



HARDWARE PROTOTYPING FOR VIDEO AND SIGNAL PROCESSING APPLICATIONS USING DM 6437 TEXAS INSTRUMENT EVALUATION BOARD

Dr. Vijayalaxmi Biradar¹,
Benjaram Madhusudhan Reddy²,
Dr. Kiran Kumar Anumandla³

¹Professor, Department of ECE
Vignan Institute of Technology and Science
Deshmukhi, Hyderabad, India
b.vijay.1981@ieee.org

²Part time Research scholar, Dept. of ECE
KL University, Guntur.

Assistant professor,
Dept of ECE, VITS, Hyderabad, India.
benjaram.msreddy@gmail.com

³Assistant Professor, Dept of ECE
KL University, Green Fields, Vaddeswaram,
Guntur, India.
kiran.anumandla@kluniversity.in

June 20, 2018

Abstract

In real time applications, Signal and Video processing provides an interesting research area such as in medical

field, surveillance, biometric, etc., This paper presents fast prototyping to develop signal and video processing application using DM 6437 Evaluation board. During the experimental research DM 6437 EVM is programmed with Matlab/Simulink model and code composer studio version4 software. This paper presents the complete procedure to implement signal and video processing applications in real time with TMS320DM6437 Texas Instrument Evaluation board. This paper is a part of research work on the project “Development of Non-Intrusive Driver Fatigue Detection & Warning System to avoid on road Accidents” sanctioned under Early Career Research Award sponsored by Science & Engineering Research Board, Govt. of India ,New Delhi at Vignan Institute of Technology & Science, Vignan Hills, Hyderabad.

Keywords:CCSv4, DM 6437 EVM, API, CAN, I2C, USART, DVSDK,C6000and C6xCSL etc.

1 INTRODUCTION

Recently in real world the importance of signal and video processing applications has increased, there has also been a trend towards the use of video cameras in all aspects of life. Video sources are used in the smart systems that can automatically process such images and generate results according to the real time applications. This paper presents the hardware prototyping procedure for signal and video processing applications. Programming of DM6437 EVM can be done with the help of the softwares like Matlab SimulinkDVSDK, Code Composer Studio Version4 (CCSv4), C6000 Code Generation Tools v7.3.1, C6xCSL etc.

Matlab Simulink software is used to create the application model by the Simulink library blocks and it also used to simulate and verify the model. DVSDK software is used to create make and out target files. C6000 Code Generation Tools are the c/c++ compilers for the development of digital signal processor applications. CCSv4 is

This paper is a part of research work on the project “Development of Non-Intrusive Driver Fatigue Detection & Warning System to avoid on road Accidents” sanctioned under Early Career Research Award sponsored by Science & Engineering Research Board, Govt. of India ,New Delhi at Vignan Institute of Technology & Science, Vignan Hills, Hyderabad.

used to generate the c file from the Matlab Simulink model. The C6xCSL provides the Application Programming Interface (API) for the Configuring and Controlling the DM 6437 Evaluation board. Programming flow model of DM 6437 is shown in below figure1 [1][2].

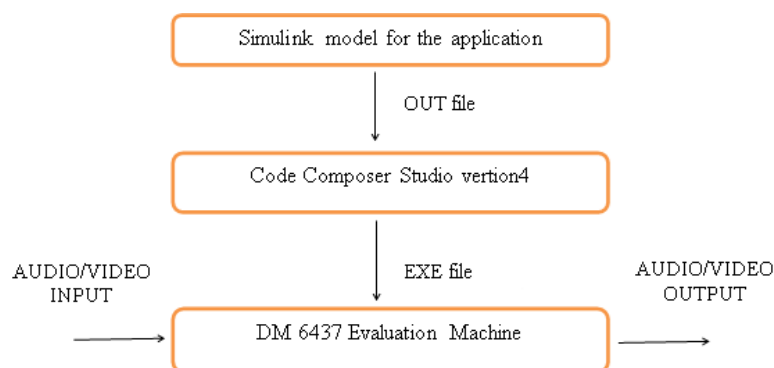


Figure 1: Programming Flow diagram of DM 6437 EVM

2 HARD WARE ARCHITECTURE TEXAS INSTRUMENT DM 6437 EVALUATION BOARD

The DM6437 EVM is a Peripheral Component Interfaced based development board which enables users to develop the signal and video processing applications. The DM 6437 EVM has board peripherals which suits a wide variety of application in the area of Digital image processing. Key features of DM 6437 EVM are, it will operated with the frequency up to 600 MHz, it has inbuilt audio and video decoders, it has 4 video DAC outputs, it has 80 Mbytesof Flash memory (16Mbytes Flash+64 Mbytes NAND Flash) and 130 Mbytes RAM (128 Mbytes of DRAM+2 Mbytes of SRAM),it has USART, CAN and I2C I/O Interface etc. The block diagram and Evaluation board of DM 6437EVM is shown in below figure2 & 3[3][14].

