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Wireless Body Area Nework – A Review

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Abstract – Wireless Body area networks have its applications in healthcare applications like remote monitoring of vital signs of patients in hospitals. Due to the increasing population an change of lifestyle health problems are getting worse. Due to busy schedule people does not have time to visit the doctor. Sometimes in case of emergency doctors are not available. WBAN technology also helps the old people who are not able to visit the doctor regularly. This paper presenting a survey in the area of wireless body network infrastructure, Research Trends in WBANs, Requirements of QoS , QoS based routing protocols, and optimization Techniques.

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Keywords: ACO, GA, PSO, Routing Protocols, WBANs etc.

1. Introduction

Wireless body area network is utilized in healthcare systems [1,2]. In traditional healthcare systems patients have to stay in hospitals but WBAN free the patients not to stay in the hospitals, it reduces the medical labor cost and cost of infrastructure. In WBAN sensors are placed in or on the human body to quantify the physiological signals of the patients [3]. The utilization of WBANs may enable remote diagnosis of diseases in an early stage. These systems provide uninterrupted health monitoring Accommodations, sanctioning patients to perform everyday activities, which lead to the enhancement of the quality of life [4]. Sensors sense the signal to the sink which is further remitted to the medical server room where medical experts monitor the patient's activities. WBAN is a resource constrained technology by their circumscribed battery life, bandwidth, recollection, energy consumption etc. These are issues which have to be considered while designing an incipient protocol or algorithms for network [5]. Sundry authors proposed routing protocols or mac protocols to increases the network lifetime of the network.

Section 2 provides an overview on WBAN architecture. Section 3 presents the research trends in WBANs. Section 4 provides a overview on QoS in WBAN. Section 5 provides overview of QoS predicated routing protocols. In section 6 optimization techniques are discussed. Section 8 concludes the paper.

2. WBAN Infrastructure

In WBAN sensor nodes are placed in or on the patient's body to monitor the vital signs of patients. Figure 1 shows the WBAN infrastructure for medical and nonmedical applications. Personal Server and Medical server are the two main parts of the WBAN architecture. In WBAN patient wear the sensor nodes on or in the body that sense of collect the data and transmit that data to the Personal Server using communication standards(Wi-fi, Zigbee etc).further data is transmitted to the medical server. Medical Server provides services to the various users. The data is transmitted to the doctor from the medical Server from where he can access the data from anywhere using the internet. WBAN data is normally divided into three parts Normal data, Emergency data and On-demand data. In case of Normal data doctor observes the data which is provided by the Medical Server he gives the necessary advice and prescription to the patient through internet. It saves time of the patients as well as doctor. Emergency traffic is unpredictable, not generate on regular basis. Nodes sets the threshold level, when the data exceeds that threshold emergency is considered. In this case doctor observed the data and generates an alert signal so that necessary actions can be taken in order to save the patient's life. On-demand data is initiated by the doctor to know some important information for diagnosis purpose.

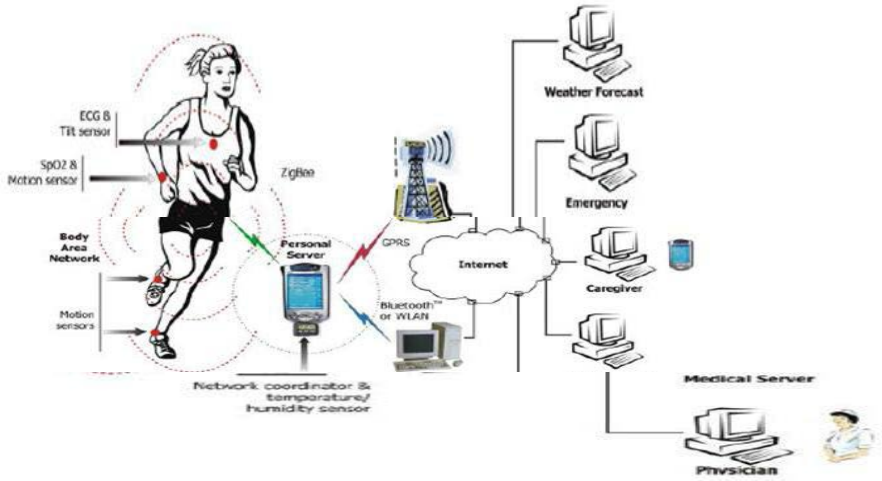

Fig 1. WBAN Infrastructure

3. Research Trends in WBAN

Through the analysis of the results of the systematic review utilizing the SLR method, it is possible to deduce the following trends in the research on WBANs [6].

(1) Research associated with the physical layer and the MAC layer under WBAN main research themes have been studied at length since 2005. In recent years, research cognate to applications, radio, and surveys has been conducted more than other fields.

(2) Many studies on MAC protocols under the MAC layer main research theme and on surveys under the main survey research theme have been conducted. Many studies associated with m-health applications, the channel, routing protocols, and UWB as research subthemes have been conducted.

(3) As for the consequentiality of the research, the consequentiality of research cognate to implementations, HW/SW architectures, transmitters, and surveys is relatively high. The trends, according to the consequentiality of the papers, do not match up precisely with the trends according to the ratio of the studies. However, the trends in some research subthemes, such as the channel, MAC protocols, and surveys, are kindred to the ratio of studies.

(4) For paper types among the culled literature, SCI journals and proceedings constitute the majority. In particular, under the channel and physical layer main research themes, there is considerable SCI journal research. For research trends in each country, the physical layer field has been studied mainly in Belgium and Singapore. The application, channel, and cross-layer fields have been studied extensively in the USA, the UK, and Belgium, respectively.

4. Requirements of QoS in WBAN

QoS requirements of WBAN are categorised into two parts. Application based QoS and Network based QoS. Brief description of these two is given below.

