An Efficient Adaptive Motion Estimation with Encoding for Video Compression in WSN

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Abstract - Wireless Video Sensor Networks (WVSNs) - a kind of WSNs - involve sensor nodes that can capture, process and convey video outlines. Video compression is a procedure of avoiding redundancy and irrelevant data for an effective storage and transmission. Motion estimation is one approach that can be utilized as a part of a request to compress videos while preserving their great quality. In this paper, we proposed the Adaptive Motion Estimation (AME) based video compression technique. At that point, the motion estimation is finished by adaptive motion estimation algorithm, for choosing the motion, in which the underlying search point is haphazardly chosen. At last, the assessed motion frames are encoded by methods for Huffman encoding (HE) process. Furthermore, the proposed technique is compared with Equal-Distance-Lossless-Recompression (EDLR) and demonstrates that the test results reveal that the memory bandwidth can be decreased. It executes as a more grounded security algorithm for the motion vectors, which prompts raising the security level of video compression framework.

Key words: Wireless sensor network (WSN), Video, compression, frames and motion estimation.

I. INTRODUCTION

Wireless sensor networks (WSN) are drawing in a significant interest, since they represent an ease system for completing appropriated applications, for example, environmental monitoring, sea life science, natural surroundings studies, and video-reconnaissance, just to specify a couple of [1,-3]. Presently days, the utilization of videos are fundamental to the end goal of entertainment as well as communication. Regularly video record possesses a huge amount of memory to store [19]. Video compression is performed through a video code that takes a shot at one or more compression algorithms. Generally, it is finished by removing repetitive pictures, sounds,and scenes from a video. The benefit of video compression is Variable dynamic range and Byte-order independent [20].This procedure is very like customary vide coding, embracing a considerable measure of complex algorithms. In spite of the fact that, the processing speed could be truly constrained, they are still appropriate for compact/versatile applications [4]. The essential aim of advanced video compression innovations is to symbolize the first information into a substantially much smaller number of bits while securing a worthy video quality [5]. Recently there are some motion estimation algorithms, for example, whose estimation a range is focused for successions or beneath [6] propose an update-type motion estimation plot with a multi-resolution approach for motion compensated image addition [7].Presents a fast altered precious stone scan algorithm for motion estimation. Furthermore, some video coding procedures planning to help the high definition sequences are additionally proposed [8]. It's portrayed as looking through the best motion vector, which is the disengagement of the coordinate of the best-related square in before design for the piece in present casing. In video compression, the essentialdesign objective is to reduce the normal number of bits utilized to symbolize a video quality [9].

The best proficiency is accomplished when utilizing the costly rate-mutilation optimization. It can reduce computational multifaceted nature with great quality performance. All things considered, this algorithm can't completely use the stereo-motion consistency limitation to acquire motion and dissimilarity vectors at the same time [10]. Since the lossless compression, the length of compressed information can't be ensured to be littler than a specific value.

II. LITERATURE REVIEW

In 2016 Christos P. Antonopoulos et al. [11] have proposed the differentiates it from comparative research endeavors, is the work of real-world Electroencephalography (EEG) and Electrocardiography (ECG) datasets including the two most requesting Epilepsy modalities. Accentuation is put on WSN applications, in this way the respective measurements focus on compression rate and execution dormancy for the chosen datasets. The assessment results reveal critical execution and behavioral attributes of the algorithms related to their many-sided quality and the relative negative impact on compression inactivity instead of the increased

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compression rate. It is noticed that the proposed method figured out how to offer significant favorable position particularly expecting to accomplish the optimum tradeoff between compression rate-latency. In particular, proposed algorithm managed to combine the highlycompletive level of compression while guaranteeing least latency consequently showing real-time abilities.

Compressing encrypted data with the assistance of a subservient information and Huffman coding by KasmeeraK S et al. in 2016 [12].For scrambling the first picture, it is controlled with a pseudorandom number grouping produced utilizing a secret key. The subservient information is likewise created by the substance proprietor. The encoded information is then compressed utilizing a quantization component and Huffman coding. For quantizing the image the subservient data delivered by the substance proprietor is utilized. The quantized esteems are then coded utilizing Huffman coding. At the reconstruction side, the essential substance of the information is reconstructed. Exploratory results demonstrate that the compression proportion mutilation execution of this strategy is better than the current Techniques.

