

Automatic Image Registration using MATLAB Simulink model configured on DM6437EVM processor

Megha M Pandya, Nehal G Chitaliya and Sandip R Panchal

Abstract— The most interesting application of image processing is Image registration, which can be shown as initial stage of Image Fusion. It can be used for making panoramic image which is the combination of two or more images from the same scene. Many image processing applications are implement on DSP processor i.e. edge detection, object tracking, motion detection etc. This paper contains the MATLAB Simulink model for Image registration and it is configured on DM6437EVM processor. It is the latest Da-Vinchi video processor and fulfils all the requirements for Image Registration. The results for different images are taken and also compared with the results of MATLAB software. To improve the results, filters are also applied. The block for unsharp filter is also shown with registration result.

Index Terms— Da-Vinchi video processor, MATLAB Simulink model, Panorama image, Unsharp filter

I. INTRODUCTION

Image Registration is the geometric alignment of two or more images from the same scene to make one panoramic image. It is a technique for creating images which cannot be created by a single frame of the camera i.e. satellite imagery [1]. In algorithm of Image Registration, the user gives a series of pictures with overlapping regions and obtained one large image with all the pictures merged as accurately as possible and that image is called as panorama image. The target of this paper is to make MATLAB Simulink modal for image registration algorithm and then configured the modal on DM6437EVM video processor. The results obtained from the simulation will be compared with the results of MATLAB program in the following section.

This Simulink model is for automatic featured based image registration. This registration will be performed using point correspondences between the two images. The goal of registration is to establish geometric correspondence between the images [1]. It can be used for solving a variety of problems in image processing such as object recognition, monitoring satellite images, matching stereo images for reconstructing depth, matching biomedical images for diagnosis etc. [3]. Registration is also the central task of image mosaicking procedures [2].

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To improve the quality of panoramic image, the number of matching points from both the images must be increased. For that many filter operators i.e. log filter, sobel filter, prewitt filter, unsharp filter etc. are applied to original reference images using MATLAB program. By comparing the results, unsharp filter is the best to get increased matching points. So the block for unsharp filter will also add to the Simulink model and verify the results.

II. FLOW OF IMAGE REGISTRATION WITH EXAMPLE

The flow for Image Registration can be shown as given below:

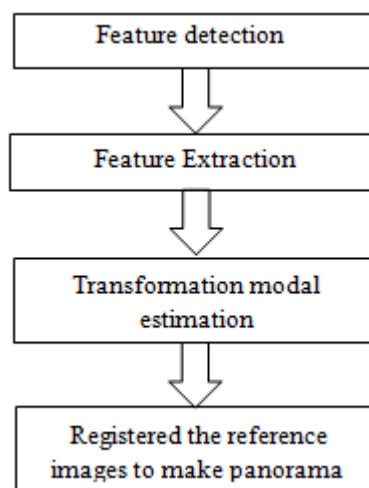


Fig. 1. Flow of Image Registration [2]

For image registration, two reference images are taken from the same scene. Detect the feature points in both the images, match the points and by using that points estimate transformation model. Register both the images to make panoramic image. The example of it is as shown below.

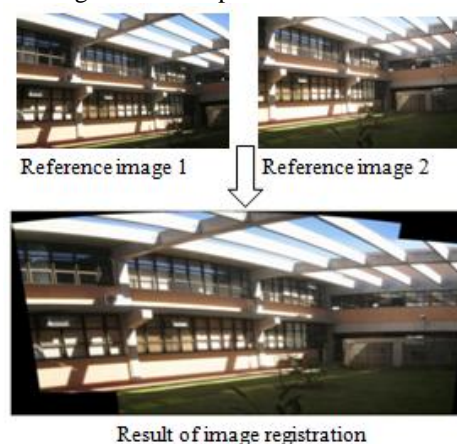


Fig. 2. Example of Image Registration

III. FEATURES OF DM6437EVM DA-VINCHI PROCESSOR

The image of Da-Vinci DM6437EVM video processor is as shown below:

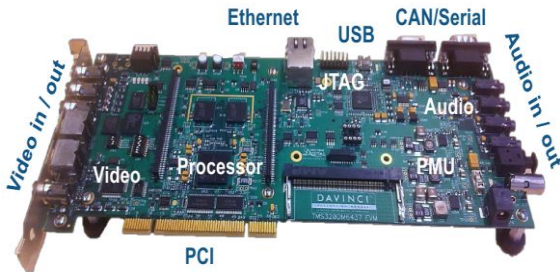


Fig. 3. DM6437EVM video processor

The DM6437 EVM is a PCI based or standalone development platform that enables users to evaluate and develop applications for the TI DaVinci processor family. The EVM comes with a full complement of on board devices that suit a wide variety of application environments. The key features of the digital media 6437 EVM processor are given as [4]:

- DM6437 processor operating up to 600 Mhz.
- 1 TVP5146M2 video decoder, supports composite or S video
- 4 video DAC outputs - component, RGB, composite (3 populated)
- 128 Mbytes of DDR2 DRAM
- UART, CAN I/O Interfaces
- 16 Mbytes of non-volatile Flash memory, 64 Mbytes NAND Flash, 2 Mbytes SRAM
- 10/100 MBS Ethernet Interface
- Configurable boot load options
- Embedded JTAG emulation interface
- 4 user LEDs and 4 position user switch
- Single voltage power supply (+5V)

IV. MATLAB SIMULINK MODEL WITH BLOCKS

Image Registration can be performed by using MATLAB Simulink model. The model contains different blocks for every steps of registration as shown previously. To make Simulink modal, computer vision system toolbox is main requirement. Computer Vision System Toolbox provides algorithms and tools for the design and simulation of computer vision and video processing systems. These capabilities are provided as MATLAB functions, MATLAB System objects, and Simulink blocks. The system toolbox includes algorithms for feature extraction, motion detection, object tracking, stereo vision, video processing, and video analysis. Tools include video file I/O, video display, drawing graphics, and compositing. For rapid prototyping and embedded system design, the system toolbox supports fixed-point arithmetic and C-code generation.

First, the simulation model for Image Registration is shown and then input and display blocks. The simulation

model with target preference block is as shown below. The block can be added under Target Support Package TI C6000→Target Preferences. From that the Simulink model can be configured on the specific processor.

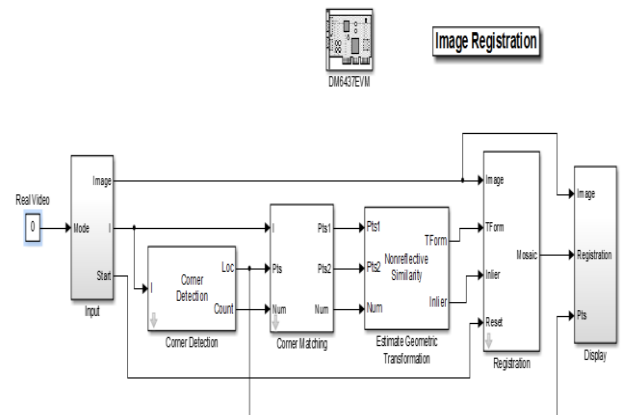


Fig. 4. Simulink model configured on DM6437VM processor

A. INPUT block without applying filter

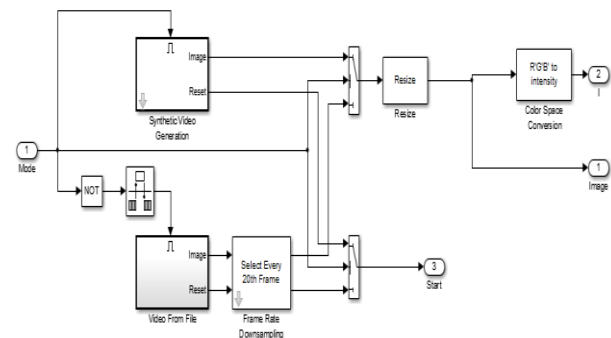


Fig. 5. input block without applying filter

The .avi video file is given as input from the file saved in computer then every 20th frame is taken using Frame rate down sampling block. Then resize block add so any size of frame can be proceed. Frame image is in the RGB format. Convert it in intensity using RGB to intensity colour space conversion.

B. DISPLAY block of model

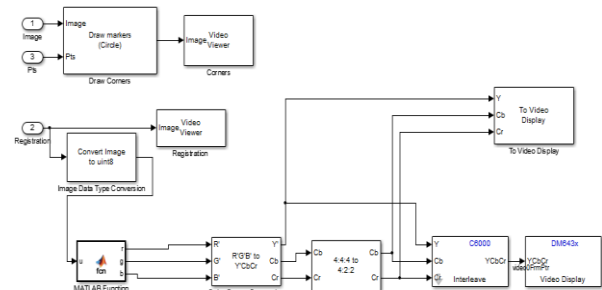


Fig. 6. display block of Simulink model

Use video display block of DM6437 under Target Support Package→Supported Processors→TI C6000→Board Support→DM6437EVM, found Video display block. Set Sample Time to -1. For that RGB signals are converted into YCbCr signals.