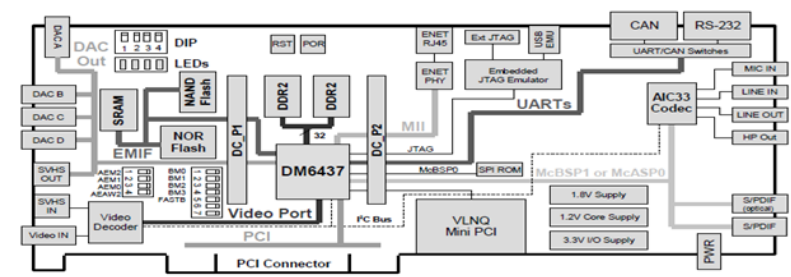


Figure 2: Block diagram of DM 6437 EVM



Figure 3: Evaluation board of DM 6437

3 SOFTWARE ARCHITECTURE OF DM 6437 EVM

Software Architecture of DM 6437 EVM consist of Simulink software to create the Simulink model for the application that Simulink model will be linked to the Code Composer Studio. Code Composer Studio will generate the Execution file for the DM6437EVM. On Evaluation board BIOS is the DSP Operating System to Control the DM 6437 Evaluation board and also have different codecs for audio, video and image processing. Drivers are used to connect to the Simulink Model to the DM 6437 EVM. Software architecture of DM 6437 EVM is shown in below figure4 [13].

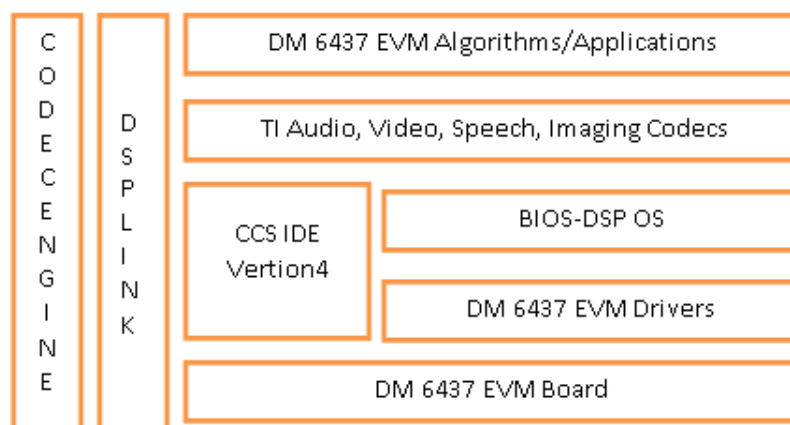


Figure 4: Software Architecture of DM 6437 EVM

4 CODE GENERATION PROCEDURE FOR DM 6437EVM

Code Generation procedure consists of MATLAB Simulink Software, CCSv4Software, and DM 6437 EVM Library tool for the generation of code for the target. Code generation procedure steps for DM 6437 EVM are shown in below flow chart figure5.

Following are the steps to generate code for DM6437

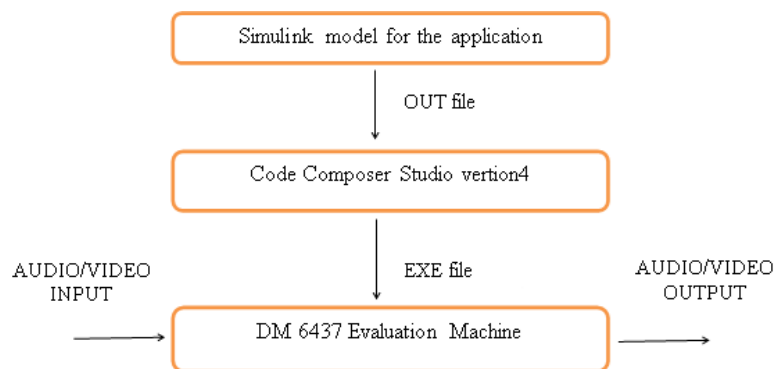


Figure 5: Code generation Procedure flow chart for DM 6437 EVM

- Open the Matlab/Simulink model, create the Simulink model for the required application
- Run the model, create the make file and after creating the make file build the model and set the PSP driver path
- If no errors, an .out file is generated.
- Open the CCSv4 software, create the new configuration file and launch configuration file
- Connect the target then load program i.e., .out file generated from MATLAB/SIMULINK model.
- Run the code and check the output on the screen.