A standout amongst the best searching techniques that yield precise results yet is computationally exceptionally costly is the Full Search algorithm by Nijad Al-Najdawi et al in 2014.[13] Researchers attempt to build up fast search motion estimation algorithms to reduce the computational cost required by full-Search algorithms. In this research, the creators present another fast search algorithm in view of the progressive hunt approach, where the quantity of searched locations is reduced compared to the Full Search. The original image is sub-inspected into extra two levels. The Enhanced Three-Step Search Algorithm and another proposed searching algorithm are utilized as a part of the back to back two levels. The results demonstrate that by utilizing the standard precision measurements and the standard set of video groupings, the execution of the proposed hierarchal search algorithm is near the Full Search with 83.4% reduction in unpredictability and with a matching quality more than 98%.

In 2014 Twinkle Sebastian *et al.* [14] have recommended thehierarchical search approach influencing utilization of three different algorithms To full Search Algorithm, New Cross Diamond Search Algorithm and a New Three-Step Search Algorithm are utilized. The input image is sub-tested into extra two levels. The Full Search is performed on the most elevated amount where the multifaceted nature is relatively low. The New Cross Diamond search algorithm and a New Three-Step Search Algorithm are utilized as a part of the back to back two levels.

In 2014 Bernatin *et al.* [15] the proposed strategy utilizes the motion vectors, found from estimation utilizing adaptive rood design search and is repaid all inclusive. The hybrid DWT-DCT change abuses the properties of both the DWT and DCT systems and gives a superior compression. The hybrid compressed edge is quantized and entropy coded with Huffman coding for produced bit streams are transmitted to the decoder. The algorithm accomplishes the measure of the compressed frame sparing by around 98% in its storage space.

III. METHODOLOGY

Wireless Video Sensor Networks (WVSN) is a classification of WSNs in which sensor nodes are furnished with a computerized camera. Therefore, they are equipped for capturing, processing and communicating mixed media substance in real time. This video compression WSN process, at first, the video is changed over into video frames. Motion estimation is the way toward deciding the motion vectors, where a region in the current frame is compared with neighboring regions in an arrangement of reference frames. It can be utilized as a part of a request to compress videos while preserving their great quality. Our motion estimation algorithm finds the best coordinating piece with a reduced number of search points. At first, the input video is read out and the frames are extracted. Here consider AME method to video frames. With a specific end goal to accomplish the separated motion vectors are encoded by utilizing HE for video compression process, this entire video compression model appeared in beneath figure 1. It is a procedure which for the most part done in two procedures. In the first as a statistical model is going exorbitantly amassed, and then, in the second, the data of the frame is encoded which is created by that statistical model.

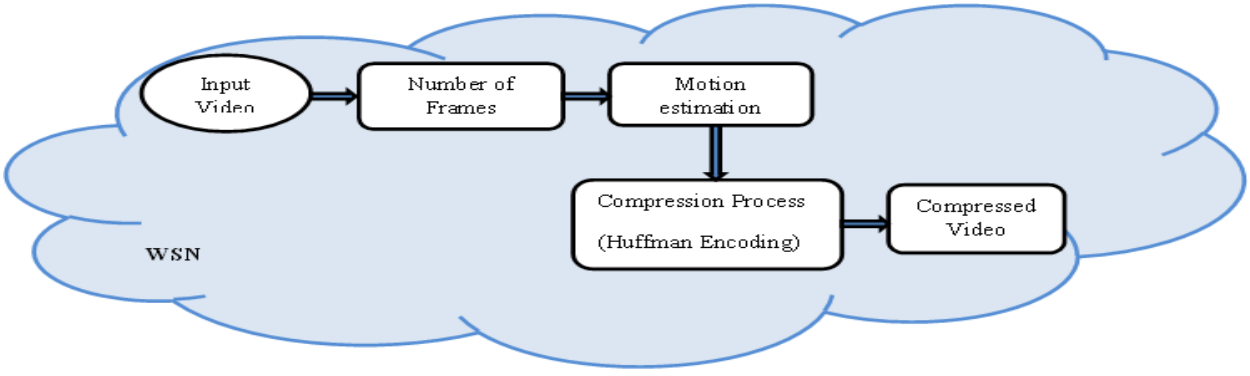

Fig 1: Block Diagram for WVSN

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3.1 Motion Estimation

To abuse the image data redundancy in image sequences there is a need to assess motion in the image sequence so one can process along motion directions. The interframe introduction is the method that additions one or more frames between two consecutive frames in the video sequence.

