PSYCHOLOGY AND EDUCATION (2021) ISSN: 0033-3077 Volume: 58(4): Pages: 1420 - 1441
Article Received: 08th October, 2020; Article Revised: 15th February, 2021; Article Accepted: 20th March, 2021

ENERGY EFFICIENCY AND QOS CONCESSION TECHNIQUE UTILIZING OMAC PROTOCOL FOR WBAN

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Abstract— Wireless body area network (WBAN) is the special purpose sensor that can self-rulingly interface with different sensors and apparatuses, situated inside and outside of a human body. The small battery-operated implanted biomedical sensor nodes are used to monitor and gathers the physiological signs. While transmitting the signal most of the energy is wasted and Quality of Service. In this paper, we propose an optimal MAC (OMAC) convention for WBANs utilizing the Multi-Dimenision(MD) graph advancement to bargain the energy utilization and QoS in information transmission. OMAC convention uses MD chart enhancement calculation to upgrade the planned channel and traffic of WBAN. In channel planning, assembled information consistently stand by a timeframe to be sent for gathering more information at the hub; all accumulated information is collected into one or a few delegate information and afterwards communicated to an upper adjoining hub. The holding up time at nodes is customizable and is constantly settled by comparing applications, which accord the energy by improving transmission delay, information transmission quality and organization lifetime..

Keywords—OMAC, WBAN,QoS MD graph, channel scheduling

1. Introduction

Wireless body sensor Network (WBSN) is one class in a remote organization of wearable figuring gadgets. WBAN devices may be introduced inside the body and could be surface mounted on the body in a clear position or may be utilized with different devices which individuals can place in different positions [1]. Bigger gadgets actually have a fundamental impact as a data place point, data passage and giving an interface to take a superior control of WBAN applications. The beginning of WBAN innovation uses the Wireless body area Network (WBAN) to execute correspondence on, close, and around the actual body [2]. WBAN came to utilize anyplace correspondence is totally among, on, and inside the speedy proximity of an individual body. WBAN system will use

longer ranges and the wearable devices on the human body can be associated with the web. WBANs empower us to utilize versatile, little and lightweight sensor nodes for quite a while of wellbeing checking. Utilizing detecting capacities, these little energies obliged gadgets to quantify human body boundaries and speak with some outer observing station for diagnosing or medicine from a doctor. The information spilling from the human body to the checking station utilizing a remote correspondence channel is an energy burning-through measure [3]. The sensor nodes of little size with low force and restricted computational abilities are connected or embedded to the human body for estimation of physiological signs. Coming up next are the physiological signs; heartbeat, respiratory examples, act, breathing rate, temperature, Electro Cardio Gram (ECG), Electro Encephalo Graphy (EEG) and so on [4]. Transmission information rates for these physiological boundaries fluctuate from 1Kbps to 1Mbps. The sensor nodes gather data from the human body and speak with a focal gadget called an organizer.

The MAC layer is the most appropriate level for addressing energy efficiency. The allocated wireless medium is applicable to organize node entry [5]. To attain quality of service (QoS) MAC is the main platform for transmitting and receiving protocol stack. A flexible MAC should assist different utilization and various class of information like recurrence, non-recurrence, regular and huge information through QoS [6]. MAC plays a significant deciding element in improving by and large organization execution. The essential undertaking in MAC convention is to forestall synchronous transmissions while protecting the most extreme yield and to maintain a strategic distance from impacts, greatest energy proficiency, correspondence unwavering quality and least inertness. For constructing a MAC protocol it is necessary to understand the nodes which are subject to failure, artificial potential and narrow energy tools. For satisfactory access of shared medium, A Time-division numerous entrance (TDMA) method is utilized for short-range remote advances and WSNs in MAC convention. [7] transporter sense various access with crash shirking (CSMA/CA) [8]. In WSN the medium access is not appropriate for CDMA and TDMA due to system hardware and huge calculating power obligations [9][10]..

