Indonesian Journal of Electrical Engineering and Computer Science
Vol. 31, No. 2, August 2023, pp. 1201~1210
ISSN: 2502-4752, DOI: 10.11591/ijeecs.v31.i2.pp1201-1210

Optimizing multimedia communication in internet of thing network for improving quality of service

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Article Info

Article history:

Received Mar 13, 2023
Revised Mar 29, 2023
Accepted Apr 2, 2023

Keywords:

Data transmission
Internet of things
Multimedia
Quality of service
Traffic

ABSTRACT

The internet of things (IoT) has revolutionized the way we interact with technology, with the proliferation of interconnected devices leading to an increase in the volume of data transmitted over the network. One of the key applications of IoT is in multimedia communication, where real-time audio and video data is transmitted over the network. However, the diverse nature of applications and the sheer volume of data in IoT networks can lead to network congestion, latency, and variable quality of service (QoS) at the internet side, resulting in a degradation of the overall QoS for multimedia traffic. In this paper, we propose a cross-layer multimedia optimization solution for multi-point to point IoT networks that incorporates service differentiation and bandwidth reservation techniques to improve the QoS of multimedia traffic. We evaluate the performance of our proposed solution using simulations and compare it with existing solutions. Our results show that our proposed solution can significantly improve the QoS of multimedia traffic in IoT networks, even during periods of high network congestion or variable QoS at the internet side.

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1. INTRODUCTION

The internet of things (IoT) has revolutionized the way we interact with technology, allowing for the creation of smarter, more efficient, and interconnected devices [1]. One of the key applications of IoT is in multimedia communication, where real-time audio and video data is transmitted over the network [2]. Moreover, with the proliferation of IoT devices, the volume of data transmitted over the network has increased significantly, leading to network congestion [3]. This congestion can result in packet loss, delays, and a degradation in the quality-of-service (QoS) of multimedia traffic [4]–[6]. Further, in multimedia communication, latency can also lead to delays in audio and video, resulting in synchronization issues and a poor user experience [7]. Also, most of the IoT devices often have limited bandwidth, which can affect the transmission of multimedia traffic [8]. This limitation can lead to lower resolution, lower quality, and a decrease in overall QoS for multimedia communication [9]. Furthermore, the QoS of the internet can vary depending on factors such as network congestion [10], server load [11], and network infrastructure [12]. This variability can affect the QoS of multimedia communication in IoT networks, leading to a degradation in the overall user experience [13]. Nevertheless, different devices may use different codecs and compression techniques for multimedia transmission, leading to compatibility issues and a decrease in QoS [14]. Most of the IoT devices are often powered by batteries or have limited power sources [15], and multimedia communication can consume a significant amount of power [16], leading to a shorter battery life and reduced device functionality [17].

In conclusion, the sheer volume of data and the diverse nature of multimedia applications in IoT networks can lead to network congestion, bandwidth limitations, codec and compression issues, higher energy consumption, latency, and variable QoS at the internet side, leading to a degradation of the overall QoS for multimedia traffic. Addressing these challenges requires a comprehensive approach that includes the optimization of network protocols, the use of efficient codecs and compression techniques, the implementation of QoS mechanisms such as service differentiation and bandwidth reservation, and the use of cross-layer optimization techniques. Hence, to address all these challenges, service differentiation and bandwidth reservation are two important techniques that can be used to improve the QoS of multimedia traffic in IoT networks. By reserving bandwidth and providing different levels of service to different types of traffic, service differentiation and bandwidth reservation can help to ensure that multimedia traffic receives the required QoS levels even during periods of high network congestion or variable QoS at the internet side. However, the effective implementation of service differentiation and bandwidth reservation in IoT networks requires a cross-layer approach that involves the optimization of various network layers, such as the physical, data link, network, transport, and application layers. This approach can ensure that multimedia traffic is transmitted efficiently and reliably, leading to an overall improvement in the QoS for IoT devices. Hence, the contributions of this work are as follows:

- Propose a cross-layer multimedia optimization solution for multi-point to point IoT networks that incorporates service differentiation and bandwidth reservation techniques.
- Propose a solution that will consider the variable QoS at the internet side for improvement of QoS and overall throughput for multimedia traffic.

