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Energy Efficient and Reliable High Quality Video Transmission Architecture for Wireless Sensor Networks

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Abstract: Due to advancements in the technology, video transmission is a key feature in several applications. The transmission of the video from the source to the sink is quite different from the transmission of images-based data. The transmission of the video over the wireless sensor network is not an easy task with the available protocols. They have several disadvantages related to the energy efficiency and the reliability. Novel architecture namely high-quality video transmission architecture has been proposed in this paper. This is an energy efficient architecture. To conserve the energy during the transmission, this architecture does not support retransmission of the packets. But the dropping of the packets helps in improving the reliability and the life time of the network. This architecture majorly involves three layers namely the application layer, the network layer and the transport layer. The transmission of the data packets is based on the priority levels. Moving Picture Experts Group (MPEG - 2) technologies is used in the proposed work. Two different frames namely the key frame and the variant frame are used to prioritize the packets. The data packets with the highest priority from the variant frame is transmitted first and then followed by the data packets of the key frame. The data is segmented into smaller units and discrete cosine transform is applied over each unit. The inter link between the transport layer, application layer and the network layer is analysed by means of the state diagram. The results have been tabulated and depicted by means of graphical representations. Comparative analysis has been made between the proposed high quality video transmission architecture and the diversified architecture. The proposed method has been found to have produced comparatively better results and possesses a high quality video transmission with enhanced Peak Signal to Noise Ratio (PSNR) and reduces energy consumption.

Keywords: packet dropping technique; transport layer; variant frame compression; video transmission; wireless sensor networks

1 INTRODUCTION

The integration of voice, video, and data communications can be consolidated into a unified service commonly referred to as multimedia over Wireless Sensor Networks (WSN). "Multimedia" encompasses various media formats, including music, movies, and games [1]. The potential consequence of employing this data transfer over a WSN is increased system congestion. The utilization of the split and transfer method holds significant importance in this project as it effectively mitigates potential issues, as exemplified above. Wireless Multimedia Sensor Networks (WMSNs) are self-organizing networks comprising sensor nodes that establish wireless connections. These devices can acquire video and audio streams, capture still images, and collect scalar sensor data. However, it is important to note that these sensors have certain limitations regarding power consumption, poor Peak Signal to Noise Ratio and data processing speed [2]. The transmission of multimedia content over Wireless Sensor Networks (WSNs) poses significant challenges due to the need for Quality of Service (QoS) guarantees, such as high bandwidth availability, stringent delay requirements, and minimal data loss. In recent times, wireless multimedia sensor networks (WMSNs) have adopted a cross-layer methodology to enhance the transmission of multimedia data across wireless sensor networks (WSNs) under various wireless conditions [3]. This work aims to develop an adaptive cross-layer approach that enables efficient transmission of multimedia data over Wireless Sensor Networks (WSNs) while concurrently conserving energy resources. The utilization of an adaptive priority video queue facilitates the scheduling of transmissions by considering the nature of the data being transmitted. Additionally, it offers adaptive channel selection at the application layer, enabling the determination of optimal video encoding parameters based on the prevailing conditions of the wireless channel. Advancements in microelectromechanical systems (MEMS) and wireless communications have facilitated the development of wireless sensor networks (WSN) [4]. An ideal network path between the source and the sink can be easily determined by employing the proposed single-path routing protocol [5]. With this method, data can be sent along a reliable route [6] in segments by first negotiating with the chosen parent node at each intermediate step [7]. Probability functions [8] are used by the dropping scheme [9] to select data packets for deletion. Prioritisation [10] of data packets and the hierarchy level [11] of the video source nodes [12] are also taken into account by the dropping scheme. Modifications to the EQV-Architecture's parameters allow it to be successfully implemented in MANETs.

The existing applications like live streaming, monitoring, were intended to communicate the video files (MPEG) from point of occurrence to the base station. These communicated files experience a major setback in terms of Peak Signal to Noise Ratio (PSNR) due to the existence of high power noise signal and thus degrade the level of signal. In addition, the communication of MPEG files required huge power and the packet dropping loss is also a major concern. These concerns deteriorate the MPEG file communication and its applications, which is the motivational factor of this proposed research work.

