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An Energy Efficient Weighted Clustering Scheme with Packet Service Time in Multimedia Data Transmission in WMSN

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Abstract: Wireless multimedia sensor Network (WMSN) are formulated with the deployed sensor devices within specified location aimed to monitor the target. With the target information multimedia data were generated in the form of audio, video or image. The multimedia data were stored in the devices of the sensor to achieve the higher storage capacity. Upon the effective sensing of the multimedida information for the transmission between the source to destination node the effective routes are identified with the intermediate nodes. However, the comparison the scalar data handling multimedia data is complex to achieve the effective multimedia communication in the WMSN. In the multimedia data environment the challenges associated with the scenario are routing and data delivery. To achieve the effective network performance in WMSN sensor nodes need to be optimized for the route establishment. In order to efficiently transmit multimedia data in a multimedia setting, the clustering method was presented in this study. The proposed model is defined as the Efficient Weighted Communication Protocol (EWHCP) model for the optimal route selection and data transmission to increased the QoS with the reduced end-to-end delay. The proposed EWHCP method implements energy aware admission control among the sensor nodes to achieve efficient utilization of resources for data transmission. After that, the measure of packet service time and channel utilization is carried out for all sensor nodes in the network to select the next forwarding node through which the data is transmitted. QoS aware routing is performed with the help of neighbor node's weight factor. Therefore, the proposed EWHCP attains minimum delay for multimedia content to reach the destination sink node from source sensor node. Based on the obtained experimental results, the suggested EWHCP approach is able to select an efficient route for multimedia data transmission by taking into account the average Packet Service Time (PST), channel utilization, and minimal hop count.

Keywords: *Wireless Multimedia Sensor Network, Clustering, QoS, weighted factor, routing, PST*

1. Introduction

Enhancing surveillance applications against crime and terrorism [1] is one of the primary uses for Wireless Multimedia Sensor Network (WMSN). The ability of law enforcement to keep an eye on public events, private properties, criminal identification, and other sensitive places is greatly enhanced by wide-area networks (WANs) equipped with video sensors [2]. Multimedia sensors record potentially relevant activities (i.e. occurrence of thefts, road traffic patrol, traffic violations) and make multimedia content accessible for future query. Many prevalent works for sensing multimedia information using wireless technologies has received greater attention due to the increase in surveillance applications.

WMSNs are a type of Wireless Sensor Networks (WSN) where the data flows are mainly composed of images, audio and video streams [3]. Networks of wirelessly connected devices capable of capturing multimedia data like video and audio streams, pictures, and scalar sensor data from the environment have advanced thanks to the availability of inexpensive technology like CMOS cameras and microphones. WMSNs are employed in target tracking, multimedia surveillance networks, traffic management systems and environmental monitoring applications [4]. Besides, transmitting multimedia streams effectively in WMSNs is a considerable challenging problem owing to the inadequate bandwidth and power resource of sensor nodes. WMSNs model comprises of the tiny number of audio or video traces that are capable to extract the information from the surrounding scenario. Multimedia data transmission are image, audio and video those involved in provision of the desire quantity of the scalar data such as humidity, pressure and temperature. The efficient energy-aware routing employs the shortest path selection for the effective data transmission [5]. The increases in availability of the low-cost sensor devices increases the transmission of the multimedia data such as audio, video and text effectively in the wireless network [6 – 9].

Wireless Sensor Networks comprises of the distributed infrastructure to sense the information in the nearest environment through wired or satelllite communication techniques. With the embedded hardware the sensor nodes are deployed with increases in the reliable data transmission for the sensed data [10]. The protocol uses an ad hoc cluster-based architecture flexible enough to alter the topology of the logical sensors in the network.

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Multimedia stream QoS parameters like bandwidth, latency, jitter, and packet loss are taken into account during cluster formation and management in wireless sensor networks [11]. WSN is a group of nodes ordered through a co-operative network. The schemes developed for routing in sensor networks, depends on the limited capabilities of the nodes and the application nature of the networks.An agent-assisted QoS-based routing protocol is designed in WMSNs. The replication QoS of WMSNs is selected as the adaptive value of efficient optimization algorithms for enhancing the entire performance of the network [12]. A swarm intelligence technique is employed in optimization problem for handling many optimization issues in WMSNs. A swarm intelligence technique is also employed as agents to perform QoS based tasks like routing in WMSNs [13 & 14].

When it comes to safeguarding military operations and thwarting potential threats, wireless multimedia sensor networks are an essential component. In order to enable these operations, the WMSN requires efficient approaches to deliver multimedia information with QoS. This QoS is an essential parameter whichis focused in WSN for improving the bandwidth utilization and throughput in the network. When it comes to building communication protocols for WSNs, energy efficiency is another crucial factor. Therefore, based on the requirement of QoS and energy conservation, Efficient Weighted Hybrid Communication Protocol is designed to achieve high data rate in multimedia communication over Wireless Sensor Networks. EWHCP is proposed for improving QoS in WMSN by optimizing the route selection and multimedia data transmission among the network. In EWHCP protocol, energy aware admission control is processed to achieve efficient utilization of resources. Then, packet service time and channel utilization are computed for each sensor node in the network to make decision about effective route selection. The proposed EWHCP provides minimum delay for multimedia content to reach the sink node from source sensor node. Lastly, QoS aware routing is performed with the help of node's weight factor. Through the identified effective route, data transmission is performed in WMSN. Hence the proposed EWHCP technique improves the performance of in terms of the throughput and reduced end-to-ende delay & bandwidth utilization.

