

# DESIGN AND IMPLEMENTATION OF KIDNEY STONE DETECTOR USING RDLSS ON FPGA

<sup>1</sup>Asha K R, <sup>2</sup>Dr. Mallikarjuna Swamy S

<sup>1</sup>M. Tech Student, <sup>2</sup>Associative Professor,

<sup>1</sup>Electronics and Communication Engineering Dept

<sup>1</sup>SJB Institute of Technology, Bengaluru, India

**Abstract**—Formation of kidney stone is life threatening and it is persisting worldwide. The people didn't aware about the stone formation in its beginning stage. So, early detection of the disease is very important before damaging the organs gradually. The most popular Ultrasound scanning tool is used in diagnosis of kidney abnormalities. The identification of stone in the US based images is very much difficult due to the decreasing in contrast and presence of speckle noise. To eliminate the noise inside the US kidney images and to get better quality of the image connected to pre-processing and segmentation is done by using RD-LSS (Reaction diffusion level set method) to detect precise stone location. The proposed system is implemented with Virtex-2 Pro (FPGA) by writing the code in Verilog HDL.

**Keywords**—RD-LSS, Ultrasound, Verilog HDL and FPGA

## I. INTRODUCTION

A renal calculus (Kidney stone) is the life threatening problem present worldwide and it is increased by 70% from last two decades. Formation of stone in the kidney leads to damage, if it is not noticed in the beginning stage. Hence early detection is significant.

The scanning tools like CT, MRI and US were used for analyzing the kidney problems. In which US (Ultrasound) is the most popular device used and it is of low cost and non-invasive method. But the identification of the stone within the images recorded from the Ultrasound device is very difficult, at the time of surgical process.

Since the image comprises the noise (speckle), low contrast in image and some degradation occurred during the recording, the identification of stone is not possible. Hence removing of noise is necessary in the US based images in order to analyze the kidney related problems.



## II. LITERATURE REVIEW

Urolithiasis is the name for kidney stone disease. The kidney stones are formed when a solid piece of material occurs in urinary tract. Formation of stones will leads to many complications including blockage of ureter, blood in the urine etc. History behind the existence of stone formation is recorded as thousands of years ago, and the surgical procedure to remove the stones is lithotomy, in 1901[1].

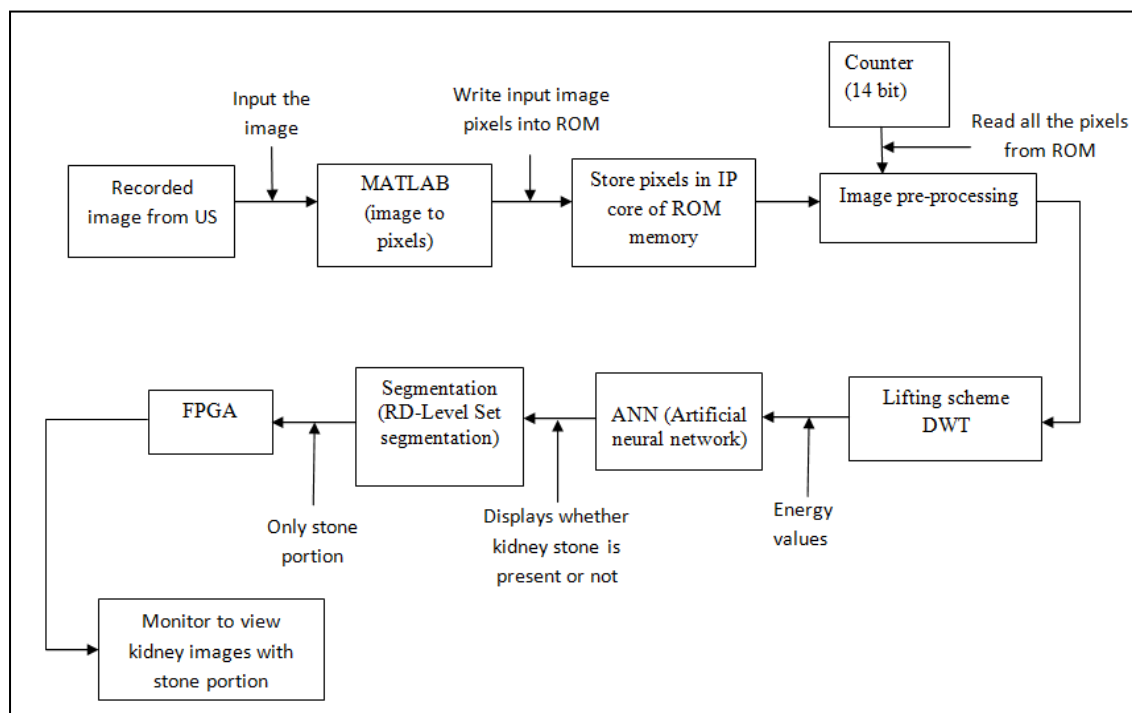
In this, proposed a system, where detection of stone in the US based images is difficult due to the speckle noise. Here he use the pre-processing method to remove the noise and to improve the quality of the image and then the pre-processed image is segmented by using the 2 segmentation methods region and cell based method to. Compared to cell based method region based method gives the good results [2].