Adaptive Motion Estimation (AME)

The significant benefit is that it can increase the possibility of finding the genuine motion vector and reduce the computational requirement if the center-biased Block Matching Algorithms (BMA's) are utilized. After motion estimation, modules, for example, noise reduction and compression can be executed. In AME algorithm, three levels of the hierarchy are utilized as a part of a request to disentangle the procedure. The accompanying delineates the steps of the proposed work for every video frames. This motion estimation process having a few stages, for example,

- The most minimal level comprises of the reference frame as well as a current frame at its full resolution. And after that, the input frame is converted into (8*8), absolutely all frames as (32*32 pieces) to the second level.
- Here select initial five squares of video frames from total frames of both reference and the current frame to deliver next level.
- The motion evaluated in highest level utilizing block size; here diamond search algorithm is performed to get the underlying motion vectors. So as to accomplish the better performance, initial search point is haphazardly chosen.

After estimation of motion frame, it is essential to provide encoded to the estimated motion frame. For this purpose, HE algorithm is utilized.

3.2 Video Compression Process

Video compression is a procedure of reducing the size of video documents. Fundamentally, it can be compressed by abusing Spatial as well as temporal redundancy. The procedure of Video Compression is comparative as Fractal Image Compression. The primary difference between them is that the video compression exploits the closeness between consecutive frames and thus it acquires higher compression rates if compared with image compression. The work we have considered Huffman encoding (HE) for the compression process.

3.2.1 Huffman encoding (HE)

Huffman Coding Technique is a methodology which tackles the two data and image for compression. It is a procedure which usually done in two passes. In the initial pass, a statistical model is going exorbitantly amassed, and from that point onward, in the second pass, the image data is encoded which is created by that statistical model. These codes are of variable code length using a basic number of bits. Huffman codes must be determined remotely as a contribution to JPEG encoders. Note that the shape in which Huffman tables are represented in the data stream is an indirect determination with which the decoder must develop the tables themselves preceding decompression. The flowchart of the Huffman algorithm is delineated in figure 2.

