강인한 비디오 워터마킹을 적용한 실시간 DVR 시스템 구현에 관한 연구

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System Realization for Real Time DVR System with Robust Video Watermarking

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요 약

본 논문은 실시간 DVR 시스템에서 다양한 공격에 강인한 비디오 워터 마킹 알고리즘을 적용한 시스템 구현에 관한 것이다. DVR 시스템에서 영상 및 알고리즘을 실시간으로 처리하기 위해 DSP 프로세서를 사용 하여 강인한 비디오 워터 마킹 알고리즘을 실시간 DVR 시스템에 적합한 형태로 적용하였다. 실험 결과, D1크기의 영상에서 한 프레임 당 처리 시간이 약 2.5ms 소요되었다.

ABSTRACT

A system realization for real time DVR system with robust video watermarking algorithm against is attacked various is presented in this paper. The main system is composed of DSP processor and robust video watermarking to be processed at real time on image data and algorithm of the DVR system. The experimental result shows that the processing time takes about 2.5ms on the D1 size image per frame.

Keywords

Video Watermarking, Robust, DSP, DSP Processor, DVR system, Encoder, Decoder, MPEG-4, DCT

I. Introduction

According to surveillance system is realized by using DVR system recently, digital data occurred from DVR not get damaged the data quality however frequently that is reproduced in contrast to analog data, and a supply to the people is rapid by developing network technology. Meanwhile, an important subject of inquiry from standpoint of security has been rising because somebody enable it to do. For the purpose of data protection, encoder is required a secure technology. One of that is used the watermarking technique to be protected digital data. The digital watermarking method is applied in the research institute of NEC the first. The digital data is able to become protected effectively as a result of the method is concealed a special code of multimedia data from a person. Now most of video and audio digital data are applied the watermarking.[1-9] For security of video and audio data against an various attack, the real time DVR system realization with robust video watermarking algorithm, MPEG-4, FPGA and high performance dsp processor is presented in this paper.

II. System Realization

2-1 DVR System Encoder

The DVR system Encoder is shown in fig. 2-1 is composed of video and audio encoder, MPEG-4, DSP processor and host computer. The video and audio signals is inputted from camera and microphone is coded in the encoder block. The video processor block is a sampled digital data is compressed video and audio in the DSP processor and MPEG-4. The created video and audio compressed data are transmitted to network and stored into storage media from host processor block.

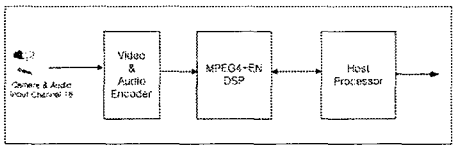


Fig. 1-1 DVR encoder block

2-2. Video Processor Block

The video processor block as shown fig. 2-2 is composed of video and audio encoder, DSP and FPGA, and data is sent to the host computer over parallel interface. The video and audio signals of 16 channel are sent from CCD camera and microphone. The synchronizing and controlling signals is processed in the FPGA. The DSP processor module creates video and audio data compression by the algorithm.

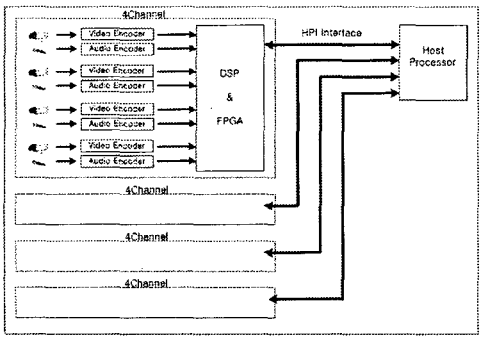


Fig. 2-2 Video processor block

DSP processor module is processed the compressing algorithm from the input data, and video watermarking inserting algorithm. And then the created compressed data get sent to host, and also the compressed video and audio data from the host is decompressed, sent to video and audio output port, and is extracted the video watermarking. DSP processor used is operated 64 bits data, and is designed for the special purpose for video processing. All of algorithm is processed in the DSP processor. It is difficult to program algorithm all with C language. Because D1 image, 30 frames per second with MPEG-4 operation and the watermarking inserting algorithm is processed. The most operation routine is programmed in assembly language to be adequate DSP processor structure.

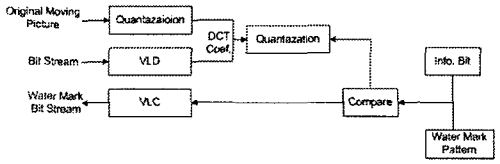
III. Robust Video Watermarking

Video watermarking is inserted a watermarking on the digitized data, the method is used the still image algorithm extending in the space region. the method is that watermark is inserted in processing the moving image compressing, and image stream compressed previously is inserted. The process is as the following. The first, method is that is created the image inserted a watermarking in the space region, make the compressed stream from the encoder processed the compression algorithm. That has a merit to enable the original image to insert a watermarking with simple and various method. However, there is a weakness that enable stream to increase in contrast to become compressed the original image, and to cause a loss in carrying out the reconstruction. And enables watermarking to be eliminated and be changed by transforming and filtering the signal. Thus, the method is used the frequency region insertion to make good. One of the method that is inserted a watermarking into frequency region transforms data into frequency space get inserted a watermarking into less sensitive component in the frequency region. That method makes a weakness to make good through the various postprocessing. It is used the method inserted the DCT coefficient into a watermarking mainly. DCT get used in a lot of compression algorithm including JPEG compression, that reason leads robust watermarking to become used mostly. There is a typical method, DEW(Differential Energy Watermarking algorithm proposed by Langelaar.

