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Qos-Mindful Channel Allocation in Directional Wireless Sensor Networks

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Abstract: ***In WSN, two important parameters play a vital role such as energy efficiency and data traffic. We need some QoS parameters to handle this issue. Hence, image and video sensors are introduced to allocate the channel which boosts up the energy in WSN. We proposed a novel QoS mindful channel allocation algorithm, QMCA (QoS-mindful Channel Allocation in Directional Wireless Sensor Networks) to support the data traffic in the network. Based on the priority, direct contact and cluster will allocate the channel. The advantage of the work is, it ensures bandwidth, delay, and throughput for real data. Enhanced QMCA system and EQMCA also proposed to improve the throughput by reducing the computational overhead. The results and implementation have been evaluated in the simulation to show the performance of delay and throughput.***

Index Terms**: Wireless Sensor Network, QoS, Channel Allocation.**

I. INTRODUCTION

A. Computer Network

Networking implies sharing. A PC organizing is a procedure of associating at least two PCs to share data. A framework is a social occasion of PCs, servers, incorporated servers, arrange devices, peripherals, or various contraptions related with one another to allow the sharing of data [1, 26]. The figure of a computer network is shown in Figure 1.

B. Wireless Network

A wireless network system is a PC arranges that utilizes remote information associations between system hubs. Wireless networking is a technique by which homes, media communications systems keep away from the expensive procedure of bringing links into a structure or as an association between different hardware areas. Wireless telecommunication networks are commonly actualized and administrated utilizing radio correspondence [2, 26].The figure of a remote system is given in Figure 2.

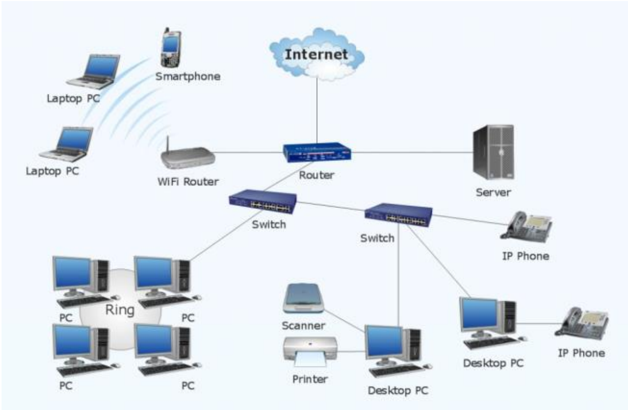

Fig 1. Computer Network

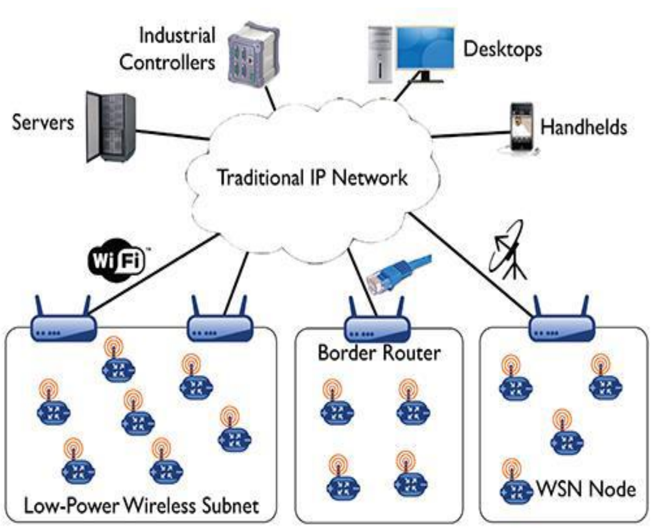

Fig 2. Wireless Network

C. The Benefits of Wireless Network

Preferred position of a wireless network over a wired one is that clients can move around unreservedly inside the territory of the system with their PCs, handheld gadgets and so forth and get a web association. Clients are additionally ready to impart documents and different assets to different gadgets that are associated with the system without being cabled to a port. Not having to lay bunches of links and put those through dividers and so forth can be a significant bit of leeway as far as time and cost. It likewise makes it simpler to add additional gadgets to the system, as no new cabling is required. On the off chance that you are a business, for example, a bistro, having a remote system that is available to clients can bring you additional business. Clients for the most part love wireless network since they are advantageous. Privately owned businesses can experience numerous focal points from a remote framework, including [3]:

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- Comfort. Access your framework resources from any region inside your remote framework's extension area or from any WiFi hotspot.
- Versatility. You're never again joined to your work zone, as you were with a wired affiliation. You and your laborers can go online in social occasion room get-togethers, for example.
- Efficiency. Remote access to the Web and to your association's key applications and resources empowers your staff to do what needs to be done and underpins joint exertion.
- Simple setup. You don't have to string joins, so foundation can be lively and down to earth.
- Expandable. You can without quite a bit of a stretch broadens remote frameworks with existing equipment, while a wired framework may require additional wiring.
- Security. Advances in remote frameworks give enthusiastic security protections.
- Cost. Since remote frameworks shed or diminishing wiring costs, they can cost less to work than wired frameworks [3].

D. Types of Wireless Network

There are four sorts of Wireless Network. The numerous types are depicted in the underneath.

- Wireless personal area network (WPAN): A wireless personal area network (WPAN) is an individual, short separation zone remote system for interconnecting gadgets focused on a unique individual's workspace. WPANs address remote systems administration and portable processing gadgets, for example, PCs, PDAs, peripherals, mobile phones, pagers and buyer hardware.
- Wireless local area network (LAN): A wireless local area network (WLAN) is a remote PC organize that joins at least two gadgets utilizing remote correspondence inside a restricted territory, for example, a home, school, PC research center, or place of business.
- Wireless metropolitan area network(WMAN): The wireless metropolitan area network (WMAN) is a wireless PC arrange that interconnects clients remotely with PC assets in a geographic territory or district bigger than that secured by even an local area network (LAN) yet littler than the zone secured by a wide area network(WAN). The term MAN is connected to the interconnection of systems in a city into a solitary bigger system which may then additionally offer productive association with a wide territory arrange. It is likewise used to mean the interconnection of a few neighborhood in a metropolitan zone using point-to-point associations between them.
- Wireless wide area network (WWAN): A Wireless wide area network (WWAN), is a type of wireless network. The bigger size of a wide area organizes contrasted with a neighborhood requires contrasts in innovation. Remote systems of various sizes convey information as phone calls, site pages, and spilling video [4].

E. Wireless Sensor Networks (WSNs)

A Wireless Sensor Networks (WSN) is a lot of thousands of small scale sensor hubs that are fit for detecting and setting up remote correspondence. A remote sensor arrange comprises of dispersed sensors to screen physical and natural conditions which are of self-ruling sort. These of sensors are utilized to quantify temperature weight and so forth [5].

II. RELATED WORK

WNS innovation impart on the different channels and this channel expands organize limit parallel transmission and power. In light of the advantages and the difficulties in the multichannel interchanges, mainly recurrence of channel task, channel choice strategy and channel task technique. Different procedures are given and contributed numerous various ways. Last referenced class is talked about which manages MCC in WMSNs. WMSNs are not fitting for MC arrangement specially appointed systems. At once, a sensor hub has a solitary radio handset can utilize just one channel. Lower vitality and transmission capacity confinement makes imperative to apply present MC conventions. There are two noteworthy strides in multichannel conventions: one is multichannel MAC and another is channel task conventions.

A few advantages and issue for the adjustment on multichannel WSN have been distinguished first. Arranging three classes channel task is utilized: static, dynamic and semi dynamic technique and give a few plans to execute and genuine use cases. A table is produced for characterization and investigations of existing multichannel task conventions. This table is overviewed conventions [18].

The primary point of this paper, Free Space Optical(FSO) correspondence inside the remote sensor organize utilizing medium access control (MAC) convention. Two photodiode for accepting information rather than one photodiode and utilized a stop transmission demand (STR) signal is proposed here.

A FSO is the correspondence framework where air is utilized as a medium to transmit light wave sign to another area. The principle preferred position of optical correspondence is that optical sign don't spill through dividers nor meddle with sensitive remote gear. In this way, giving security from interlopers Sensor systems have reliably depended on Radio Frequency (RF) to give availability between different sensor hubs and Cluster Head (CH). Sensor hubs sense the current circumstance all things considered. The prerequisites for Medium Access Control (MAC) convention in directional sensor systems are not quite the same as customary sensor systems. The convention must be quick in giving access to the hub and vitality utilization must be least [19].