2 RELATED WORKS

Wireless multimedia sensor networks (WMSNs) are networks composed of ad hoc wireless sensor nodes. The data types that can be transmitted via these networks range from video and audio to still images and scalar sensor readings. However, it is critical to recognise that these sensors have constraints in areas such as power requirements, storage space, network connectivity, and processing speed. Path scheduling is a method for determining the best route between two nodes in terms of delay, bandwidth, loss, and energy consumption, as well as the minimum number of hops between them [13]. Metrics for the Wireless Sensor Network (WSN) application are determined by the following criteria. In constrained networks like Wireless Sensor Networks (WSNs), path scheduling uses routing metrics like congestion, hop count, and interference to rank available paths in order of preference [14]. Data packets with strict deadlines are sent over the quickest possible path; data packets that cannot tolerate errors are sent over the most reliable connections, and data packets with no special requirements are sent using the least amount of power [15]. This research shows how to transmit video data in a way that takes into account the data's nature and prioritises its transmission over multiple paths. Periodically, source nodes will send control messages to sink nodes, updating the latter on the current state of the routing path [16]. The sink nodes will then inform the source nodes of the paths that should be prioritised based on energy, buffer status, hop count, and path reliability. As a result, packets can be sent from their respective source nodes via the optimal path determined by the packet type. A routing algorithm inspired by ant behaviour prioritises and ranks paths based on a number of quality of service (QoS) metrics, including loss ratio, memory utilisation, waiting delay, and energy consumption [17]. An alternate strategy involves applying AI to evaluate and rank potential routes. The system evaluates a number of factors, including the link's remaining lifetime, the link's probabilistic reliability time, the packet error rate, the received signal strength, and the battery life. In this investigation, we evaluate each possible route not by signal strength, remaining energy, or available memory, but by drain rate, delay, cross-layer protocol levels, and available buffer space [18]. In this paper, they present a new communication cross-layer architecture for video transmission over Wireless Sensor Networks (WSNs). This study demonstrates the methodology for discarding packets by considering node energy and video compression layer priority information [19]. This paper analyzes the CLAR protocol, a novel communication protocol. The network layer of this protocol employs the Ad-hoc routing protocol known as Dynamic Source Routing (DSR) to determine the optimal route. Using the DRMACSN MAC layer protocol, this estimation is saved for each neighbouring node [20]. This protocol determines the maximum number of transmissions allowed for each neighbouring node before exchanging routing control packets. The assumption posits that the degradation of communication in the p-data, encompassing structural and positional information of an image, exerts a more pronounced influence on image quality compared to a loss in the v-data about pixel value information [21]. This study demonstrates that the decoding process for p-data is contingent solely upon the segment. As a result of using a cross-layer strategy, both distortion and power consumption were decreased. The optimisation function takes into account the Bit Error Rate (BER), the Automatic Repeat Request (ARQ), and the data transmission rate.

In order to save power, it is preferable to either allow each node to independently determine its transmission range or to transmit data using the minimum amount of power required to sustain connections [22]. The cross-layer strategy employed in this approach establishes a direct connection between the Application and MAC layers while disregarding the Transport and Network layers. This approach streamlines the process of protocol design. The study presents the Low Energy Self-Organizing Protocol (LESOP). Wireless sensor networks of significant magnitude can effectively monitor and trace targets [23].

The Arduino Uno microcontroller board was utilized in this experiment. The single-board microcontroller discussed herein is widely recognized and utilized, rooted in the open-source Wiring platform [24]. The primary objective of this initiative is to streamline the utilization of electronics in projects spanning multiple fields.

The syntax and libraries for programming Arduino hardware are developed using the Wiring programming language. This programming language resembles C++'s structure and syntax, albeit with simplifications and modifications. Additionally, a Processing-based Integrated Development Environment (IDE) is employed. As per the specifications outlined by the World Wide Web Consortium (WVSN), certain application layer aspects exhibit complexity [25]. The authors consider the quality of service (QoS) at the application layer; however, their proposed solution fails to fulfill various Wireless Multimedia Sensor Networks (WMSNs) requirements, such as delay, reliability, and energy consumption [26]. The communication optimizations necessitate a substantial amount of network computation, a task beyond the capabilities of WVSN.

Nevertheless, it has been observed that MPEG, H.263, and H.264 employ intricate encoding algorithms that result in inefficient energy utilization. TCP protocols are afflicted by several issues, namely high energy consumption, retransmission expenses, and latency problems. UDP is considered more advantageous than TCP in real-time applications such as media streaming due to the prioritization of timeliness over reliability [27].

Several additional transport protocols have been devised for scalar wireless sensor networks (WSNs) to conserve energy, guarantee reliability, and effectively manage traffic [28]. Event-driven applications can be facilitated by a network with a relative geographical topology, enabling efficient routing and adaptive prioritization. The mechanics of the game operate in the following manner [29].

The multipath routing protocol facilitates the transmission of packets in both best-effort and real-time scenarios. However, it cannot accommodate real-time traffic priorities requiring varying quality levels. This protocol aims to enhance the performance of third-generation mobile sensor networks to optimize service delivery [30].

The implementation of "back-pressure re-routing" effectively mitigates congestion. The proposed methodology effectively mitigates the transmission of packets over congested links. The topic of interest is the estimation of link quality [31, 32]. The inability of BAR to fulfill multimedia transmission needs can be attributed to the fact that WMSN encompasses considerations beyond energy efficiency.

