ADVANCED VIDEO CODING/H.264 ENCODING AND DECODING PROCESS WITH IPPPP SEQUENCES

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Abstract— As the world expanded around us and increased the popularity of the Internet by sending receiving, uploading or downloading the high definition videos, it was necessary to use a good technology to reduce the size of the dedicated video and specialized high-quality one. If the videos are send or receive, they need a wide bandwidth to capture this amount of information in the video. Based on the above, the H.264/AVC is a good video coding standard that gives great results for encoding and decoding videos in terms frames. This technology was developed jointly by (ITU-T) International Telecommunication Union–Telecommunication Standardization, and (ISO) International Organization for Standardization. Our work involves applying the encoding and decoding process of the standard using MATLAB TOOL. The work is focusing in inter frame prediction using the (IPPPPP) frame pattern. The video that was subjected to encoding and decoding processing is using with different video coding standards such as H.264/AVC.

Keywords—IPPPP, High Quality, video, encoding, decoding

I. INTRODUCTION

H.264/AVC is the international video coding standard. It is coding. approved by ITU-T as Recommendation H.264 [1] and by ISO/IEC as International Standard MPEG (Motion Picture Expert Group)-4 part 10 AVC[2]. It is widely used for the transmission of Standard Definition (SD) and High Definition (HD) TV signals over Satellite, cable, and terrestrial emission and the storage of high-quality SD video signals onto DVDs[3]. However, an increasing number of services and growing popularity of high definition TV are creating [4] greater needs for higher coding efficiency. Moreover, other transmission media such as Cable Modem[5] offer much lower data rates than broadcast channels, and enhanced coding efficiency can enable the transmission [6] of more video channels or higher quality video representations within existing digital transmission capacities[7]. Digital Video is a sequence of still images or frames and represents scenes in motion[8]. A video signal is a sequence of Two Dimensional (2D) images projected from a dynamic three dimensional (3D) scene onto the image plane of a video camera[9]. Video coding is the process of compressing and decompressing a digital video signal[10]. Coding of video is performed picture by picture. Each picture to be coded is first partitioned into a number of slices[11]. Slices are individual coding units in this standard as compared to earlier standards as each slice is coded independently[12]. The hierarchy of video data organization is as follows: picture-slices-macroblocks-sub macro blocks-blocks-pixels[13]. The main elements of the H.264, source coder are prediction, block transformation (spatial to frequency domain translation), quantization, and entropy[14-16].

II. LITERATURE SURVEY

The purpose of this section is to provide a short description of the various video compression standards. Standards allow interoperability between different manufacturers and a variety of equipment worldwide. Two standards bodies have strongly influenced the development of video compression standards: the International Telecommunications Union (ITU) and the Moving Pictures Experts Group (MPEG)[3-5]. The oldest body is the ITU .Of particular interest is the Telecommunication Standardization Sector, or ITU-T sector[11]. Their goals have been transmitting video over both the analog and digital telephone system although in recent years the difference between their goals and ISO MPEG are very much blurred[16]. Video compression standards developed by ITU are designated by the label"H.26X"[17].

In the early 1990's the International Organization for Standardization (ISO) began looking at video compression for computer and multimedia applications. ISO formed MPEG to develop video compression standards for ISO. MPEG can be thought of as the "computer guys." Standards developed by MPEG are designated by the label "MPEG-x." The MPEG committee tends to be better known than the ISO although both had an equally important impact on the video compression industry[18]. It is important to note that both ITU and MPEG video compression standards only describe the decoder and not the encoder structure[19]. The standards describe the syntax of the encoded bit stream as well as behavior of a compliant decoder. Developers then are allowed to design the encoder anyway they want as long as it produces a compliant bit stream[21- 21].

In order to achieve better compression, the video may be pre-processed before being processed by the encoder. Since errors may be introduced to the com- pressed video data, error conceal mentor block-artifact reduction techniques may be used after the decoding process to enhance the overall quality of the video. It should be emphasized that such techniques are not part of the video compression standards.

A timeline of the development of video compression standards is shown in Figure 2.2, with the contributions of MPEG and ISO shown above and below respectively. It should be noted that MPEG and ITU jointly developed two standards, these are MPEG-2/H.262 and MPEG-4: Part10/H.264.