III. PROPOSED CHANNEL ALLOCATION MECHANISM

We have considered a sensor arrange on agrarian field which will detect information from the field and go to the sink hub. From the sink hub the required information can be gathered and perusing the information one can without much of a stretch think about the natural state of the field.

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In light of the information, essential advance can be taken to improve the state of the farming field and furthermore the choice can be taken developing which crop is increasingly useful for the field. At the point when sensor hubs require transmitting information to the sink, a channel is required to be allotted. We select to designate great quality channel to higher need information so as to guarantee auspicious conveyance of information. The Real Time (RT) information will have the higher need to designate with the channel. The Non Real Time (NRT) will have the second most astounding need and the Best Effort (BE) information will have the last need to get the channel. We have utilized directional radio wire for correspondence among the sensor hubs and with the sink hub. In this postulation work, we have proposed two channel assignment systems, to be specific QoS-mindful Channel Allocation for Directional Sensor Networks (QMCA) and Enhanced QMCA (EQMCA) for accomplishing high throughput and low inertness information conveyance for constant and Non Real-Time information. Our proposed instrument allots channel to transmitting hubs to diminish correspondence overhead and dormancy.

A. System Model and Assumption

We have considered a wireless sensor network over 2600m2 territory around. There is a sink hub in the focal point of the field. The inclusion region of the sink hub will be appropriated in four areas. There are two group heads in each division and the bunch heads which are associated with the sensor hub of the area will speak with the sink hub through directional reception apparatus. On the off chance that we separate 2600m2 in four parts, at that point the region of every segment will be around 650m2 and there might be more than one group head in every one of the division which will cover the sectored territory. There are n number of sensor hubs under a bunch head. On the off chance that any sensor hub is in one bounce remove from the sink hub, at that point it will straightforwardly pass the information to the sink hub. The group heads will impart through a door with one another.

Network System Model Structure

In our QMCA organize there is sink which has the focal control. Every one of the information gathered by the sensor hubs are passed to the sink. To diminish the weight on the sink hubs we have grouped the system. We have partitioned our system in four areas. There is sensor hubs (SN), Gateways, Cluster heads (CH) in each part. The sensor hub which has the most elevated vitality will fill in as the group head. The system depends on directional recieving wire yet the reception apparatus can't cover the each of the four area at once. It can just cover the segment which is toward this recieving wire.

Network System Model (QMCA)

In our proposed network system model, we have thought about a 2600m2network region. A sink will cover the entire zone. The sink inclusion zone will be appropriated in 4 part and zone of each segment is 2600m2. There will be 2 bunch head in each segment. Separation between 2 group head is around 95m and the bunch leaders of the area will be associated through a passage.

- N → 1
- A → 2600m2
- s ϵ S
- A/S → 650m2
- CHi/s → 2
- CHi ϵ H
- gi,j/s → 1
- ni,s → 100m2
- d(CHi, CHj) → 95m

Enhanced Network System Model (EQMCA)

In our EQMCA model all most every one of the components and structure are same as the QMCA strategy. Be that as it may, in our EQMCA technique there are four bunch heads in each division. At that point the separation between the bunch heads has diminished.

B. Clustering

We have bunched our system to improve the absolute execution. The development of this bunching has three section. Every one of the parts have been depicted beneath.

1. Arrangement of cluster
2. Determination of gateways
3. Reestablishing of Cluster head(CH) and gateways

C. QoS Mindful Channel Allocation (QMCA)

In our work the sensor hubs will detect 3 kinds of information (RT, NRT, BE) and the information type depends on their need. We will designate the best channel to the hub to pass the higher need information to sink.We have determined the channel c choice dependent on certain parameters. We have determined channel achievement rate (μc) and for this count we have thought about some result (o) of past transmission. On the off chance that the transmission is fruitful, at that point we have set the result an incentive to 1, on the off chance that the transmission isn't effective, at that point we have set the result an incentive to 0. At that point we have duplicated the result an incentive with the I-th interim and summated the 'm' no of interims augmentation esteem and afterward partitioned with the summation estimation of the interims. The μ is given beneath.

D. QoS Mindful Channel Allocation (EQMCA)

We have utilized a similar calculation for channel allotment for EQMCA strategy as we have utilized for QMCA technique. Be that as it may, in EQMCA technique we have apportioned two parallel channel for each group head for accepting information from sensor hubs and transmitting information to the sink hub at once.