2. Related Works

In [15] developed an efficient routing algorithm for reduction of the packet loss and end-to-end delay. The presented routing algorithm utilizes the greedy forwarding algorithm for energy awareness and maximization of throughput. The developed algorithm is termed as SGFTEM. The designed routing algorithm involved in the transmission of the multimedia packets in the WSN with the selection of the path with the higher throughput rather than the shorter path in the sink. With the presence of the holes in the network the void is bypass to improve the network reliability. The designed scheme effectively performs the energy management with the extension of the lifetime of the sensor nodes to minimize the coverage of the radio transmission to reach the suitable distance in the sensor environment. End-to-end delay and packet loss ratio are both lowered by 40% and 35%, respectively, according to the simulation analysis of the proposed SGFTEM model. In addition, when compared to the current method, the proposed model has the lowest energy requirements. Distributing the power from the sensor nodes fairly across the network is achieved through an effective energy management technique. The suggested SGFTEM model has been shown to perform better than the existing models AGEM, TPGF, GPSR, and AODV.

Improve the Quality of Service Using Multipath Routing Protocol (IQMRP) for Wireless Multimedia Sensor Networks was studied and implemented in [16]. The proposed IQMRP model involved in assistance of the multi-path communication to achieve the higher communication bandwidth for the effective multimedia data transmission between two nodes. In the developed model the single path communication involved in effective transmission of the data transmission ability with multi-path transmission traffic in the network load is balanced to increases the lifetime of the network. The presented method incorporates the Ant Colony Optimization (ACO) technique for route preference computation and multi-path selection in a network. The route preference is calculated by considering the next-hop count, bandwidth, and remaining node energy. The load in the route is balanced with the allocated network traffic in the connection between sender to receiver. Simulation analysis expressed that proposed model minimizes the average delay and load in route.

In [17] proposed a 3D localization algorithm model for the smart environment to achieve the stability in the network and channel condition. The developed model incorporates the recursive least squares (RLS) for computation of the image coordinates those are synchronous in WMSN to determine the indoor environment mobile location. To reduce the data transmission the distributed architecture comprises of the different smart devices in the data content for the different visual sensor. However, the analysis is based on examination of the factor involved in the evaluation of the instability in the network for the parameter localization in the mobile robots. The proposed model has been shown to improve upon existing approaches in terms of reliability, efficiency, and localization in experimental settings.

The WMSN was built in order to boost QoS and save energy costs, as described in [18]. The suggested framework is referred to as EDACR, which stands for energy-efficient distributed adaptive cooperative routing. To improve network efficiency in terms of both dependability and latency, the suggested model makes use of reinforcement learning to boost QoS while also balancing energy consumption. Compared to traditional cooperative and distributed cooperative routing, simulation findings show that energy consumption is reduced and quality of service (QoS) is enhanced with this approach.

Through the use of data size reduction techniques like picture compression and Compressive Sensing (CS), the WMSN environment was assessed for industrial applications in [19]. The created strategy combines the Error Control (EC) method with the Mixed Integer Programming (MIP) framework model to extend the lifespan of the network. In comparison to Binary Compressive Sensing (BCS) and Indoor Solar Harvester (ISH), the presented model shows greater performance in terms of enhancing network lifetime.

In [20] designed an effective scheme for the WMSN to achieve the privacy protection and routing efficiency. At first, we classify Key and non-key frames using a two-pattern adaptive picture grouping. Second, in order to simplify sampling, we optimize the deterministic binary block diagonal matrix. Finally, to protect against any possible attacks, we use a scrambling replacement method of encryption. Experimental analysis demonstrated that developed scheme is effective for the high-efficient video coding process in the real-time environment for the secure data transmission in the WMSN.

In [21] constructed a cross-layer routing scheme in contextual information transmission in the non-correlated and non-disjoint paths those actively involved in the transport multimedia data transmission between source to destination. The developed scheme involved in the evaluation of the cooperation between the routing protocol in the MAC layer for effective adjustment and regulation for the scheduling process in the forwarding phase. The mathematical analysis incorporates the initial duty cycle scheduling for the maximal overlapping in the interval for the activity periods. The comparative analysis expressed that the FMRP involved in the design of the multipath routing through non-correlated paths. Simulation analysis demonstrated that the performance of the network is improved in terms of the throughput and latency. The energy conservation is achieved as 27% and increases the throughput 50% in the single path.