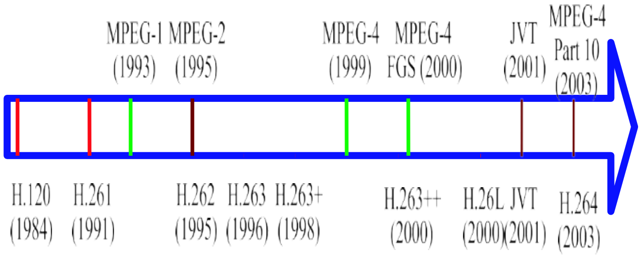

Fig. 2.2. Timeline of video coding standards. MPEG- 2/H.262 and MPEG-4: Part 10/H.264 were joint projects of MPEG and ISO.

H.120 Standard:

H.120 was the first digital video compression standard. It was developed by COST 211. The video turned out not to be of adequate quality, there were few implementations, and there are no existing codecs for the format, but it provided important knowledge leading directly to its practical successors, such as H.261.The drawbacks are

H.120 video was not of good enough quality for practical use it had very good spatial resolution (as differential PCM works on a pixel-by-pixel basis), but very poor temporal quality. It became clear to researchers that to improve the video quality without exceeding the target bitrate for the stream, it would be necessary to encode using an average of less than one bit for each pixel.

H.261 Standard:

H.261 is an ITU-T video compression standard, first ratified in November 1988. It is the first member of the H.26x family of video coding standards in the domain of the ITU- T Video Coding Experts Group (VCEG), and was the first video coding standard that was useful in practical term. was originally designed for transmission over ISDN lines on which data rates are multiples of 64 kbit/s. There are however a few difficult problems in H.261: Motion vector search, Bit-rate Control, Propagation of Errors.

Standard:

H.262or MPEG-2 Part 2 (formally known as ITU-T T Recommendation H.262 and ISO/IEC, also known as MPEG-2 Video) is a video coding format developed and maintained jointly by ITU-T Video Coding Experts Group (VCEG) and ISO/IEC Moving Picture Experts Group (MPEG). MPEG-2 Video is similar to MPEG-1, but also provides support for interlaced video (an encoding technique used in analog NTSC, PAL and SECAM television systems). MPEG-2 video is not optimized for low bitrates (less than 1 Mbit/s), but outperforms MPEG-1 at 3 Mbit/s and above. All standards-conforming MPEG-2 Video decoders are fully capable of playing back MPEG-1 Video streams.

Standard:

is a video compression algorithm and protocol which is standardized by ITU. It is due to be published sometime in 1995/1996. It was designed for low bitrate communication, early drafts specified data rates less than 64 Kbits/s, and however this limitation has now been removed. It is expected that the standard will be used for a wide range of bitrates, not just low bitrate applications, and expected that H.263 will replace H.261 in many applications. The Video source coding algorithm of H.263 is based on Recommendation H.261 and is a hybrid of inter-picture prediction to utilize temporal redundancy and transform coding of the remaining signal to reduce spatial redundancy, however with some changes to improve performance and error recovery. So, In comparison with video compression H.261 which is widely used for ISDN video conferencing, H.263 can achieve the same quality as H.261 with 30-50% of the bit usage. Most of this is due to the half pixel prediction and negotiable options in

H.263. H.263, in addition, is also better than MPEG- 1/MPEG-2 for low resolutions and low bitrates.

/ MPEG-4 Part 10: Advanced Video Coding

In early 2000 ITU and MPEG began working jointly again on a new video com- pression standard. They formed a group known as the Joint Video Team (JVT) to examine new issues in video compression . The offcial ITU and MPEGdesigna- tions are H.264 and MPEG-4 Part 10: Advanced Video Coding respectively. In this thesis, the ITU designation H.264 will be used to refer to the standard.

This standard was designed to target a wide variety of applications, including wireless , IP networks , and digital cinema.The standard has defined two separate main coding layers: the Video Coding Layer (VCL) and the Network Abstraction Layer (NAL). The VCL will be the focus of this paper, although the NAL will be discussed in some detail.