The identified limitations of the existing works are that it consumed huge power for data transmission and a poor Peak signal to noise ratio at the receiver end. The transmitted video signal is prune to the noisy attack and the signal content in the transmitted file deteriorates as it propagates through the wireless sensor nodes. In addition, the existing work experiences a massive packet loss which is termed as packet dropping and is highly insecure during the video file transmission.

To overcome this drawbacks the proposed work is intended to introduce a transport layer protocol for the secure video transmission and a network layer protocol to overcome the data packet dropping. The proposed work aims to provide a better Peak signal to noise ratio with minimal power consumption and packet dropping.

3 PROPOSED WORK

The available architectures for video transmission have certain drawbacks. They do not prove appropriate services to the layers. This lead to the development of a novel method called high quality video transmission protocol. The proposed architecture provides video transmission in an energy efficient manner. It deals with three layers of the OSI model. The communication between these layers is shown in Fig. 1.

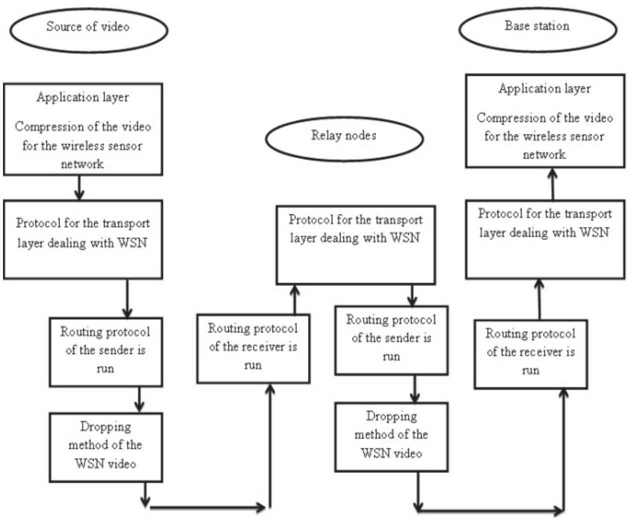


Figure 1 Block diagram of the proposed architecture

3.1 Transport Layer Protocol for Video Transmission

The major drawback of the video transmission using the transport layer protocol is that the existing techniques do not provide the required real time services. This drawback can be avoided using the proposed architecture. In the proposed architecture, the transport layer uses the information provided by the upper layers. The transport layer provides reliability during the data transmission but it does not take responsibility for the re-transmission. It also provides inter layer commands that are used by other layers to get real time services.

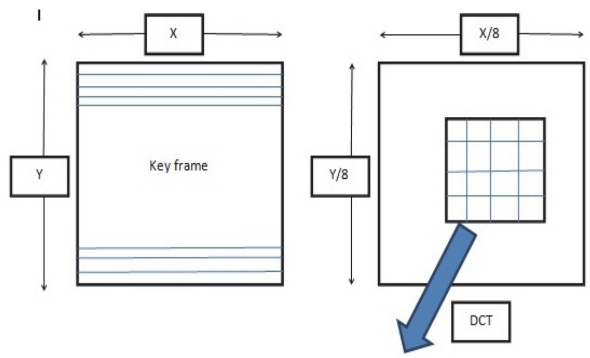
3.2 Network Layer Protocol with Dropping Technique in WSN for Video Transmission

Network plays a crucial role in the transmission of the video from the source to the destination. The energy efficiency is achieved with the help of the routing protocol and the dropping method. The proposed protocol used for routing uses a single path for the transmission. The energy efficiency is found to be more than the multipath routing techniques. The dropping technique used in the proposed architecture has helped in the conservation of energy. This in turn increases the life time of the network. Depending upon the energy consumed by the packets and the video information it holds, the dropping technique determined whether to keep the packets or to discard them. As a result the quality of the video can be retained and the energy can also be conserved.

Fig. 1 represents the block diagram of the proposed work. The source MPEG file is compressed in the application layer of the wireless sensor networks. The routing protocol of the sensor node executes the dropping method and is communicated over the relay nodes. In turn the receiver base station receives the MPEG signal and executes the protocol for the transport layer to verify the key in the received MPEG signal. Finally, the MPEG signal is decompressed to obtain the original MPEG signal.

3.3 Sub Application Layer Protocol for Video Transmission

The compression and the transmission of the video can be done using the sub application layer protocols. It is based on the MPEG-2. The drawbacks related to the energy and bandwidth can be reduced using the MPEG model. The energy consumption, bandwidth and the quality of the video can be adjusted by the user. Two different kinds of frames for video utilized by the MPEG are key frame and the variant frame. The key frame can be carried out through the following steps. Fig. 2 shows the key frame and blocked key frame after discrete cosine transform.



-325	121	-22	-16	16	0	-11	13
112	-46	22	13	-9	0	20	0
97	-81	19	9	-16	0	0	0
56	-19	16	-10	0	0	0	0
-6	33	-16	0	0	0	0	0
9	-15	0	-2	0	0	0	0
-41	20	-20	0	0	-20	0	0
0	-21	0	0	-20	2	0	2

Figure 2 Key frame and blocked key frame after discrete cosine transform

Step 1: zero is included in the middle of each range by subtracting 128 from the pixel. The Key frame is segmented into 8 × 8 blocks. This segmentation is done without overlapping.

