Sensitive Health Data Transmission in Ambient Intelligent Environment Wban using Life Time Increasing Quality Awarenesspeering Routing

M.Santhalakshmi, P.Kavitha

Abstract: ***Wireless body area networks (WBAN) is one of the sensor networks that helps to continuously monitoring the human health activities by using the wearable computing devices. The wearable ambient electronic devices examines the patient health information such as air flow, temperature, blood pressure, electromagnetic information which need to be transmitted from source to destination for analyzing their health in emergency situation. During the information transmission, quality of the information should be difficult to maintain due to node and link failure which leads to create the intermediate attacks. So, in this paper introduces the life time increasing quality awareness peering routing protocol for managing the sensitive data with effective manner. The method examines the energy of the node and delay value by calculating the weighted average moving which helps to manage the energy of the node as well as providing the efficient path for transmitting the sensitive data from source to destination. In addition this algorithm eliminates the intermediate attack by using the peering routing protocol. Finally the performance of the system is evaluated in terms of the end to end delay, packet delivery ratio, energy consumption and QoS metric related constraints.***

Keywords:

Ambient Intelligence, Wireless body area networks (WBAN), life time increasing quality awareness peering routing protocol, weighted average moving, end to end delay, packet delivery ratio, energy consumption and QoS metric related constraints.

1. INTRODUCTION

Ambient Intelligence [1] is one of the upcoming technologies that provides the various intelligent services, electronic device, and technology interface that used to examine various task, activities and information transmission process [2].

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The growth of the technologies leads to create many devices, for monitoring the patient health, medical treatment in regular basis [3]. Due the importance of the wireless body area network based communication patient health information's are monitored for eliminating the critical issues such as heart attack, blood pressure, sugar level and temperature [4]. The wireless sensor networks consist of collection of heterogeneous sensor nodes which are placed in human body that continuously records the patient health information such as ECG, EEG, pulse, blood pressure, temperature and SpO2 level that is transmitted to the nearby health center [5]. During the data transmission process emergency data has been transmitted to the destination according to the priority of the data which are examined in terms of ordinary packet, middle packet and emergency packet [6]. The categorized packets are transmitted to the destination using different routing technologies [7] such as energy routing protocol, life time maximization routing protocol, Ad-hoc routing protocol, distance vector routing process and quality based routing protocols are mostly utilized for transmitting data with effective manner from source to destination. According to the different author opinions, different research protocol used to understand the problem definition of this work. In [8] the creator tended to the inadequacy of QOS in the past MAC conventions and proposed a QoS profile to be specific DRT that includes the deferral, unwavering quality and throughput. The better unwavering quality has been achieved with in certain eras and information rates with the DRT profiles. In [9], the creator proposed buries client obstruction diminishment plot in view of amusement theoretic approach for Body sensor organize and the plan performed with no incorporated organization. The amusement has been demonstrated to choose the channel and transmission control between the players i.e. the hub with their obstruction level as utility. In [10] talk about the remote body territory arrange therapeutic application in which the WBAN is utilized to screen the patient points of interest with successful way and

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limited cost. The WBAN comprises of three layers in particular, sensor organize, figuring system and remote checking system. The layers get the data from the different sensor arrange spots and it transmits to the doctor's facility by means of the PC systems. Along these lines the remote based observing procedure guarantees the security to the patient wellbeing with proficient way. In [11] actualize the Wireless Body Area Network framework for observing the patient exercises, movement order et cetera. The created framework used to beat the issues like low power, vitality and different issues by utilizing the MAC convention situated in-reception apparatus plan. The in-reception apparatus configuration underpins the fix receiving wire outline that is utilized to set up the human body correspondence. In this manner the proposed WBAN configuration improves the human body correspondence framework utilizing the in-radio wire and MAC convention.

Depending on the above discussions and various authors opinions, the wireless body area network transmit the information with effectively. Even though the wireless body area network one of the effective communication medium in the patient health monitoring system, during this process, the sensitive information's are recorded using the wearable computing device. The captured information need to transmit from patient to health center for assisting the patient based on their health condition [12]. At the time of transaction, node failure, network failure, link failure may be happened due to lower energy node, intermediate issues and so on. These issues are affecting the quality of the data that leads to creating the serious problem because the transmitted data is very sensitive. Due to these issues [13]the life time of the node and energy of the node must be improved for eliminating the node, link and network failure while transmitting the information which also eliminates the intermediate attacks. For overcoming these issues in this work utilize the life time increasing quality awareness peering routing protocol. This protocol maintains each and every node details by creating the neighboring node table which avoids the intermediate malicious node participation as well as improves the network failure because of estimating the node energy, reliability, cost and link method manages the quality of the data due to these reason the work uses this method.

