FRAME RATE BLOCK SELECTION APPROACH BASED DIGITAL WATER MARKING FOR EFFICIENT VIDEO AUTHENTICATION USING NETWORK CONDITIONS

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ABSTRACT

The modern information technology has provide great impact on information transfer and even if there are many network protocols supports video transfer the problem of information security has not been handled properly. Online video conferencing and live chat are the common applications of modern information technology but the quality of video being transferred or received is based on the frame rate. Also there are many situations where the content of video has to be authenticated before displayed to the user. To perform such authentication there are many approaches has been discussed earlier and suffers with the problem of malformed content display and accuracy. We propose a novel video authentication approach which is performed according to the network conditions. The method encodes the image in a selected block of the video frame, which will be used to decrypt the image. The water marking is performed on the selected block only and with the identified hidden information the original image could be retrieved. The method also proposes a frame rate selection approach according to the network conditions and the same is used to choose the block where the watermarking could be performed. The proposed approach has produces efficient results in video authentication and data transfer.

Keywords: frame rate, video authentication, water marking, QoS.

INTRODUCTION

The growth of information technology has generated great impact in many areas, particularly the television channels and video conferencing uses the technology growth in more strategic manner. The television channels are responsible for the content being displayed or telecast in the network and each channel is being telecasted in certain frequency. Similarly the defense unit of any country uses the video transfer to share secret information between the units of the defense sector. They use video transfer to send stream of data using which the end unit can make decisions.

In such conditions, the data being transferred has to be secure so that the malicious user could not identify the content of the data being transferred. There are many encryption approaches described earlier, the digital water marking is one among them which hides information inside the video frame or image. The water mark is generated using specific algorithm and later the end user can identify and remove the watermark to get the original image.

In broadcast network there are many content being telecasted and the broadcaster is the only responsible person for the content of telecasted. There are situations where some malicious users, can broadcast or telecast the malformed video in the same frequency. If so, the end user will receive some malformed video and the channel will loose the reputation. For some national security channels and the frequency they use, the content has to be authenticated before being used.

To enhance the information security there are many methods has been used in reality, the video authentication is one where the content of the video will be authenticated using some methods. Some of them use different coding schemes to differentiate the content of the video. The quality of service is highly based on the throughput conditions, traffic and the quality of the video being telecasted. To enhance the quality of service of the network or the channel the content of the video has to be authenticated and there should be no video frame should be broadcasted without authenticating the video.

Each video has different number of video frames and the visible quality of the video differs with video format. The frame rate of the video occupies the bandwidth of the network and to increase the throughput, continuity and continuous communication or telecasting the bandwidth has to be utilized efficiently. The frame rate can be modified and altered to increase the throughput and continue the transmission continuously.

RELATED WORKS

There are many different approaches has been discussed to support video authentication and we discuss few of them in this section.

High-Performance H.264/AVC Intraprediction Architecture for Ultra High Definition Video Applications [4], presents an H.264/AVC intra-prediction design for ultrahigh definition (ultra-HD) video. Due to the huge throughput requirements of ultra-HD, design challenges

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such as complexity and data dependency, which currently exist for lower resolutions, become even more critical? To solve these problems, we first propose an interlaced block reordering scheme together with a preliminary mode decision (PMD) strategy to resolve the data dependency between intra mode decision and reconstruction. In the meantime, hardware cost is reduced by PMD. We also propose a probability-based reconstruction scheme to solve the problem of long pipeline latency. In addition, hardware reuse strategies including a shared fine decision module and processing element-reusable prediction generator, are applied to further optimize the design.

Hardware Implementation of a Digital Watermarking System for Video Authentication [10], employs pipeline structure and uses parallelism. Hardware implementation using field programmable gate array has been done, and an experiment was carried out using a custom versatile breadboard for overall performance evaluation. Experimental results show that a hardware-based video authentication system using this watermarking technique features minimum video quality degradation and can withstand certain potential attacks, i.e., cover- up attacks, cropping, and segment removal on video sequences. Furthermore, the proposed hardware based watermarking system features low power consumption, low cost implementation, high processing speed, and reliability.