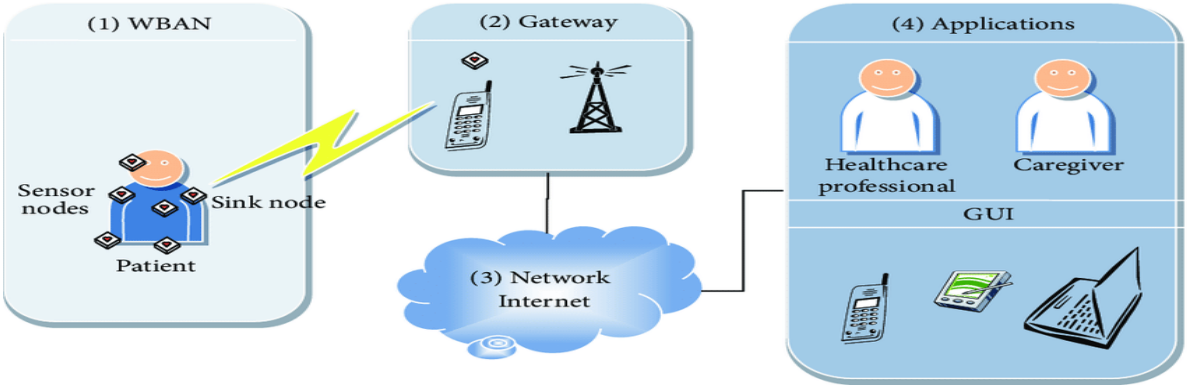

Fig 1: WBAN Architecture

To monitor crucial signs in the human body like heart attack, body temperature and other activity. An energy-efficient MAC protocol is constructed uniquely for WPSN concentrated towards common health care utilization. In a free system, everybody sensor is allocated with several cross-layer process variables of various nature which is applicable to affiliate a fuzzy-logic method with the support of the cross-layer energy scale program and energy-aware polices activation [12]. The body sensors are suitable to command a collision-free program slot and demand for accurate method packet delaying or fewer body sensors less battery lifespan. In wireless observations of physiological signs like EEG and ECG, energy-efficient MAC protocol is appropriate for transmission in WBAN.WBAN observations are used for wireless healthcare. A TDMA MAC protocols are applicable for the cross-layer battery. A traffic status register bank depends on an energy-efficient protocol the traffic-aware dynamic (TAD) MAC protocol which is based on a productive transformation of mount interruption [15]. The consumption of advanced energy result follows the method which grants the mount interruption to assemble a regular code for fixed and volatile traffic standards. The present rate of MAC includes logical dealing with interruption readdressing carefully, adopting relays in especially crucial conditions, like body sleeping and carry power control [16]. The effective alteration of MAC superframe design supported on channel condition and traffic nature To transmit data nodes can apply appropriate access device transmitting time period and sampling rate in order to attain both transmitting efficiency and accuracy. [17].

Related Work

An energy proficient MAC convention is known as Quasi-rest seize support (QSPS). It depends on TDMA – based framework and nodes send parcels in the doled out openings while showing up in the Q-rest mode. A hub with a crisis parcel can course an extraordinary arranged moving message to awaken acquires the option to utilize the current space to send that crisis bundle, along these lines diminishing postponement. QSPS acquired tremendous energy effectiveness and decrease the deferment of both crisis and typical parcels. [18].

Various simultaneous WBANs applying social correspondence is movable aggravation control conspire. This plan perceives the movement of nodes inside each WBAN just as the corresponding activity of WBANs as for one another. As for this portable situation traffic load, signal strength and the thickness of sensors in a WBAN are consolidated to upgrade transmission time with simultaneous and equal transmissions to fundamentally lessen the radio impedance and energy utilization of nodes. This methodology prompts higher parcel conveyance proportion (PDR) and a more drawn out network lifetime even with nodes progressively moving into and out of one another's obstruction district [19].

3. Research methodology

A bit of the standard objectives in a WBAN are to achieve the most limit throughput, least deferral, and to expand the framework lifetime by controlling the key wellsprings of imperativeness waste, i.e., crash, dormant tuning in, getting, and control bundle overhead. An effect happens when more than one package sends data all the while. The affected groups should be retransmitted, which exhausts extra imperativeness. The second wellspring of imperativeness squander is idle tuning in, suggesting that a centre checks out a dormant channel to get data. The third source is getting, i.e., to get packages that are bound to various centre points. The last source is control package overhead, inferring that control information is added to the payload. An unimportant number of control bundles should be used for data transmission.

Medium Access Control (MAC) shows accept a huge occupation in handling the recently referenced issues. Generally, it is accumulated into struggle based and plan based MAC shows. In clash based MAC shows, for instance, CSMA/CA shows,

centre battle for the channel to send data. If the channel is involved, the centre point yields its transmission until it ends up idle. These shows are adaptable with no extreme time synchronization constraint. Nevertheless, they secure colossal show overhead. In plan based shows, for instance, TDMA shows, the channel is isolated into plan openings of the fixed or variable term. These openings are given out to centre points and each centre sends during its space period. These shows are essentialness directing shows. Since the commitment pattern of radio is reduced, there is no question, dormant tuning in and getting issues. In any case, these shows require visit synchronization.

The improvement of a low-control MAC convention for a WBAN has been a hot research theme throughout a previous couple of years. Impressive research endeavors have been committed to proposing/explore new MAC conventions that could fulfill the significant WBAN prerequisites. Various scientists have considered IEEE 802.15.4[14] for a WBAN since it supports low data rate applications, but it is not enough to support high data rate applications (data rate > 250 Kbps).