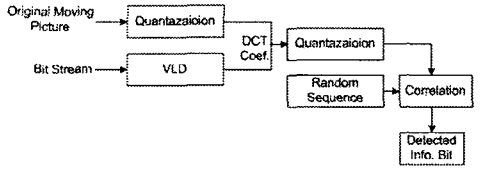
Secondary, The technique inserting a watermarking after compressed is inserted a watermarking in the compression processing. Typically this method is inserted a watermarking after transformed into DCT by

macro block unit. Data of MPEG consists of I P B frames. Only the lowest data loss frame I is used, or is inserted a watermarking into intra-block of B and P frames that is lower data loss. And another there is used the FFT. FFT method is robust to be attacked geometrically, but is required long time to operate. So, That is not good to be used the DVR system at real time.

In order to complement the weakness as above mentioned, the robust system is composed of the method is inserted a watermarking into the intra- frame space region, and enable a watermarking to be inserted by using inter-frame information to be able to be extracted the information in the geometrical attacking on the moving image in this paper. In case of the inserting a watermarking into space region in the intra-frame, insertion and extraction of information for frames is ease. The method inserting a watermarking in utilizing the inter-frame information has information of frame not to be affected with geometrical attack is inserted one information to several frames. And also, these methods are not complicated, and insertion and extraction of watermarking is simple. Fig. 3-1 is shown the processing of insertion and extraction.



(a) Watermarking insertion



(b) Watermarking extraction

Fig. 3-1 Watermarking insertion and extraction

The processing of watermarking insertion as shown in fig. 3-1(a) is that DC coefficient is derived from applying DCT to the original image, in case of bit stream DCT coefficient take over VLD from DC coefficient, DC coefficient is quantized, comparing with watermark, and change the quantized DC coefficient equal to watermark bit. The extraction process is similar to the insertion. DC coefficient obtained from VLD in the bit stream, and in case of the original image, DC coefficient procure from quantizing the DCT to bit stream, and quantize them into same size and calculate the correlation.

IV. Experiment and Results

Fig. 3-2 is shown the realized 16 channel DVR system board. This system become installed MPEG-4 and video watermarking algorithm. Encoder is processed image compression and video watermarking insertion. Decoder is operated image reconstruction and watermarking extraction. The system has been realizing for more with robust algorithm especially.

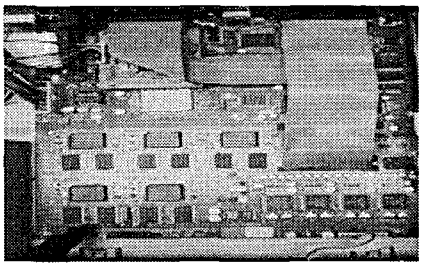


Fig 3-2 Realized 16 channel DVR system

Experimental sample image takes D1(720 x 480) size, A firm object moving image and 60% moving object moving image as shown in fig. 3-2. Fig. 3-3 is shown the result image processed the system. The original image (a) and watermarking image (b) is inputted into the system, and the reconstructed image (c) is generated as the output.

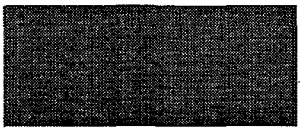
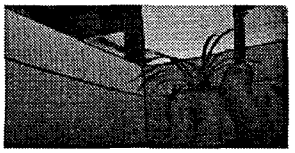
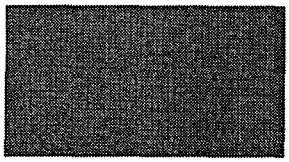


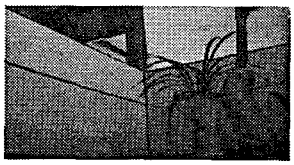
Fig. 3-2 Firm and moving sample pattern



(a) The original image



(b) watermarking image



(c)Reconstructed image

Fig. 3-4 Firm object moving image

The experimental results, using sample pattern, firm object moving image and 60% moving object moving image , as is shown in table 4-1, encoder and decoder are required time for being video watermarking insertion, reconstruction and watermarking extraction to be compressed with MPEG-4 per frame. a watermarking insertion and extraction takes about 2.5ms. A real time system requires 2.0ms below. A lot of moving object image takes 0.5ms to add.

Table 4-1 Experimental results

Coder / Image	Firm object	60% moving object
Encoder		
Preprocessing time	1.5ms	1.5ms
MPEG4 compressing time	13.3ms	23.6ms
Video watermarking inserting time	0.7ms	1.0ms
Postprocessing time	0.4ms	0.4ms
Frame/second	**17ms**	**26.5ms**
Decoder		
Preprocessing time	0.4ms	0.4ms
MPEG4 reconstructing time	5.0ms	8.1ms
Video watermarking extracting time	1.0ms	1.5ms
Postprocessing time	0.6ms	0.6ms
Frame/second	**7.0ms**	**10.6ms**

V. Conclusion

The real time DVR system realization with robust video watermarking is driving. The system requirement for the processing time is 2.0 ms below to encoder and decoder. The experimental result shows 2.5ms on a lot of moving object video image to be processed a watermarking insertion and extraction. This result is short of real time processing. Thus, the hardware and software algorithm is required the optimizing and improving further to be rapid

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