Research Gap

An efficient content delivery in WMSN is a challenging problem for QoS support in these kinds of networks. An efficient bandwidth allocation mechanism was introduced for increasing the efficiency in terms of video quality and bandwidth utilization under different network conditions. Cross layer architecture was introduced to optimize the network resources. To satisfy the needs of a wide variety of traffic patterns, an Antbased multi-QoS routing metric (AntSensNet) was developed and implemented with a hierarchical network topology. It also increases the network utilization through improving the performance results. AntSensNet has used distortion reduction mechanism for sending the video packets with better quality. However, it takes more energy for data transmission. A bandwidth allocation algorithm is designed by Zhang Jian Ming et al. (2015) for WMSN. Initial allocation algorithm depending on distortion and congestion model presents efficient system performances. The allocation algorithm depending on pricing mechanism equalizes the real-time need of different users by changing the bandwidth price. The spatial and temporal correlation of data is used to save energy while attaining the signal-to-noise ratio (SNR). A tree based routing scheme and encoding scheme are used by Rajib Banerjee et al. (2015) with compression scheme with the target to minimize the energy usage.

3. Network Model and Assumptions

Let us consider a number of sensor nodes $SN_i = SN_1, SN_2, SN_3 \dots\dots, SN_n$ in a WMSN that is represented as a graph $G = (V, E)$. Here 'V' denotes a set of sensor nodes within the transmission range in a network and 'E' stands for the links between sensor nodes. The architecture for the energy efficient communication is presented in figure 1.

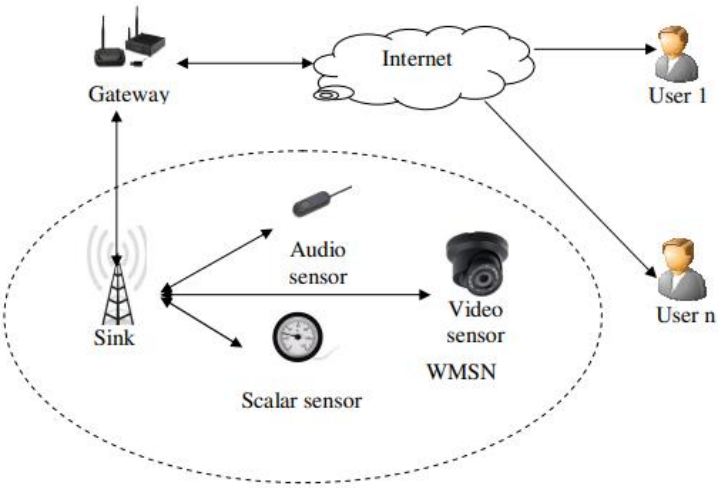

Fig 1: Architecture of Energy Efficient Communication

In figure 2 shows the working flow of the proposed EWHCP that includes several tasks such as energy aware admission control, routing decision based on packet service time, channel utilization and minimum hop count, path establishment and data delivery to sink node. As shown in Figure2, the proposed EWHCP method reduces energy consumption, delay and bandwidth utilization and therefore improves the QoS in WMSN.