Initially the quality aware routing protocol estimates the reliability of the possible path using the neighboring table information while transmitting the sensitive reliable packets. If the reliability is lower than the computed reliability, the method compares the two paths and greater reliability path has been chosen for transmitting the data from source to destination. After estimating the path reliability, the method estimates the link reliability between nodes is calculated with the help of the exponentially weighted average moving method. Further the network life time has been increased in the dynamic energy efficiency method for avoiding the node failure in wireless information transaction. The node energy has been maintained by using the three different phase's initialization, selection of the next hop and maintenance phase. In the initialization phase, the nodes are selected according distance to the sink node, and the next hop nodes are selected depending on the cost of the link and energy. This process is continuously maintained while transmitting the information from patient to sink node. Thus the quality aware routing protocol maintains the reliability of the data which leads to improve the quality of the data and the network life time has been maintained according to the node energy with effective manner.

Then the rest of the section has been organized as follows, section 2 discusses about the Life Time increasing Quality Awareness Peering Routing Protocol, section 3 evaluates the efficiency of Life Time increasing Quality Awareness Peering Routing Protocol Life Time increasing Quality Awareness Peering Routing Protocol and concludes in section 4.

2. LIFE TIME INCREASING QUALITY AWARENESS PEERING ROUTING PROTOCOL BASED INFORMATION TRANSMISSION

In this section discusses about the Life Time increasing Quality Awareness Peering Routing Protocol based information transmission in wireless body area network. Initially, wearable device based information has been collected from patients which are need to transmit to the destination so called health center for starting the treatment process. The structure of ambient wireless information transmission process structure is shown in figure 1.

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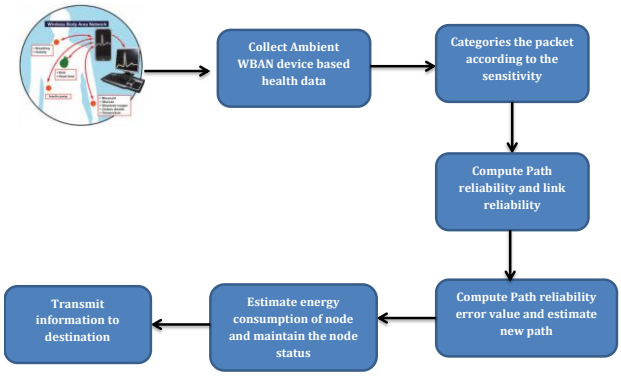

Figure 1: Ambient WBAN based Sensitive Information Transmission Process Structure

Before making the information transmission process, reliability of the path has been predicted for eliminating the intermediate attacks, unauthorized access also helps to manage the reliability [14] of sensitive packets. During the reliable path estimation process, neighboring table information has been effectively utilized to detect the path reliability. First the source node itself estimates the reliability value which is compared with the neighboring path reliability value that has been obtained from the routing table. If the reliability is lower than the computed reliability, the method compares the two paths and greater reliability path [15] has been chosen for transmitting the data from source to destination. This process is continuously performed until to detect the path reliability. So, the path reliability between source and destination has been calculated as follows,

$$R_{path(i,Dis)} = R_{link(i,j)} * R_{path(j,Dist)} \quad (1)$$

In the eqn (1), i *is source node,*

Dis *is destination node*

Based on the estimated path reliability value, reliability between nodes has been examined as follows,

$$R_{link(i,j)} = (1-\propto) R_{link(i,j)} + \propto X_i \quad (2)$$

In the eqn (2),

$\propto$ *is represented as the average weighting factor of the node*

The weighting factor of node should satisfy $0 < \propto \leq 1$. Then for making the effective transmission, average probability value is computed as follows.

$$X_i = \frac{N_{acks}}{N_{Trans}} \quad (3)$$

In the above eqn (3), $R_{path(i,Dis)}$ *is the reliability path between node i to destination*

$R_{link(i,j)}$ *is the link between node i and j.*

The average weighting factor is 0.4,

N_{acks} *is represented as the number of acknowledgement received for packets*

N_{Trans} *is denoted as the number of packet transmitted*

.