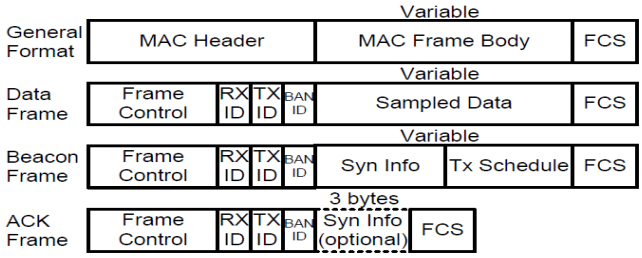

Fig 3b: MAC protocol frame format

The organization shaped by the clinical device is supposed to be body nodes which are heterogeneous frame and execute the particular capacity. Each capacity requires a heterogeneous measure of ability to execute an unmistakable undertaking which is related to assessment, noticing and treatment of patient wellbeing and it requires different nature of administration for each. Additionally, the quantity of nodes and their size is really restricted to a fixed sum as the human body nodes face space conditions. In this way, the exhibition of each hub is shrewd and proficient because of the restricted space accessible. Since the size and weight of body nodes are corresponding to the force limit of the gadget, this expands the limit of the battery which further builds the size and weight of the body hub along these lines, make it as little as conceivable to make it agreeable for the human body. Further, less limit of the battery likewise put a constraint on the body hub life period. However long the battery is supplanted a controlled hub can productively act its

capacity which is reasonable to play out its taste unobtrusively. The battery charge is declined from its abundant level, the errand performing pace of the body hub declined from the assumed level. All things considered, the battery is unfilled and the hub forms into latent perpetually to restart the fitting working of the body node.It is important to supplant the battery at the most punctual. Be that as it may, it is may not be commonsense as it might prompt a patient's life in harm's way. This intricacy turns out to be more convoluted when the hub is inserted inside the body as the change needs careful activity. [26].

3.1 Existing Model.

The star geography WBAN is considered as referenced in fig 1. The proposed framework oversees the significant activities of WBAN. The TDMA based MAC convention is utilized to forestall crashes, catching and optimal tuning in. As demonstrated in Fig. 3a, we isolate the time hub into customary time stretches, called super edges with steady length T. as indicated by examining rate necessity, an adequate opening has been held for the sensor nodes. The excess superframe is treated as an inactive part during which no correspondence is normal. To accomplish these capacities, we depict the MAC outline configuration of the proposed convention dependent on IEEE 802.15.6 standard [26], as demonstrated in Fig. 3b.

4. Our contributions.

An optimal MAC (OMAC) convention is proposed for WBANs utilizing the Multi-Dimenision(MD) graph enhancement. The fundamental target of the proposed OMAC convention is to bargain the energy utilization and QoS during information transmission, additionally improves network lifetime. The data get-together and transmission getting ready for a singular WBAN is referred to in the norm in detail. Nevertheless, when at any rate two customers wearing WBANs are in proximity the between customer impedance between the WBANs can't be disregarded, especially if they are using a comparative channel for transmission. In any case, IEEE 802.15.6 fails to demonstrate any passageway coordination between the WBANs at the MAC sub-layer. This could provoke genuine co-channel impedance among the current together WBANs. This between framework impedance will raise the sign to block notwithstanding SINR and can achieve throughput corruption and group setback. Package disaster is a threat to patient's lives

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when WBANs are used in the restorative administration's territory. This will similarly incite essentialness wastage and reduction in imperativeness adequacy of WBAN centre points (Fig.4).Common traffic is the data traffic which is used to screen the ordinary condition of a person with no criticality and on interest events. Emergency traffic is begun by center points when they outperform a predefined limit or in any emergency condition. On-demand traffic is begun by the affirmed work power like trained professional or master to acquire certain information for demonstrative explanation.

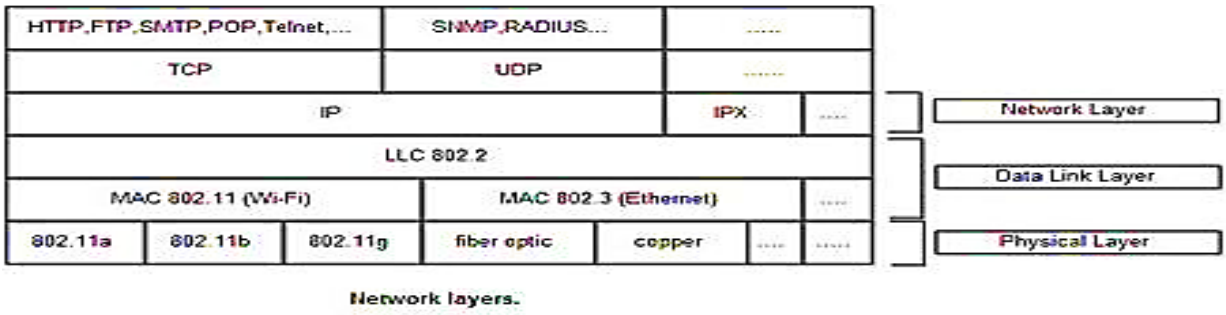

Fig 4

To overcome those problems, an optimal MAC (OMAC) protocol is proposed to compromise energy consumption and QoS during data transmission. The main contribution of proposed OMAC protocol is summarized as follows:

- •The proposed OMAC convention configuration uses MD graph improvement calculation to advance the booked channel and traffic of WBAN. In channel planning, accumulated information consistently stand by a timeframe to be communicated for gathering more information at a hub; all assembled information are totaled into one or a few delegate information and afterward sent to an upper adjoining hub.
- The holding up time at nodes is movable and consistently chose by comparing applications, which bargain the energy by improving transmission delay, information transmission quality and organization lifetime.