4.1. Application based QoS

As the application vary QoS parameters in WBAN changed.. Some of the application considers QoS parameters are delay, energy efficiency, fault tolerance, bandwidth [12], network lifetime optimum number of sensors [13] etc. The various application demands certain requisites from the deployment of sensors which are directly affects to the quality of application.

4.2. QoS Requisites from the Network Perspective

In identifying QoS requisites, we rely on the type of applications, especially their data distribution model from sensors to the base station, which can be: perpetual, query driven, event driven and hybrid [14, 15, 16]. Each of these data distribution models has its own QoS requisites. Table 2 summarizes the key QoS requisites for each data distribution model and its associated QoS metrics.

Table 2. QoS mechanism and the QoS requirements addressed by them

QoS Mechanism	Reliability	Real-Time Delivery	Energy Efficiency	Adaptability
Collision Management	No	Yes	Yes	Yes
Clustering	Yes	Yes	Yes	Yes
Data Compression	No	No	Yes	Yes
Error Recovery	Yes	Yes	Yes	Yes
Power Control	Yes	Yes	Yes	Yes
Service Differentiation	No	No	No	Yes

5. Routing Protocols for WBAN

Researchers have proposed various Routing Protocols for WBAN. These protocols are divided as Cluster-based, Thermal-aware, QoS aware, cross-layered and posture-based routing protocols.Fig2. shows these protocols.

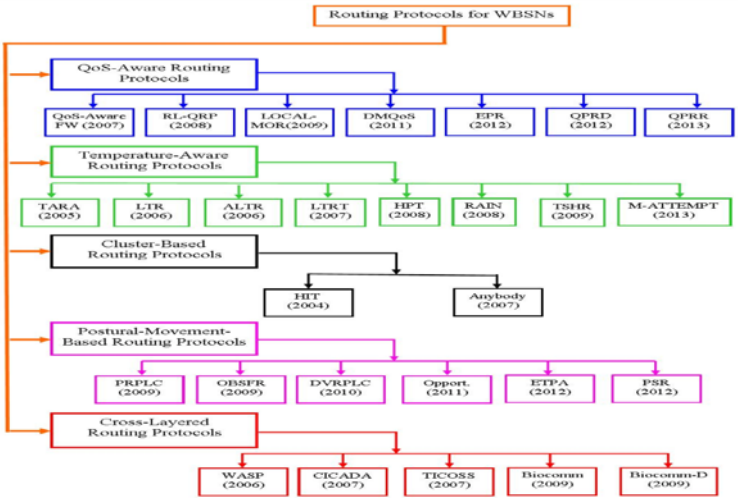

Fig2**.** QoS Aware routing protocols for WBANs

Various energy efficient and QoS-aware routing protocols have been proposed recently for wireless body area networks [17–20] .Routing protocols proposed for WSN and MANETs are not cannot be directly used for WBANs because of their different constraints. They can be used in WBAN after some modification. Wireless communication in used in WBAN which makes the conditions more complex.

6. Optimization Algorithms

Very consequential thing in optimization is to cull a congruous algorithm .An efficient algorithm is to ascertain that optimum solution we get. There is no single algorithm which is congruous for all types of quandaries. There are variants of algorithms are utilized which are divided as derivative-predicated algorithms, derivative-free algorithms and bio-mimetic algorithms. First two types are kenned as classical algorithms. . They are generally either Hessian matrix-predicated methods or gradient-predicated methods [21,22], whereas most of the bio-mimetic algorithms use pattern matrix-predicated methods which give arbitrary solutions to the cognate quandaries. This method enables the information exchange between the patterns and results in consequential amelioration.

7.1 Derivative-Based Algorithms

This type of algorithms uses the information of the derivative. As they have proved their competence as local search algorithms, they are widely used in many scientific applications and in discrete modeling [23, 24]. One disadvantage of this method is that, if the problem of interest is not convex, they may fall into local optima. For that reason, the objective function should be sufficiently smooth and the first or sometimes second derivatives should be present. Some classical examples of this strategy are Newton‘s method and hill climbing, which is also a root-finding algorithm. On the other hand, one of the modern examples is the conjugate gradient method. This strategy is widely used to solve unconstrained optimization problems such as energy minimization [25].

7.2 Derivative-Free Algorithms

Unlike the anterior one, this method only requires the value of the objective function, not the information of the derivative. If some discontinuity subsists in cost functions, derivative-free algorithms may act in a more efficient manner. The Hooke-Jeeves pattern search method is one such method. It incorporates the past history of iterations in engendering an incipient search direction [26]. Some other examples of this type of algorithms are the trust-region method and the Nelder-Mead downhill simplex method [27].

7.3 Bio-Mimic Algorithms

Modern optimization algorithms are often nature-inspired/bio-mimetic, and they are felicitous for ecumenical optimization. There subsist a diverse range of bio-mimic or Meta-heuristic algorithms for optimization, including Particle Swarm Optimization (PSO) [28], Genetic Algorithm (GA) [29], Ant Colony Optimization (ACO) [30], Cuckoo Search (CS) [31], Bat Algorithm (BA) [32], etc. The right cull of an optimization algorithm can be crucially consequential in finding the right solutions for a given optimization scenario.

For the past 20 years, many authors have focused their investigations on wireless sensor networks. Sundry issues cognate to wireless sensor networks such as energy minimization (optimization), compression schemes, self-organizing network algorithms, routing protocols, quality of accommodation management, security, energy harvesting, etc., have been extensively explore.

8. Conclusion

In this paper we presenting a survey of the literature in the area of wireless body network infrastructure, main technologies of WBANs, Research Trends in WBANs, QoS requirements, QoS based routing protocols, and optimization Techniques.

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