5 PROTOTYPING APPLICATION FOR VIDEO AND SIGNAL PROCESSING

A) Audio Processing using DM6437 EVM

Audio Processing application on DM6437 consists of audio input given through microphone/any audio file to ADC block of DM6437. Output is observed over speaker before that digital data is again converted into analog using DAC block of DM6437. The sampling

frequency used is 44.1KHZ. Hardware set up of Audio Processing application consists of a Microphone for audio input ADC block of DM 6437EVM, Speakers for output connected through DAC block of DM 6437 as shown in below figure7.

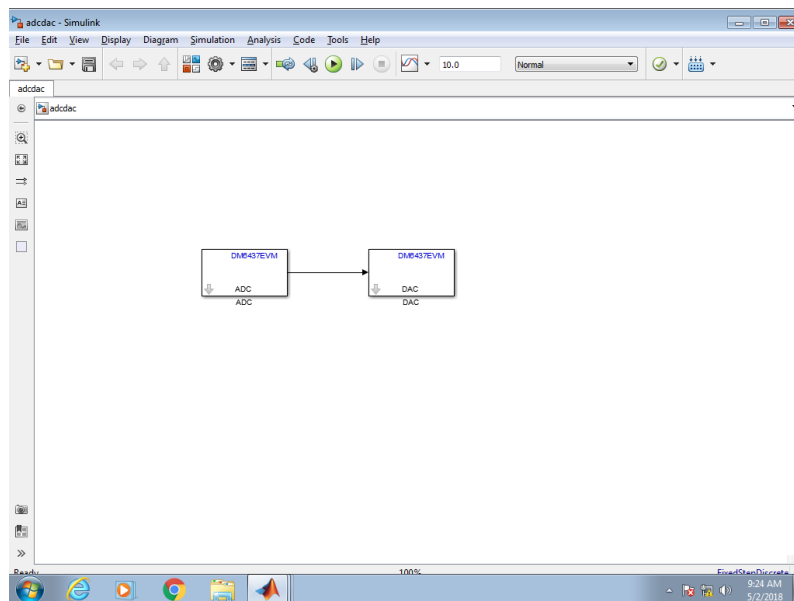


Figure 6: Simulink model of Audio Processing

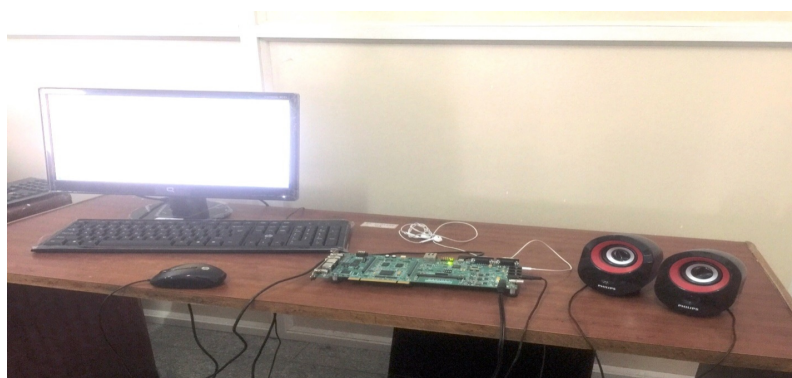


Figure 7: Hardware set up of Audio Processing

B) Video Processing using DM 6437 EVM

Video Processing application on DM6437 consists of Video capture block of DM6437 to capture the video through camera module as shown in Figure 9. Video capture model settings are changed to Video Capture mode: PAL, Sample time is 1/25s. Output of captured video is observed on LCD screen connected through Video Display block of DM6437.

Simulink Model of video processing is shown in Figure 8. Hardware set up of Video Processing shown in Figure 10.

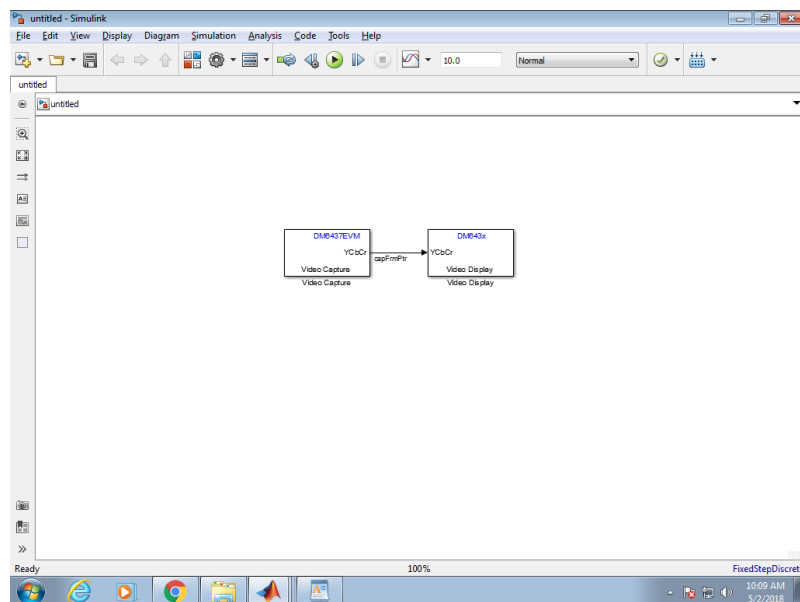


Figure 8: Simulink Model of video processing

6 CONCLUSIONS

This paper presents a unique approach of designing signal and video applications using MATLAB/SIMULINK model which gives an opportunity to experience real-time hardware implementation. The analysis report of Signal and Video processing application shows that the total time required to process the signal is 0.9s and