Future television-super Hi-vision and beyond [5], consider Super Hi-Vision as the ultimate 2-dimensional television system. It is designed to be viewed with 100 degrees of visual angle to provide viewers with a sensation of reality and immersion as if they were present at the site of the video scene. This super-realistic television system requires sixteen times more resolution than the current Hi-Vision system. In the talk, the specifications of Super Hi-Vision are explained and a roadmap toward the introduction of Super Hi-Vision for the home will be shown. Research on Integral 3DTV will also be introduced as a post-Super-Hi-Vision candidate system. In the talk, the capabilities of this system and current status of research will be discussed along with expected breakthroughs.

A low power high-performance H.264/AVC intra-frame encoder for 1080 pHD video [7], present a low-power and high-performance H.264/AVC intra-frame encoder. We propose several novel approaches to alleviate the performance bottleneck caused by the long data dependency loop among 4 × 4 luma blocks, integrate an efficient CABAC entropy encoder, and apply a clock-gating technique to reduce power consumption. Synthesized into a TSMC 0.13 μm CMOS cell library, our design requires 265.3 K gates at 114 MHz and consumes 23.56 mW to encode 1080pHD (1920 × 1088) video sequences at 30 frames per second (fps). It also delivers the same video quality as the H.264/AVC reference software. Compared with all state-of-the-art designs, our design has a lower working frequency and achieves both better bit-rate saving and lower power consumption.

A high throughput H.264/AVC intra-frame encoding loop architecture for HD1080p [9], present a high throughput hardware architecture for the H.264/AVC intra-frame encoder exploiting the parallelism of intra prediction, forward and inverse transforms and quantization. Since there is a strong data dependency between the intra prediction and the image reconstruction loop, the latency of this path is a key design issue in order to provide high performance coding. Considering that 77% of the total intra-encoding computation is spent in these modules, our architecture handles a 4-pixel wide intra prediction module and a 16-pixel wide reconstruction loop. Compared to the state-of-the-art our approach reduces by 47% the number of cycles to process a macroblock. Running at 150 MHz our architecture guarantees encoding of 61 HD1080p frames per second. The developed architecture requires 73.4 MHz to real-time encode HD1080p, which is a 46% reduction of the frequency requirement compared to the state-of-the-art.

PROPOSED METHOD

The proposed frame rate block selection approach has various stages namely Frame-Rate-Selection, Video Encoding, Video Decoding and each will be discussed in detail in this section.

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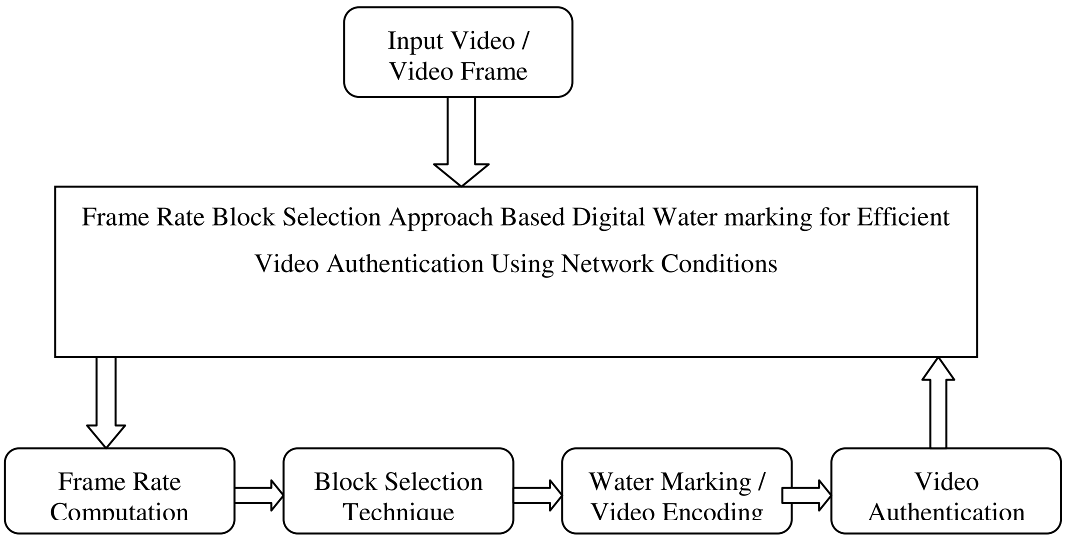

Figure-1. Proposed system architecture.