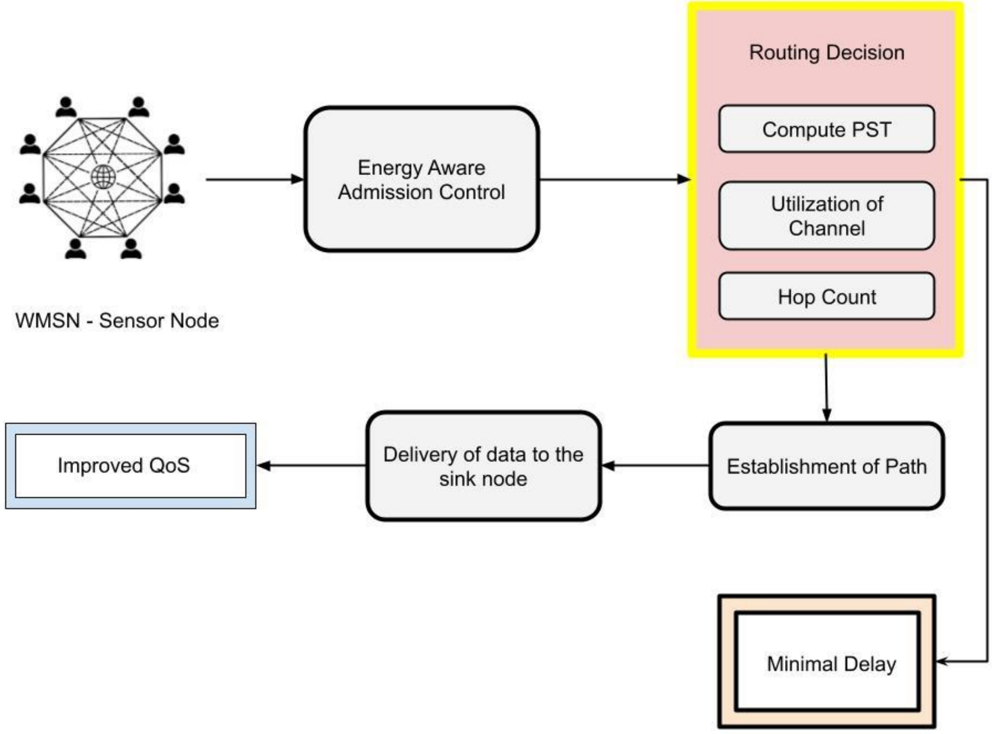

Fig 2: Working of EWHCP

The proposed EWHCP method considers the measurement of Packet Servicing time (PST), Channel Utilization and hop count with the objective of making routing decisions in WMSN in such a way that, the selected route has the minimum delay for data transmission.

For each received packet at time interval t, let us consider 'T_t' as a packet received time for a sensor node and 'T_t ' as packet transmitted time. PST is varied for each sensor node in WMSN based on incoming and outgoing data packet rates, packet size and time taken for route discovery. PST is calculated and at the end of time interval t, average PST is measured as follows equation (1).

$$Packet\ Service\ Time\ (PST) = T_t - T_r \quad (1)$$

$$PST_{avg} = \frac{PST_{total}}{total\ sensor\ nodes} \quad (2)$$

From equations (1) and (2), average PST is calculated based on total PST taken for the sensor nodes 'PST_{total}' to transmit the data and total number of sensor nodes in that path of WMSN. The objective of measuring average PST 'PST_{avg} ' is to decide whether the discovered route is able to transmit the multimedia content successfully to sink node with less amount of energy consumption. Therefore with the help of 'PST_{avg} ', energy efficient path is selected for data transmission and hence QoS is ensured in WMSN. By selecting suitable sensor nodes to obtain the route, traffic is also reduced in the network. Sensor nodes in WMSN utilize the communication channel for sharing multimedia content from source sensor node to sink node through the intermediate sensor nodes. While performing route discovery, it is essential to consider the bandwidth utilization for every sensor node that are participated in data transmission. Channel utilization of a sensor node affects its neighbor node so that, it periodically listen to the channel. Channel utilization $Cutil$ is formulated as follows.

$$Cutil = \frac{T_{busy}}{T_{interval}} \quad (3)$$

From equation (3), '$T_{interval}$' represents the time interval of monitoring the channel and 'T_{busy}' represents number of times the channel found as busy due to transmission of bytes. Each node in WMSN calculates its average channel utilization $Cutil$ as follows

$$Cutil_T = \beta(Cutil_r) + (1 - \beta)Cutil_{T-1}$$
(4)

From equation (4), β represents the constant value where '$0 \leq \beta \leq 1$'. If the multimedia content is transmitted through a busy channel, then packet loss may occur. Hence, the proposed EWHCP detects a busy channel and also discover the node which uses less bandwidth for transmitting the data effectively71. The discovery of optimal routing path is achieved depending on the weight factor. Every node in WMSN measures its weight based on average PST_{avg} and average channel utilization $cutil_r$ as given below

$$W_i = \alpha\left(1 - PST_{avg}\right) + \gamma\,(1 - cutil_r) \quad (5)$$

From equation (5), W_i' is the node's weight factor at time interval i, which helps for selecting the next neighbor node in WMSN by making use of route request packet (RREQ). Here, α and $\gamma$are the coefficients and varied from 0 to 1, such that $\gamma = (1 - \alpha)$.

the source node 'SN' broadcasts RREQ packet to its neighbor nodes 'N1' and 'N2' if there is any data to be transmitted to sink node. RREQ packet has the information about source ID, broadcast ID, number of hops traveled $Hopcount_{prev}$, weight of previous node 'W_{prev}' and previous node ID. Hop count is defined as the number of sensor nodes (i.e., hops) participated in the route which helps for the current node to make effective decisions.

Source ID	Broadcast ID	$HopCnt_{prev}$	W_{prev}	ID_{prev}

Fig 3: Packet format of RREQ

In Figure 3, among the nodes 'N1' and N2, the node 'N1' only retransmits the updated packet to SN because 'N1' is having higher weight value when compared with 'N2'. The node 'N2' does not retransmit the packet to 'SN' instead the packet is dropped. Therefore the node 'N1' is selected as next hop for transmission in WMSN. This route discovery is performed by using the following equation at every node.

$$if\,\left(\left(Hopcount_{prev} - Hopcount_r\right) \leq n \text{ and } \left(W_{prev} > W_T\right)\right) then$$

$$update\ reverse\ route\ with\ ID_{prev}$$
(6)

From equation (6), if the conditions are met, then the node updates its reverse route by replacing current weight 'W_T' and '$Hopcount_r$-' values in the received RREQ. Otherwise the packet is not further transmitted or simply dropped.

