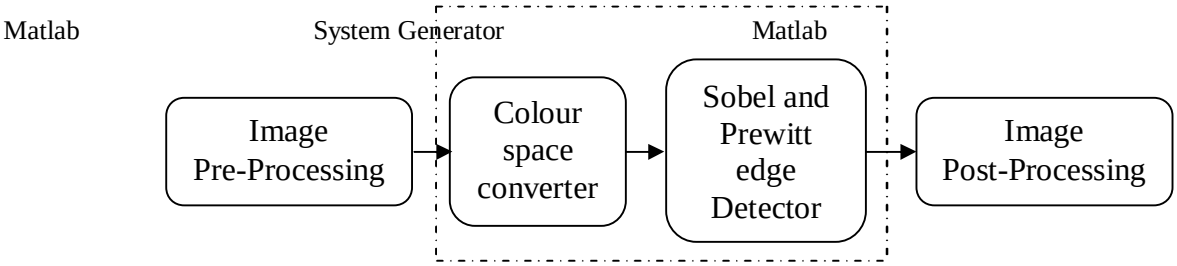

Fig. 1 Block diagram of design

In the fig 1, the block diagram of the design methodology is given.

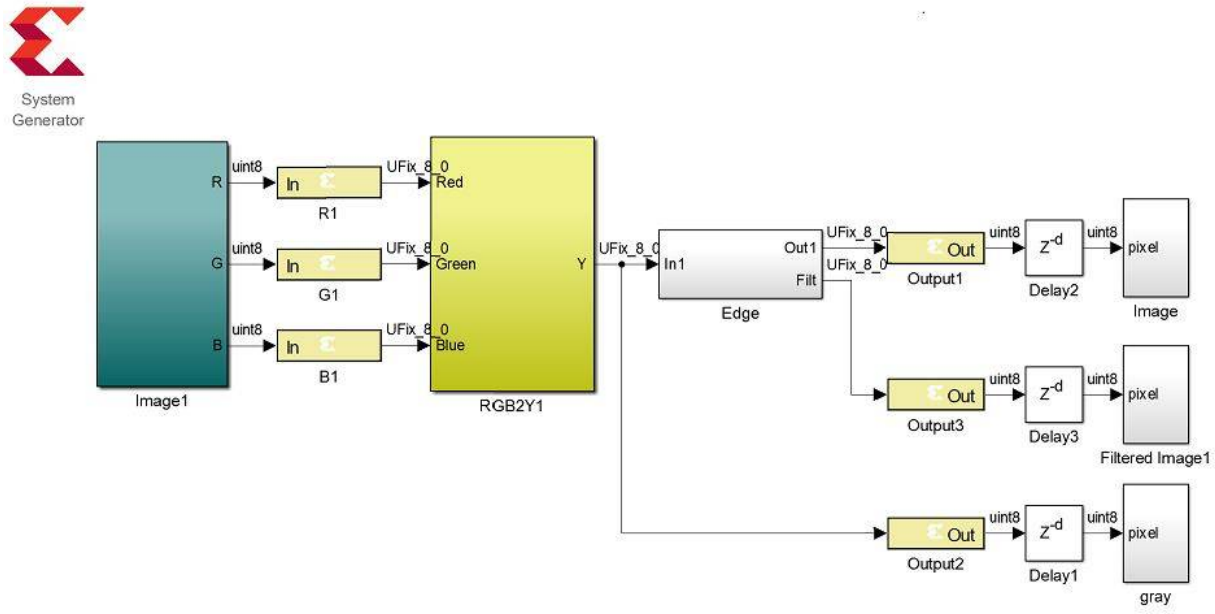

Fig. 2Design methodology

In the fig 2, the design involves colour image read, colour space converting, edge detection and image write is shown.

Image Pre-Processing: Image pre-Processing involves mainly reading an image from the file, converting into 1D array and converting the data type of the pixel values.

