

Wireless Body Area Sensor Networks Based on IEEE 802.15.4: A Survey

Parshant Saini¹, Dr. Vaibhav Jain², Dr. Sandeep Tayal³, Rajeev Kumar⁴

¹M.Tech Scholar, Vaish College of Engineering, Department of ECE, Rohtak, Haryana, India

²Assistant Professor, Vaish College of Engineering, Department of ECE, Rohtak, Haryana, India

³Professor, Vaish College of Engineering, Department of ECE, Rohtak, Haryana, India

⁴Assistant Professor, PIET Samalkha, Department of ECE, Panipat, Haryana, India

ABSTRACT

In recent growth and development of information and communication technologies aid people in diverse extent of life. Out of them, there is huge growth can be seen in healthcare industry in different aspects. One of the mainly significant services is to monitor of inaccessible patients, which enables healthcare providers to examine, identify and stipulate the patients without being actually present. Wireless body area network is very eminent technology through which patients can be monitored at remote locations. The benefit of miniaturization of sensor technologies gives the flexibility of installing in, on or off the body of patients, which is competent of forwarding physiological data wirelessly to isolated servers and name given to this technology is wireless body area network. Combining tiny sensors and wireless communication technology, wireless body area network (WBAN) is one of the most promising fields. Wearable and implantable sensors are utilized for collecting the physiological data to achieve continuously monitoring of people's physical conditions. To implement WBAN technology there are various challenges exist like size of sensors, power consumption of sensors, antenna designs, security and privacy issues and many more.

Keywords: WBAN, Sensors, Wireless Sensor Network, Cross layer protocol, Healthcare

1. INTRODUCTION

There is tremendous revolution taking place in technological innovations used in the field of communication and computation. The capability for co-ordination and communication in-between many instruments/devices affect many areas in our life by using wireless technology. But there is slow alteration in field of medical care. The main concern is how much the systems in which information about the patients is stored are secured and upto what level integration of the information of patients takes place [1]. The privacy and Patient and security are crucial parameters when applying any of new innovation in wireless communication is applied for the solutions of problems encountered by the medical care centers. The patients are bothered particularly about storage and availability of their information and its care. Medical facilities are also worried for quality of the data they receive [2]. For alleviating the anticipated issues for applying wireless techniques for patient invigilation, the security and integrity related issues have to be resolved first. This can be done by the previous experiences that we gain from wireless technologies. By applying the experience gained from wireless implementations the concerns and necessities of medical community can be addressed. The capability for remotely tracking patient's information can allow clinics a particular picture for better operation [3-4].

The patient information received will help in better perception of the results patient receive with different medical approaches and techniques. WBAN is a growing field in computing and communication technology, which has an important role in our society. It allows the clinicals for remotely monitoring and provides required medication to patients. In WBAN technology, routing has crucial part for prolonging the lifespan of WBAN. Routing generates the path inbetween WS nodes and sink node. The author proposes protocols in WBAN that transfer information of body from all sensing devices, working on body of human being, to sink node utilizing multi-hop routing techniques [5]. The author focuses on how to prolong the average network life time of WBAN by reduction of overall energy that gets consumed. The capability for remotely tracking patient's information can allow clinics a particular picture for better vital observation remotely without any physical contact with the patient. The patient information received will help in better perception of the results patient receive with different medical approaches and techniques.

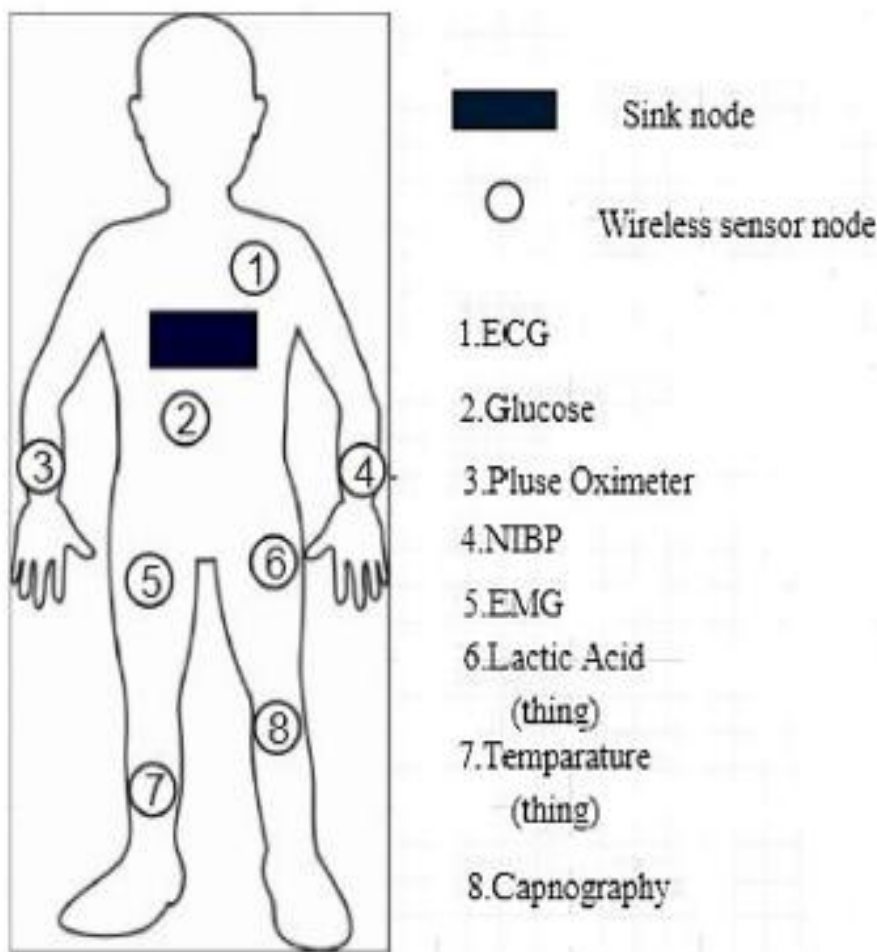


Figure 1 Node deployment in parts of body

2. LITERATURE SURVEY

WBAN is becoming one of the most important fields. It combines various small sensors and wireless transmission techniques. There is continuous advancement in WBAN technique due to research in WSN technology. There are various papers available in which researchers have given survey of WBSNs and also provides comparative analysis of WBSN systems. The authors provide relevant characteristics of the networks, issues and threats related with WBAN in many areas, and mainly in medical healthcare systems. Recurrent techniques utilized in WBANs are also studied in detail including future scope for the technique.