IV. Execution Analysis

A. Experiment Setup

We have built up a directional remote sensor arrange and separated the system in four parts. There are two bunches in every part. We have utilized a passage to build up correspondence with group to bunch. The data that the sensor hubs gather reach to sink through bunch head. The sensor hubs pass the information to its bunch head and the group head send to the sink. For this correspondence we have utilized directional radio wire.

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In our system we have different channels for transmitting information and we have estimated the channel execution dependent on certain parameters. We have organized the information that are gathered by the sensor hubs dependent on their significance. The best performing channel is allotted for the most significant information. In our work, we utilized the divert in recurrence area. The work is connected with us, they likewise attempted to designate the better performing channel for the higher need information. They assigned their divert in time division yet they didn't group their system and they had no bunch head too. In their model sink hub controlled the system. We have executed our work utilizing the strategy QMCA and EQMCA and contrasted and the QFSA-MAC [20].

B. Performance Metric

We have estimated the exhibition of our work dependent on four matrics. We have estimated the throughput, delay, fairness, reliability of our system. Throughput: The information in bits are effectively come to from sensor hub to the sink in a second is throughput. [22]

Delay: We have thought about the delay of data as an exhibition matric. To figure the delay, we have checked the entry time and got time of the information bundle. We have included the holding up time with the subtraction of landing time from got time. [23]

C. Scenario

In our reproduction part, we have tried our calculation changing the traffic load and expanding the channel. We see that on the off chance that we increment the traffic load the throughput increments at the beginning yet at after a point throughput decline. We additionally observe that defer increments if the heap of the system increment and the unwavering quality of the system decline if the heap increments. From our yield we see that, on the off chance that we increment the channel of the system the unwavering quality and throughput increment however defer diminishes. Contrasting and others work that is identified with our work we see that on the off chance that we increment the traffic burden and channel at both case our yield is better.But we can say that, the decency of the two of us is around over 90%, regardless of whether the traffic burden and channel both are being expanded.

D. Increasing Traffic Load

We have expanded the traffic heap of our system to see the yield of our system in regard of throughput, reliability and fairness. We see that, expanding the traffic heap of our system and improved system the throughput begins expanding. It quits expanding at a dimension and after that it begins diminishing. Table 1 shows that the comparison of Packets Vs Throughput with the strategy QFSA-MAC, QMCA and EQMCA. The yield chart of throughput in regard of the expanding traffic load is given Figure 3.

Table 1. Comparison of Number of Packets Vs Throughput

Number of packets	QFSA-MAC	QMCA	EQMCA
20	10	9	10
40	15	13	16
60	22	17	24
80	30	22	32
100	36	27	40
120	42	28	45
140	48	28	52
160	48	28	52
180	48	28	52
200	47	27	50

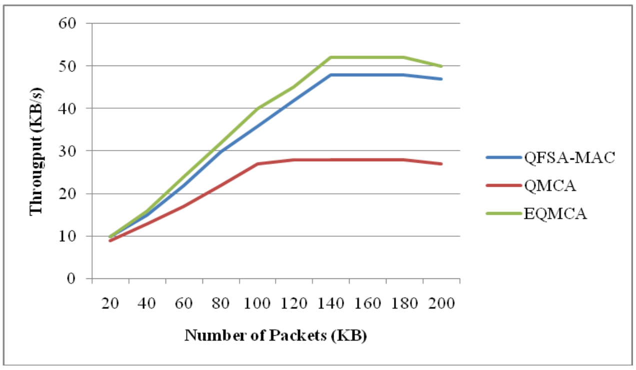

Fig 3. Number of Packets (KB) vs. Throughput(KB/s)

Table 2 shows that the comparison of Number of packets Vs Reliability. Expanding the traffic load, we see that the dependability of our first system and improved system diminishes constantly. The unwavering quality can be most extreme 1 on account of effectively conveying of all transmitted bundle to the sink. In any case, it is an uncommon case. The diagram between the traffic load and the unwavering quality is given Figure 4.