In this paper the segmentation method is proposed to extract stone part in an image. Where stone is detected from the ultrasound kidney images using improved seeded region growing (SRG) segmentation method and this will shows the presence of stone or absence in the early stage. Here the image size is set to 6x6 pixels and the detection of stone is 95% in this system [3].

The paper describes, ureteroscopic lithotripsy (UL) is used for the stones of >2mm in size compared to other methods like ESWL and PCNL. In order to achieve highest success rate it will undergoes more than one procedure. It will give 68%, 87%, 94% with respect to 3 procedures [4].

Here the proposed method is DRLSE it is improved method of level set function, used to reduce the problem due re-initialization but this method has disadvantage, that it takes more steps to give the result. It takes more time to process and to give the result [5].

### III. METHODOLOGY



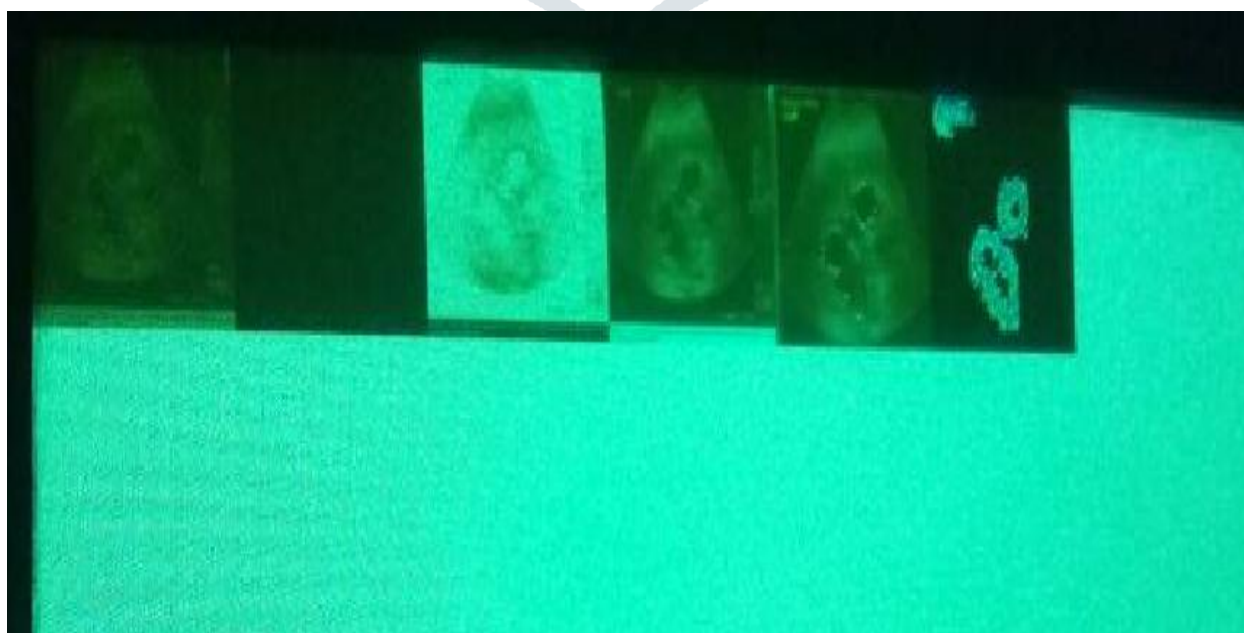
**Figure 1:-** Block diagram representation of Kidney stone detector.

Above proposed system involved in many steps to detect the stone in the US image it involving in following processes:

1. The image from the database is 100X100 in size and it is transformed into pixels by using MATLAB, and stored in the ROM memory of size 10000X24.
2. Then these pixels are undergoes pre-processing to remove the speckle noise and the quality of the image is improved by this method. Here for pre-processing we use the Plain intensity filter.
3. The pre-processed image is the applied to lifting scheme DWT, here the energy features are extracted by using the Daubechies filter (Db12) and energy values are averaged. These features or energy values are varied if stone exist in that part of an image.
4. The above energy values are given to the input of MLP-BP (Multi layer perceptron-Back propagation) it is one of the artificial neural network used for classification of images based on the energy values inputting. This method classifies the normal and abnormal (Kidney stone is present) images.
5. The classified abnormal images from the MLP-BP are then segmented by using the Reaction diffusion level set method where it segment out the stone portion from the image.
6. The above system is implemented with FPGA (Virtex-2 Pro) using Verilog and output consists of pre-processed and stone detected images is shown on the monitor with the help of VGA.