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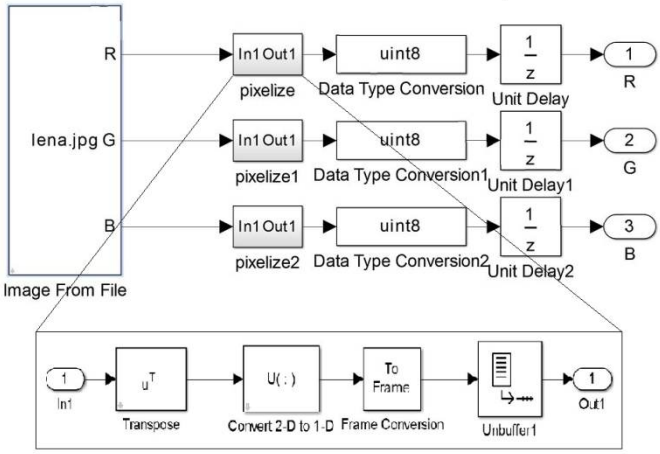

Fig. 3 Image Pre-Processing

In the fig 3, the image pre-processing algorithm is explained.

Colour space Converter: The Conversion of RGB colour image to Y gray image. There is a formula to convert RGB to Y that is

$$Y = 0.2991R + 0.5869G + 0.144B$$

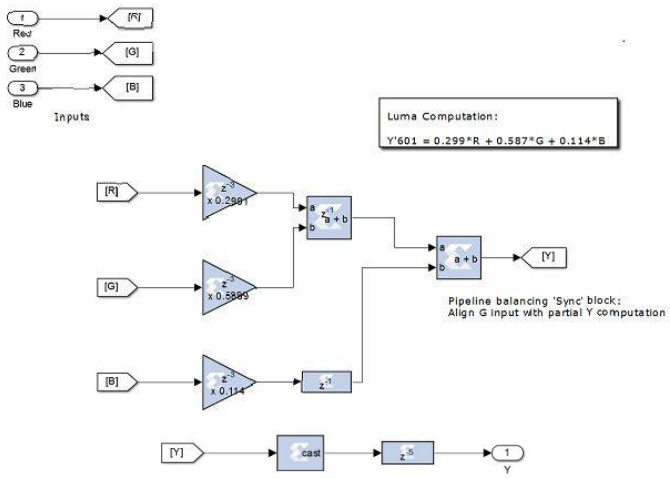

Fig. 4 Colour space Converter

Edge Detector: The Sobel and Prewitt operators are used for finding the horizontal and vertical gradient of the image. Then both horizontal and vertical gradient are absolutes and added for overall Edge detection.

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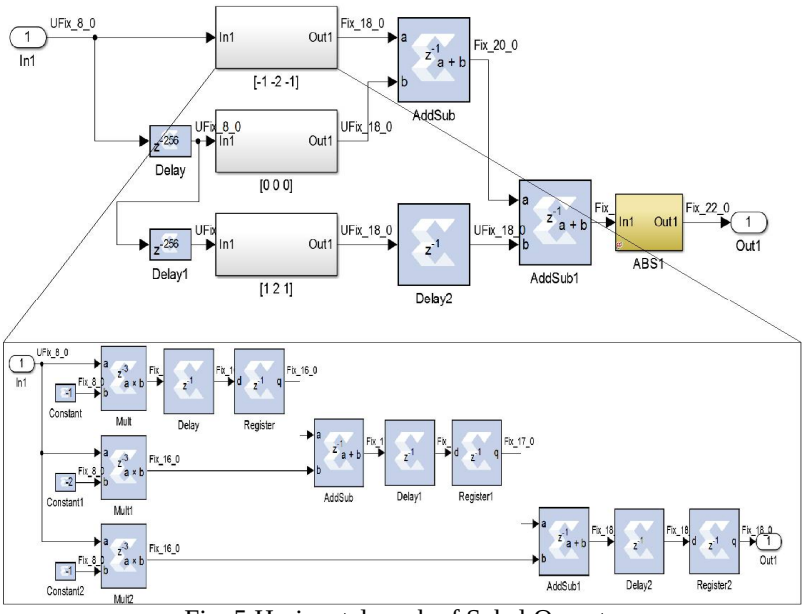

Fig. 5 Horizontal mask of Sobel Operator

In the fig 5, the Horizontal gradient of Sobel Operator is done by using Xilinx block sets.

