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Design of Gabor Filter for Noise Reduction in Betel Vine leaves Disease Segmentation

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Abstract: *Gabor filter had a very vast application in the field of image processing. This proposed system is used to reduce the noise and to increase the speed of the system in betel leaves image segmentation using Verilog HDL under the cadence platform. In this proposed system the MAC was used to increase the speed. Input of the proposed system was given in the form of pixels. Then this input pixel was convoluted by the filter coefficient which was stored in the proposed system memory. The main objective of this proposed system is to improve the speed of the design and noiseless image segmentation without affecting the area.*
Keywords: *Gabor filter, Verilog HDL, MAC, Noiseless image segmentation*

I. Introduction

India is the largest consumer and producer of betel vine leaves, nearly 20-30 million peoples are consuming the betel vine leaves daily to satisfy a huge community in a single day needs a huge production of betel vine leaves and such massive production leads to disease infection in the betel vine leaves and some common disease infection in the betel vine leaves are leaf rot disease, foot rot disease and powdery mildew. A recent survey on consuming of betel vine leaves says continuously consuming disease infected betel vine leaves also leads to oral and liver cancers, hence a new grading system was proposed to identify leaf rot disease under MATLAB interfaced with the CADENCE platform for noiseless disease segmentation.

II. Proposed Model

A. Sobel Edge Detector

Sobel edge detector is a type of edge detector used for the purpose of edge detection. The Sobel edge detector is used to filter the input images by means of horizontal and vertical direction, which was commonly used edge detection filter for its high computation speed. In this proposed system Sobel edge detector was created by means of MATLAB the input leaf rot disease infected betel leaf was edge detected at the horizontal and vertical directions to spot the disease infected area accurately, the Sobel edge detected output was shown in fig: 2.1 Sobel Edge Detection Output.

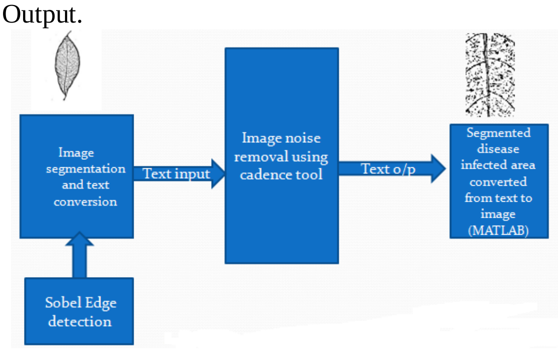

Figure: 2.1 Block Diagram of the Proposed System

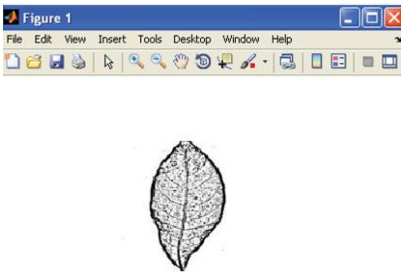

Figure: 2.2 Sobel Edge Detection Output

B. Image Segmentation and Pixel Conversion

This is the second stage of the proposed system. The process of image segmentation and pixel conversion plays a vital role in the proposed system, the input images are first segmented and then converted into pixels, where the disease infected area alone taken and converted into pixels and given as input to the Gabor filter and the process of fourth stage of the proposed system is similar to that of second stage where the Gabor filter output i.e., pixel was converted into noiseless segmented image, which is the required output of the proposed system.

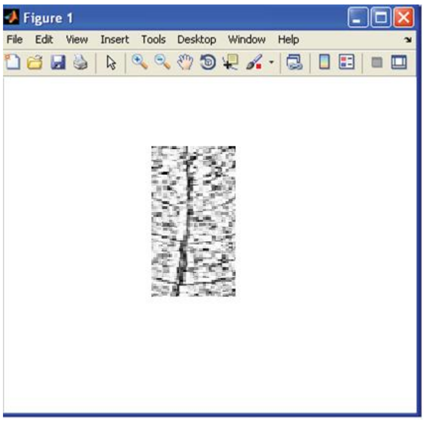

Figure: 2.3 Noisy Segmented Disease Infected Area

III. Gabor Filter

Heart of the proposed system is the Gabor filter, which was designed by means of Verilog HDL language under cadence platform, here the Gabor filter is used to segment unwanted background noises and the image noises for spotting the leaf rot disease infected area in the betel vine leaves. The input to the Gabor filter is given in the form of image pixels. In this proposed system the pixel to the Gabor filter was reduced at the previous segmentation stage as shown in fig: 2.1 to increase the computation speed as well as the noise reduction performance rates of the Gabor filter. Hence the quality of the leaf rot disease infected betel vine leaves are enhanced using Gabor filter.

C. Gabor filter Algorithm

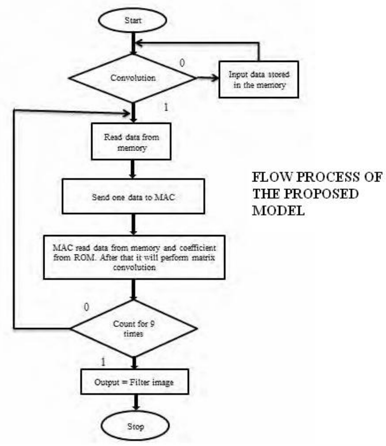

Figure: 3.1 Gabor filter design flow

The Gabor filter has three major units namely

i) Convolution operator & ALU
ii) MAC
iii) Memory unit

D. Gabor Filter Algorithm

- **Step: 1** Initially the convolution signal is '0' then the input data is stored in the memory unit and when it reaches '1' data is stored in the memory, which is the kernel co-efficient and are fixed values.
- **Step: 2** When the convolution signals reaches '1'the process takes place between the memory and the values stored in the MAC unit.
- **Step: 3** Only one set of data will be convoluted at a single process.
- **Step: 4** If convolution signals become '0'it will be moved to the **Step: 1** process.