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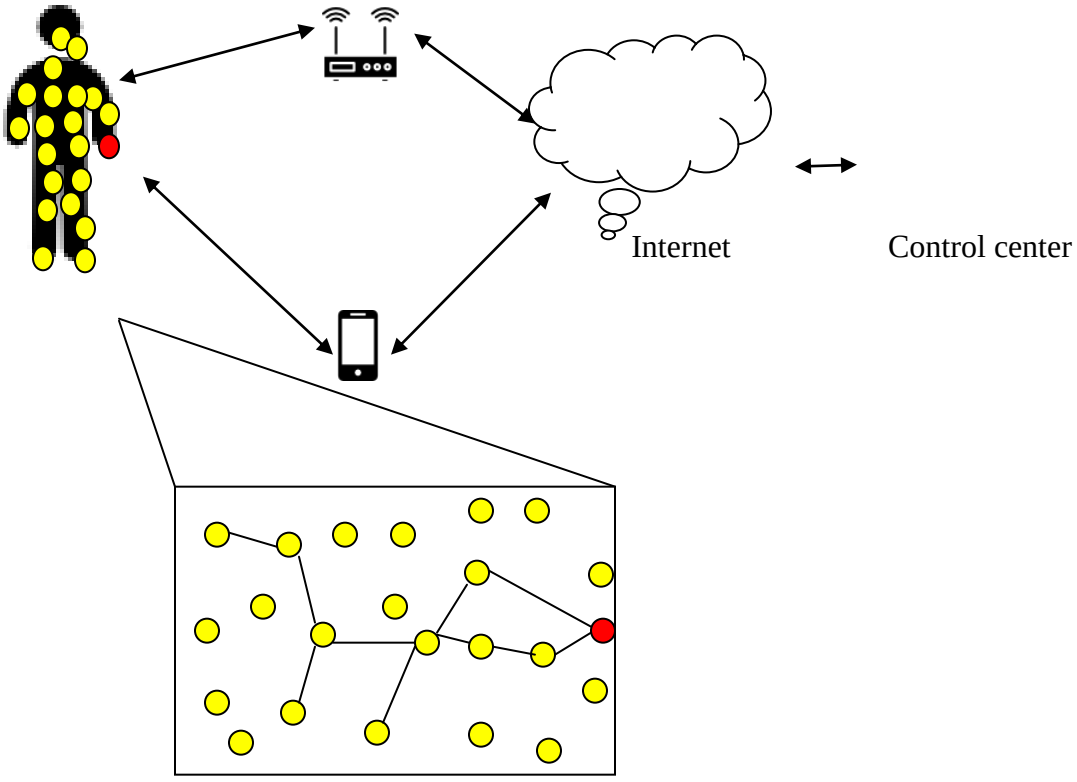

System model of proposed protocol

Optimal MAC protocol

The information assortment and transmission planning for a solitary WBAN is referenced in the norm in detail. Notwithstanding, when at least two clients wearing WBANs are in closeness the between client obstruction between the WBANs can't be overlooked, particularly on the off chance that they are utilizing a similar channel for transmission. However, IEEE 802.15.6 neglects to determine any

entrance coordination between the WBANs at the MAC sub-layer. This could prompt serious co-channel obstruction among the coinciding WBANs. This between network impedance will raise the sign to obstruction in addition to commotion proportion (SINR) and can bring about throughput debasement and bundle misfortune. Parcel misfortune is a danger to patient's lives when WBANs are utilized in the medical services area. This will likewise prompt energy wastage and abatement in the energy effectiveness of WBAN nodes. Typical traffic is the information traffic that is utilized to screen the ordinary state of an individual with no criticality and on request occasions. Crisis traffic is started by nodes when they surpass a predefined limit or in any crisis circumstance. On-request traffic is started by the approved faculty like specialist or advisor to secure certain data for an analytic reason.

The working flow of proposed MD graph optimization algorithm is given in Algorithm 1.