2. LITERATURE SURVEY

In this section, a survey on various techniques used for improving the QoS in the multimedia IoT devices has been presented. In order to facilitate dynamic video streaming across software defined network networks, the authors of Zhong *et al.* [18] develop a full QoS-aware multicast method. First, they show the planned framework for the multimedia broadcasting multicast network, and then they frame the issue of QoS-aware multicast scheduling as just a non-linear programming issue. Further, they offer a basic tree construction method which breaks down video streaming demands into smaller demands and handles those demands in a bottom-up way. Lastly, experimental findings verifying the effectiveness of their approaches in terms of scalability, network efficiency, video playback resolution, as well as playback interruption ratio are shown. Liu *et al.* [19], they present a new online control method which maximizes the probability of a complete preamble communication for devices with greater priority needs, making the random-access technique more useful for those devices. They improve upon their original approach by adding support for access delay demands as well as expanding it through utilizing access-class-baring (ACB) to optimize the method. Extensive computations demonstrate the performance of the presented methods across several priority and validate their capacity to overcome congestions again for widespread deployment of IoT gadgets. Ji *et al.* [20], they offer a smart video communication architecture for a Video-IoT network with a variety of cameras. To begin, they develop a device-hypergraph (DH) architecture that allows gadgets with varied capacities to do complicated video tasks together by laying out the issue of joint video allocation of tasks as well as heterogeneous gadget management. A variety of system parameters have been tested with positive results for the suggested architecture. The suggested approach is verified using numerical findings for its bandwidth utilization, delay, as well as computational efficiency. The simulation findings verify the efficiency and quality of the presented approach. Sodhro *et al.* [21], the quality of experience (QoE) as well as energy efficiency of communication (EoC) of the user while multimedia transmission over User-Terminal devices is the topic of this study. So, initially, a joint-energy as well as entropy-optimization (QJEEO) algorithm that takes QoS into account has been developed in this work. Furthermore, a methodology as well as architecture for evaluating QoE across time in the context of acquirement have been built using 6G-driven multimedia data structures. The results of the experiments suggest that QoE is modelled and analyzed with acquisition time as well as connected with QoS parameters, specifically packet-loss-ratio (PLR), as well as average-transfer-latency, during energy-efficient multimedia transmissions throughout 6G-based networks in order to increase the degree of user satisfaction.

Zhou *et al.* [22], They present a vast vehicular IoT network as well as look into the method which would provide every vehicle the freedom to choose its own transmission scheme from among vehicle to infrastructure, vehicle to vehicle sidelinks, as well as wireless resources. In this work, they create a multi-agent deep reinforcement learning framework by integrating the WoLF-PHC multi-agent reinforcement learning approach using deep Q-learning (DQN) approaches, resulting in an architecture that can capture the impacts of communication among learning entities as well as variables inside a complex environment. The simulated results show that the suggested method provides more overall traffic throughput and higher vehicle experience in communication than the comparison methods. Aljubayri *et al.* [23], they utilize opportunistic-routing (OR) to decrease multipath TCP (MPTCP) latency by sending fewer data packets. Using the broadcasting approach, OR is a routing concept that improves the delivery rate as well as accuracy of information transfer in wireless networks. As a result, numerous relays can be used to transmit information for every sub-flow. Inside an IoT setting, they implemented OR on several MPTCP protocols, including the original MPTCP traffic splitting control as well as redundant MPTCP (Re MPTCP). The findings demonstrate the superior performance of OR-based MPTCP systems over the state-of-the-art. Finally, they examined the OR-based MPTCP protocols with regard to starting delay and power consumption.