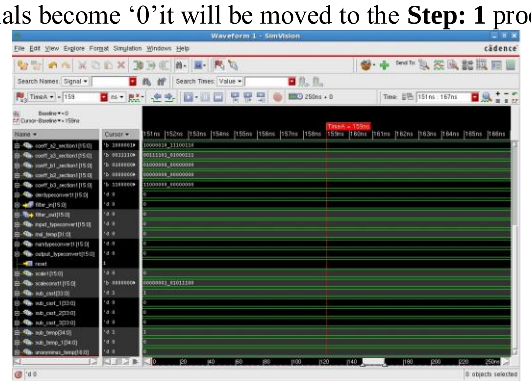

Figure: 3.2 Gabor Filter Output Waveform

IV. RESULTS AND DISCUSSION

Noiseless, high speed filtering has been achieved by means of the proposed system, fig: 4.1 show the noiseless segmentation of leaf disease infected area of the betel vine leaf.

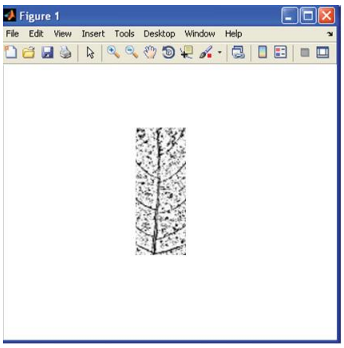

Figure: 4.1 Noiseless Segmentation

A. Resource Utilization Table of the CADENCE Tool

Utilized Components	Utilization
Number of slices	3
Number of Flip Flops	1
Number of 4 Input LUT's	2
Number of bounded IOB's	37
Number of MULT18X18S	2
Number of GCLKS	1
Number of Warnings	0
Number of Info's	6

Table: 4.1 Resource Utilization of CADENCE Tool

Column1	Ref 1	Ref 2	Proposed
Slices Used	818	4	3
F/F's Used	615	2	1
LUT's	552	2	2
IOB's	29	37	37
MULT18X18S	1200	37	2
GCLKS's	8	12	1
WARNINGS	80	12	12
INFO's	34	6	6

Table: 4.2 References Vs Proposed System

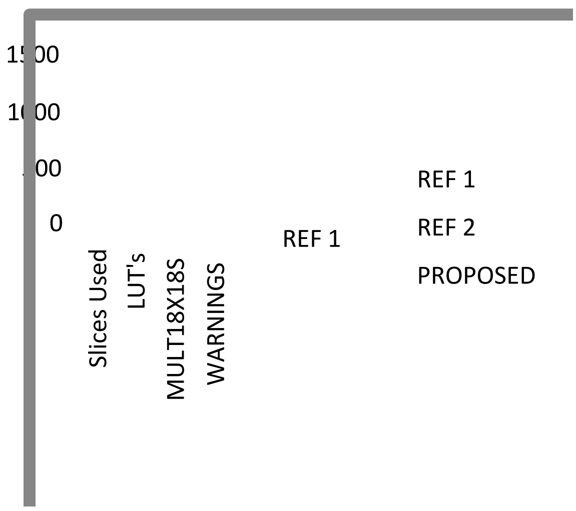

Figure: 4.2 Proposed System Vs References

Utilized Components	Ref2	Proposed
Slices	4	3
F/F'S	2	1
LUTS	2	2
IOB's	37	37
MULT18X18S	37	2
GCLKS	12	1
Warning's	12	12
Info's	6	6

Table: 4.3 Ref2 Vs Proposed System

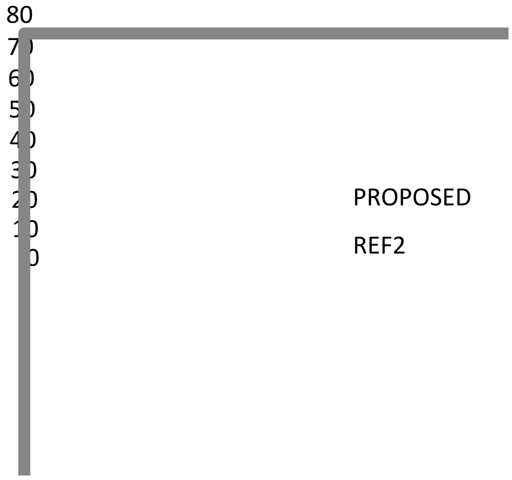

Figure: 4.3 Ref2 Vs Proposed System

From the above results it is concluded that the noise reduction ratio of the proposed was increased, delay was reduced and the speed of the filtering process was increased. The accurate results was obtained using gabor filter model and the total convolution cycles was reduced to 9 clock cycles, which was just a one percent utilization compared with the existing systems.

V. Conclusion And Future Work

In this proposed system we had successfully achieved a Gabor filter for noise reduction and increased the filter performance for the segmented betel vine leaves input, here we had proposed the system for 1-Dimensional image segmentation and noise reduction in the future the system can be implemented for 2-Dimensional and 3-Dimensional images for the further system performance enhancement it can be trained by means of Artificial Neural Networks.

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