Step 2: Discrete cosine transform is applied to the blocks separately. The output of this step is matrix with dimension of 8 × 8.

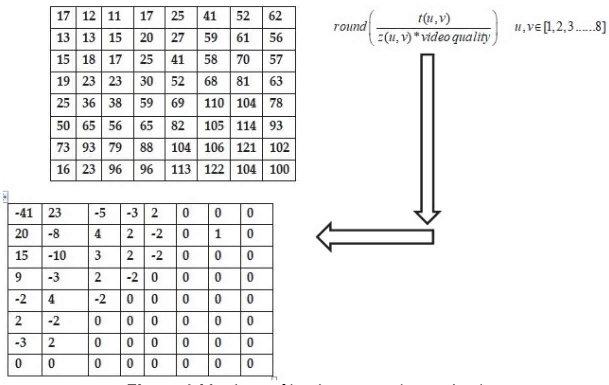
Step 3: This step deals with quantization. The discrete cosine transform coefficients that are not very important are neglected using the matrix of quantization. To carry out this step, the discrete cosine transform matrix is segmented by the elements of the quantization matrix. The compression quality can be varied by using the quality coefficient.

Step 4: The block elements are segmented into 13 levels. This is done with the help of the coefficients of the discrete cosine transform. Each level has a unique priority level. This step paves way for the linearization.

Algorithm:
Input: MPEG signal
Output: Pkey (N)
Processes:
For j = 0 to 13
If $j < N$
Then
Assign Pkey(j) to Li
Else
Assign
Assign Pkey(N) to Li
End if
end

The quality is determined by the user and the quality determines the number of pixels transmitted. The quality of the video and the consumed energy is directly influenced by the value of N.

Step 5: The run length encoding is applied to the 64 blocks. The linearization is done in the zigzag manner. After the Key frame, the data is transmitted to the successive communication layer where the data transmitted to the base station is a hop by hop manner.



17	12	11	17	25	41	52	62
13	13	15	20	27	59	61	56
15	18	17	25	41	58	70	57
19	23	23	30	52	68	81	63
25	36	38	59	69	110	104	78
50	65	56	65	82	105	114	93
73	93	79	88	104	106	121	102
16	23	96	96	113	122	104	100

$$round\left(\frac{t(u,v)}{z(u,v)*video\ quality}\right) \quad u,v \in [1,2,3......8]$$

-41	23	-5	-3	2	0	0	0
20	-8	4	2	-2	0	1	0
15	-10	3	2	-2	0	0	0
9	-3	2	-2	0	0	0	0
-2	4	-2	0	0	0	0	0
2	-2	0	0	0	0	0	0
-3	2	0	0	0	0	0	0
0	0	0	0	0	0	0	0

Figure 3 Matrices of luminance and quantization

3.4 Variant frame compression

The result obtained after performing the subtraction operation in the key frame is called the variant frame. In the key frame, the transmitter and the receiver are buffered until the arrival of the next frame. A new video can be drawn from the key frame at the sink. The steps involved in the variant frame compression are different from those of the Key frame steps. They are listed below.

Step 1: The variant frames are segmented on the 8 × 8 basis.

Step2: The zeroes of each block are counted using the function $F(blk)$. The highest number of blocks is 64 and they are divided equally with the minimum boundary of $Z(k)$ and a maximum boundary of $Z(k + 1)$.

Algorithm:
Input: MPEG signal, m
Output: Level assigning to BZ
Processes:
For m = 1 to 1/8
Do
For n = 1 to y/8
Do
$BZ = F(blk)$
If $Z <= BZ < Z(1)$
Then
Assign Level(1) to BZ
Else if $Z(1) <= BZ < Z(2)$
Then
Assign Level(2) to BZ
Else if $Z(k) <= BZ < Z(k)$
Then
Assign Level(k + 1) to BZ
Else if $Z(N – 2) <= BZ < Z(N – 1)$
Then
Assign Level(N – 1) to BZ
Else
Assign Level(N) to BZ
End if
End for
End for
End

Fig. 4 shows the blocked variant frame.The assigning of priority to each block is done based on the following equation.

$Blk(m, n)$ ($1 <= m <= x/8$ and $1 <= n <= y/8$) gets $P(1)$ ($1 <= t <= N$) if and if $L(t)$ is assigned to $blk(m, n)$.

The priority of the variant frame is quite important since it has pixels that vary a lot. The priority of level $P(1)$ has more number of varying pixels. Highly reliable transmission is used for the transmission of packets to the receiver. The priority of the level $P(N)$ has less number of varying pixels and the quality of the transmission remains unaffected. Half reliable techniques can be used for the transmission of these packets.

