The Study of The Comparative Routing Methods in The Body Wireless Sensor Networks

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ABSTRACT:

The body wireless sensor networks are new subset of sensor ones that take charge of monitoring the body health. The wireless sensors are planted in some internal or external regions of the body to monitor the vital signs such as blood pressure, body temperature, heartbeat, glucose rate and soon. They also make possible to monitor the body health from remote distance. In the body sensor networks, some of the sensors are prior to others. So the vital signs they receive from the patients should be quickly sent to the physician or specialist. So the energy consumption rate of these sensors is one of the great challenges. One of the cases that can play a major role in energy consumption reduction and packet delivery rate increase is the routing process in body sensor network. In this paper, we study and evaluate some of the routing algorithms proposed, for body wireless sensor networks, in recent years.

1. INTRODUCTION

The wireless sensor networks include a set of sensors that collect the information concerning their own environment and then transmits them sink to process the collected data. The wireless sensor networks have different uses. Among them, we can refer to the significant uses in the fields of science, medicine, commerce and military. One of the major uses of the wireless sensor networks is in medicine. They can be used for monitoring the physical health and medical care [1].So these networks are known as physical wireless sensor ones. Figure one shows a sight of patient monitoring in a physical wireless sensor network. Since some of the sensors are planted in the body, so their batteries are not easily chargeable or changeable. In some uses of these networks, the charge or change of batteries is not easily done as well. So the optimum energy use is one of the great challenges of these networks. It is necessary that a network should be well designed and sufficiently considered for the

prevention of related energy waste. There are many major aspects which cause the energy consumption in designing the system; including the major source of energy consumption, measurement and continuous transmission of data, single hub communication, more communication distance in node so on. Nevertheless in order to preserve the energy and increase the network longevity which is the indicator of total time for the network procedure up to the all nodes death, we should choose those routing protocols that least distance for routing and data transmission to the sink [2].
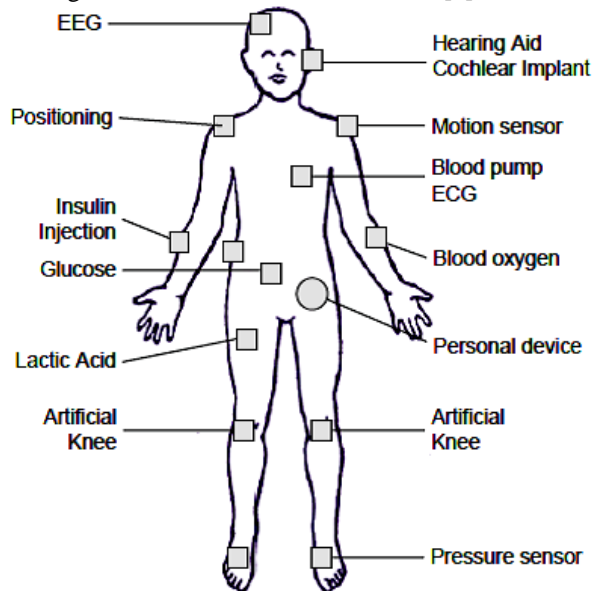

Fig. 1. Patient monitoring in a body wireless sensor network.

2. THE ROUTING PROCESS IN THE BODY WIRELESS SENSOR NETWORKS

Routing in the body wireless sensor networks is more challenging because of special characteristics that make them different from other ones. Firstly, the sensor nodes have limitations in energy, memory processing and capacity, hence; they need exact management resources. Secondly, in most applicable scenarios, the nodes in body wireless sensor networks and fixed after general expansion. Maybe, they have a few movable nodes that cause some changes alternatively and unpredictably in network topology. Recently the issue of quality service in different layers of network has been seriously noticed through consideration of the new applications of these networks. Routing algorithm in the body wireless sensor networks can cause the increase or decrease of the network lifetime as well we can improve the network function and lifetime finding efficient energy and consideration of the different criteria [3].
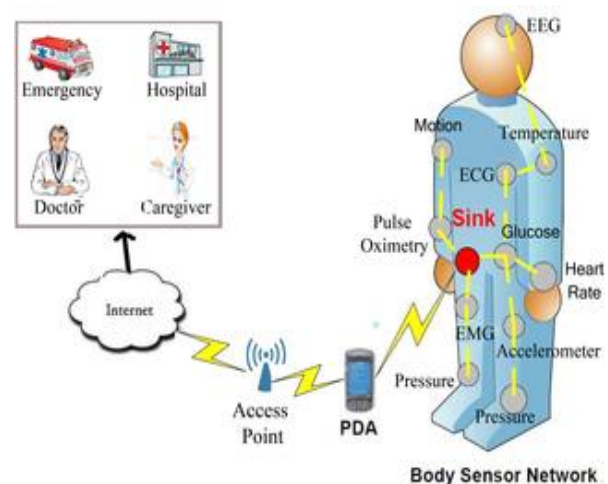

