I J C T A, 8(5), 2015, pp. 1803-1807

A Novel Approach for Body Health Monitoring-a Middleware Mediated Body Sensor Networks

Velayutham R*, Divya Vinotha R., Anusha M.*****

Abstract: As the population increases, people with chronic diseases are also increasing by making it an expensive problem. Patients need a continuous health monitoring and also their routine works to be carried out. They don't want themselves to be confined to a hospital room. In order to get timely intervention, the physiological parameters are monitored continuously and the observed parameters are transmitted to a remote location over a network. This can be made possible by the fast growing technology called Wireless Body Area Networks (WBAN). The body health monitoring system consists of several wireless sensor nodes connected over a network. This system can sense, and collaborate among them, and transmit the physiological signs of the person being monitored. The person is monitored with wearable sensors which can be implanted or mounted on the body[1]. Some of the sensors that could be used for heath monitoring are blood pressure sensor for monitoring pressure level, heart beat sensor for monitoring heart beat, arm position sensor for ensuring right position of arms before measuring blood pressure, etc. The main objective is to manipulate multiple physiological data from different sensors using a middleware which helps the health care unit and the patients to avert untoward situations in early. This also lets the patients know about their health condition and recover soon.

Keywords: Wireless Sensor Networks (WSN), Wireless Body Area Networks (WBAN), Health Care Unit (HCU), Middleware, Coordinator node.

1. INTRODUCTION

Wireless technologies have been developing rapidly in recent times. Sensors nodes are spatially distributed to monitor physical or environmental conditions and to cooperatively pass their data to a remote location[6]. They are being used in many fields such as monitoring, tracking and management. Monitoring includes environmental monitoring, health and wellness monitoring, power monitoring, etc. Tracking includes tracking objects, humans, vehicles, etc.

The sensors nodes are smaller, cheaper, and intelligent and they could communicate through their wireless interfaces and form a network. The sensor in a network can be connected. In WSN, there are three main classifications of groups. First group is a set of sensors. The second group is some communication protocols to make the sensors and the applications communicate. The third group is the services developed to enhance the application.

1.1. Complications in providing security:

There are some difficulties in providing security to sensor nodes. Some of the security issues in wireless sensor communication are physical captures of sensor nodes and eavesdropping. Malicious messages can be easily injected to the network. Anti-jamming and physical tamper proofing techniques are impossible due to greater design complexity and energy consumption.

* Professor/CSE Department, Einstein College of Engineering, Tirunelveli, Tamilnadu, India, *Email: rsvel_kumar@yahoo.co.uk*

** P.G.Student, CSE Department, Einstein College of Engineering, Tirunelveli, Tamilnadu, India, *Email: divya.balu93@gmail.com*

*** Asst.Prof/CSE Department, Einstein College of Engineering, Tirunelveli, Tamilnadu, India, *Email: anusha.saiganesh@gmail.com*

2. EXISTING SYSTEM

The existing system is designed for monitoring patient with specific disease continuously. The available set of on-body and ambient sensors monitor, configure and send information. This system concentrates on supporting multiple sensors and integrating them to the user's environment and is user-centric. Interoperability is the basic requirement for distributed systems which makes all the components in the system work together including interpretation of data from other components and communication among them[5].

Event-based systems are used in health care applications for high data processing. Some e.g. are intensive care solution, real time sleep analysis, and large health care networks. Bluetooth can be used for connecting the available sensors. It is used in most of the android devices, so Bluetooth will be an appropriate choice. Zigbee or GPRS can also be used for communication. Design choices for middleware are also available.

3. PROPOSED SYSTEM

The proposed system has a set of sensor nodes with a coordinator node, a middleware [8], [9] that manipulates the signals it receives from the sensor nodes, and multiple applications. Patients are monitored continuously and their health parameters are transmitted to the health care unit over GPRS[4]. This system is more sophisticated as the health parameters of the patient is immediately transmitted and analyzed by the physician. The sensors are small, can be mounted or implanted on the body of the patient.