3. METHOD

3.1. System model for proposed method

In this proposed work, we have considered a heterogenous wireless sensor network (HWSN) which consists of various devices such as IoT nodes, sensors, devices, actuators, gateways and routers. All these devices work on different protocols. The architecture of the complete HWSN has been given in the Figure 1. With this architecture, various IoT devices or IoT users can move around freely even in a densely packed network of IoT devices. In most cases, the network coverage provided for the different wireless devices will overlap with one another. Moreover, in some cases, network coverage overlap can lead to interference and congestion, which can result in reduced throughput and degraded QoS for multimedia traffic. For example, if multiple devices are transmitting multimedia data simultaneously over overlapping wireless networks, the resulting interference can lead to packet loss, delay, and jitter, which can negatively impact the QoS of the multimedia communication. In a given HWSNs, multiple multimedia IoT devices are placed randomly in different directions within a given network coverage. In this network, the multimedia IoT device are considered to be capable of supporting multiple communication modes and can access various wireless network services. Further, a gateway plays a crucial role in facilitating communication between different layers and optimizing the performance of multimedia traffic. Specifically, a gateway acts as an intermediary between the multimedia IoT devices and at the Internet side. Furthermore, for the purpose of determining a suitable gateway, the following steps are involved: gateway identification, decision making on gateway selection, and deployment of multimedia IoT devices towards the gateway access. Every multimedia IoT device inside a HWSN is assumed to be able to independently acquire various decision parameter data for every gateway within its coverage area. In addition, the multimedia IoT devices can assign a ranking to each potential gateway depending on the data they've acquired, and then use the gateway selection technique to carry out the appropriate gateway selection. In this proposed work, for improving the QoS as well as the QoE of the multimedia IoT devices, we have considered the service differentiation method and bandwidth reservation method. In addition to this, this proposed work takes into account three of the user's preferred characteristics, namely the jitter, latency, and packet loss rate. Furthermore, as various multimedia IoT devices have varying sensitivities within a single gateway parameter, such as the need for more bandwidth for data-based services (image), the need to adapt the resolution of videos to the available bandwidth, the need for very little bandwidth in audio-based services, and so on. Hence, in this work, the multimedia IoT devices have been segmented as completely flexible (data-based), half flexible (video-based) and not flexible (audio). In addition, it is assumed in this research that the final multimedia IoT devices can utilize any of these segmentation techniques.

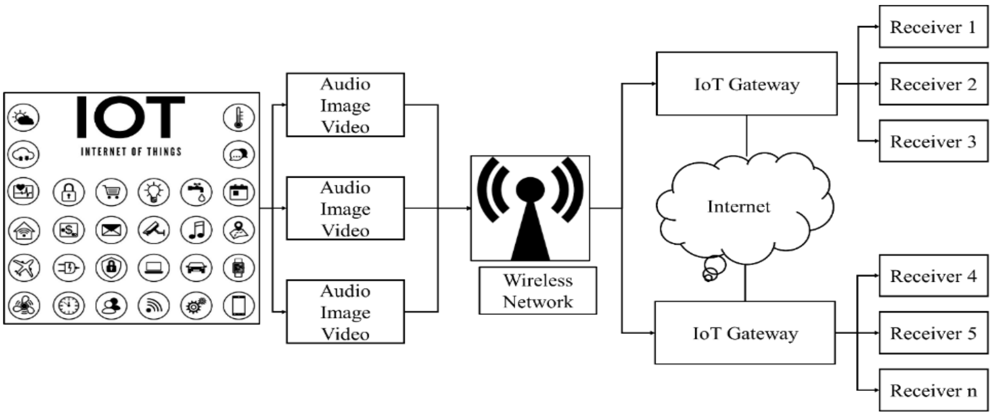

Figure 1. Architecture for a HWSN

The approach for selecting gateways that has been proposed in this work is divided into two stages. In the first stage of this work, prioritization is first determined by the criteria weights in accordance with the criteria of communication networks as well as the priorities of multimedia IoT devices. Further, in the second stage, decisions are made based on criteria and the organization of an accessible gateway. Moreover, in the first stage, from the relevance of the criterion weight on the basis of the priority or selection for the multimedia IoT devices is evaluated. Further, a pair wise matrix is constructed for the multimedia IoT devices on the basis of the criterion weight. The evaluation of the pair wise matrix has been further given in the section 3.2. After the evaluation of the pair wise matrix, the ranking of the gateway is done by mapping out the accessible gateways on the basis of the decision matrix (pair wise matrix). Further, a technique for order of preference by similarity to ideal solution (TOPSIS) has been proposed to obtain the ranks of the gateways for the creation of a ranking list. Further, the optimal gateway is described by the structure of the ranking list when chosen in descending order. Further explanation for the complete process has been given in the section 3.3. The selection model for the gateways for the multimedia IoT devices has been given in Algorithm 1.