In comparison to previous standards, this standard is a departure from earlier standards, introducing many new technical features to further increase compression effciency, such as flexible macroblock sizing, 1/4-pixel interpolation , multiple reference picture capabilities, and an in-loop filter.

III. PROPOSED WORK

Encoder Decoder:

The objective of image processing is to analyze image data to make the system to understand, recognize and interpret the processed information available from the image pattern. For example, noise removal, sharpening, or enhancing brighten an image, making it easier to identify key features. These enhancement can be classified into two main groups – spatial domain based and transformation domain based methods . The popular histogram equalization (HE) based methods come in to the spatial domain, which can be further classified into two categories, i.e., global and local histogram equalization based techniques. Global Histogram Equalization (GHE) methods explore the histogram information of the entire image to form its transformation function. The classical HE can efficiently utilize display intensities, but it tends to over enhance the contrast if there are high peaks in the Histogram, which often results in a harsh and noisy appearance of the output image.

The video can be divided in to number of frames, that sequence can me in the form of f1,f2,f3 fn-1,fn.Then again frame can be divided in to macro block is encoded in an inter and intra mode can be perform with motion estimation and motion compensation that is to be count as prediction process.

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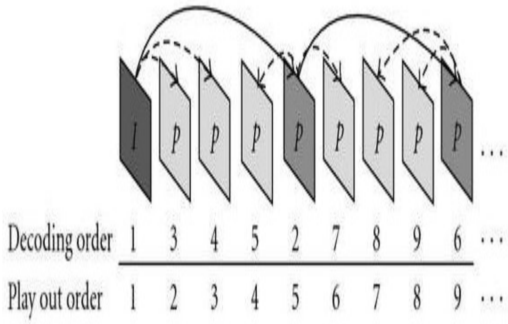
In this work inter prediction mode is performing with motion compensation prediction with previous frame that is to be consider as reference frame. That the sequence



to be consider as IPPPPPPP----.

Figure. 2. IPPPPsequence

The prediction picture is subtracted from the current block to produce as residual block that process can be consider as transformation process. Here transformation technique has implemented with hybrid wavelet transform. And quantized to be a set of coefficients i.e quantized transform coefficients, which are to be ordered and apply entropy process.

H.264 decoder is inverse process of H.264 encoder and it is used to decode the encoded video come from the encoder. Decoder receives compressed bit stream and decodes data elements to produce set of quantized coefficients, these coefficients has to be decoded from the bit stream and decoder creates prediction block, from that prediction block it has to send to Deblocking filter and generate frames.

