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FPGA Based Motion Tracking System

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Abstract: This paper uses computer vision and embedded system technologies to track moving objects in real time video streams using Field Programmable Gate Array (FPGA). Several algorithms are used in this paper in order to improve the tracking and recognition process of moving objects. The suitable algorithm is built and presented for tracking moving objects and are implemented on FPGA successfully.

Keywords: FPGA, Verilog, MATLAB, Simulink, Motion.

I. INTRODUCTION

In computer vision, the fundamental component is tracking of the moving objects. It has wide applications such as surveillance, biomedical image analysis, unmanned aerial vehicle, intelligent robots, and automated traffic control etc. objects tracking in video sequences is a demanding application nowadays. It's much more challenging as it has to improve tracking and recognition performances. Several methods exist but all have their own drawbacks. So in this paper all the existing methods for the objects tracking are explained. An important role is played by field programmable gate array (FPGA) for object tracking in order implement video and image processing applications. First the code is written in MATLAB or Verilog and then implemented on FPGA.

II. METHODOLOGY

In this paper following image processing algorithms are used for moving objects tracking.

i. A square block of 100 pixels is drawn with the starting co-ordinates x and y, length h with 100 pixels, depth v with 100 pixels. The position of the square block is shifted randomly by changing x and y values. White Gaussian or salt and pepper noises are added.

ii. The noise is removed using median filter.

iii. Background is removed using background removal algorithm.

iv. Background static images are removed using thresholding algorithm.

v. Center computation algorithm.

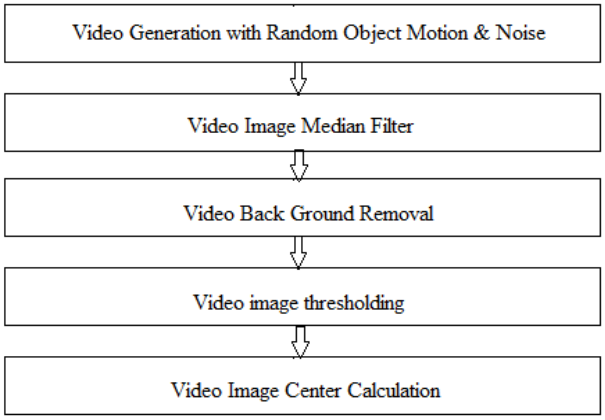

Fig 1. Flow chart

Random motion video is generated with the additive white Gaussian noise or salt and pepper noise. In this paper salt and pepper noise is generated and is added to input video. So next in order to remove the salt and pepper noise median filter is used. Median filter is more suitable for removing salt and pepper noise. It can be used by taking 3 by 3 pixels or 5 by 5 pixels depending on the amount of noise present. Median filter is nonlinear digital filter. It works by replacing centermost pixel by the median of the all the neighboring pixels. It is commonly used in digital image processing techniques. Next the static objects are removed leaving the objects which are in motion. The objects that are in motion are influenced by noise. Normally the gray level values of background are little different from the gray level values of object. So by using thresholding, objects are separated from background. Thresholding is an easy and effective method to separate moving objects from the static background. The object center is calculated and centroid is found out.

III. SIMULATION RESULTS

First the video of moving vehicles is taken. Previous frame of the video is subtracted from the present frame of the video. Next the video is converted into saturation colour model. If noise is present then it is removed by using median filter. In order to differentiate between the moving objects and background, background is made black and moving objects are made white. The noise

present in the background is removed by erosion method. The noise present in Next the centre of the object is calculated. In this way the moving vehicles are detected.

Fig 2. Background image

Fig 3. Saturated background image

Fig 4. Moving objects image

Fig 5. Saturated moving objects image

Fig 6. Subtracted image

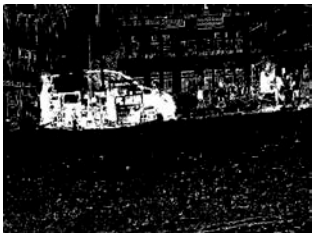

Fig 7. Black and white image

Fig 8. Eroded image

Fig 9. Dilated image

Fig 10. Moving objects with centres marked

IV. CONCLUSION

The entire algorithm was first developed using MATLAB and then implementated using FPGA with the help of Verilog files. This ways motion in any kind of environment can be tracked and necessary action can be performed based on the requirement.

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