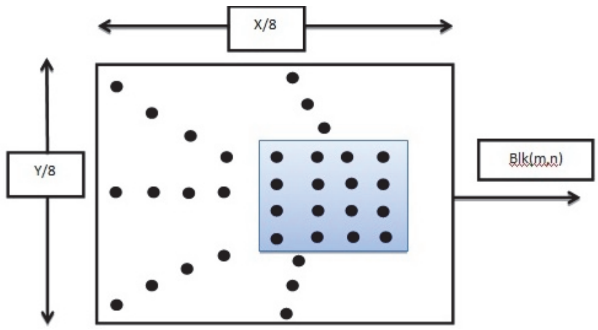


Figure 4 Blocked variant frame

Step 3: Application of the coding techniques is done in this step. The coding techniques used here are run length coding and Huffman coding. The packets with the less priority levels are transmitted to the lower levels.

The information from the upper layers is used for the transmission of the video data packets. The ley frame and the highest priority levels of the variant frame are the most important ones. The proposed video transmission architecture does not support retransmission. The reliability is sustained with the help of some other methods. The highest priority packets of the key frame are transmitted first. The variant frame overtakes the key frame at some circumstances. The Solomon error correction method is used to transmit the packets according to the priority.

3.5 Intervention at Network Layer Stage

The video data packets are received from the network layer or the sub application layer. The received frames are extracted based on the levels of priority. Command messages are used between the layers for the transmission of the packets in a reliable manner. The intermediate messages used are requested to send (RTS), positive clear to send (PCTS) and negative clear to send (NCTS). RTS notifies the presence of data for transmission. It contains the priority levels of the data. Separate connections are established based on the priority. CTS is the response message that is received for the RTS before the data is sent from the transport layer. The positive clear to send message indicates that the transport layer is available for the transmission of the data packets whereas the negative clear to send message indicates the non availability of the transport layer for the data transmission. After the reception of the positive CTS, the data transmission phase takes place.

3.6 Data Transmission Stage

The reception of the positive CTS signal indicates that there is a proper path for data transmission. After the completion of the data transmission, the intervention of the successive priority starts. Fig. 5 gives the state diagram for the transmission layer protocol.

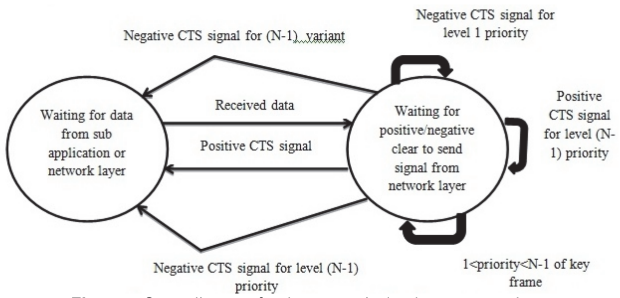


Figure 5 State diagram for the transmission layer protocol

3.7 Packet Dropping Technique

The packet dropping techniques are of two types. They are energy aware technique and the early random dropping technique. In the energy aware dropping scheme, the packet to be dropped is calculated based on the energy normalization. All the packets with the lower priority are dropped. The priority of the packet is assigned based on the user application strategy. With the help of the energy aware dropping technique, the video quality is sometimes not satisfactory. Random early technique is applied on the packets that are not dropped. This helps to increase the life time of the network. This is done based on the energy level and the hierarchical level.

4 RESULT AND DISCUSSION

Tab. 1 shows the PSNR of various priority levels and Fig. 6 depicts the graphical representation of the PSNR of various priority levels. The PSNR values when the priority levels are 2, 3 and 4 are 31.92, 32.90 and 37.15 respectively. The levels of priority 5and 6 have the PSNR values of 42.5 and 75.31 respectively. The PSNR value of priority level 7 is 45.86. The PSNR value of priority level 8 is 47.32. The PSNR value of priority level 9 is 47.56. The PSNR value of priority level 10 is 48.59. The levels of priority 11 and 12 have the PSNR values of 48.62 and 48.69 respectively.

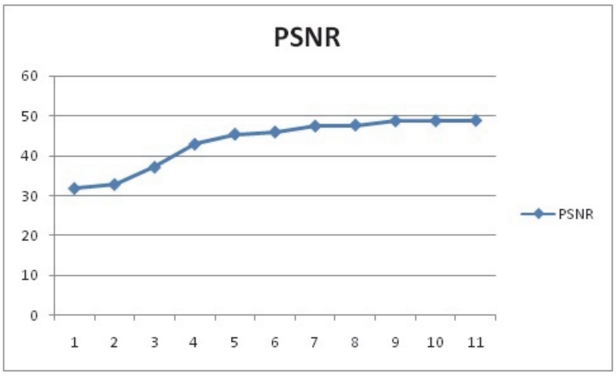


Figure 6 Graphical representation of the PSNR of various priority levels

Table 1 PSNR of various priority levels

Priority levels	2	3	4	5	6	7	8	9	10	11	12
Corresponding PSNR	31.92	32.9	37.15	42.85	45.31	45.86	47.32	47.56	48.59	48.62	48.69