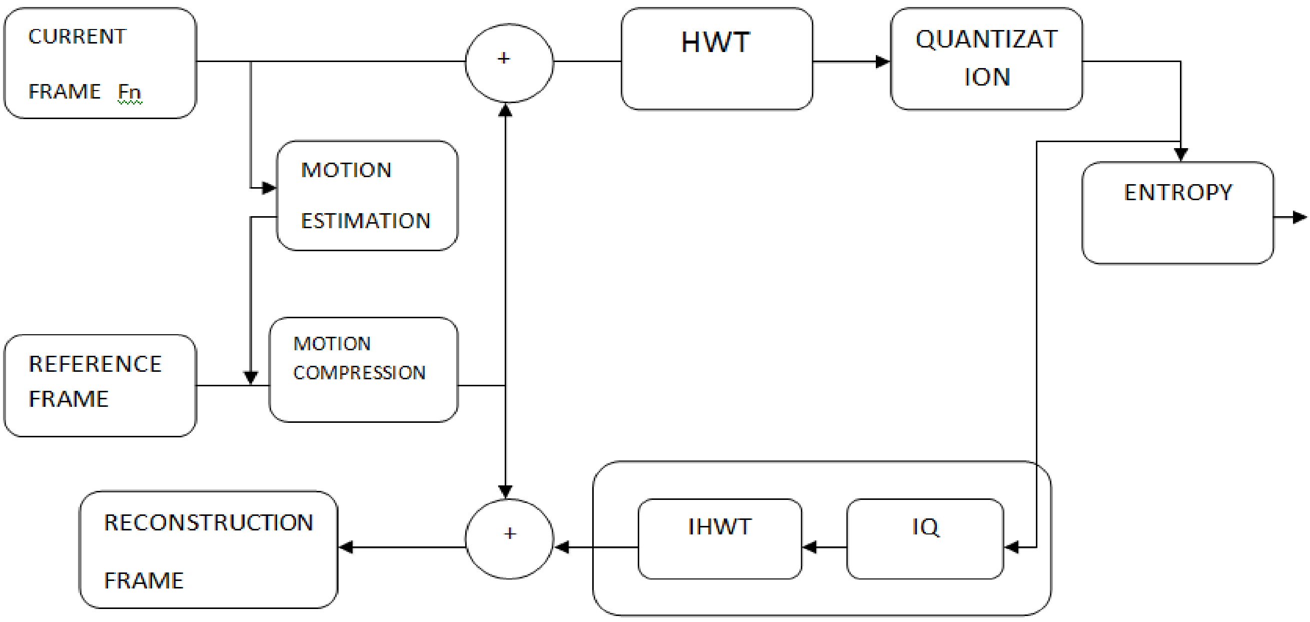


Figure 3 Proposed Block Diagram Of H.264

In figure 3 represents the encoder and decoder of the proposed techniques. It gives the detail explanation of the process of the video sequence uses the intra and inter frame formats in terms of compression efficiency at the time of writing (early 2010). The Moving Picture Experts Group (MPEG) and Video Coding Experts Group (VCEG) are examining the need for a new video compression standard. The consensus was that (a) there is likely to be a need for a new compression format, as consumers demand higher-quality video and as processing capacity improves and (b) there is potential to deliver better performance than the current state-of- the art. A number of different techniques were proposed, including decoder-side motion estimation, larger macro block sizes (up to 32 × 32), and more sophisticated in-loop Deblocking

filters, adaptive transform sizes and improved intra prediction. In general, all of these proposed algorithms offer the potential for better compression performance at the expense of increased computational complexity. Results of subjective comparison tests of the proposed architecture to conclude that ‘for a considerable number of test sequences significant peak signal noise ratio (PSNR) could be achieved’.

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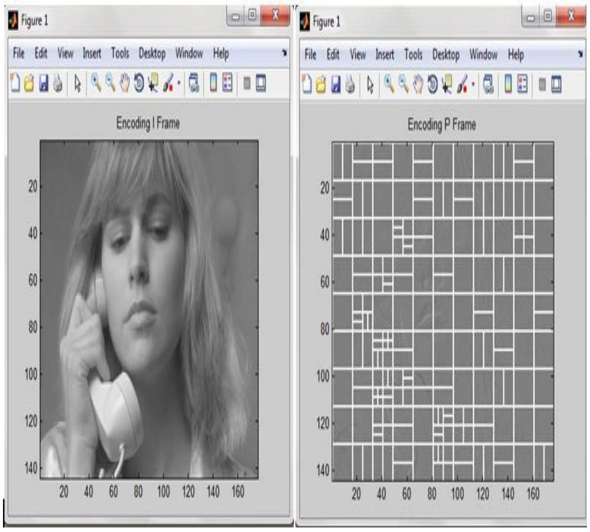
prediction, later on motion Compensation and motion Estimation is done on the frames by using the reference frame.