3.1. Architecture

The system consists of three layers. The components present in each layer perform its own functionality. The first layer of the system consists of different set of sensors with a coordinator to monitor the patients regularly. The coordinator node collects all the parameters and sends the parameters to the gateway. The second layer is the middleware, responsible for processing the data. It consists of a system monitor, and an event composer. The event composer is responsible to detect the kind of event received from the sensor. The system monitor monitors the life of the sensors. The third layer is the health care unit. Here is where the health parameters of the patient are assessed and necessary actions are taken. If the condition is critical, the HC is alerted and it reaches the patient at the earliest. If the health condition is likely to go down, feedback messages are sent to the patient. The system can also provide an alert message to the patient. For e.g. a patient having diabetes needs to walk a certain distance every day. But if he forgets to walk, the motion sensor fixed in his leg, would remind him to walk or exercise. The architecture of the system is shown below in the Figure (1)

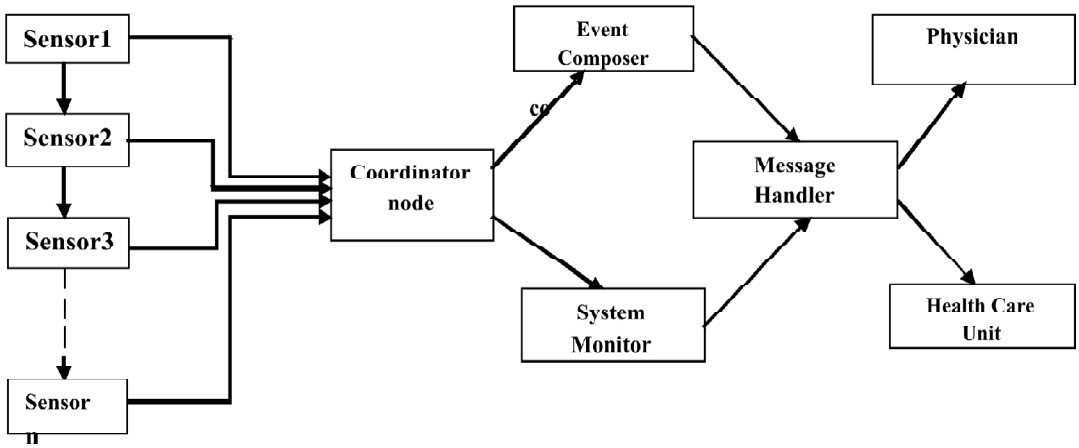

Figure 1: Architecture of a Body Health Monitoring System

4. METHODOLOGY

The system used for continuous body health monitoring uses Priority Scheduling algorithm. This algorithm prioritizes the received health parameters according to some criteria and appropriate signals are sent to the next layer. There are different types of parameters transmitted between the sensor networks and the middleware. Each of them has its own priority level. The classifications are as follows, high data rate and low latency, low data rate and low latency, low data rate and high latency, and high data rate and high latency

High data rate is the critical data value. Low latency is the time delay to the response of transmission of signals. Each parameter will be given a priority. Here, the priority value is given as $V_{Thresh1,}$ $V_{Thresh2,}$ and $V_{Thresh3,}$ $V_{Thresh4.}$ The highest priority among the three threshold values is $V_{Thresh1.}$ Each priority value has its own actions to be done[7]. The highest priority indicates that the condition is critical and raises alarm. The second priority gives some kind of notification messages to the heath care unit. The health care unit can also communicate to the patients by giving some instructions to take medicines, or motivational messages, or any feedbacks. The third priority value has nothing to do since it transmits no critical data. The fourth priority value is assigned when the middleware get some irrelevant data which is useless to be processed. So, if the system finds as irrelevant data, it just drops the packets and thus reducing the processing and power resources. The event composer is responsible for prioritizing the values it receives, sends the value of with high priority first. Till that it doesn't send other values which are of low priority. This helps the health care unit and the physician to recognize the patient who is at risk. The priority scheduling method not only reduces the delay of critical data transmission, but also reduces traffic congestion [2], [3].