Algorithm 1: MD graph optimization algorithm

1 Introduce the nodes and their situations
2 with get-together requirements $\gamma, E_s,$
3 and p_n.
Compute the fitness for every node using equation-17
4
Process aggregate wellness utilizing dolphin's standards and decide the best hub by contrast introductory wellness
5 with proposed wellness with the choices picked for each hub.
Give out the probability of the best space dubious to the predefined validity regard in the current circle and offer out rest of the probability between various decisions as shown by the coordinated assembling wellness'.
Choose next loop node for best determination.
Process repeat channel scheduling

5. Simulation Tools

The proposed OMAC convention is carried out in the Network Simulator (NS-2) instrument. It is an open-source occasion driven test system planned explicitly for research in PC correspondence organizations. It is a discrete occasion test system for systems administration research. It offers significant help to reenact a lot of conventions like TCP, FTP, UDP, HTTP and DSR. It mimics the wired and remote organization. The NS2 present the clients with characterized network conventions and recreate their comparing practices.

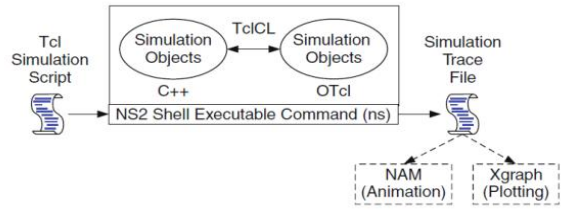

Fig 5: NS2 Architecture.

the basic architecture of NS2. NS2 provides users with executable command ns which take on input argument, the name of a Tcl simulation scripting file.

Performance Evaluations

Comparative analysis, Varying sensor nodes

In this scenario, the performance analysis is computed by varying sensor nodes as 20, 40, 60, 80 and 100. Fig. 2 shows the energy consumption comparison of proposed and existing algorithms. The plot clearly depicts the energy consumption of the proposed OMAC protocol is very low compare to the existing MAC protocol. Fig. 3 shows the average frame latency comparison of proposed and existing algorithms. The plot clearly depicts the average frame latency of the proposed OMAC protocol is very low compare to the existing MAC protocol. Fig. 4 shows the loss reduction comparison of proposed and existing algorithms. The plot clearly depicts the loss reduction of the proposed OMAC protocol is very low compare to the existing MAC protocol. Fig. 5 shows the network lifetime comparison of proposed and existing algorithms. The plot clearly depicts the network lifetime of the proposed OMAC protocol is very low compare to the existing MAC protocol. Fig. 6 shows the delay comparison of proposed and existing algorithms. The plot clearly depicts the delay of the proposed OMAC protocol is very low compare to the existing MAC protocol. The result of NS2 performance can be evaluated along with routing protocols namely OMAC and MAC compared in terms of energy consumption, average frame latency, network lifetime and delay. Table 5.2 shows results of energy consumption with varying number of nodes in NS2 simulator. After 100 iterations performed in NS2 simulation, the results of arithmetic mean values are obtained. When compared to additional routing protocols, it provides a better network lifetime for OMAC routing protocol. In a stable network environment, OMAC performs better and leads to more nodes, which reduces the value of MAC energy. As for the OMAC, it performs best on a number of different nodes. The performance of MAC was poor when compared to OMAC..

Table 5.3 shows results of average frame latency with varying number of nodes in

NS2 simulator. After 100 iterations performed in NS2 simulation, the results of arithmetic mean values are obtained. When compared to additional routing protocols, it provides better network lifetime for OMAC routing protocol. In a stable network environment, OMAC performs better and leads to more nodes, which reduces the value of MAC energy. As for the OMAC, it performs best on a number of different nodes. The performance of MAC was poor when compared to OMAC.

Table 5.4 shows results of loss reduction with varying number of nodes in NS2 simulator. After 100 iterations performed in NS2 simulation, the results of arithmetic mean values are obtained. When compared to additional routing protocols, it provides better network lifetime for OMAC routing protocol. In a stable network environment, OMAC performs better and leads to more nodes, which reduces the value of MAC energy. As for the OMAC, it performs best on a number of different nodes. The performance of MAC was poor when compared to OMAC

Table 5.5 shows results of network lifetime with varying number of nodes in NS2 simulator. After 100 iterations performed in NS2 simulation, the results of arithmetic mean values are obtained. When compared to additional routing protocols, it provides better network lifetime for OMAC routing protocol. In a stable network environment, OMAC performs better and leads to more nodes, which reduces the value of MAC energy. As for the OMAC, it performs best on a number of different nodes. The performance of MAC was poor when compared to OMAC.

Table 5.6 shows results of delay comparison with varying number of nodes in NS2 simulator. After 100 iterations performed in NS2 simulation, the results of arithmetic mean values are obtained. When compared to additional routing protocols, it provides better network lifetime for OMAC routing protocol. In a stable network environment, OMAC performs better and leads to more nodes, which reduces the value of MAC energy. As for the OMAC, it performs best on a number of different nodes. The performance of MAC was poor when compared to OMAC.