Figure 9: Video camera



Figure 10: Hardware setup of video processing

Video is 0.33s, number of block methods for signal are 8 and video are 9, number of internal methods for signal are 5 and video are 5, number of model methods are for signal are 10 and video are 10, the clock precision for signal and video is 3ns and clock speed is 3001MHz. This paper presents an effective implementation of signal and video applications on DM6437 evaluation board for real time applications.

References

- [1] Matlab/Simulink environment description, Mathworks Inc., 2013.[Online]. Available: <http://www.mathworks.com>
- [2] Code Composer Studio IDE Overview, Texas Instruments, 2013.[Online]. Available: <http://www.ti.com>
- [3] TMS320DM6437 Evaluation Module with TVP5146M2, Texas Instruments, 2007. [Online]. Available: <http://www.ti.com/lit/ug/spruev6/spruev6.pdf>
- [4] T. Marciniak, D. Jackowski, P. Pawowski, and A. Dabrowski, "Realtimpeople tracking using DM6437 EVM", in Proc. IEEE Signal Processing Algorithms, Architectures, Arrangements, and Applications Conference Proceedings, Poland Sect, (SPA'2009), Poznan, Poland, Sep. 2009, pp. 116120.
- [5] J. Balcerek, A. Chmielewska, A. Dabrowski, D. Jackowski, A. Konieczka, T. Marciniak, and P. Pawowski, "Recognition of threats in urban areas by means of the analysis of video sequences", in Proc. IEEE Multimedia Communications, Services and Security (MCSS2010), Krakw, Poland, May 2010, pp. 4148.
- [6] A. Chmielewska, P. Pawowski, and A. Dabrowski, "The use of video sequences processing methods to support the CCTV", Scientific Papers of Computer Science College in Lodz, vol. 10, pp. 6583, Oct. 2010.
- [7] V. K. Ingle and J. G. Proakis, "A DSP Course based on Lecture/ Lab Integration", IEEE Signal Processing Magazine, vol. 9, no. 4, pp. 2529, Oct. 1992.

- [8] R. Chassaing, W. Anakwa, and A. Richardson, "Real-Time Digital Signal Processing in Education", in Proc. Int. Conf.on Acoustics, Speech and Signal Processing (ICASSP), Minneapolis, USA, Apr. 1993, IEEE, vol. 1, pp. 2831.
- [9] L. Shuo, L. Teng, L. Fanghui, and T. Liyu, "RealtimeSignal Waveform Library and Processing System Based onTMS320C5x DSP Starter Kit", in International Conference on Signal Processing (ICSP), Beijing, China, Oct. 1998, vol. 2, pp. 16621665.
- [10] W.-S. Gan, "Teaching and Learning the Hows and Whys of Real-Time Digital Signal Processing", IEEE Trans. on Education, vol. 45, no. 4, pp. 336343, Nov. 2002.
- [11] Jacob Fainguelernt and ArieYeredor, "Bridging the gap between dsp theory and real-time implementation", in EuropeanDSP Education and Research Symposium (EDERS2004), Birmingham, United Kingdom, 2004, IEEE and TI.
- [12] W.-S. Gan, Y.-K.Chong, W. Gong, and W.-T. Tan, "Rapid Prototyping System for Teaching Real-Time Digital Signal Processing", IEEE Trans. on Education, vol. 43, no. 1, pp. 1924, Feb. 2000.
- [13] W. S. Gan and S.M. Kuo, "Transition from Simulink to MATLAB in Real-Time Digital Signal Processing Education", TheInternational Journal of Engineering Education, vol. 21, no. 4, 2005, Special issue on MATLAB and Simulink in Engineering Education.The Mathworks Inc., Matlab and Simulink Users Guide, 2005.
- [14] Texas Instruments Inc., TMS320C6416/C6713 DSK One-Day Workshop - Student Guide, 3.1 edition, Aug. 2003.
- [15] B. Widrowet al., "Adaptive Noise Cancelling: Principals and Applications", Proceeding of the IEEE, vol. 63, no. 12, pp. 16921716, Dec. 1975.