Algorithm 1: Multimedia IoT devices gateway selection method
```
Step 1. Start.
Step 2. Input: Priorities aware associative criteria.
Step 3. Build pairwise matrix correlating criteria with respect to other criteria.
Step 4. Pair wise matrix is normalized.
Step 5. Then, by using priorities aware weight evaluation method the weight vector is obtained.
Step 6. The pairwise matrix consistency (PMC) is estimated for validating weight consistency.
Step 7. If PMC < μ then
Step 8. Return to step 7.
Step 9. Else
Step 10. Return to step 3.
Step 11. End if
Step 12. Decision Making is created by associating the criteria overs accessible gateways.
Step 13. Apply normalization for ease of computing matrix using TOPSIS method.
Step 14. The TOPSIS is used on normalized decision making for obtaining the ranking vector using weight obtained from step 5.
Step 16. Output: The gateways with maximum weight in ranking vector is selected as the best gateway.
Step 17. Stop.
```

From the proposed Algorithm 1, the best gateways can be selected for the multimedia IoT devices for the communication and to meet all the demands and provide better QoS and QoE for all the IoT devices in the network. According to euclidean-theory, the selection of the best gateway using the TOPSIS approach, which uses a multiple parameter decision making technique, is a suboptimal approach having a considerable divergence from the optimal negative approach. For priority aware data to be established, it is necessary for both the network as well as the multimedia IoT devices work together. The selection of the criteria is primarily focused on the number of multimedia IoT devices sending traffic as well as the QoS requirements. Additionally, a priority aware weight evaluation approach is used to calculate the selection of weighted parameters. While making a choice about which gateway to use, it's important to take into account multimedia IoT device priorities, and the computed weight represents the relative importance of each criterion. Moreover, the priority aware weight has the information of the gateway which will be helpful for the handoff of the multimedia device towards the internet side. Moreover, future gateways inside a communication field can be set up using the TOPSIS technique, which takes into account the relative importance of different criteria when determining which ones should be prioritized.

3.2. Multimedia IoT device priority-based criteria-weight evaluation technique

In this section the decision making for the multimedia IoT device priority-based criteria-weight evaluation technique has been proposed. There are two stages for the decision-making approach. In the first stage of the decision-making approach, the decision impact B, pairwise matrix $(o * o)$ and the objective requirement are settled upon through establishing associations or correlations between criteria. Consider a set of criteria represented as $D = [D_k; k = 1,2, \dots, o]$. Consider that the pairwise matrix, decision impact having the feature denoted as $b_{jk}(j, k = 1,2, \dots, o)$ are denominator for the given criteria weight. Moreover, there is a wide range of dimensions to the provided selection. Hence, the parameters are transformed into a dimensional-representation through normalization. Each feature set in the created pairwise matrix is given a different weight based on the QoS requirements of the corresponding application. The mathematical representation of the pairwise matrix is given by (1).

$$B=\begin{bmatrix} b_{11} & b_{12} & \vdots & b_{1n} \\ b_{21} & b_{22} & \vdots & b_{2n} \\ \cdots & \cdots & \dots & \dots \\ b_{n1} & b_{n2} & \cdots & b_{nn} \end{bmatrix} where, b_{jj}=1, b=\frac{1}{b_{jk}} \quad (1)$$

In (1), the b_{jk} is used for denoting the weight of one set of criteria in relation to another in the pairwise matrix $(o*o)$ that is generated, and the weight of a decision B is determined by the intensity of significance evaluated. The process of establishing a relationship between criteria in which the existence of other criteria is known. The decision impact is then compared in a pairwise matrix, weighted by the strength of each decision. Further, in the second stage, the pair wise matrix is normalized and the correlation weight set is evaluated. The pairwise matrix is made up of different units with different dimensions. Due to this issue, it has to be normalized for further computation. From the (1), the decision impact B can be constructed. To generate the feature sets of the normalized matrix in (2), we divide each feature of both the correlated matrix B with its associated column summation:

$$B=\begin{bmatrix} \frac{b_{11}}{\sum b_{j1}} & \frac{b_{12}}{\sum b_{j2}} & \vdots & \frac{b_{1n}}{\sum b_{jn}} \\ \frac{b_{21}}{\sum b_{j1}} & \frac{b_{22}}{\sum b_{21}} & \vdots & \frac{b_{2n}}{\sum b_{jn}} \\ \cdots & \cdots & \dots & \dots \\ \frac{b_{n1}}{\sum b_{j1}} & \frac{b_{n2}}{\sum b_{j2}} & \cdots & \frac{b_{nn}}{\sum b_{jn}} \end{bmatrix} where, b_{jj}=1, b=\frac{1}{b_{jk}} \quad (2)$$

by evaluating the decision impact and the criteria weight, X_j can be evaluated by (3),

$$X_j=\frac{\sum_{o}^{k=1} b_{jk}}{o}, X=\begin{bmatrix} X_1 \\ X_2 \\ \cdot \\ \cdot \\ \cdot \\ X_o \end{bmatrix} \quad (3)$$

in the (3), the o is used for representing the similar criteria size. Further the consistency of the pair wise matrix is calculated from the (4),

$$PMC=\frac{\mathcal{C}}{\mathcal{R}} \quad (4)$$

in the (4), the $\mathcal{C}$ is used for representing the consistency indexed function and $\mathcal{R}$ is used for representing the random function which is dependent on the considered value of the criteria. The consistency function as well as the random function can be evaluated from the (5)-(7).

$$\beta=\frac{B*X}{X}=\begin{bmatrix} \beta_1 \\ \beta_2 \\ \cdot \\ \cdot \\ \cdot \\ \beta_o \end{bmatrix} \quad (5)$$

$$\beta_{\uparrow}=\frac{\beta_1+\beta_2+\cdots+\beta_o}{o} \quad (6)$$

$$CP=\frac{\beta_{\uparrow}-o}{o-1} \quad (7)$$

When the value of the pairwise similarity matrix is smaller than μ $(i.e., 0.1)$, the pairwise matix is considered to be in an ideal state. Hence, the computed qualifying weights are obtained by determining W with respect to greatest $\beta_{\uparrow}$.

3.3. Multimedia IoT device priority based TOPSIS technique for gateway ranking

The TOPSIS technique which uses the multiple parameter decision making technique is constructed using the ET has been proposed in this section for the gateway ranking of the multimedia IoT devices. The

TOPSIS technique takes into account the fact that the chosen outcome is somewhat near to the perfect approach for the best possible outcome, while at the same time being extremely distant from the ideal approach for the worst possible outcome. The proposed work utilized the priority aware technique inside the TOPSIS to construct the multimedia IoT device priority aware TOPSIS. By mapping appropriate substitutes to criteria outlined by a multimedia IoT device, the decision making is generated. The proposed TOPSIS technique can provide efficient ranking for the accessible gateway by using the decision making. Dynamic input criteria are possible with the TOPSIS, and the proposed technique also provides assistance in picking the best possible gateway. Priority contextual parameters, such as those pertaining to decision making, are used to illustrate the circumstances under which decisions must be made regarding the necessary characteristics of communicating devices for established associations. The computation for the ranking of the gateway utilizing the TOPSIS technique is done as follows. The associated mapping of substitute gateway with regard to qualified criteria is used to establish the decision-making E. Every component in the association of the given substitute B corresponds with the criteria D, that is, $B_j D_k$ where $j = 1, \dots, 4$ and $k = 1, \dots, 5$:

$$E = \begin{bmatrix} B_1 D_1 & \cdots & \cdots & B_1 D_n \\ \cdots & \cdots & \cdots & \cdots \\ \cdots & \cdots & \dots & \dots \\ B_n D_1 & \cdots & \cdots & B_n D_n \end{bmatrix} \quad (8)$$

the normalized decision-making pair wise matrix is then applied to the TOPSIS technique using the (9).

$$S_{jk} = \frac{e_{jk}}{\sqrt{\sum_{j=1}^{n}\cdot}} \; where, j = 1, \dots n; k = 1, \dots, o \quad (9)$$