Number of nodes	**OMAC**	**MAC**
20	200	210
40	205	225
60	215	250
80	230	260
100	240	270

Table 5.2

Number of nodes	**OMAC**	**MAC**
20	230	250
40	240	260
60	232	265
80	250	290
100	258	270

Table 5.3

Number of nodes	**OMAC**	**MAC**
20	3	1.5
40	7	2.5
60	6	3.5
80	8	4.2
100	9	5

Table 5.4

Number of nodes	**OMAC**	**MAC**
20	3	1.5
40	7	2.5

60	6	3.5
80	8	4.2
100	9	5

Table 5.5

Number of nodes	**OMAC**	**MAC**
20	3	1.5
40	7	2.5
60	6	3.5
80	8	4.2
100	9	5

Table 5.6

5.2 Varying channel variation speed 0.1, 0.2, 0.3, 0.4, 0.5

In this situation, the presentation examination is figured by fluctuating channel variety speed as 0.1, 0.2, 0.3, 0.4 and 0.5. Fig. 7 shows the energy utilization correlation of proposed and existing calculations. The plot obviously portrays the energy utilization of the proposed OMAC convention is exceptionally low contrast with the current MAC convention. Fig. 8 shows the normal casing inactivity examination of proposed and existing calculations. The plot obviously portrays the normal edge dormancy of the proposed OMAC convention is low contrast with the current MAC convention. Fig. 9 shows the misfortune decrease correlation of proposed and existing calculations. The plot plainly portrays the misfortune decrease of the proposed OMAC convention is extremely low contrast with the current MAC convention. Fig. 10 shows the organization lifetime correlation of proposed and existing calculations. The plot plainly portrays the organization lifetime of the proposed OMAC convention is extremely low contrast with the current MAC convention. Fig. 11 shows the postpone correlation of proposed and existing calculations. The plot unmistakably portrays the deferral of the proposed OMAC convention is low contrast with the current MAC convention.

Table 5.7 shows results of energy consumption with varying number of nodes

in NS2 simulator. After 100 iterations performed in NS2 simulation, the results of arithmetic mean values are obtained. When compared to additional routing protocols, it provides better network lifetime for OMAC routing protocol. In a stable network environment, OMAC performs better and leads to more nodes, which reduces the value of MAC energy. As for the OMAC, it performs best on a number of different nodes. The performance of MAC was poor when compared to OMAC. From fig 7 we evaluated the OMAC routing protocol by force, which was a quiet fine compared to the routing protocol MAC. The plot clearly illustrated the proposed OMAC is 10.58% less than existing MAC.

Table 5.8 shows results of average frame latency with varying number of nodes in NS2 simulator. After 100 iterations performed in NS2 simulation, the results of arithmetic mean values are obtained. When compared to additional routing protocols, it provides better network lifetime for OMAC routing protocol. In a stable network environment, OMAC performs better and leads to more nodes, which reduces the value of MAC energy. As for the OMAC, it performs best on a number of different nodes. The performance of MAC was poor when compared to OMAC. From fig 8 we evaluated the OMAC routing protocol by force, which was a quiet fine compared to the routing protocol MAC. The plot clearly illustrated the proposed OMAC is 11.3% less than existing MAC.

Table 5.9 shows results of loss reduction with varying number of nodes in NS2 simulator. After 100 iterations performed in NS2 simulation, the results of arithmetic mean values are obtained. When compared to additional routing protocols, it provides better network lifetime for OMAC routing protocol. In a stable network environment, OMAC performs better and leads to more nodes, which reduces the value of MAC energy. As for the OMAC, it performs best on a number of different nodes. The performance of MAC was poor when compared to OMAC. From fig 9 we evaluated the OMAC routing protocol by force, which was a quiet fine compared to the routing protocol MAC. The plot clearly illustrated the proposed OMAC is 47.2% high than existing MAC.

Table 5.10 shows results of network lifetime with varying number of nodes in NS2 simulator. After 100 iterations performed in NS2 simulation, the results of arithmetic mean values are obtained. When compared

to additional routing protocols, it provides better network lifetime for OMAC routing protocol. In a stable network environment, OMAC performs better and leads to more nodes, which reduces the value of MAC energy. As for the OMAC, it performs best on a number of different nodes. The performance of MAC was poor when compared to OMAC. From fig 10 we evaluated the OMAC routing protocol by force, which was a quiet fine compared to the routing protocol MAC. The plot clearly illustrated the proposed OMAC is 29.6% high than existing MAC.

Table 5.11 shows results of delay with varying number of nodes in NS2 simulator. After 100 iterations performed in NS2 simulation, the results of arithmetic mean values are obtained. When compared to additional routing protocols, it provides better network lifetime for OMAC routing protocol. In a stable network environment, OMAC performs better and leads to more nodes, which reduces the value of MAC energy. As for the OMAC, it performs best on a number of different nodes. The performance of MAC was poor when compared to OMAC. From fig 11 we evaluated the OMAC routing protocol by force, which was a quiet fine compared to the routing protocol MAC. The plot clearly illustrated the proposed OMAC is 56% less than existing MAC.