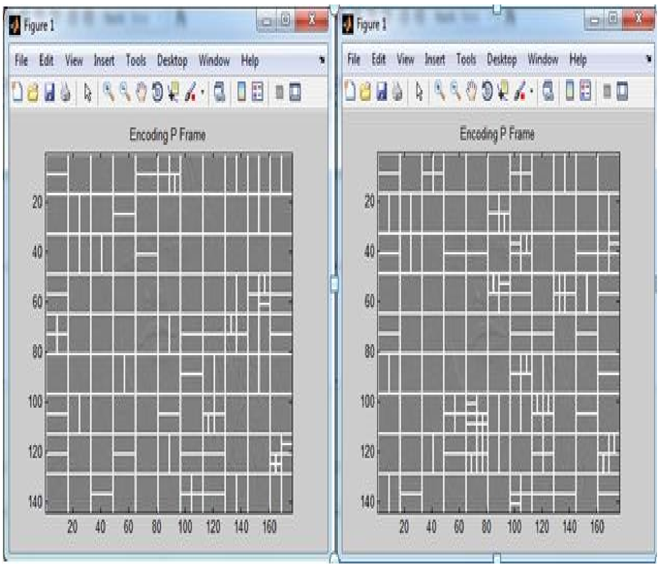
IV. SIMULATION RESULTS

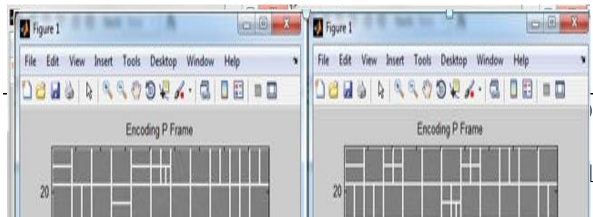
Encoding Process:

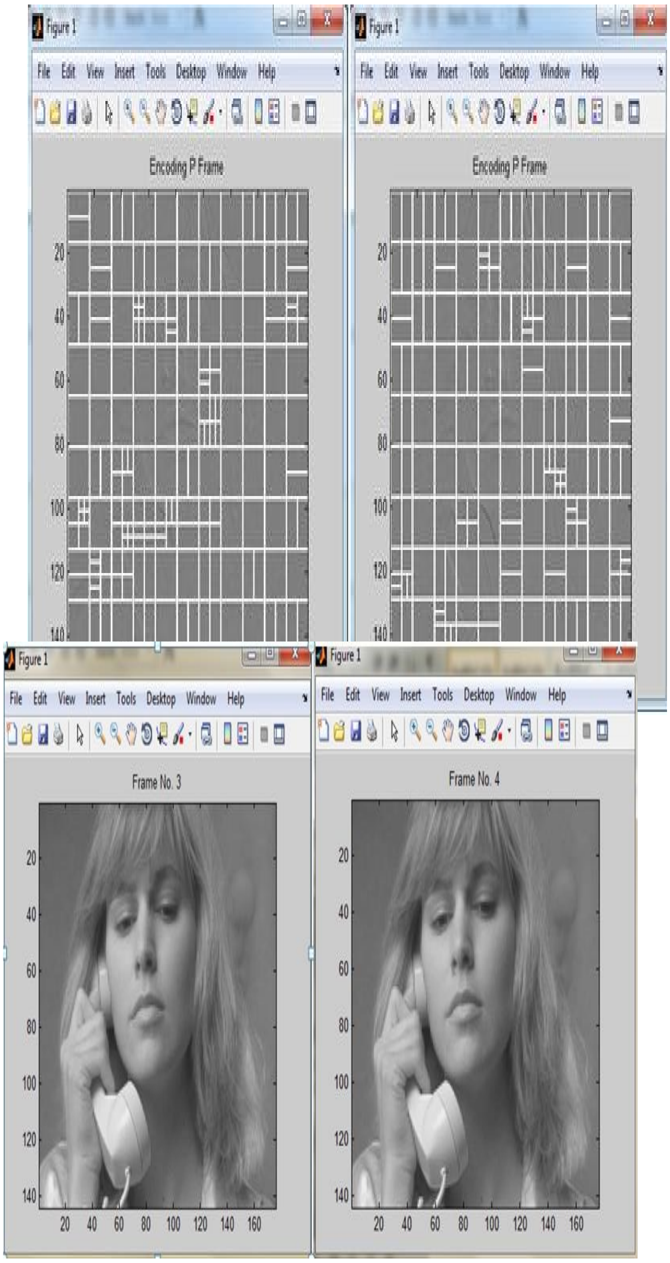
In this process ‘suzie_qcif.yuv’ is considering as a input video sequence. The block diagram of the basic encoder with extensions for non-intra frame coding techniques is given. Of course, this encoder can also support intra frame coding as a subset. Starting with an intra, or I frame, the encoder can forward predict a future frame. This is commonly referred to as a P frame, and it may also be predicted from other P frames, although only in a forward time manner. As an