Input: Sensor nodes $SN_i = SN_1, SN_2, SN_3 \ldots\ldots, SN_n$
Step 1: Begin Step 2: Initialize $PST = 0$ Step 3: For each sensor node SN_i

Step 4: Calculate PST using equation (1)
Step 5: $PST_{total} = PST_{total} + PST$
Step 6:End for
Step 7: Measure average PST using equation (2)
Step 8: For eachtime interval
Step 9:Measure the channel utilization ‘ $cutil$ ’ using equation (3) and (4)
Step 10: End for
Step 11: Calculate weight factor by using equation (5)
Step 12: Perform route discovery by using equation (6)
Step 13: Transmit multimedia data through the discovered route
Step 14: End

3.1 Optimal Route Selection with Clustering

Let us consider a radius or sensing range of sensor node as SR. Then the measure of distance between two nodes $Dis(SN_i, SN_j)$.

$$Dis(SN_i, SN_j) = \sqrt{(a_i - a_j)^2 + (b_i - b_j)^2}. \quad (7)$$

By using equation (7), WMSN is formed in such a way that, $Dis(SN_i, SN_j) < 2SR$’, where sensor nodes SN_iandSN_j’ are neighbouring nodes that share the sensing area. Hence the proposed EWHCP method achieves spectral route selection with minimum data loss and delay for transmitting sensed multimedia content over the network. Sensor nodes are having differentiated channels (bands) for different groups. By finding effective spectral band during route selection, the throughput rate is improved in WMSN with the help of the proposed RO-SRS method.

Gaussian Distribution-based Data Aggregation helps indetermining how the sensor nodes are distributed in a transmission area based on similar size. In addition, sinks and a group of sensors are specified in WMSN where a particular sink may correspond to different groups. Therefore, the WMSN's vast number of high-capability sensor nodes is deployed with the use of a Gaussian Distribution-based Data Aggregation model. On the other hand, Poisson distribution model is utilized for achieving sink distribution in such a way that different groups may belong to same destination sink. Figure 4 shows the block diagram of Gaussian Distribution-based Data Aggregation.

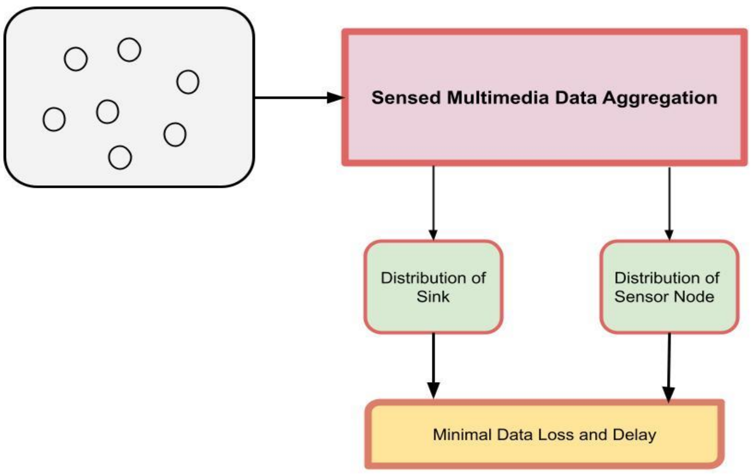

Fig 4: Gaussian Distributed Data Aggregation

Sink nodes in WMSN are distributed over a group of sensors with the help of Poisson distribution γ_i such that $\gamma_i = \frac{SN_i}{Area}$ Here, 'SN_i ' represents the sensor nodes in each sink area space in WMSN and $Area$ represents the total area of WMSN. The probability of m_i sinks distribution over a group of sensors is given as follows.

$$Prob(S_i) = \frac{\left(\frac{SN_I}{Area}\right)^{m_i}}{m_i} \qquad (8)$$

Each sensor node in a network has coordinates a_2, $b_2$to monitor square area$Area$' using $(\sigma a_2, b_2)$

$$f(a_2, b_2) = \frac{1}{\sqrt{2\pi\sigma a_2^2 b_2^2}} e^{\frac{(a_2 - b_2)^2}{2\pi\sigma a_2^2 b_2^2}} \qquad (9)$$

By using equation (8) and (9), sensed multimedia data contents are aggregated effectively in WMSN with similar size using Gaussian density and same destination sink using Poisson distribution.

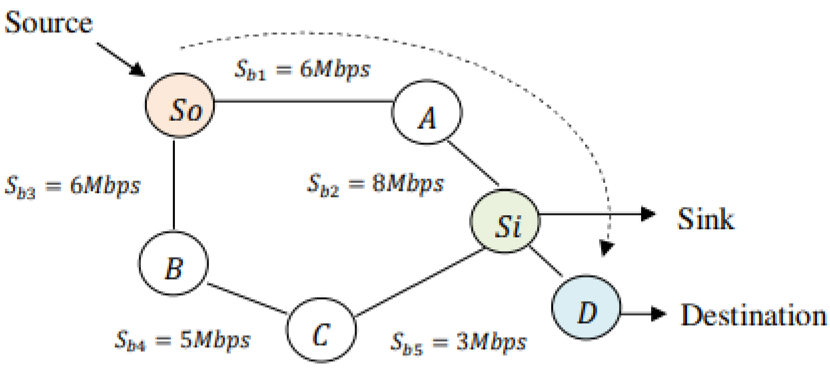

Fig 5: Route Selection

Figure 4.3 shows the route selection in WMSN using spectrum bands. Let us consider a WMSN which is implemented with source node S_0 intermediate nodesA, B, C, sink node S_i and destination node D respectively. Let us further assume that, each sensor node is having different spectrum bands availability.