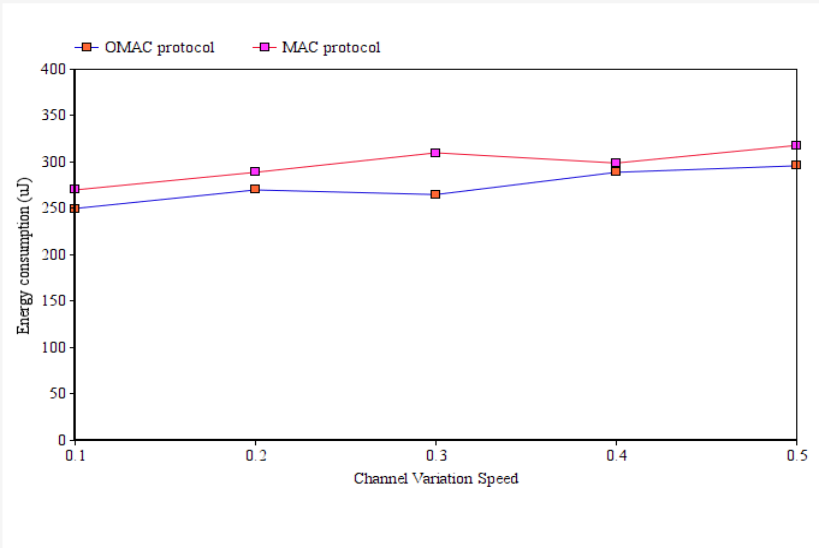

Fig. 7 Energy consumption comparison of OMAC and MAC protocol

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Table 5.7 Energy consumption comparison (J)

Channel variation speed	OMAC	MAC
0.1	250	260
0.2	255	280
0.3	252	310
0.4	260	290
0.5	265	300

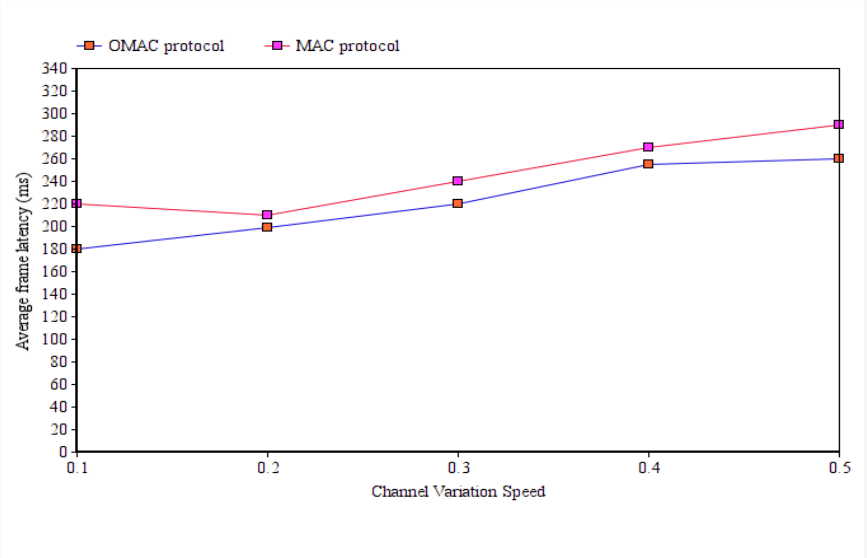

Fig. 8 Average frame latency comparison of OMAC and MAC protocol

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Table 5.8 Average frame latency comparison (ms)

Channel variation speed	OMAC	MAC
0.1	180	220
0.2	200	210
0.3	210	240
0.4	250	270
0.5	250	290

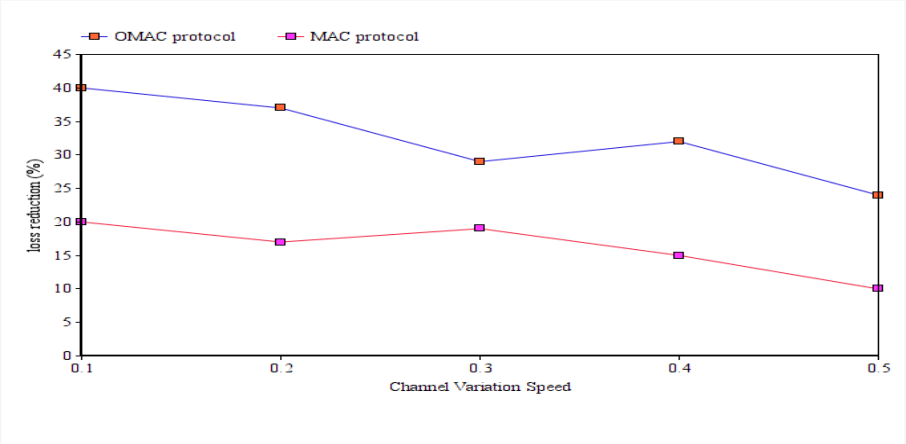

Fig. 9 Loss reduction comparison of OMAC and MAC protocol

Table 5.9 Loss reduction comparison (%)

