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Wireless Sensor Network in Healthcare Application–A Survey

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Abstract— *Wireless sensor network (WSN) is used in different application areas. In this paper, we discussed and compared the WSN based protocols in healthcare application area based on different parameters like energy, security, latency, congestion etc.*
Keywords— WBAN, MAC, TEG, WFAT

1. INTRODUCTION

WSN includes sensor nodes to sense the patients by monitoring various components such as body temperature, heart rate, blood pressure etc. and send this sensed data to base station for references used by healthcare professionals. Sensor nodes can be deployed on patient's body to monitor him/her at any place. This type of network called as wireless body area networks.

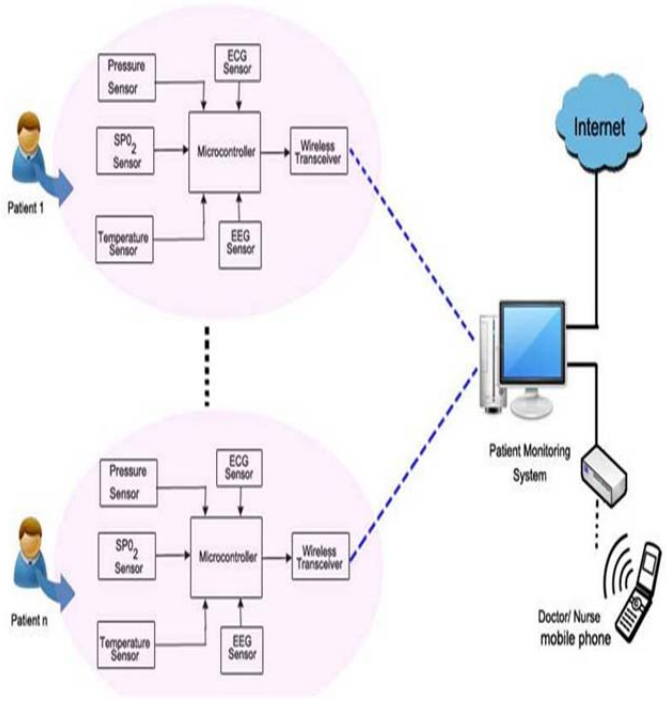

Fig. 1 WSN in Healthcare Application

An outline of this paper is as follows. Section II presents the RELATED WORK. Section III presents comparison of protocols and section IV describes the conclusion of the paper.

2. RELATED WORK

2.1 Thermal energy harvesting from human warmth for wireless Body Area Network in Medical Healthcare System

In [1] authors proposed protocol to improve the lifetime of network for WBAN in healthcare application. In traditional WBAN system sensors are deployed on patient's body could be inside or outside. These sensor nodes sense the patient's condition and further send it to gateway which is fixed and sends the data to base station. As gateway is fixed so while collecting and transmitting data would deplete its energy sooner. So authors provide method to select one gateway from all sensor nodes that have high residual energy. At every round gateway selection is processed. Hence this method increases lifetime of network. Along this authors also provide energy harvesting technique to recharge sensors from heat of human body with the help of thermoelectric generator (TEG). This is applied on sensors that detect body posture of patient to alarm for emergency need if patient falls down.

2.2 An open and reconfigurable wireless sensor network for pervasive health monitoring

In [2] authors proposed system architecture to provide functionalities of doing easily modification in WSN by adding or removing sensor nodes and also can change the configuration of sensor nodes during run time according to the rules defined by healthcare professionals.

2.3 A Smart Gateway for Healthcare system using Wireless Sensor Network

In [3] authors proposed prototype for gateway of WSN healthcare system to have better communication among WSN, gateway and remote server. This discussed the hardware design of gateway which consists of center control unit that provide logics to different modules and external

communication modules to communicate with WSN, caregivers through SMS and other via internet. In software implementation of gateway it includes:-

1) Data decision system for regular monitoring to inform about patient.

2) *Service Manage Platform* gets requests from remote server of information about WSN, patient's health and needs to do configuration in WSN and responds to it.

3) *Database f*or data storage.

4) *I/O interface* to communicate with all external communication modules.

2.4 Remote Healthcare Monitoring System Architecture using Sensor Networks

In [4] authors proposed MACH protocol (Medium Access Control protocol for healthcare sensor networks). In this protocol the preemption scheduling is done to packets where if any emergency arrives then it exchanges with low priority traffic of sensor node to send it first and then resumes the routine network. Hence due to quick response it reduces latency for emergency conditions.

2.5 Toward Ubiquitous mobility Solutions for Body Sensor Networks on Healthcare

In [5] authors proposed mechanism to provide solution for monitoring patients continuously having mobile nature. Patient could go to any new place therefore sensor node find out access point in that particular place and register itself to current access point. Access point stores the registered sensor node for future reference so next time linkage between them can be achieved fast.

2.6 Wireless Sensor Network based E-Health system-implementation and experimentation results

In [6] authors proposed the mixed positioning algorithm to monitor elder people continuously at home which includes various kind of sensors attached to home areas and also to the person. This algorithm is used to find the position of elder people by introducing methods:-

1) Object proximity positioning- sensor nodes deployed on any object at home to sense the patient.

2) Active signaling positioning- sensor nodes deployed at home sense the signal of sensor node deployed on patient to track the patient's position.

2.7 Pervasive, Secure Access to a Hierarchical-based Healthcare Monitoring Architecture in Wireless Heterogeneous Sensor Networks

In [7] authors proposed architecture to provide secure sensor data to mobile users and then to remote server. Different kind of sensor networks can be used and sends the data to mobile device with the help of Bluetooth. The data sends in encrypted form and the mobile devices shared the secret key managed by the third association party. Mobile devices also share secret keys for data sharing.

2.8 Energy Efficient Medium Access Protocol for Wireless Medical Body Area Sensor Networks

In [8] authors proposed MAC protocol for wireless body area sensor networks to reduce energy consumption. Ti describes master-slave method for sensors where all sensor nodes act as slave except node that collects data from slave nodes act as master node. Master node determines the time slot for each slave node for transmission process.

For communication b/w master and slave nodes authors introduced three processes-

1) *Link establishment process*- the process where the connection is established b/w slave and master node. After connection has made master node assigns fixed time slot for slave node.

2) *Wake-up service process*- in this process both slave and master nodes wake-up as assigned time-slot to slave node starts.

3) *Alarm process*- in this if data at slave node overflows then it transmits the data to master node before wake-up service process. Data transmission is only happened if master slave is not busy with other slave nodes.

Along master-slave method, authors also introduce wake-up fallback time (WFT) for collision avoidance. If slave node fails to transmit data then it goes in sleep mode which is assigned by WFT. After WFT over slave node wakes up again.

3. PROTOCOL COMPARISON

The papers surveyed have worked on different parameters in same application area of health care in WSN. Protocols discussed in above section are compared and presented in Table 1.

Table 1:Comparison of protocols of WSN in healthcare

Protocol	Worked on parameters			
	Energy	***Latency***	***Security***	***Congestion***
[1]	Yes	No	No	No
[2]	No	No	No	No
[3]	No	Yes	No	No
[4]	No	Yes	No	No
[7]	No	No	Yes	No
[8]	Yes	No	No	Yes

4. CONCLUSION

WSN in healthcare application area is widely used for continuous monitoring of patients. In this area, WSN shows effective results in emergency conditions. This is really beneficial to monitor patients or elder people who are all alone

at home. In this paper, we presented the various protocols proposed in this area and we compared these protocols.

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