Based on the above process, the path and link reliability[16] has been computed successfully which helps to transmit the sensitive data from source to destination nodes. Along with this path reliability error probability is detected as follows,

$$R_{option1\ (i,Dist)} = R_{path1(i,Dist)} \quad (4)$$

$$P_{error1} = 1 - R_{path1(i,Dist)} \quad (5)$$

$$P_{error2} = 1 - R_{path2(i,Dist)} \quad (6)$$

$$P_{error3} = 1 - R_{path3(i,Dist)} \quad (7)$$

From the detected error value, option 2 path reliability value is estimated as follows.

$$R_{option2\ (i,Dist)} = 1 - (P_{error1} * P_{error\ 2}) \quad (8)$$

Along with this option 3 path value is computed using error value as follow,

$$R_{option2\ (i,Dist)} = 1 - (P_{error1} * P_{error\ 2} * P_{error3}) \quad (9)$$

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But before making the transaction, energy consumption of the node is calculated [17] for eliminating the node failure, link failure, network failure, data failure and so on because it creates so much difficulties such as affects patient health conditions, seriousness of the patients. The network energy is investigated in terms of applying three stages such as phase's initialization, selection of the next hop and maintenance phase. The first phase is considered as the level 0, in which participation nodes are continuously monitored and hop distance [18] has been examined from source to destination. According to the distance measures, the next hop nodes are selected depending on the energy factor which is estimated with the help of neighboring table as well as link cost factor which is estimated as follows.

$$C_{uv} = min\{RE_u - E_{tx}, RE_v - E_{rx}\} \quad (10)$$

In the eqn (10), E_{tx} *is represented as the node transmission cost*

E_{rx} *is the reception cost for node,*

RE_u *and* RE_v *is residual energy of the node*

After selecting the next hop nodes, it has been arranged in the tree format because it used to transmit the data without making any data loss. The tree development stage utilizes the link availability, energy consumption factor, based on these values, the incoming nodes are dynamically add the network for eliminating the misbehavior activities. Finally, the constructed tree has been maintained [19] simentanously, if the neighboring node does not give any response, it considered as the dead node, then it has been removed from the tree phase. In addition to this, the tree is maintained by comparing the residual energy with the threshold value of the node and link between the network is computed for effectively transmit the data from source to destination successfully.Then the algorithm of the Life Time increasing Quality Awareness Peering Routing Protocol based Information Transmission is discussed as follows Algorithm

Step 1: Collects the ambient WBAN based information using wearable devices

Step 2: Categorize the packet according to the recorded spot such as emergency packet, ordinary packet and middle packet

Step 3: Compute the path reliability with the help of neighboring table information as follows,

$$R_{path(i,Dis)} = R_{link(i,j)} * R_{path(j,Dist)}$$

Step 4: Source node reliability value is compared with the two neighboring node reliability value and selects the path according to higher reliability value.

Step 5: Then compute the link reliability value as follows,

$$R_{link(i,j)} = (1-\propto) R_{link(i,j)} + \propto X_i$$

Step 6: During the link reliability estimation process, weighted average moving value has been identified according to the probability value.

Step 7: Based on the link and path reliability value, energy consumption of the node is estimated.

Step 8: Based on the node energy, it has been arranged in tree structure for making the transaction with level by level.

Step 9: Finally tree has been maintained if the node does not reply for any request, it considered to be dead node and eliminated from the tree. else its neighboring value is updated continuously and transmit the data..

This process is repeated continuously for improving the lifetime of the network which minimizes the node failure, network failure, and data failure. Then the excellence of the system is analyzed using experimental results and discussions.