Tab. 2 shows the pixel transmission count of various priority levels and Fig. 7 shows the pixel transmission count of various priority levels. The pixel transmission count when the priority levels are 2, 3 and 4 is 4, 7 and 11 respectively. The levels of priority 5 and 6 have the pixel transmission count of 16 and 22 respectively. The pixel transmission count of priority level 7 is 29. The pixel transmission count of priority level 8 is 37. The pixel transmission count of priority level 9 is 44. The pixel transmission count of priority level 10 is 50. The levels of priority 11 and 12 have the pixel transmission count of 55 and 59 respectively.

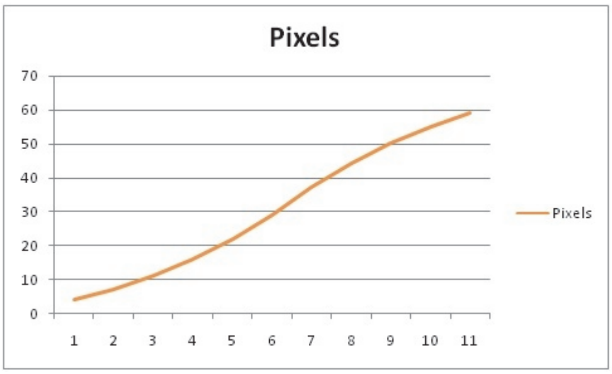


Figure 7 Pixel transmission count of various priority levels

Table 2 PSNR of various priority levels

Priority levels	2	3	4	5	6	7	8	9	10	11	12
Pixels	4	7	11	16	22	29	37	44	50	55	59

Tab. 3 shows the consumption of energy in different locations and Fig. 8 gives the graphical representation of consumption of energy in different locations. When the level of hierarchy is 4, the energy consumed by the immobile location is 200 and the energy consumed by the little mobile location is 250. When the hierarchy level is 4, the energy consumed by the moderate mobile location and the high mobile location is 360 and 480 respectively. Fig. 7 is not a comparative analysis and it illustrates the pixel transmission count for various priority levels. The priority level determines the level of hierarchy thus reducing the energy consumption.

Table 3 Consumption of energy (W) in different locations

Level of hierarchy	4	8	12	16	20	24
Immobile location	200	460	520	700	700	900
Little mobile location	250	630	1000	1300	1400	1100
Moderate mobile location	360	770	1200	1500	1600	2100
High mobile location	480	1000	1500	1800	2200	2600

When the level of hierarchy is 8, the energy consumed by the immobile location is 460 and the energy consumed by the little mobile location is 630. When the hierarchy level is 8, the energy consumed by the moderate mobile location and the high mobile location is 770 and 1000 respectively. When the level of hierarchy is 12, the energy consumed by the immobile location is 520 and the energy consumed by the little mobile location is 1000. When the hierarchy level is 12, the energy consumed by the moderate mobile location and the high mobile location is 1500 and 1800 respectively. When the level of hierarchy is 20, the energy consumed by the immobile location is 700 and the energy consumed by the little mobile location is 1400. When the hierarchy level is 20, the energy consumed by the moderate mobile location and the high mobile location is 1600 and 2200 respectively.

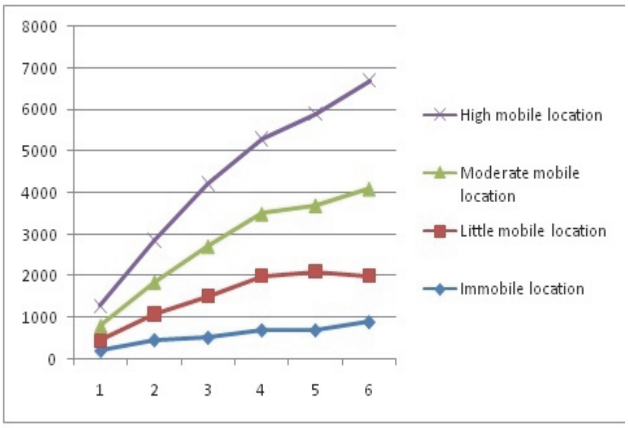


Figure 8 Graphical representation of consumption of energy in different locations

Tab. 4 shows the average value of PSNR in different locations.When the hierarchy level is 4, average value of PSNR of moderate mobile location and the high mobile location is 42.1 and 41.8 respectively. When the level of hierarchy is 8, average value of PSNR of the immobile location is 42.5 and average value of PSNR of little mobile location is 41.9. When the hierarchy level is 8, average value of PSNR of moderate mobile location and the high mobile location is 41.5 and 40.3 respectively. When the level of hierarchy is 12, average value of PSNR of the immobile location is 42.1 and average value of PSNR of little mobile location is 41.7. When the hierarchy level is 12, average value of PSNR of moderate mobile location and the high mobile location is 40.6 and 39.2 respectively.