Channel variation speed	OMAC	MAC
0.1	40	20
0.2	38	18

0.3	30	19
0.4	32	16
0.5	25	13

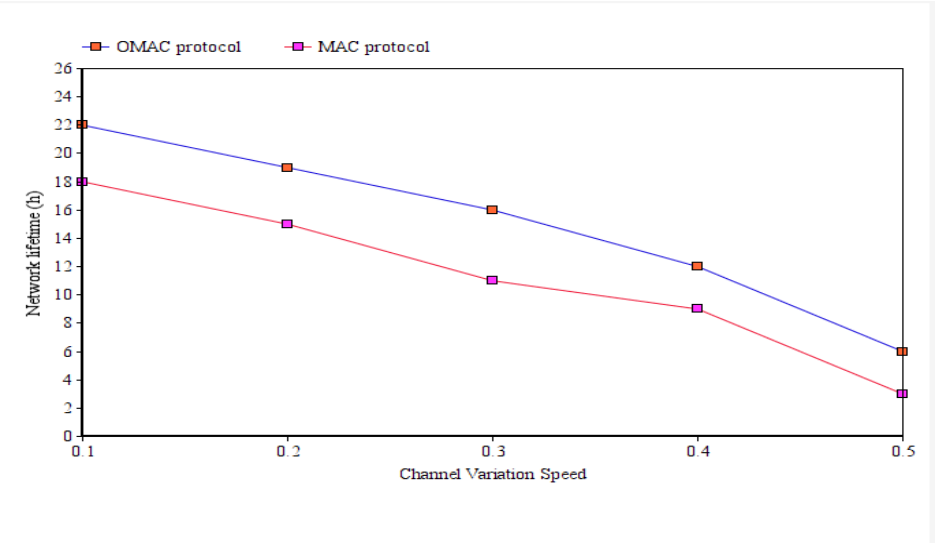

Fig. 10 Network lifetime comparison of OMAC and MAC protocol

Table 5.10 Network lifetime comparison (h)

Channel variation speed	**OMAC**	**MAC**
0.1	22	18
0.2	19	15
0.3	17	12
0.4	13	10
0.5	7	3

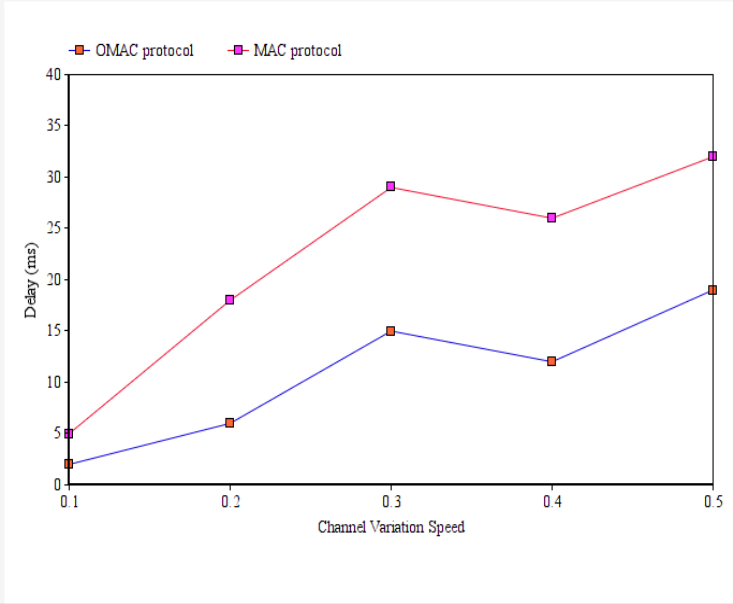

Fig. 11 Delay comparison of OMAC and MAC protocol

Table 5.11 Delay comparison (ms)

Channel variation speed	OMAC	MAC
0.1	2	5
0.2	5	17
0.3	14	29
0.4	12	26
0.5	17	32

CONCLUSIONS

We have proposed an Optimal MAC (OMAC) convention for WBANs utilizing the Multi-Dimension(MD) chart advancement to bargain the energy utilization and QoS in information transmission. OMAC convention uses MD chart streamlining calculation to advance the booked channel and traffic of WBAN. The accumulated information consistently stand by a timeframe to be communicated for

gathering more information at the hub for assembled information are amassed into one or a few agent information and afterwards sent to an upper adjoining hub. The holding up time at nodes is movable and is constantly settled by comparing applications, which bargain the energy by improving transmission delay, information transmission quality and organization lifetime.

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