3. RESULTS AND DISCUSSIONS

This section examines the excellence of Life Time increasing Quality Awareness Peering Routing Protocol (LTQAPRP) approach. The introduced system has been implemented with the help of NS2 simulation tool that uses the real hospital scenario based collected information in 3 to 5 meters distance. The excellence of the routing protocol is compared with the traditional techniques such asLocalized Multi Objectives Routing protocol (LOCALMOR) [20] and Energy Efficient Node Disjoint Multipath Routing Protocol(EENDMRP) [21]

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Table 1. Simulation Parameters

Parameters	Values
Simulation Area	250 m^2
Number of nodes	47 node (40 sensor node, 3 sink node, 6 relay node)
MAC	IEEE 802.15.4
Packet size	40 bytes
Transmission rate	250kbps
Frequencies band	420MHz,868MHz, 2.4GHz
Channel mode	Log shadowing wireless model
Evaluation Parameters	Delay, Energy Utilization factor, packet delivery ratio
Simulation time	400sec

According to the above simulation parameters, the excellence of Life Time increasing Quality Awareness Peering Routing Protocol (LTQAPRP) approach is examined in terms of End to end delay, packet delivery ratio, energy utilization that has been explained as follows

End to End Delay

The metric end to end delay [22] used to measure the time to taken for transmitting data from source to sink node which measured as follows,

$$Delay = QD + PD + PGD \quad (5)$$

Where,

QD is the queuing delay,PD is processing delay and PGD is propagation delay.

Energy Utilization Factor

EUF [23] is used to examine the energy utilization factor for transmitting data with effective manner which is computed as follows.

$$EUF = EU/TE \times 100 \quad (6)$$

Packet Delivery Ratio

Packet Delivery ratio[24] is measure used to how effectively transmit the data to destination without making any delay.

$$PDR = \frac{No\ of\ packets\ transmitted\ successfully}{No\ of\ packets\ generated} \times 100 \quad (7)$$

Throughput

Throughput [25] is measure as how effectively data has been transmitted from source to destination with particular time which is measured as follows.

$$Throughput = \frac{Number\ of\ packet\ sent}{Time\ to\ taken} \quad (8)$$

Normalized routing load (NRL)

It is defined as total number of packet received to the total number of routing packet received that is computed as follows.

$$NRL = \frac{Number\ of\ packet\ received}{Number\ of\ routing\ packet\ received} \quad (9)$$

According to the above metrics, the obtained end to end delay value is shown in table 2

Table 2: End to End Delay

	End to End Delay		
Number of Nodes	LOCALMOR	EENDMRP	LTQAPRP
10	57	52	41
20	64	61	51
40	79	65	62
50	112	98	83
70	147	121	92
80	175	138	100
100	210	169	114
120	264	175	121

.

The above table 2, clearly indicates that LTQAPRP protocol ensures the minimum dealy (83s) when compared to the other methods such as LOCALMOR (138.5s) and EENDMRP (109.875s)

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while transmitting data from source to destination [26]. Then the obtained delay value graphical representation is shown in figure 2.

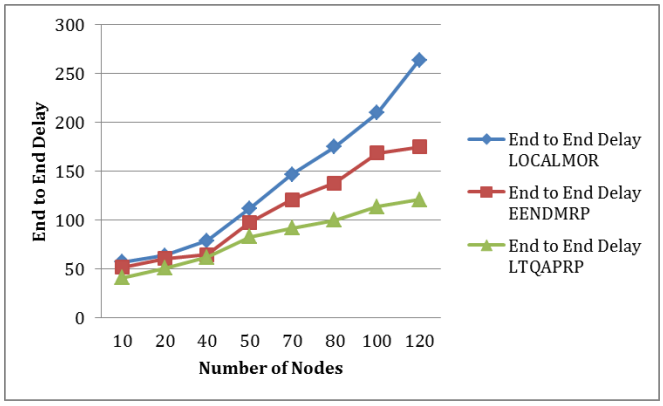

Figure 2: End to End Delay

Thus the LTQAPRP method ensures the minimum delay compared to the traditional methods such as LOCALMOR and EENDMRP method. In addition to this, the method effectively transmit the data packet according to the priority which is measured in terms of using packet delivery ratio that is shown in table 3.

Table 3: Packet Delivery Ratio

Number of Nodes	LOCALMOR	EENDMRP	LTQAPRP
10	83	85	94.6
20	86.4	87.9	95.7
40	88.2	91.3	96.3
50	87.5	93.2	97.4
70	88.8	92.5	97.8
80	89.1	94.3	98.2
100	85.6	91.2	99.4
120	83.8	92.2	99.6

The above table 3, clearly indicates that LTQAPRP protocol ensures the high packet delivery ratio (99.6%) when compared to the other methods such as LOCALMOR (83.8%) and EENDMRP (92.5%) while transmitting data from source to destination. Then the obtained value is shown in figure 3.