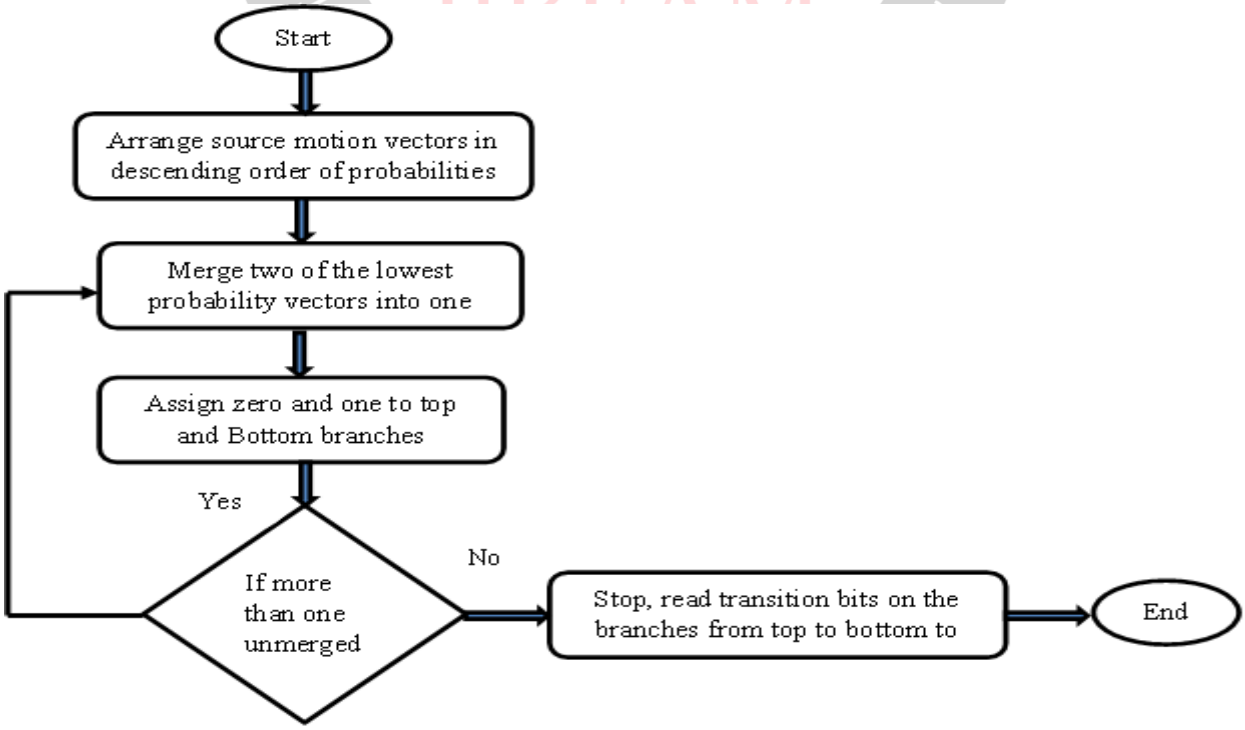

Fig 2: Flowchart for Huffman Encoding

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This idea causes a reducing in the normal code length and in this way the broad size of compacted data is smaller than the first. The algorithm for building the encoding follows this algorithm every image is a leaf and a root.

- Read the estimated motion vectors from frames
- The probability of images are organized in diminishing request and lower probabilities are combined and this progression proceeds until the point that lone two probabilities are left and codes are relegated by deciding that; the most astounding plausible image will have a shorter length code.
- Advance Huffman encoding is performed i.e. mapping of the code words to the comparing images will bring about a packed data. Generally,it consists of four steps it's described in below section.

(a) Creating Huffman code for original data

Make another node by using these two probabilities as branches and the new node will be the arithmetic sum entirety of these two probabilities. This procedure should be rehashed using the new code until the moment that only a single node left. Each upper part and lower individual from each consolidate should be indicated as "0" and "1" or a different way. The code for every one of the principal image is resolved while exploring from the root node to the leaf of the tree by observing the branch name of each node.

(b) Code conversion

The code transformation ought to be conceivable evidently in the wake of producing the Huffman code for the principal data. The procedure is according to the accompanying: Initially, the first data and its code word will be taken. Using this code conversion process is done by uniting the two images (i.e.) the number of times the selected blend of two images is rehashed.

- ✓ In the first place, the joining procedure can be associated with the chosen images when it satisfies the going with condition (i.e.) if the chosen frame is rehashed for more than two times. By then, it satisfies the condition and met all requirements for the joining procedure.
- ✓ Second, from the chosen contest there should not be a similar blend of the primary digit of the pair.
- ✓ Third, the bit length of the essential position of the pairshould be lesser than the bit length of the second position of the pair.

If the over three conditions are fulfilled and the principal position of the symbol is repeated as twice, at that point the new combine ought to be replaced for the chosen match or old pair. Also, the above procedure is repeated for all chosen code words.

(c) Encoding

The encoding strategy is done on the premise of the amalgamation of the image used as a piece of the code change based on a couple of conditions and consolidating. The procedure is according to the accompanying: at initially, the code change process is to be checked to select whether the code molded with the help of code transformation process is to be measured or not. By then, the more than three conditions are associated with a check each frame to encode the first data. After this affirmation, a code is framed for the principal data [18].

(d) Decoding

The decoding procedure is misleadingly basic. Beginning with the first bit in the stream, one at that point utilizes successive bits from the stream to decide if to go left or right in the decoding tree. When we reach a leaf of the tree, we've decoded a character, so we put that character onto the (uncompressed) output stream[21].

IV. EXPERIMENTAL RESULT ANALYSIS

Our proposed video compression model implemented stage as Matlab software. Here Akiyo database is considered for the compression process. The result was assessed by utilizing Equal-Distance-Lossless-Recompression (EDLR), Compression Ratio (CR) and Memory-Bandwidth Effective (MBE) parameters.