The Figure-1, shows the proposed system architecture and the functional components which will be discussed in detail in this section.

Frame rate computation

The proposed method analyses the total bandwidth and available bandwidth according to the number of stream being transmitted through the channel. Using all these information, the proposed method compute the frame rate could be used to perform the video transmission. For a generic video the frame rate used is 12 per second and according to the available bandwidth condition the frame rate will be increased for further transmission of videos. The computed frame rate will be used to perform block selection technique.

Algorithm

Input: Video
Output: Frame Rate fr.
Step1: start
Step2: compute the total bandwidth Tb.
Step3: compute available bandwidth Ab = Tb- $\sum Process(Bw)$
Step4: Compute number of processes Np = $\sum Processes \propto Channel$
Step5: Frame rate Fr = $\frac{Ab}{Np} \times \beta$ β=1.5
Step6: stop.

Block selection technique

The video authentication requires a secret key to be encoded with all the video frames of the video. The proposed method encodes the key in a selected block of the video frame. The selection of the block is performed with the help of frame rate computation process. With the computed frame rate, we compute the block selection as follows:

Algorithm

Input: Frame Rate Fr
Output: Selected block Sb.
Step1: start
Step2: compute the size of the frame Fs
Step3: compute the block bl = $\frac{Fr}{Fs} \times 10$
Step4: stop.

Digital watermarking with video encoding

The digital watermarking is performed on the selected block to produce secure video frame from the input image. For each part of the stream the method constructs the block in different size from 3×3 to 50×50 and will be changed for every part of the whole stream. The selections of the block size also consider the time complexity and based on that an optimal block size with the computed value will be selected. According to the size of the secret key being used for authentication, the method selects a block size in optimal manner. The secret key will be encoded with the block in the image and will be sent to the end user. The block number and the size of block will be computed to adapt the secret key being used.

Algorithm

Input: Secret Key Sk, Video Frame Vf, Block No Bn.
Output: Watermarked image wi.
Step1: start
Step2: compute the size of secret key SSK = $\sum size(Sk)$
Step3: Initialize block size bs=3;
Step4: while (true)
Bs = Random (50).

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If Bs>SSk
Break;
Else
Continue;
End
end
Step5: Encode Sk into the block.
Step6: stop.

Video authentication

The video authentication is performed by performing video decoding in the received video frame. From the video frame being received from the source, the receiving side performs a bit wise verification in each block of size being used in the current transmission. The source performs encoding and pads the zeros and ones in the remaining bit stream of the block being used. The destination verifies the padded values in each of the block and if anything found then same block values will be used to verify the video frame otherwise the next level block will be used to identify the block size and the block number. Based on identified block size and value the received video frame will be authenticated.

Algorithm

Input: Video Frame vf
Output: Decoded Video Frame DVF.
Step1: start
Step2: Read the current block no for decoding bl = $\sum Bl(c)$
Step3: Identify the padded bits
If Bl∈ Pb then
Decode the block stream and identify the secret key.
Verify the key.
Else
For each block size
Perform step3.
End
End
Step4: stop.

RESULTS AND DISCUSSIONS

The proposed approach has been implemented and produced efficient results. The method has been tested with varying traffic rate which changes the frame rate. This also modifies the block size and block number being used to perform video authentication. The proposed video authentication approach has produced efficient results and reduces the time complexity also.