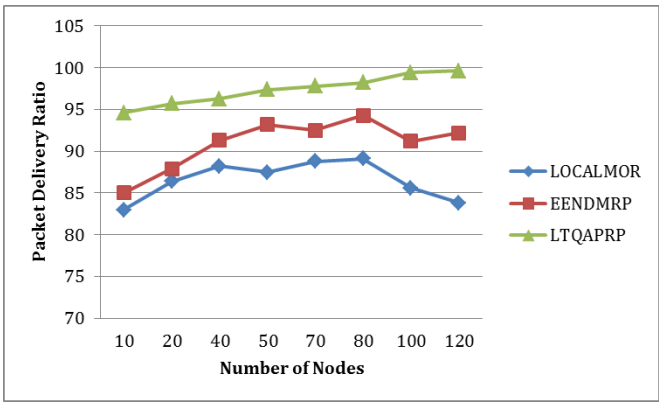

Figure 3: Packet Delivery Ratio

According to the above figure 2, it clearly indicates that system effectively transmit the emergency packets and other packets with high delivery rate. Even though the method consumes minimum energy when compared to other method which is shown in table 4.

Table 4: Energy Utilization Factor

Number of Nodes	LOCALMOR	EENDMRP	LTQAPRP
10	3.5	4.1	2.1
20	3.8	4.7	2.3
40	4.1	5.2	2.5
50	4.8	5.6	3.1
70	5.3	6.4	3.7
80	6.2	6.9	4.1
100	7.2	8.3	5.2
120	7.9	8.9	6.1

The above table 4, clearly indicates that LTQAPRP protocol ensures the high packet delivery by consuming lower energy (3.6J) when compared to the other methods such as LOCALMOR (5.5J) and EENDMRP (6.32J) while transmitting data [27] from source to destination. Then the obtained value is shown in figure 4.

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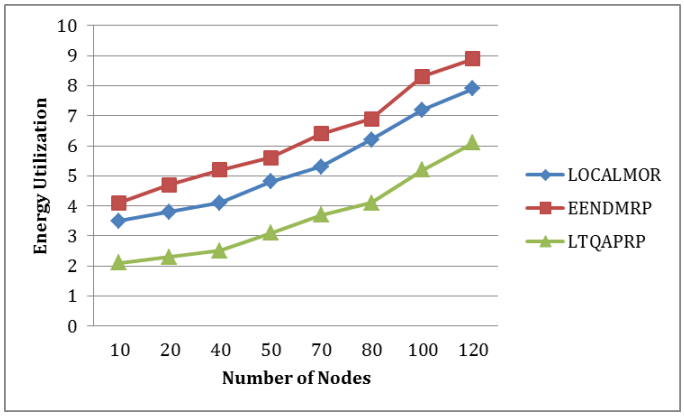

Figure 4: Energy Utilization Factor

Depending on the figure 4, it clearly indicates that the LTQAPRP system utilizes minimum energy that shows that network ability to withstand their lifetime while broadcasting the biomedical information from source to sink node. Even though the LTQAPRP method consumes minimum energy while transmitting data, it should transmit the packet with high throughput [28] and consumed value is shown in table 5.

Table 5: Throughput

Number of Nodes	LOCALMOR	EENDMRP	LTQAPRP
10	0.5	0.61	0.91
20	0.58	0.67	0.93
40	0.61	0.62	0.95
50	0.68	0.76	0.91
70	0.63	0.64	0.97
80	0.52	0.69	0.91
100	0.72	0.73	0.92
120	0.79	0.79	0.91

The above table 5, clearly indicates that LTQAPRP protocol ensures the high throughput value of different number of nodes (for node10-0.91, node 20-0.93, node 40-0.95, node 50-0.91, node 70-0.97, node 80-0.91, node 100-0.92 and node 120-0.91) when compared to the other methods such as LOCALMOR (for node10-0.5, node 20-0.58, node 40-0.61 node 50-0.68, node 70-0.63, node 80-0.52, node 100-0.72 and node 120-0.79) and EENDMRP(for node10-0.61, node 20-0.67, node 40-0.62, node 50-0.76 node 70-0.64, node 80-0.69, node 100-0.73 and node 120-0.79) while transmitting data from source to destination. Then the obtained value is shown in figure 5.