Database

Akiyo is a 300-frame head and shoulder sequence in QCIF resolution with little motion. QCIF images are 176 pixels wide and 144 pixels tall (176 x 144). A female arbitrator is reading news just by moving her lips and eyes in Akiyo arrangement. The series of video shows the news scenario.

Fig 3: Video Frames

EDLR

For a general video sequence, the most of the pixels have a higher spatial-correlation to their encompassing pixels. Equal-Distance Prediction uses the three accessible pixels.

MBR

Be that as it may, compression can also potentially increase performance by reducing bandwidth requirements, and reduce power dissipation

CR

The compression ratio is characterized as the proportion of the size of original image and size of the compressed bits stream.

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Table 1: Parameters for Proposed model

Frames	EDLR	MBR	CR (%)
1	1.67	1.54	78.22
2	1.75	1.62	82.22
3	1.59	1.40	79.22
4	1.72	1.56	86.55

Table 1 demonstrates the proposed compression method, the estimation of CR of frame 1 as 78.22%, the MBR value is 1.54 and the EDLR value is acquired by 1.67 of Akiyo video frames. From the examination about the advancements of video compression innovations in this investigation, we can see that numerous compression improvements were made by motion based process. From the result, comprehend that our strategy accomplishes the better quality with maximum compression proportion when compared to the conventional techniques.

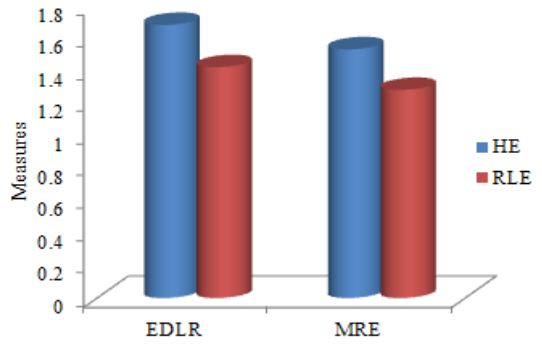

Fig 4: Comparison for EDLR and MRE

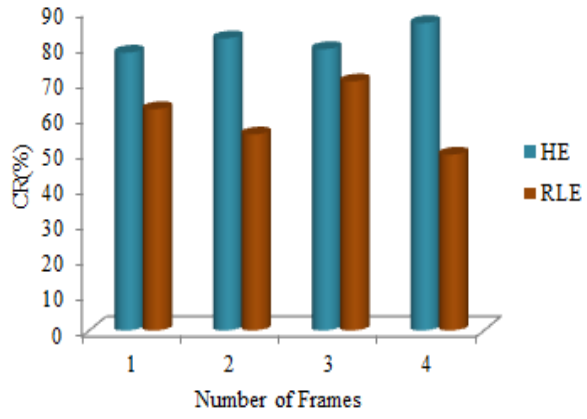

Fig 5: Comparative analysis for CR

From the figure 4 and 5 inspect the proficiency proposed and presented strategy and Run Length Encoding (RLE). Akiyo video gave the maximum CR in HE the normal as 75.56% it's compared to existing one. For the bandwidth, the proposed totalscheme accomplishes more than 85% bandwidth reduction. The bandwidth is more than that for a few sequences because that the proposed scheme applies significantly bigger search range to ensure the ME performance for high motions with giving up some bandwidth utilization. Also, the EDLR and MRE as better performance of proposed model compared to another system. The last one can convert the residuals to proficient code words. Test results demonstrate that EDLR has better lossless CR.

V. CONCLUSION

In this paper, a novel video compression scheme has been proposed and assessed. The compression scheme addresses this by utilizing a fast and simple compression algorithm previously proposed for cache compression. The proposed encoder and which results exhibited that the proposed encoder gives better compression results due to the utilize of AME algorithm and HE.This will give better performance in motion estimation in terms of search points and reduce the encoding time. This strategy applies thresholds for different motion search levels with a specific end goal to terminate the redundant high-level searches as needs are; it additionally applies the early refinement termination to avoid unnecessary refinement for high levels. The temporary results demonstrate that the proposed strategy can amazingly spare a memory bandwidth and does not decimate any visual quality. Also, the compression procedure which compresses the information by referring them to the higher level is proposed to proficiently reduce the MRE.

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