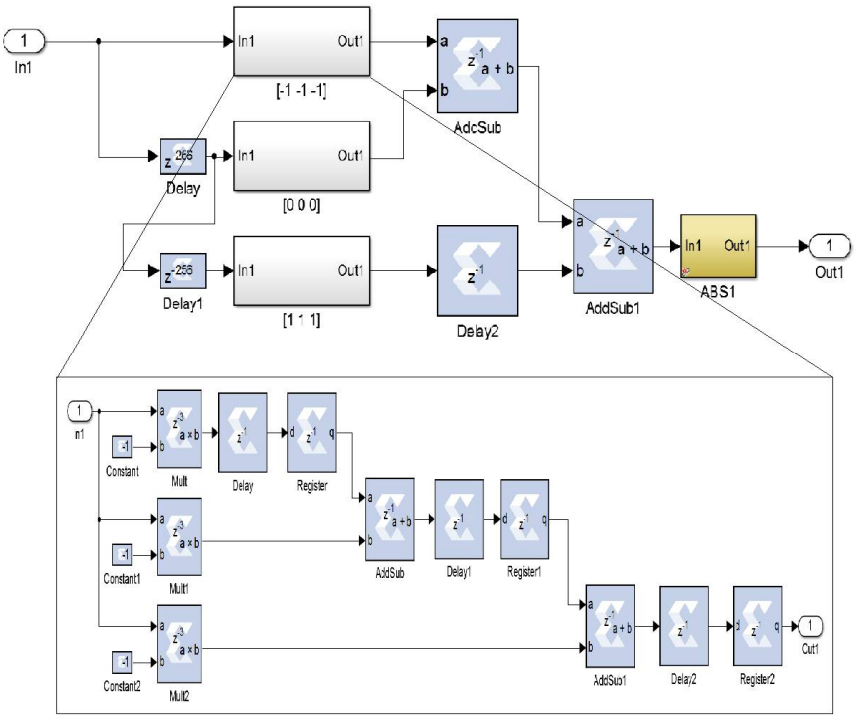

Fig. 6 Horizontal mask of Prewitt Operator

The fig 6 is used for the finding of Horizontal gradient of Prewitt operator. Similarly the vertical gradient is found for both Sobel and Prewitt. To find overall Sobel and Prewitt are explained in fig 7

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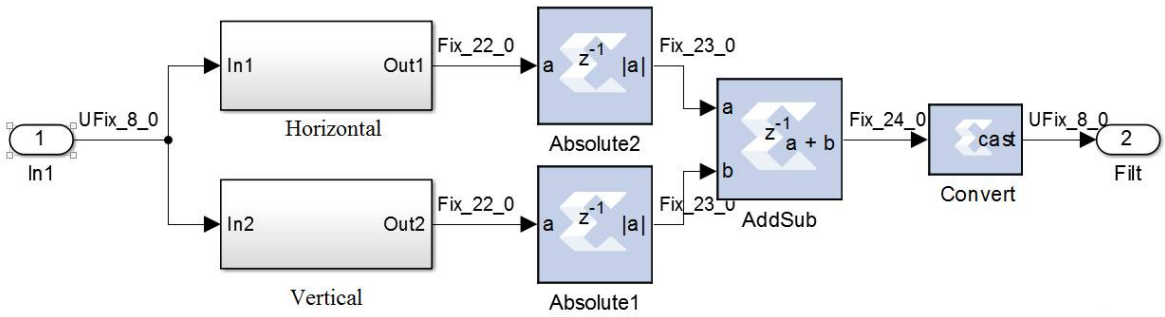

Fig. 7Sobel/Prewitt Edge detector

Image Post-Processing: Image post-Processing involves mainly data conversion, converting 1D to 2D and writing the image at the output.

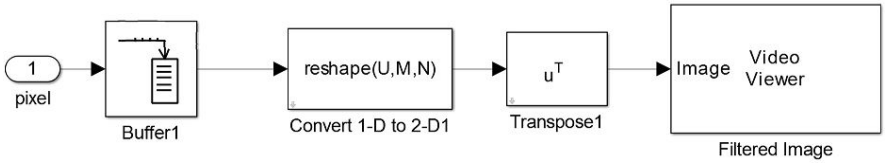

Fig. 8 Image Post-Processing

IV. RESULT AND DISCUSSION

In the fig 9, shows the input image which will be used for the edge detection operation.

Fig. 9Original image of size 256 x 256

In the fig 10, it shows the graph of throughput of received bits Vs Maximal end to end delay. End to end delay is the time taken by a packet to travel from source to reach destination.