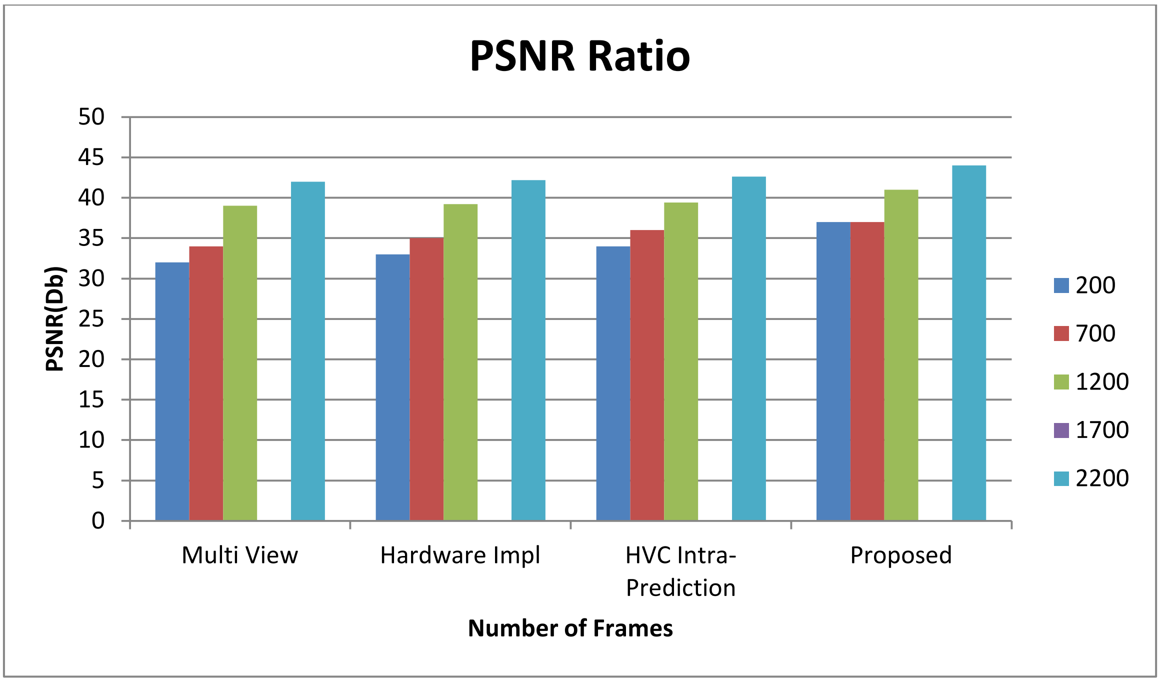

Figure-1. Comparison of PSNR Ratio.

The Figure-1 shows the comparison of PSNR ratio produced by different methods and it shows clearly that the proposed method has produced more PSNR value than other methods.

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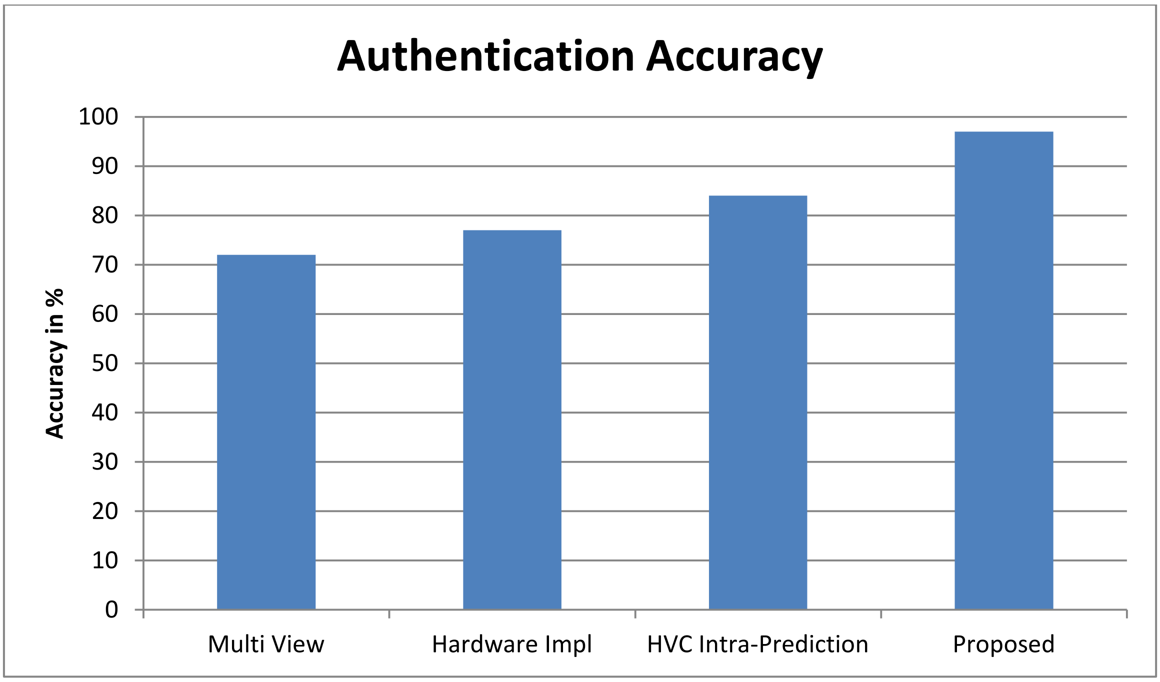