Fig.2. The routing process in body sensor networks.

3. THE PRESENTED METHODS FOR ROUTING OF THE BODY SENSOR NETWORKS

Using different algorithms, a lot of researches have been done in the field of efficient routing of energy in the body wireless sensor network. Most methods use the algorithms that attempt to reduce the nodes and increase the network's life time [4, 5]. We study some which are as follows:

In paper [6] a temperature aware routing algorithm is proposed that preserves the priority in the transmitted data by keeping the temperature in a permitted limit. In the proposed method, the fewer numbers of nodes have been considered as hot spot nodes for routing. The experiential studies have shown that the proposed routing algorithms have got more pocket delivery rate and fewer delay delivery in comparison existing routing algorithms for body sensor networks. Also it is clear, regarding the results, that the proposed algorithms in this paper give us assurance that more numbers of packets with high priority are transmitted to the sink node.

In paper [7] a protocol has been proposed in the body sensor network that conducts the body sensitive data through different sensors to sink node using multi hub routing methods. In this study, the major purpose of the proposed approach is the life time increase in body sensor network by reduction of the energy consumption. Using Mamdani (fuzzy logic) in the proposed method, a main node source, selects multi hub distance based on the remnant energy. For evaluation of the proposed method, tow routing algorithms namely SIMPLE and M-ATTE MP have been used to make comparison.

In paper [8] a routing method based on the optimum trust cluster awareness has been proposed in body wireless sensor networks. The proposed method includes three new designs namely improved particle swarm optimization algorithm, trust deduction model

based on fuzzy and self consistent buffer allocation scheduling algorithm for safe transmission of data. In this study, cluster head is selected by improved particle swarm optimization algorithm. For selecting the reliable route, the deduction model based on fuzzy is used as well. Ultimately, the self consistent buffer allocation scheduling algorithm has been introduced in body sensor to reduce traffic occurrence. The experiential results show that in this paper, the better results have been achieved in comparison with ordinary cluster protocols and some parameters determining better service quality. In the other study [9] two protocols including energy efficient routing and expense optimization have been proposed. In the first proposed protocol, the optimization with genetic algorithm with one- way cost function with residual energy, link reliability and packet loss have been considered as parameters for selecting the optimal route. The distance between two sensor nodes has been reduced using the multi step method. The second protocol has expanded the function of the first protocol by consideration of the relation between body wireless sensor networks.

In paper [10], the routing procedures have been presented in body wireless networks based on fuzzy logic. The controller of the fuzzy logic and neighbor selection between nodes have been made as output values. Then the nodes are prepare for active route selection. In this paper, the fuzzy logic decision mechanism has been used.

In paper [11], a reliable routing protocol has been proposed through saving energy for data transmission from body sensor nodes to base station by making cluster and analyzing remnant energy of all nodes. The comparison of the proposed efficient routing and reliable energy protocol with M- ATTEMPT protocol based on energy loss with time, sent data packet and life time of network shows the life time for network has increased.

In the paper [12], a routing protocol including energy saving has been presented for wireless sensor networks. In this study, the concept of multi- step with transport node has been used the transporter node accepts sensor nodes data which are not far from sink, The transporter node conducts the data towards the sink node after data reception. This plan has been compared based on four parameters: the remnant energy, network stability and shelf life, through put and drop path.