4. Experimental Setup

The effectiveness of the proposed EWHCP is evaluated experimentally with the use of a Python simulator. The coverage area of the WMSN is 1500m 1500m, and it is built with 500 sensor nodes. To run the simulations, the proposed EWHCP approach makes use of the Ad hoc On-demand Distance Vector (AODV) protocol. Table 1 displays the simulation settings used in this study.

Table 1: Simulation Setting

Parameters	**Values**
Coverage area	1500m * 1500m
Node density	500
Number of data packets	100
Packet size	500 KB
Node speed	0 – 10m/s
Simulation time	400ms
Number of runs	10
Transmission radius	105M

The performance of the proposed EWHCP method is evaluated with the following performance parameters that include energy consumption, endto-end delay, bandwidth utilization and throughput.

4.1 Energy Consumption

Energy consumption is measured in WMSN with the help of number of sensor nodes, power used and time taken for data transmission to reach the destination.

Energy consumption is mathematically formulated as follows.

$$Energy\ Consumption = Node\ Density * power * Time \quad (10)$$

From equation (10), time taken for data transmission is measured in terms of seconds; power is computed using the unit watts and energy consumption is measured in unit Joules (J). If the energy consumption is minimal then the developed method is effective.

In table 2 demonstrated the measured energy consumption for the proposed EWHCP with the existing mode is presented such as WSN-MIP and CR-WMSN. The density of the node is considered between the range of 50 – 500. The simulation analysis presented that energy consumtion is higher than the existing method for the increase in node density. The proposed model has lower energy requirements than current methods.

Table 2: Energy Use: A Comparison

Energy Consumption (J)			
Density of Node	**WSN - MIP**	**CR – WMSN**	**EWHCP**
50	101	93	87
100	106	96	91
150	113	103	98
200	121	113	102
250	125	118	108
300	133	121	113
350	138	129	119
400	143	133	122
450	149	139	126
500	153	144	129

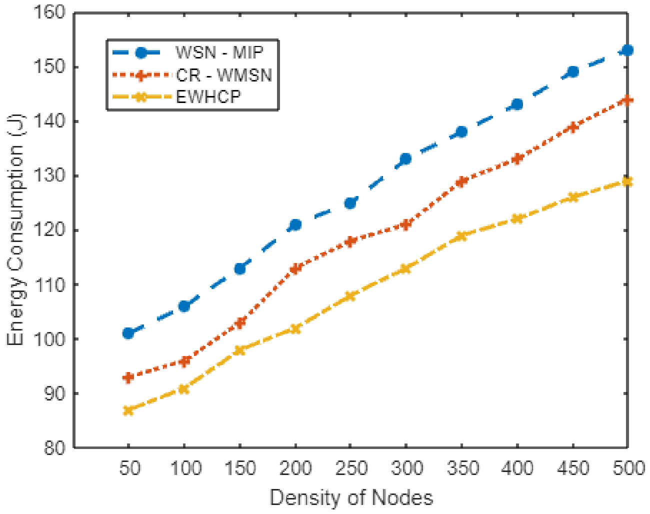

Fig 6: Comparison of Energy Consumption

4.2 End-to-End Delay

Delay for data packet transmission in WMSN is measured by considering routing delay (time taken for selecting QoS aware route) and transmission delay (based on available bandwidth and packet size). Here is the mathematical expression for a delay.

$$D = Routing_d + Transmission_d \quad (11)$$

According to equation (11), round-trip delay is expressed in ms. An efficient approach is one with a small end-to-end delay.

Table 3: End-to-End Delay Comparison

End-to-End Delay (ms)			
Density of Node	WSN - MIP	CR – WMSN	**EWHCP**
50	14.6	12.5	10.8
100	15.7	13.2	11.3
150	16.4	15.8	11.8
200	17.5	17.4	12.4
250	18.6	18.6	12.8
300	21.9	19.4	13.7
350	22.3	20.7	14.5
400	24.7	21.4	15.3
450	26.4	22.7	16.5
500	28.2	26.5	17.7