Table 2. Comparison of Number of Packets Vs Reliability

Number of packets	QFSA-MAC	QMCA	EQMCA
20	0.9	0.95	1
40	0.8	0.9	0.95
60	0.78	0.85	0.9
80	0.74	0.81	0.85
100	0.7	0.8	0.84
120	0.65	0.75	0.8
140	0.55	0.7	0.75
160	0.5	0.6	0.7
180	0.45	0.5	0.6
200	0.4	0.45	0.5

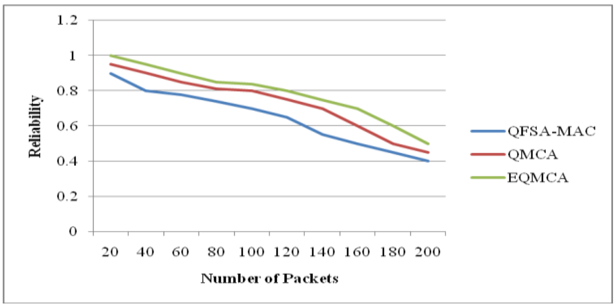

Fig 4. Number of Packets Vs. Reliability

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In our work we have profoundly considered to guarantee the reasonableness of the system. In our system as for traffic load the RT information has at least delay. On the off chance that heap is expanded the delay of RT information increments at a low rate however the delay of NRT and BE information is expanded with the expanding traffic load. The diagram of fairness of our work and improved work is given Figure 5 and Figure 6 based on Table 3 and 4.

Table 3. Fairness in QMCA

Number of Packets	RT	NRT	BE
800	175	225	300
900	175	250	420
1000	190	390	500
1100	200	400	570
1200	210	410	560
1300	225	420	570
1400	240	430	580
1500	300	430	580
1600	320	400	600
1700	370	360	640

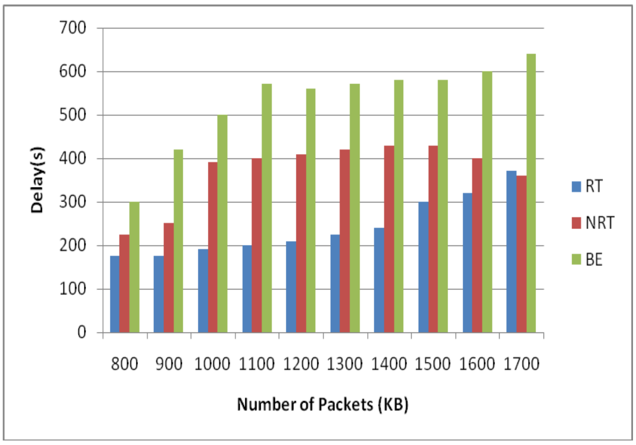

Fig 5. Fairness (QMCA)

Table 4. Fairness in EQMCA

Number of Packets	RT	NRT	BE
600	50	225	225
700	75	300	320
800	80	390	420
900	100	400	430
1000	125	410	425
1100	150	420	440
1200	175	420	450
1300	200	400	450
1400	210	400	500
1500	225	380	550

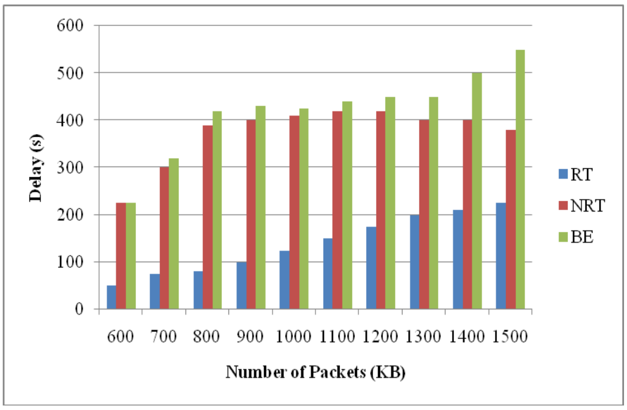

Fig 6. Fairness (EQMCA).

From the graph we see that when we increased the number of channel from 2 to 4 the throughput line went up for our both work and after the point (x) in x-axis the increasing became slower. We have better throughput for our improved work then our previous work and our both throughput line is above then the comparing line.

V. CONCLUSION AND FUTURE WORK

A. Conclusion

Our proposed work is designed to provide an exact solution for any plan. Firstly, the work sectors a network and allocates a channel with the help of load, availability of bandwidth and workload of network. The best channel is allocated by giving the preference to the data. The waiting time is calculated and the comparative analysis has been made with other techniques.

B. Future Works

Our work motivates us to apply the same concept for multiple channel allocation in the MAC layer as per the preference of the data. In the future, we are planning to simulate in NS3 and consider the issue of deafness which is not always directly connected with the antenna.

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