V. EXPERIMENTAL RESULTS

C. INPUT block with Unsharp Filter

In MATLAB program, to increase the number of matching points unsharp filter is applied to reference image. Image Registration with processed image is also implementing on Simulink model. For that only input block has been changed from previous as shown below:

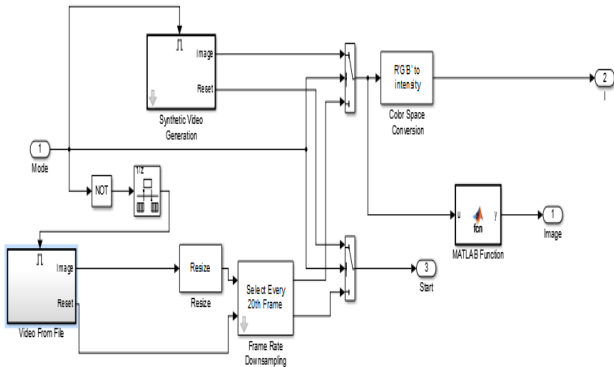
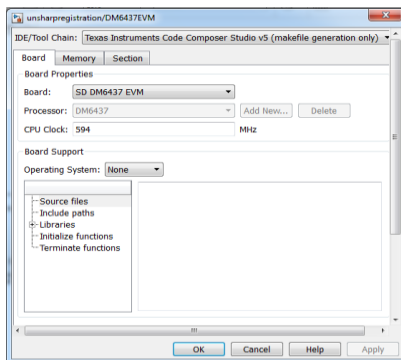


Fig. 7. input block with Unsharp filter

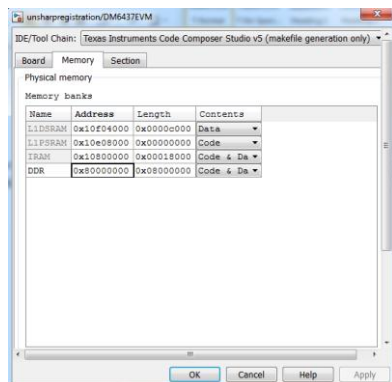
For Unsharp filter, MATLAB function block is added as shown below:

D. Settings of Target Preference

To configure the Simulink model on DM6437EVM processor, the following settings must be done for the target preference block. This is the window to set the board on which it has to be implemented.

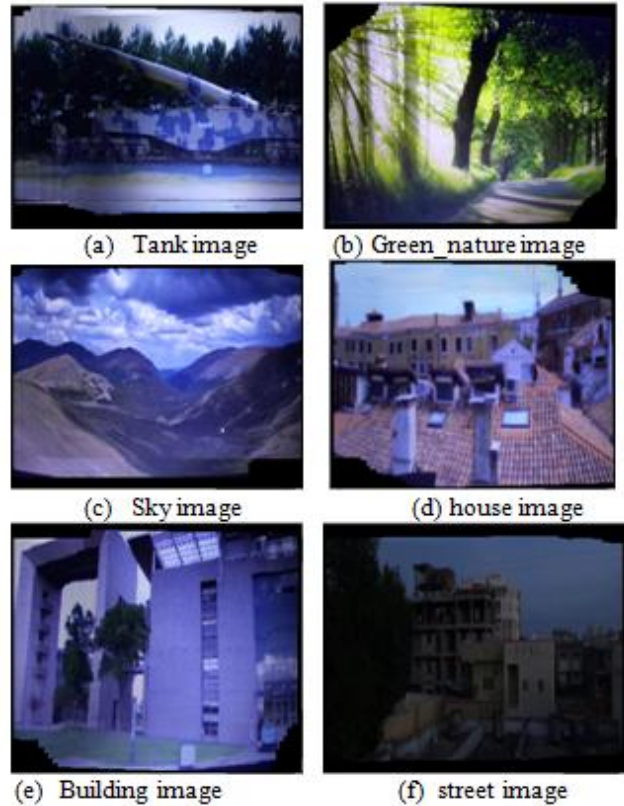


This window shows how the physical memory is distributed and which addresses are allotted to them.



The MATLAB Simulink model is applied for different .avi files and the results that obtained is as shown below.

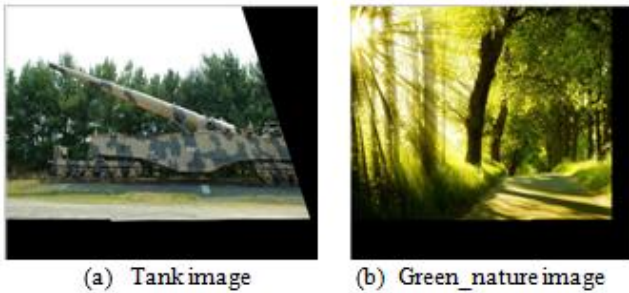
A. Image Registration without filter



B. Image Registration with Unsharp filter



C. Comparison with Result of MATLAB program



From the above images, it can be concluded that results from MATLAB program and Simulink model are approximately equal.

VI. CONCLUSION

After completing the Simulink model and configured it with target reference DM6437EVM processor, it can be concluded that Image registration can also be implemented on actual hardware. By applying unsharp filter, improved registration image can be obtained. The results are similar to MATLAB program.

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