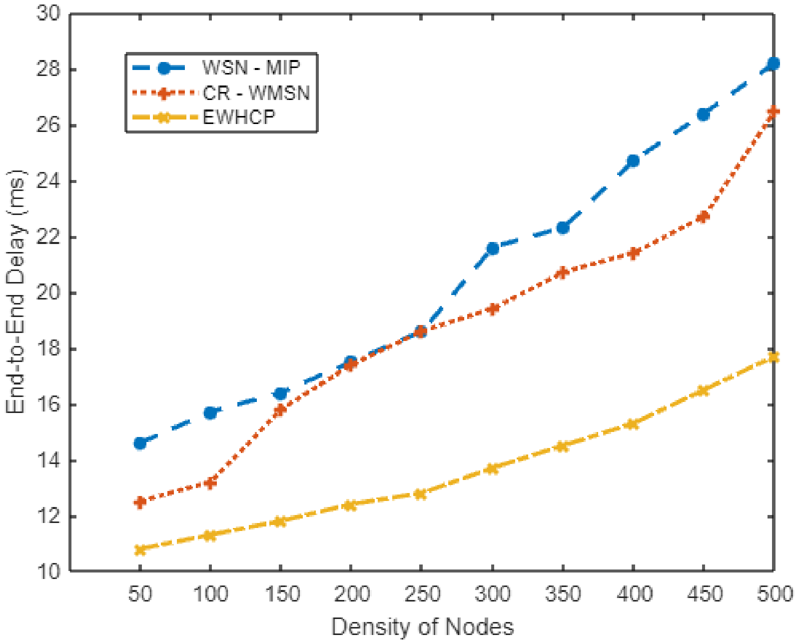

Fig 7: Comparison of End-to-End Delay

End-to-end delay for the proposed EWHCP approach is shown in Figure 7, along with a comparison to two current approaches: WSN-MIP (created by Juan R. Diaz et al., 2014) and CR-WMSN (created by Zara Hamid et al., 2012). Figure 3.6 shows that the suggested EWHCP method results in a significant decrease in end-to-end delay when compared to the state-of-the-art approaches. This efficient reduction of end-to-end delay is achieved in the proposed EWHCP method by making an effective routing decision based on average PST, Channel Utilization and minimum hop count. Then path is established through which the multimedia contents are transmitted to reach the sink node. The end-to-end delay in WMSN is decreased by 8% when compared to the current WSN-MIPmethod and by 19% when compared to the current CR-WMSNmethod thanks to the proposed EWHCP method.

4.3 Bandwidth Utilization

Bandwidth utilization is measured by the amount of channel utilized for transmitting data from one node to another in a given time interval. Bandwidth utilization is reduced in the proposed method with the objective of reducing the traffic in WMSN. Bandwidth utilization is measured in terms of kilobits per second (Kbps). If bandwidth utilization is reduced, then throughput of the network is improved significantly as shown in table 4.

Table 4: Comparison of Bandwidth utilization

Bandwidth Utilization (Kbps)			
Density of Node	**WSN - MIP**	**CR - WMSN**	**EWHCP**
10	54	61	74
20	57	63	77
30	59	65	79
40	62	68	83
250	67	69	85
300	73	71	89
350	76	74	91
400	83	77	93
450	89	81	94
500	92	89	96

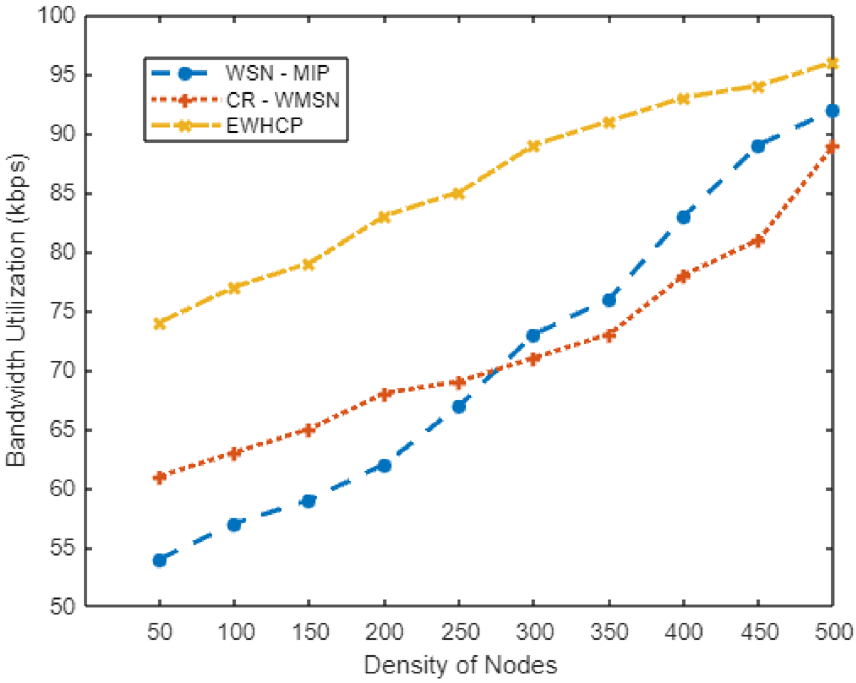

Fig 8: Comparison of Bandwidth Utilization

Figure 8 shows bandwidth utilization for the proposed EWHCP method and existing methods. The proposed EWHCP method clearly decreases bandwidth use in comparison to conventional approaches. The suggested EWHCP approach successfully lowers bandwidth consumption by identifying the busy channel through channel utilization measurement. Hence the traffic is avoided in a network by selecting the node which uses less bandwidth for transmitting the data. Therefore the proposed EWHCP method reduces bandwidth utilization for the sensor nodes in WMSN by 10 % when compared to existing WSNMIPmethod and 20% when compared to existing CR-WMSN method.