Figure-2. Comparison of authentication accuracy.

The Figure-2 shows the comparison of authentication accuracy produced by different methods and it shows clearly that the proposed method has produced higher accuracy than other methods.

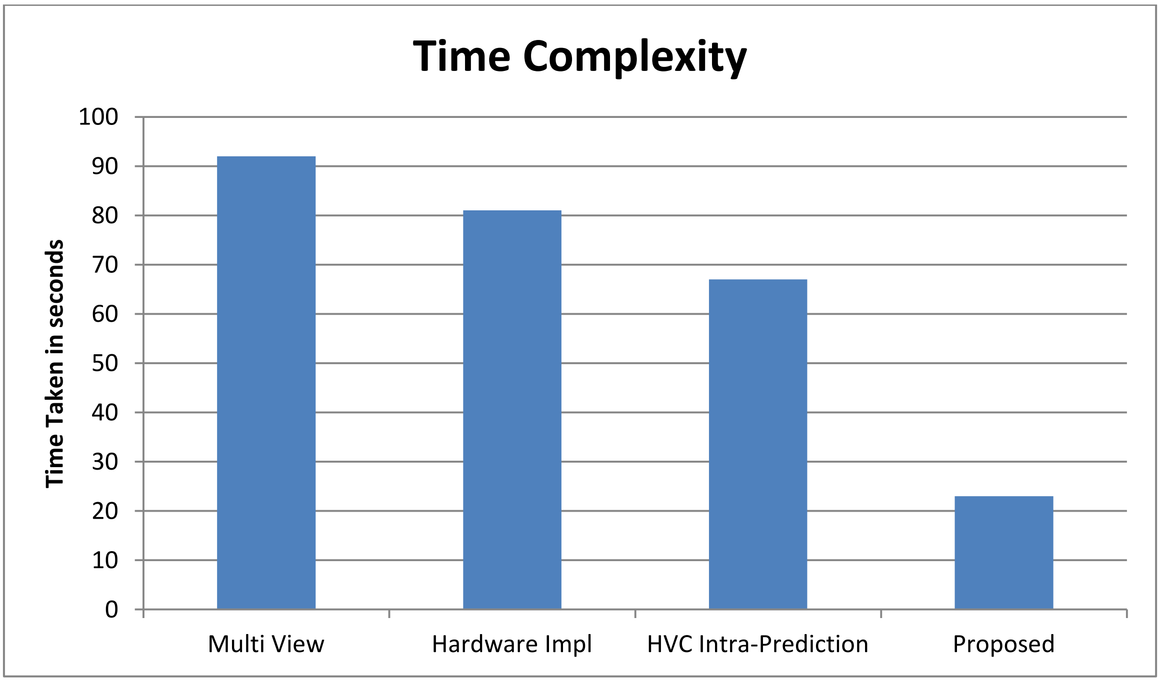

Figure-3. Comparison of time complexity in authentication.

The Figure-3 shows the comparison of authentication time complexity produced by various methods and it shows clearly that the proposed method has produced less time complexity than other methods.

CONCLUSIONS

We present a novel approach for video authentication using frame rate selection and block selection approach. The method computes the bandwidth

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availability based on which frame rate is computed. The computed frame rate is used to choose the block to perform digital water marking. The receiving side identifies the block being used to perform watermarking in regular and random basis which is modified at each stream of video. The identified block is verified with the padding details and data encoded is extracted and verified. The proposed scheme improves the performance of the overall video authentication and increases the throughput of the method. The method also reduces the time complexity of the video authentication.

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