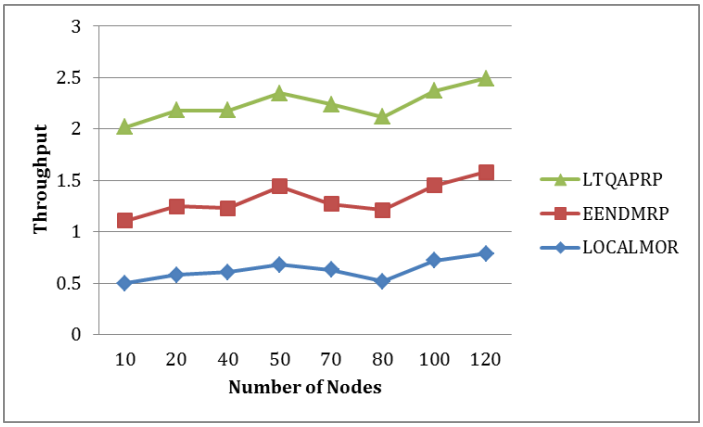

Figure 5: Throughput

In addition to this throughput value, LTQAPRP normalized routing load efficiency is evaluated for determining the excellence of routing process. Then the obtained result is shown in table 6.

Table 6:Normalized routing load (NRL)

Number of Nodes	LOCALMOR	EENDMRP	LTQAPRP
10	2.81	3.12	3.75
20	2.94	3.23	3.81
40	3.01	3.34	3.93
50	3.45	3.52	4.01
70	3.58	3.61	4.21
80	3.81	3.72	4.75
100	3.94	3.83	4.81
120	4.01	4.34	4.93

The above table 6, clearly indicates that LTQAPRP protocol ensures the high normalized routing load (for node10-0.3.75, node 20-3.81, node 40-3.93 node 50-4.01, node 70-4.21, node 80-4.75, node 100-4.81 and node 120-4.93 when compared to the other methods such as LOCALMOR for node 10-2.81, node 20-2.94, node 40-3.01, node 50-3.45,node 70-3.58, node 80-3.81, node 100-3.94 and node 120-4.01) and EENDMRP for node10-3.12, node 20-3.23, node 40-3.34, node 50-3.52, node 70-3.61, node 80-3.72, node 100-3.83 and node 120-4.34) while transmitting data from source to destination. Then the obtained value is shown in figure 6.

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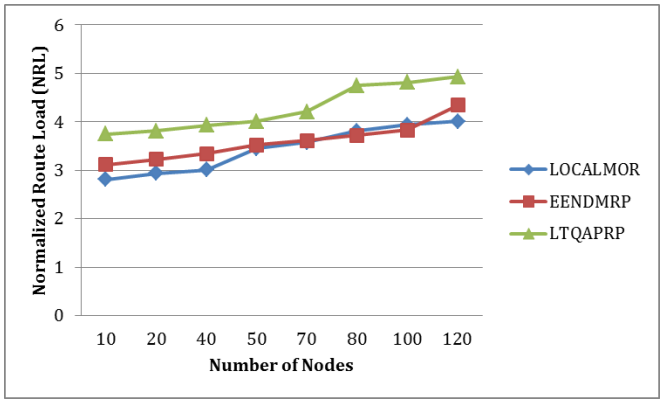

Figure 6: Normalized Route Load

Thus the proposed system efficiently transmits the patient information [29,30] via the BWSN network with minimum delay, minimum energy and packet delivery ratio when compared to other routing methods.

4. Conclusion

Thus the paper analyzed the Life Time increasing Quality Awareness Peering Routing Protocol (LTQAPRP) approach for transmitting the biomedical information in sensor networks. During the transmission process, network examines the path and link reliability because it helps to improve the overall sensitive data transmission process. The reliability of the node has been continuously examined and updated using the neighboring node information which eliminates the intermediate access as well as minimizes the sensitive data failure. Along with this reliability, the method manages the network energy and node tree has been constructed which are maintained for reducing the node failure, network failure, data failure and link failure. The simulation has been performed with the real time hospital based environment containing 40 patients and their respective readings of the sensor nodes implanted on their body. The simulation results show that the EELTMQRP performs better than the LOCALMOR and EENDMRP in terms of packet delivery ratio, end to end delay and energy utilization factor.

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