4.4 Throughput

Throughput is measured for the network by the ratio of number of successful packets received at the sink node $DP_r$to the total number of packets sent from source sensor node DP_t. The rate of throughput is mathematically formulated as follows.

$$T = \frac{DP_r}{DP_t} * 100 \qquad (12)$$

T, the throughput, is expressed as a percentage (%) in equation (12). A higher throughput rate is indicative of a more efficient approach.

Table 5: Comparison of Throughput

Throughput (%)			
Packet Number	WSN - MIP	CR - WMSN	**EWHCP**
10	39	36	41
20	48	43	49
30	56	48	53
40	62	52	65
50	67	59	69
60	73	63	76
70	76	72	81
80	79	75	86
90	81	78	91
100	83	80	94

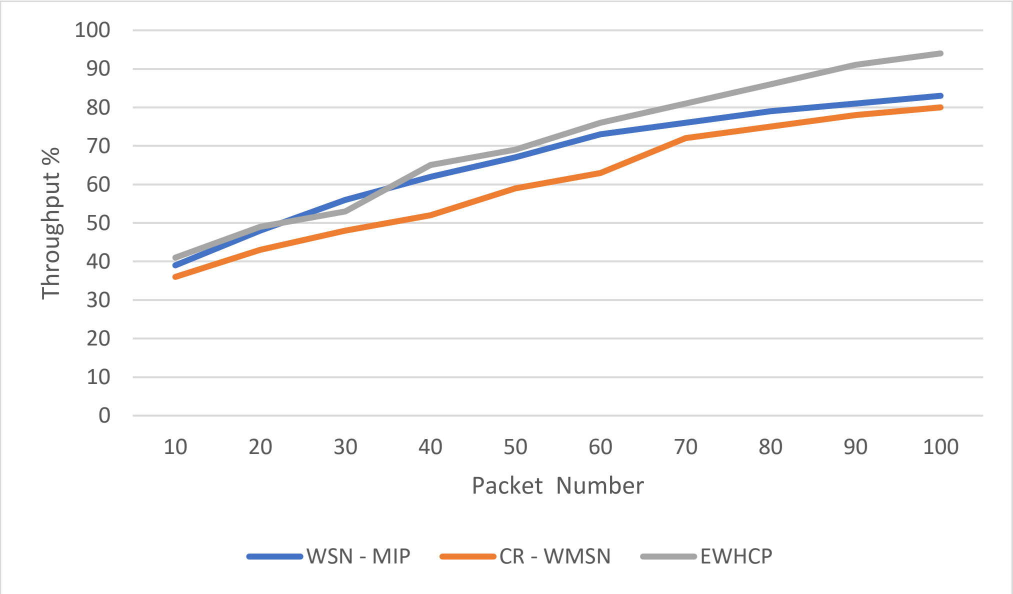

Fig 9: Comparison of Throughput

Table 5 compares the proposed EWHCP approach to previously-presented methods like WSN-MIP and CR-WMSN in terms of throughput rate, measured in terms of the number of packets in WMSN. For this experiment, we will use a sample size of between 10 and 100 packets. Throughput grows proportionally with packet count in all cases, as shown in Figure 9. When compared to conventional approaches, however, the proposed EWHCP method yields a substantial improvement in throughput.

5. Conclusion

The Wireless Mutimedia Sensor network comprises of the critical components for the emerging application operations. The WMSN demands for the efficient multimedia routing protocol design to improve QoS parameters. This QoS is an essential parameter which is focused in WSN for improving the bandwidth utilization and throughput in the network. When it comes to building communication protocols for WSNs, energy efficiency is another crucial factor. Therefore, based on the requirement of QoS and energy conservation, Efficient Weighted Hybrid Communication Protocol is designed to achieve high data rate in multimedia communication over Wireless Sensor Networks. EWHCP is proposed for improving QoS in WMSN by optimizing the route selection and multimedia data transmission among the network. In EWHCP protocol, energy aware admission control is processed to achieve efficient utilization of resources. Then, packet service time and channel utilization are computed for each sensor node in the network to make decision about effective route selection. The proposed EWHCP provides minimum delay for multimedia content to reach the sink node from source sensor node. Lastly, QoS aware routing is performed with the help of node's weight factor. Through the identified effective route, data transmission is performed in WMSN. Hence the proposed EWHCP technique improves the performance throughput in the network compared with the conventional techniques. In other hand, bandwidth utilization and end-to-end delay is reduced.

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