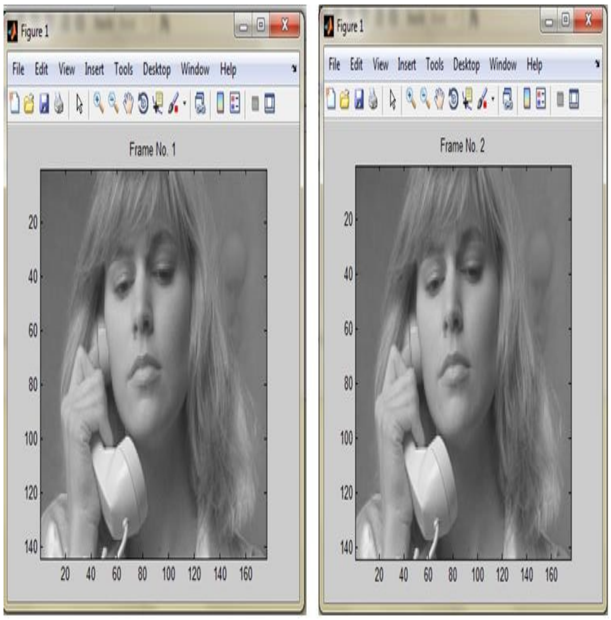


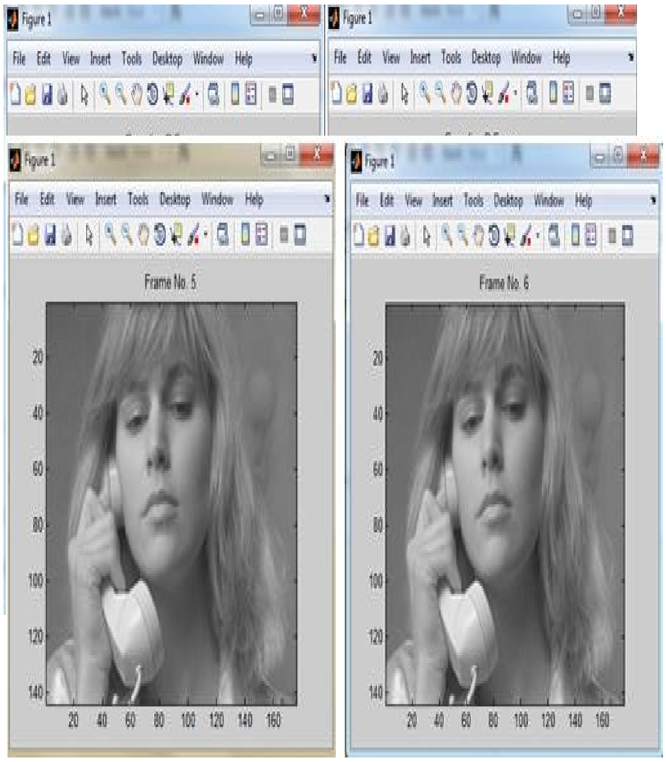
example, consider a group of pictures that lasts for 10 frames. In this case, the frame ordering is given as I, P, P, P, P, P,I,P,P,P,P,. sequence.





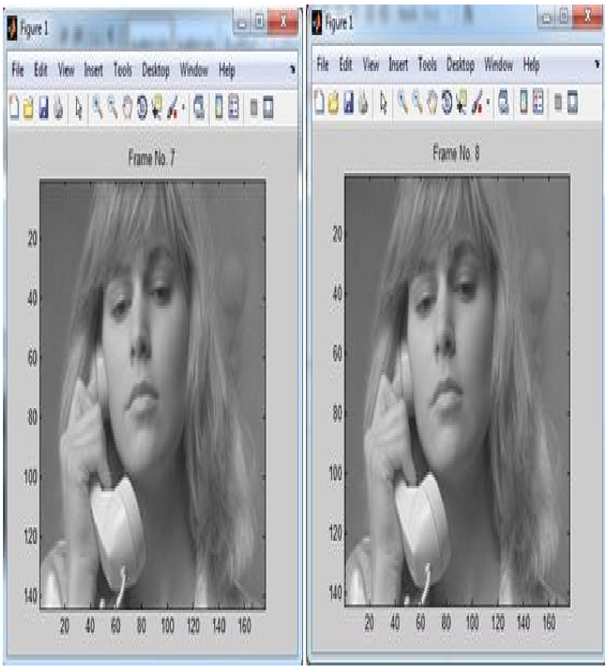






Decoding process:

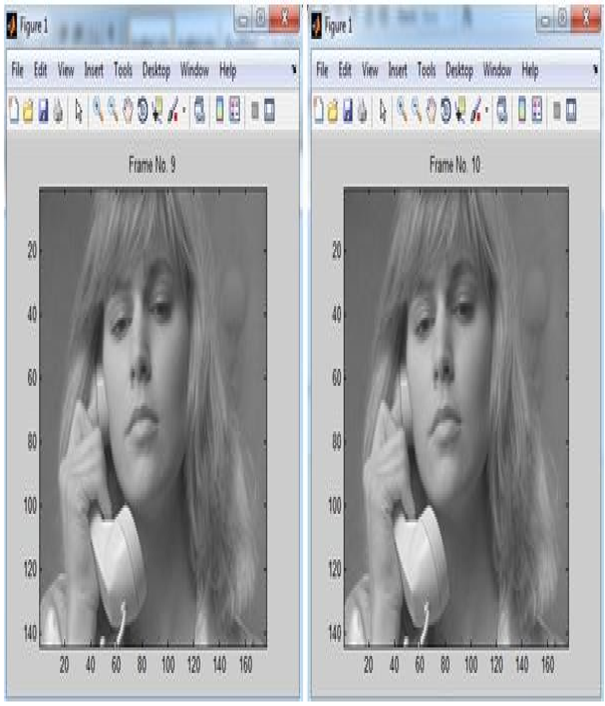
In this process bit stream, The block diagram of the basic decoder with extensions for non-intra frame coding techniques is given. Of course, this decoder can also support intra frame coding as a subset. Starting with an intra, or I frame, the encoder can forward predict a future frame. This is commonly referred to as a P frame, and it may also be predicted from other P frames, although only in a forward time manner. As an example, consider a group of pictures that lasts for 10 frames. In this case, the frame ordering is given as Frame 1 , Frame 2 ,... Frame 10.



First standardized in 2003, H.264/AVC is now a relatively mature technology. H.264 is certainly one of the leading subjective quality of one point, his implies that there is scope for a new coding format that significantly out-performs H.264/AVC. The current plan is to set up a Joint Collaborative Team (JCT) of MPEG and VCEG representatives to work on a new video coding standard. In this work, considered ‘suzie_qcif.yuv’ as test sequence its size is 176 width as well as 144 height, frame frequency is 30 Hz (30 frames per sec). The GOP test sequence is IPPPPPP-----, in this process I frame is having complete information of the scene or content of the image, whereas following P sequences is completely using comparison with I frame with process of motion estimation and compensation accounted as motion prediction technique such as inter and intra prediction. The split procedure partitions the MB into variable size block using a quad tree approach. In this method a macro block is divided into quarters of equal area Then using similarities of motion vectors of adjacent blocks we will show how to merge the sub-blocks for quarter division Loading a file and then generate the bit stream, the regular encoding process is to be done with motion estimation with different quantization parameters (QP) value. The same in the reverse process can be done in the Decoder, encoding frames and decoding frames As shown in the below

CONCLUSION

H.264/AVC represents a major steps in the development of video coding standards, in terms of both coding efficiency enhancement and flexibility for effective use over a broad variety of network types and application domains. In this work survey has been done in terms all the technical features such as Transformation in terms of various methods, motion estimation and compensation in terms of Inter and Intra Prediction and also the final section is Deblocking filtering process. Among them is enhanced motion prediction capability, use of small block-size exact-match transform, adaptive in-loop de-blocking filter, and enhanced entropy coding methods. The H.264/AVC is highly flexible with all motion



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model and the very efficient performance as comparing with the existing methods (H.261/H.262/H.263) performance of H.264/AVC as described in the project.

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