Another method to reduce the energy consumption is by sending WAKE_UP messages. There are some set of sensors with a coordinator sensor. The coordinator sends WAKE_UP message to other sensors,

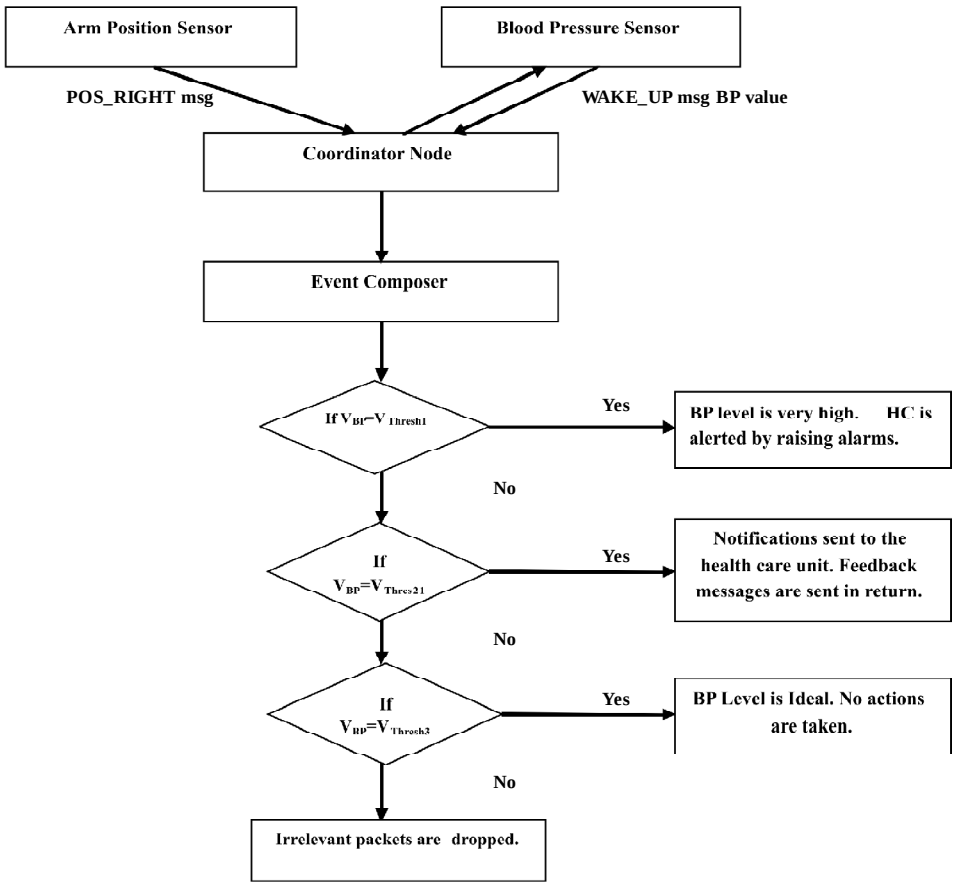

Figure (2): Working of Blood pressure and Arm position sensors

where the other sensors get active only after that message. This helps the sensor to remain idle andsave energy until it has no task. The representation of working of arm position and blood pressure sensors is given in the Figure (2) below.

5. RESULTS AND DISCUSSION

Patients are monitored continuously and timely medical assistances are provided. Performance of the system is analyzed by throughput and delay of the packets. First is the rate of successful message delivery over a communication channel and it must be high. Latter is the average time taken by a data packet to reach the destination and it must be short. The two graphs Figure (3) and Figure (4) below show the comparison between existing system (event based) and proposed system (myhealth). Figure (3) shows that the throughput of the proposed system is higher than the existing system. Next, Figure (4) shows the delay of the two systems where delay for the proposed system is very short (1.4ms) when compared to the existing system (1.8ms).

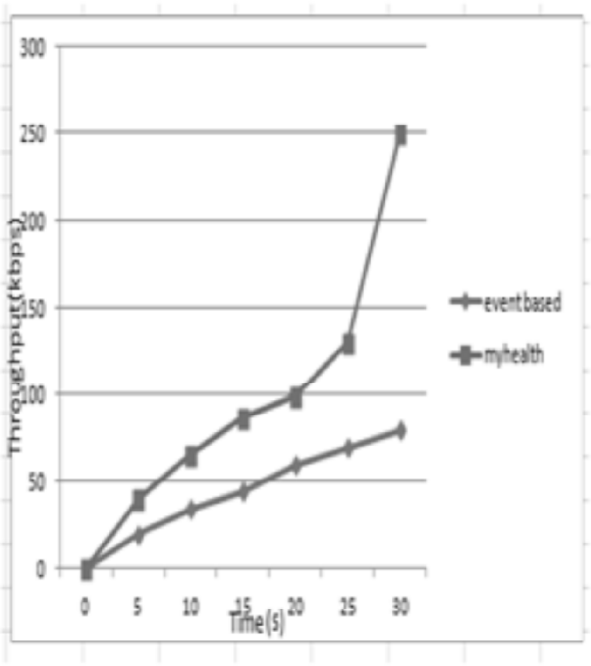

Figure (3)