Table 4 Average value of PSNR in different locations

Level of hierarchy	4	8	12	16	20	24
Immobile location	43.5	42.5	42.1	42.0	41.8	41.9
Little mobile location	43.2	41.9	41.7	41.2	41.6	40.8
Moderate mobile location	42.1	41.5	40.6	40.3	39.7	39.5
High mobile location	41.8	40.3	39.2	38.4	38.2	38.0

The sensor nodes which act as the routers placed at different locations, differ in terms of the noise and hence the PSNR is measured at different locations (mentioning different positioned sensor nodes). When the level of hierarchy is 16, average value of PSNR of the immobile location is 42.0 and average value of PSNR of little mobile location is 41.2. When the hierarchy level is 16, average value of PSNR of moderate mobile location and the high mobile location is 40.3 and 38.4 respectively. When the level of hierarchy is 20, average value of PSNR of the immobile location is 41.8 and average value of PSNR of little mobile location is 41.6. When the hierarchy level is 20, average value of PSNR of moderate mobile location and the high mobile location is 39.7 and 38.2 respectively.

Table 5 Data transmission with dropping structure

Level of hierarchy	2	4	6	8	10	12
Data in MB	40.21	80.15	115.58	147.45	176.54	203.12

Tab. 5 shows the data transmission with dropping structure of data transmission with dropping structure. The hierarchy level of 2 has the data transmission of 40.21 MB. The hierarchy level of 4 has the data transmission of 80.15 MB. The hierarchy level of 6 has the data transmission of 115.58 MB. The hierarchy level of 8 has the data transmission of 147.45 MB. The hierarchy level of 10 has the data transmission of 176.54 MB. The hierarchy level of 12 has the data transmission of 203.12 MB.

Table 6 Data transmission without dropping structure

Level of hierarchy	2	4	6	8	10	12
Data in MB	45.78	96.98	145.52	191.27	235.89	278.71

Tab. 6 shows the data transmission without dropping structure of data transmission without dropping structure. The hierarchy level of 2 has the data transmission of 45.78 MB. The hierarchy level of 4 has the data transmission of 96.98 MB. The hierarchy level of 6 has the data transmission of 145.52 MB. The hierarchy level of 8 has the data transmission of 191.27 MB. The hierarchy level of

10 has the data transmission of 235.89 MB. The hierarchy level of 12 has the data transmission of 278.71 MB.

Tab. 7 shows the average value of PSNR in different locations with and without dropping structure and figure 12 shows the bar chart representation of average value of PSNR in different locations with and without dropping structure. The hierarchy level of 4 has the data transmission of 44.5 with dropping structure. The hierarchy level of 8 has the data transmission of 44.1 with dropping structure. The hierarchy level of 12 has the data transmission of 43.6 with dropping structure. The hierarchy level of 16 has the data transmission of 43.8 with dropping structure. The hierarchy level of 20 has the data transmission of 43.2 with dropping structure. The hierarchy level of 24 has the data transmission of 42.1 with dropping structure.

Table 7 PSNR of diversified location with and without dropping structure

Level of hierarchy	4	8	12	16	20	24
With dropping structure	44.5	44.1	43.6	43.8	43.2	42.1
Without dropping structure	42.4	42.1	41.7	41.3	40.5	40.2

The hierarchy level of 4 has the data transmission of 42.4 without dropping structure. The hierarchy level of 8 has the data transmission of 42.1 without dropping structure. The hierarchy level of 12 has the data transmission of 41.7 without dropping structure. The hierarchy level of 16 has the data transmission of 41.3 without dropping structure. The hierarchy level of 20 has the data transmission of 40.5 without dropping structure. The hierarchy level of 24 has the data transmission of 40.2 without dropping structure.

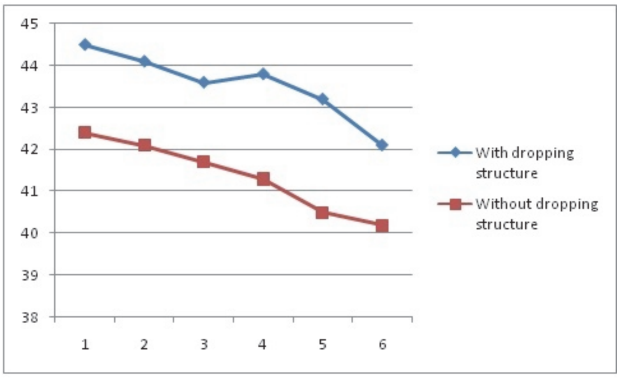


Figure 9 Bar chart representation of average value of PSNR in different locations with and without dropping structure

Tab. 8 shows the energy consumption of HQVT architecture and diversified architecture and Fig. 10 gives the graphical representation of energy consumption of HQV architecture and diversified architecture. The energy consumption of HQVT architecture is 1000 and 2400 when the hierarchy levels are 4 and 8 respectively. When the hierarchy level is 12, the energy consumed by the HQVT architecture is 2400. When the hierarchy level is 16, the energy consumed by the HQVT architecture is 6500. The energy consumption of HQVT architecture is 7200 and 8100 when the hierarchy levels are 20 and 24 respectively.