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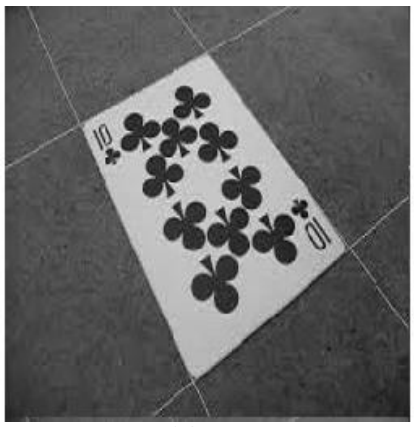

Fig. 10Gray image

In Fig 11, Sobel and Prewitt edge image is showed. The difference between these two algorithm is not seen. But the Sobel edge is preferred since it is having immunity towards noise.

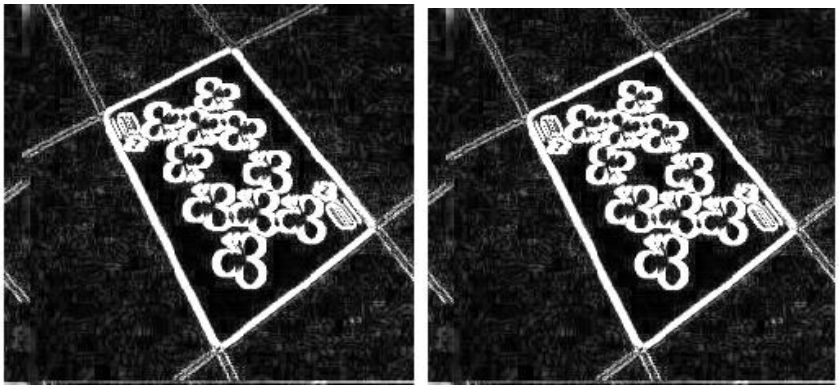

Fig .11(a) Sobel edge Image,(b) Prewitt edge Image

In fig 12,theSobel edge detection simulation result is shown.

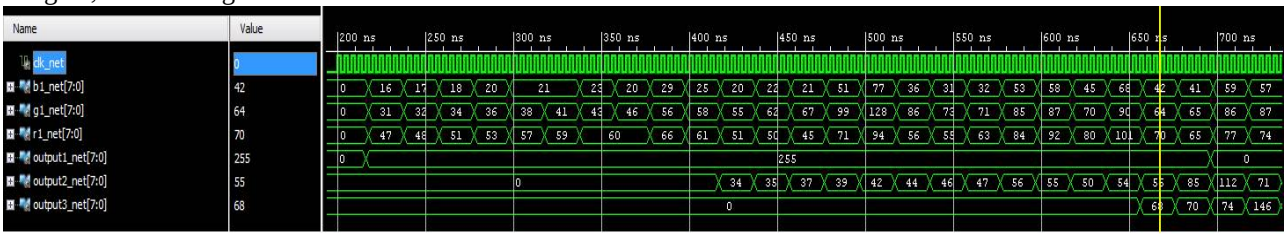

Fig .12Simulation output of Sobel edge Image

In fig 13, the simulation result of Prewitt edge detection is shown

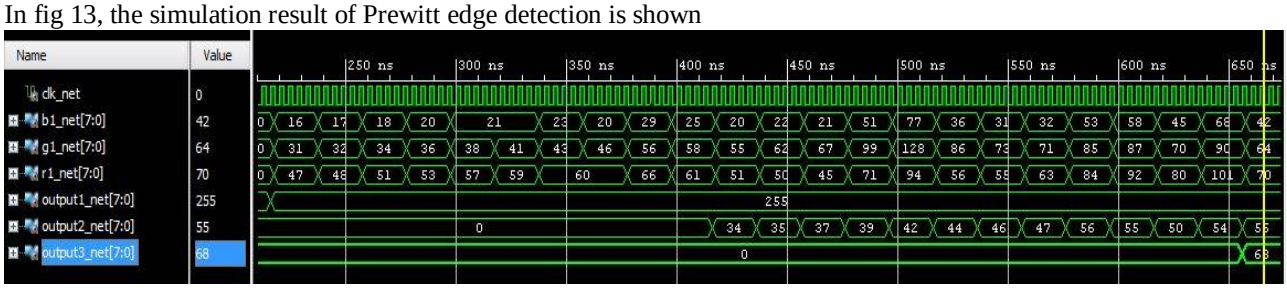

Fig .13 Simulation output of Prewitt edge Image

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V.CONCLUSION

Xilinx system generator is a useful tool for the development of the computer vision algorithms. It is advantageous and more comfortable way than Verilog or VHDL hardware description languages. In this the basic edge detection algorithms are explained and the computation speed is much less compared to any other approach. The application of Simulink is used and it is implemented by using system generator.

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