In the (9), e_{jk} relies on the result of the action j for k in decision making. For the construction of the normalized matrix, the S_{jk} normalized criteria set has to be multiplied by the weight X_l. To derive matrix W_{jk}, we first need to collect the weights, which are the result of the criteria weight evaluation method based on multimedia IoT device priority which has already been discussed in section 3.1. The W_{jk} represents the actual data which has been obtained by combining the criteria weights and substitute gateways. Moreover, the ideal positive $(+ve)$ as well as the negative $(-ve)$ technique for the given data is evaluated by utilizing the (1) till (18):

$$W_{jk} = S_{jk} * X_l \; where, \sum_{l=1}^{n} X_l = 1 \quad (10)$$

using the (11) and (12), we can determine the$+ve$ ideal strategy B +and the$-ve$ ideal strategy $B -$

$$B^+ = W_1^+, \dots, W_n^+ \quad (11)$$

$$B^- = W_1^-, \dots, W_n^- \quad (12)$$

(13) and (14) are used to derive the necessary qualification criteria,

$$W_1^+ = \max W_{jk}, k = 1, \dots, o \quad (13)$$

$$W_1^- = \min W_{jk}, k = 1, \dots, o \quad (14)$$

(15) and (16) are used to derive the necessary unqualified criteria,

$$W_1^+ = \min W_{jk}, k = 1, \dots, o \quad (15)$$

$$W_1^- = \max W_{jk}, k = 1, \dots, o \quad (16)$$

further, the similarity distance of the gateways is evaluated by utilizing the (17) and (18).

$$T_k^+ = \sqrt{\sum_{k=1}^{o} \left(W_j^+ - W_{jk}^-\right)^2} \; where, k = 1, \dots o \quad (17)$$

$$T_k^- = \sqrt{\sum_{k=1}^{o} \left(W_{jk}^+ - W_j^-\right)^2} \; where, k = 1, \dots o \quad (18)$$

The raking vector D is attained after getting the $-ve$ and $+ve$ ideal strategies, which has been given in the (19). The D represents the gateway ranking order for all the accessible gateways. For the selection of the ideal gateway, the rank in ordered in the descending order and the highest gateway is selected as the ideal gateway:

$$D_k^* = \frac{T_k^-}{T_k^+ + T_k^-} \ where, k = 1, \dots, o \tag{19}$$

the proposed gateway selection technique provides better QoS in terms of packet loss, jitter and throughput when compared with the existing method which has been given in the next section.

4. RESULTS AND DISCSSIONS

In this section, the results have been discussed by comparing the proposed method and the energy efficient communication [21] selection method. The following references [24]–[26] detail the implementation and simulation parameters taken into account. The IEEE 802.11 protocol has been used for all the multimedia IoT devices. The study of the experiment takes into consideration three distinct types of services: audio, video, and data (in other words, web browsing). Every access network receives the same level of priority. This study utilized the IEEE 802.11 standard MAC that was created in the SIMITS simulator [27] for the purpose of analyzing the efficiency of the presented technique in a dynamic mobility environment. To simulate a multimedia IoT network, an additive-white-gaussian-noise (AWGN) channel is used. The path loss model is then modelled with the help of log-normal shadowing as well as multipath fading. Moreover, the power management is ideal. Then, WLANs are modelled using IEEE 802.11, the rayleigh channel model is applied, and a bandwidth of 3-27 Mbps is employed. To provide a fair and balanced HWSN ecosystem, multimedia IoT device are dispersed at random. It is considered that all the new multimedia IoT devices follow the poisson distribution. In the end, three distinct service categories are taken into account, with video accounting for 40%, audio for 30%, and data for 30%. The performance of the proposed model has been compared with the existing EEC method in terms of throughput, packet loss rate and successful packet transmission which has been showed in the below sections.