Table 8 Energy consumption of HQVT (High quality video transmission) architecture and diversified architecture

Level of hierarchy	4	8	12	16	20	24
HQVT architecture	1000	2400	4300	6500	7200	8100
Diversified architecture	200	650	860	980	1540	1900

The energy consumption of diversified architecture is 200 and 650 when the hierarchy levels are 4 and 8 respectively. When the hierarchy level is 12, the energy consumed by the diversified architecture is 860. When the hierarchy level is 16, the energy consumed by the diversified architecture is 980. The energy consumption of HQVT architecture is 1540 and 1900 when the hierarchy levels are 20 and 24 respectively.

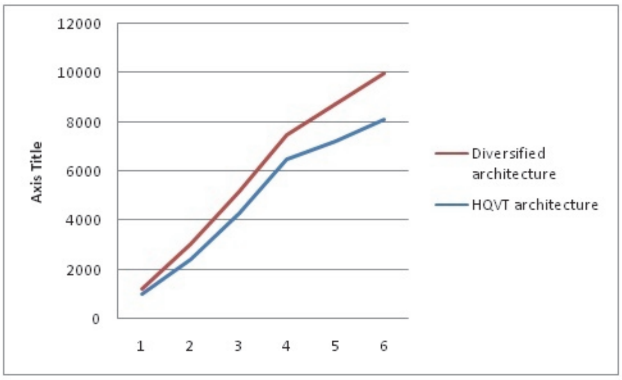


Figure 10 Graphical representation of energy consumption of HQV architecture and diversified architecture

Tab. 9 gives the PSNR values of HQVT architecture and diversified architecture and Fig. 11 gives the graphical representation of PSNR values of HQVT architecture and diversified architecture.

Table 9 PSNR values of HQVT (High quality video transmission) architecture and diversified architecture

Level of hierarchy	4	8	12	16	20	24
HQVT architecture	44.6	43.9	43.1	42.8	42.3	41.2
Diversified architecture	43.8	43.2	42.6	42.1	40.5	40.3

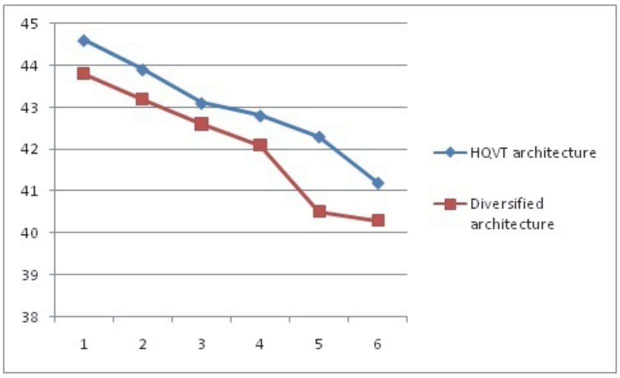


Figure 11 Graphical representation of PSNR values of HQVT architecture and diversified architecture

The PSNR values of HQVT architecture is 44.6 and 43.9 when the hierarchy levels are 4 and 8 respectively. When the hierarchy level is 12, the PSNR values of HQVT architecture are 43.1. When the hierarchy level is 16, the

PSNR values of HQVT architecture are 42.8. The PSNR values of HQVT architecture are 42.3 and 41.2 when the hierarchy levels are 20 and 24 respectively.

The PSNR value of diversified architecture is 43.8 and 43.2 when the hierarchy levels are 4 and 8 respectively. When the hierarchy level is 12, the PSNR value of diversified architecture is 42.6. When the hierarchy level is 16, the PSNR value of diversified architecture is 42.1. The PSNR value of diversified architecture is 40.5 and 40.3 when the hierarchy levels are 20 and 24 respectively.

5 CONCLUSIONS

Novel high quality video transmission architecture has been proposed in this paper. The transmission of the data packets is based on the priorities assigned to each of them by segmenting them and applying discrete cosine transforms. The proposed method does not provide retransmission of packets. This conserves energy. The reliability is sustained with the help of the key frame and the variant frame which aids in the packet prioritization. The proposed high quality video transmission architecture is compared with the other diversified architecture and found to produce better results according to the various levels of priorities.The performance of the proposed work shall be enhanced by providing variable priorities using the Artificial Intelligence (AI) technique and hence the possibility of achieving the enhanced PSNR value is higher.

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