In paper [13], an identification routing technique with advanced energy efficiency from body wireless network has been proposed. At first, the routing with optimum load balancing based on tree cluster method is determined. The K- NN algorithm has been used for increasing the uniform cluster of sensor nodes.

In paper [14], a routing protocol, allocating energy efficient route and awareness of delays based on traffic priority has been proposed for body wireless network. For comparison of the proposed protocol performance with the other advanced protocols from the view points- f energy consumption criteria, packet delivery rate and others has been done in real environments.

The purpose of paper [15] is to present a protocol named the reliable routing one based on priority and participatory energy efficiency with network coding for reliability increasing and body sensor network using the participatory communication method. In this study, at first, to identify relay nodes from a set of body sensor nodes for data transmission the cuckoo search optimization algorithm has been used. Then, in order to improve the packet transfer speed, the network on coding approach has been included in relay nodes.

4. THE EVALUATION OF THE PROPOSED METHOD FOR ROUTING IN THE FIELD OF BODY WIRELESS SENSOR NETWORK

The proposed plans have mostly taken into consideration from a search function to select the appropriate route in order to reach the sink node. The evaluation criteria calculate the most remnant nodes energy and their distance from sink. Since in the body sensor networks, human's health is important, so the appropriate routing protocols should be adapted. Nevertheless; the review results show that each routing plan has caused the increase of network stability and packet delivery to the sink. Each one has its own strengths and weaknesses. Table 1 and 2 show the comparative study of the reviewed protocols in this study.

Table. 1. The advantages and disadvantages of proposed methods to route in body sensor networks

disadvantages	advantages	used technique	the presented method
lack of selecting suitable relay node	high reliability for packet transfer	aware temperature routing	method [6]
lack of improvement in network life time	energy consumption reduction	multi- hub routing	method [7]
calculation complexity	QoS improvement	three- step criterion	method [8]
pocket delivery rate reduction	optimum route selection	genetic algorithm	method [9]
lack of selecting suitable relay node	energy consumption reduction	fuzzy logic approach	method [10]
It is not suitable for body sensor networks	reduction energy loss with two	clustering	method [11]
energy consumption increasing	network stability with increase throughput	transport node	method [12]
It is not suitable for body sensor networks	the increase uniform clustering of sensor nodes	identify confirmation	method [13]
pocket lost rate and throughput criteria are not considered	energy consumption reduction	traffic priority	method [14]
calculation complexity	high reliability for packet transfer	based on priority and participatory energy efficiency with network coding	method [15]

Table. 2.The consideration of evaluation criteria of routing algorithms.

energy consumption	reliability	life time	packet loss rate	packet rate	throughput	technique
✗	✓	✗	✓	✓	✓	[6]
✓	✗	✗	✓	✓	✓	[7]
✓	✓	✓	✓	✓	✓	[8]
✗	✗	✗	✓	✓	✓	[9]
✓	✗	✓	✗	✗	✗	[10]
✓	✗	✓	✗	✗	✗	[11]
✓	✗	✓	✓	✓	✓	[12]
✓	✗	✓	✓	✓	✗	[13]
✓	✓	✓	✗	✓	✗	[14]
✓	✓	✓	✗	✓	✗	[15]

5. CONCLUSION

In the existing researches about body wireless sensor networks, the routing is done based on route selection from the source to the target. To find the route between source and target, these algorithms are not suitable for body wireless networks because of extra energy consumption. On the other hand, in step by step routing algorithms of body sensor networks have not considered the priority of packets, the connection cost and the number of steps of the target simultaneously. In the preview step by step routing algorithms haven't been considered the energy consumption reduction and balancing the energy consumption between the nodes. By consideration of the cited problems, the designing a step by step routing algorithm seems necessary in which packets priority, the connection cost and pace number up to the target have been taken into consideration. By having the cluster methods and using other ultra discovery algorithms such as (glow worm algorithm, colonial competition and optimizing the particles swarm), it is completely practicable to access the efficient route in order to increase the life time in body sensor networks. Since in body wireless sensor networks, we don't follow high transfer data and low rate is sufficient for immediate information sending as well, so according to this sensitive routing, we should pay attention to their intended delay.

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