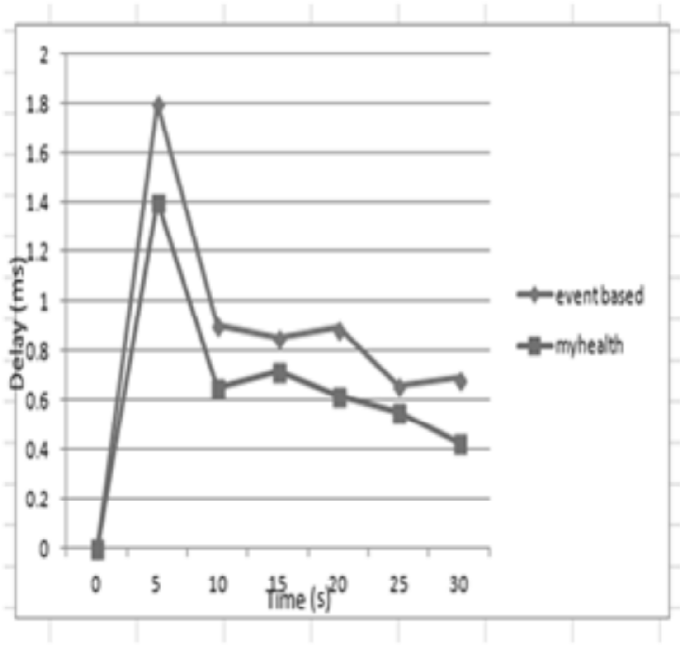

Figure (4)

6. CONCLUSION AND FUTURE WORK

The system continuously monitors and reports the patient's health to the medical server. It provides sophisticated facilities to the user with timely intervention and improves quality of life. A service scheme based on priority scheduling was discussed by which critical signals are given priority and unnecessary processing of data is avoided thus extending the battery life. The role of wireless technology is becoming more important as mobile devices and other wireless devices and networks are in increase. This technology has the potential to help people even at remote places and avoid untoward situations. More security schemes and algorithms can be adopted

References

[1] Anliker U., Ward J.A., Lukowicz P., Troster G., Dolveck F., et al. (2004), AMON: a wearable multi-parameter medical monitoring and alert system. IEEE Trans Inf Technol Biomed 8: 415–427.

[2] A. Waluyo, S. Ying, I. Pek, and J. K. Wu, "Middleware for wireless medical body area network," in Proc. IEEE Biomed. Circ. Syst. Conf., Nov. 2007, pp. 183–186.

[3] Chang, J.H.; Tassiulas, L.: Energy Conserving Routing in Wireless Ad Hoc Networks. In *Proceedings of the 19th Conference of the IEEE Communications Society (INFOCOM)*, Tel-Aviv Israel, March, 2000; pp. 22–31.

[4] J. N. Al-karaki and A. E. Kamal, "Routing Techniques in Wireless Sensor networks", IEEE Wireless Communication, vol. 11, pp. 6-28, 2004.

[5] P. Leijdekkers and V. Gay: Personalized Service and Network Adaptation for Smart Devices, IEEE APCC Asia Pacific Conference on Communications, Perth, Australia, 2005.

[6] P. Neves, M. Stachyra, and J. Rodrigues: Application of wireless sensor networks to healthcare promotion, J. Commun. Softw. Syst., vol. 4, no. 3, pp. 181–190, 2006.

[7] Varshney U. (2003), Pervasive healthcare. IEEE Computer 12: 138-140.

[8] W. Heinzelman, A. Murphy, H. Carvalho, and M. Perillo, "Middleware to support sensor network applications," IEEE Netw., vol. 18, no. 1, pp. 6–14, Jan.\Feb. 2004.

[9] Y. J. Zhao, *et al.*: A MEMS Viscometric Glucose Monitoring Device, *The* 13th *IEE International Conference on Solid-State Sensors, Actuators and Microsystems*, Pittsburgh, 5-9 June 2005, pp. 1816-1819.