4.1. Throughput performance of proposed method over existing EEC selection method

In this section, the throughput performance of the proposed method has been compared with the existing EEC method. The throughput performance has been given in Figure 2 and Figure 3. Two scenarios have been considered. In the first scenario, more traffic has been considered where more number of multimedia IoT devices are waiting for the accessible gateway. In the second scenario, less traffic has been considered where less number of multimedia IoT devices are waiting for the accessible gateway. The results show that the proposed model has improved the average throughput performance by 13.07% whereas the existing EEC method has attained the average throughput performance of 10.34% for the high traffic scenario. Further, the proposed model has improved the average throughput performance by 16.07% whereas the existing EEC method has attained the average throughput performance of 12.34% for the less traffic scenario.

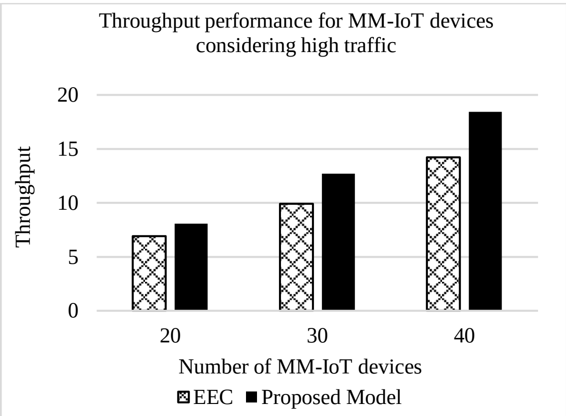

Figure 2. Throughput performance for high traffic of MM-IoT devices

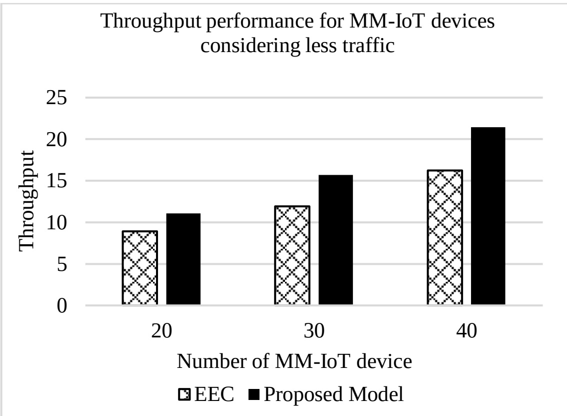

Figure 3. Throughput performance for less traffic of MM-IoT devices

4.2. Packet loss rate performance of proposed method over existing EEC selection method

In this section, the packet loss rate performance of the proposed method has been compared with the existing EEC method. The packet loss rate performance has been given in Figure 4 and Figure 5. Two scenarios have been considered. In the first scenario, more traffic has been considered where more number of multimedia IoT devices are waiting for the accessible gateway. In the second scenario, less traffic has been considered where less number of multimedia IoT devices are waiting for the accessible gateway. The results show that the proposed model has improved the packet loss rate performance by 82.47%, 47.66%, and 31.60% when compared with the existing EEC method for the 20, 30, and 40 MM-IoT devices respectively for the first scenario. Further, the proposed model has improved the packet loss rate performance by 80.76%, 55.21%, 32.45% when compared with the existing EEC method for the 20, 30, and 40 MM-IoT devices respectively for the first scenario.