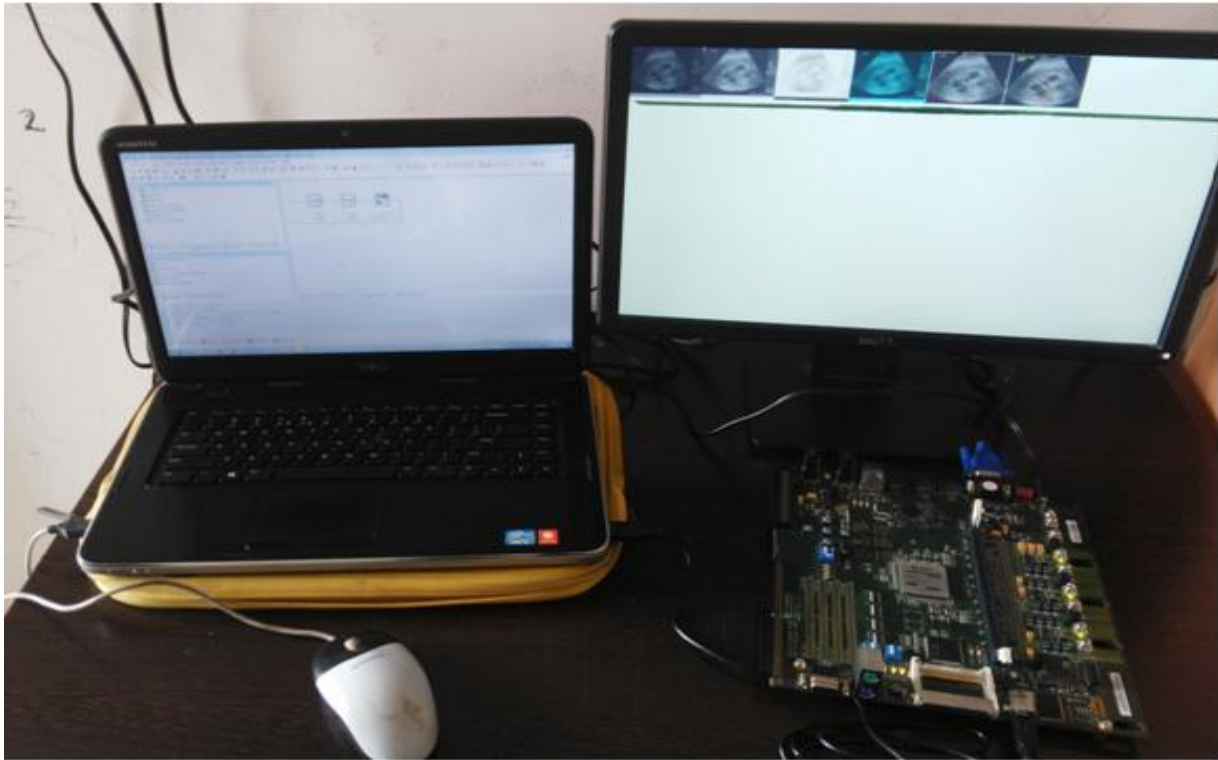
### IV. EXPERIMENTAL RESULTS

The below figure-2 shows the six images displayed on the monitor and in which the 3 images are pre-processed and 4 and 5<sup>th</sup> images are segmented images and last image where the stone is detected and it showed in color.



**Figure 2:** Kidney stone detected is shown in the sixth image.

The hardware setup is shown below and it consists of Virtex-2 Pro board connected to monitor through VGA in order to view the results in real time.



**Figure 3:-** Hardware setup of the system.

## V. CONCLUSION

The proposed work is successfully designed using the HDL, that is Verilog and the kidney stone detector is implemented on FPGA (Virtex-2 Pro). The proposed system is successfully implemented and Helps the doctors in analyzing the results obtained from it. It is checked for randomly taken pictures from the database and the system is success full in identifying the desired position of the stone. The detected stone is shown in color and is displayed on the monitor for easy identification.

## REFERENCES

- [1] K. Vishwanath, Dr. R.Gunsundari, "3D Ultrasound Imaging for Automated Kidney Stone Detector on FPGA", IJCSIS, ISSN 1947-5500, 2016.
- [2] T.anzila Rahman, Mohammad Shorif Uddin, "Speckle Noise Reduction and Segmentation of Kidney Regions from Ultrasound Image", 978-1-4799-0400-6113, 2013 IEEE.
- [3] P.R. Tamilselvi, "Computer aided diagnosis system for stone detection and early detection of kidney stones", Journal of Computer Science 7(2):250-254, 2011 ISSN 1549-3636.
- [4] Demetrius H. Bagly, Kelly A. Healy, "Ureteroscopic treatment of larger renal calculi (>2cm)", Arab Journal of Urology (2012) 10, 296-300 production and hosting by Elsevier.
- [5] C. Li, C. Xu, C.Gui, and M. D. Fox, "Distance regularized level set evolution and its application to image segmentation," *IEEE Transactions on Image Processing*, vol. 19, no. 12, pp. 3243–3254,2010.