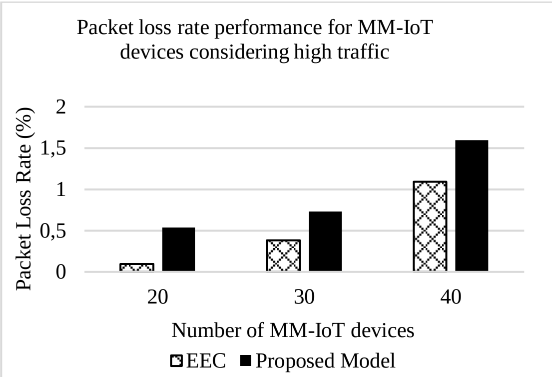

Figure 4. Packet loss rate performance for high traffic of MM-IoT devices

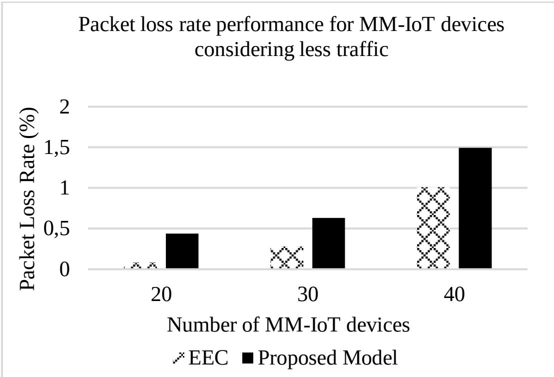

Figure 5. Packet loss rate performance for less traffic of MM-IoT devices

4.3. Successful packet transmission performance of proposed method over existing EEC selection method

In this section, the successful packet transmission performance of the proposed method has been compared with the existing EEC method. The successful packet transmission performance has been given in Figure 6 and Figure 7. Two scenarios have been considered. In the first scenario, more traffic has been considered where more number of multimedia IoT devices are waiting for the accessible gateway. In the second scenario, less traffic has been considered where less number of multimedia IoT devices are waiting for the accessible gateway. The results show that the proposed model has improved the average successful packet transmission performance by 63.33% whereas the existing EEC method has attained the average successful packet transmission performance of 48.66% for the high traffic scenario. Further, the proposed model has improved the average throughput performance by 79.66% whereas the existing EEC method has attained the average throughput performance of 56.33% for the less traffic scenario.

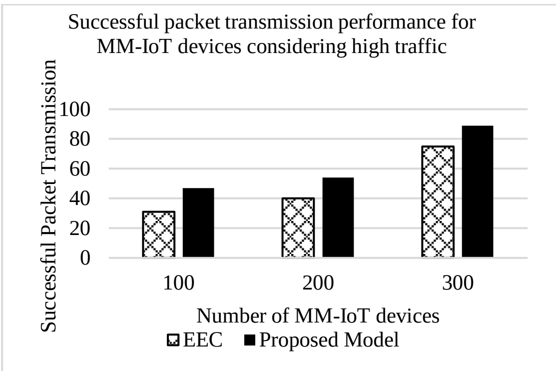

Figure 6. Successful packet transmission performance for high traffic of MM-IoT devices

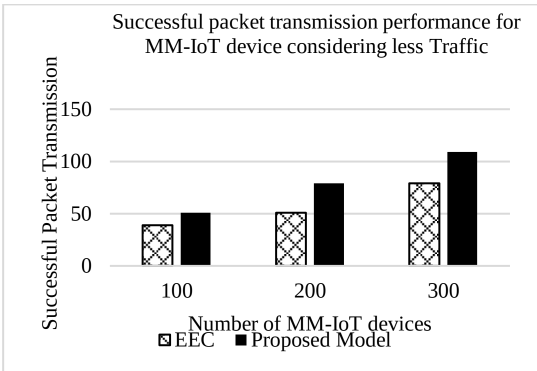

Figure 7. Successful packet transmission performance for less traffic of MM-IoT devices

5. CONCLUSION

In this work, a cross-layer multimedia optimization solution for multi-point to point IoT networks that incorporates service differentiation and bandwidth reservation techniques to improve the QoS of multimedia traffic has been proposed. The multimedia IoT device priority-based criteria-weight evaluation technique and the multimedia IoT device priority-based TOPSIS technique are effective methods for improving QoS in IoT networks by ranking gateways based on their ability to handle multimedia traffic. By considering a set of priority-based criteria, such as available bandwidth, latency, and packet loss rate, and assigning appropriate weights to each criterion, the criteria-weight evaluation technique can provide a quantitative measure of the QoS performance of different gateways. The TOPSIS technique can further refine the ranking by considering the relative performance of each gateway in relation to the other gateways. Both techniques enable network administrators to select the most suitable gateway for multimedia traffic based on their QoS requirements and network conditions. This can improve the overall performance and reliability of multimedia communication in IoT networks, particularly in scenarios where network resources are limited and need to be allocated efficiently. The proposed method has been compared with the existing method and the results show that the proposed model attains better performance in term of throughput, packet loss and successful packet transmission. For future work, the proposed solution will be extended by considering the variable QoS at the internet side and optimize the RTP/RTCP/RTSP protocols to improve QoS and overall throughput for multimedia traffic.

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