Rajeev Sharma et al: Due to advancement in technology many low weight slimmer, low power consuming devices are being developed. WBAN is a great technique that can be utilized for incorporating all these devices. It can also help in health monitoring appliances. There is more development in WSN causing the sensors to have extremely low cost making them suitable for many applications. The diverse technical challenges encountered in these applications are being studied by researchers. The sensors components in network play a crucial role in health care. WBAN are deeply related with many sectors [2].

Deying Yuan et al: In A-MAC protocol information is set having three priorities depending upon type of service it is providing; the configuration of IEEE802.15.6 is modified and gets organized again into four different phases. The length of contention access phase and the noncontention access phase is get adjusted depending upon proportions of nodes where priorities information is generated. The CAP is again having three subphases. Length of subphase is dynamically adjusted in accordance with the data precedence. In this phase, there is a competition between nodes for channel access. This is done according to channel access strategy. The information that competes productively transmits data successfully [3].

Anil Kumar Singh et al: The author had employed the significant statistics direction-finding code for the transmission of the required information and it flow from body node to MSS node. MSS controls and manages the entire injected sensing nodes in body of the patient as their own member [1].

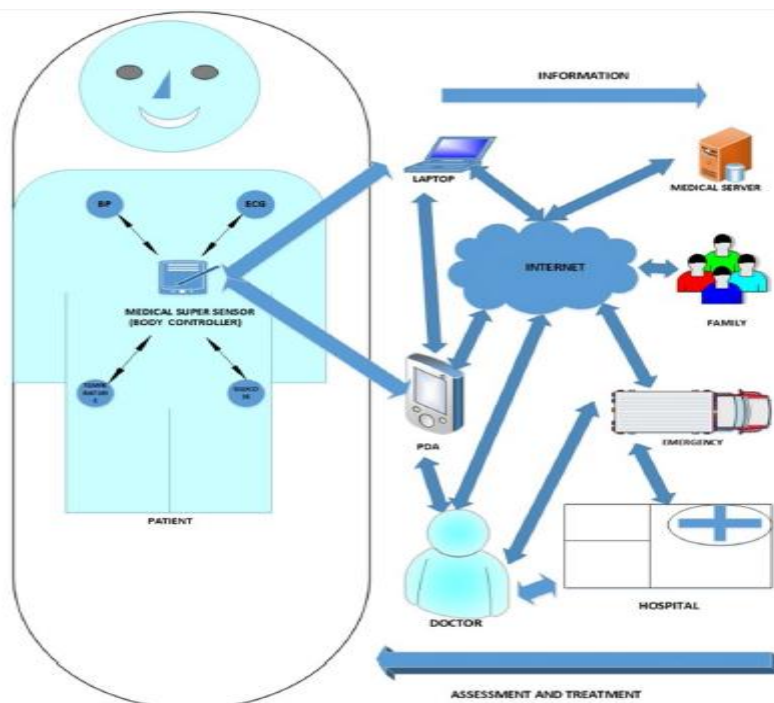


Figure 2 Nodes deployment in body under WBANs [1]

And if there is some corporeal activity in the body then the inner node senses it and then a comparison is made with the threshold values that are stored previously of sensing node and if sensors obtain large difference in the result then the CDR protocol is followed for communication process. We can also say that the sensing node will only transmit the critical data packet to the nearest controlling device and avoid the random selection of any normal data packet. In this way the monitoring of the patient can be done continuously and lifetime of network is also maximized.

3. SECURITY AND PRIVACY ISSUES

This segment describes the potential threats in wireless health care applications devoid of appropriate security algorithms and confidentiality issues of patients. Three wireless health care situations are considerable like nursing home monitoring, homecare monitoring, and monitoring in hospitals.

Security Threats

From the above mentioned situations for health care, Wireless Medical Sensor Networks undeniably perk up patient's quality of care devoid of any disturbance in their console. These remedial sensors get the patient body sensed and transmit the information/data through the wireless channels that are much more prone to security threats than any wired network [10]. Because patient's perceptive physiological information must stay secured and personal from any such security intimidation. The potential security intimidations unsafe for wireless health care achievements are as follows:

- Monitor and Eavesdrop on Patient crucial physiological parameters
- Routing Threats in WSNs
- Signs
- Intimidation of data in Transition state
- Selected forward

4. APPLICATION OF WBAN

The development of Wireless medical sensor networks for health care application has made patient monitoring more feasible. Recently, several wireless health care researchers have developed many techniques for the sole purpose of incessant monitoring of patients, monitoring in hospitals and clinics, monitoring in ambulance, and free environmental monitoring. As per the WHO survey conducted in year 2005, the cause of death of 17.5 million people was cardiovascular disease. This was 30% of total deaths occurred in 2005. At present 180 million people are diabetic across the world and the number of these patients is likely to increase more to near about 360 millions by year 2030. People having chronic diseases increase quickly each year. So excellence and amount of health care services is also needed to get improved with the enhancement in number of patients.

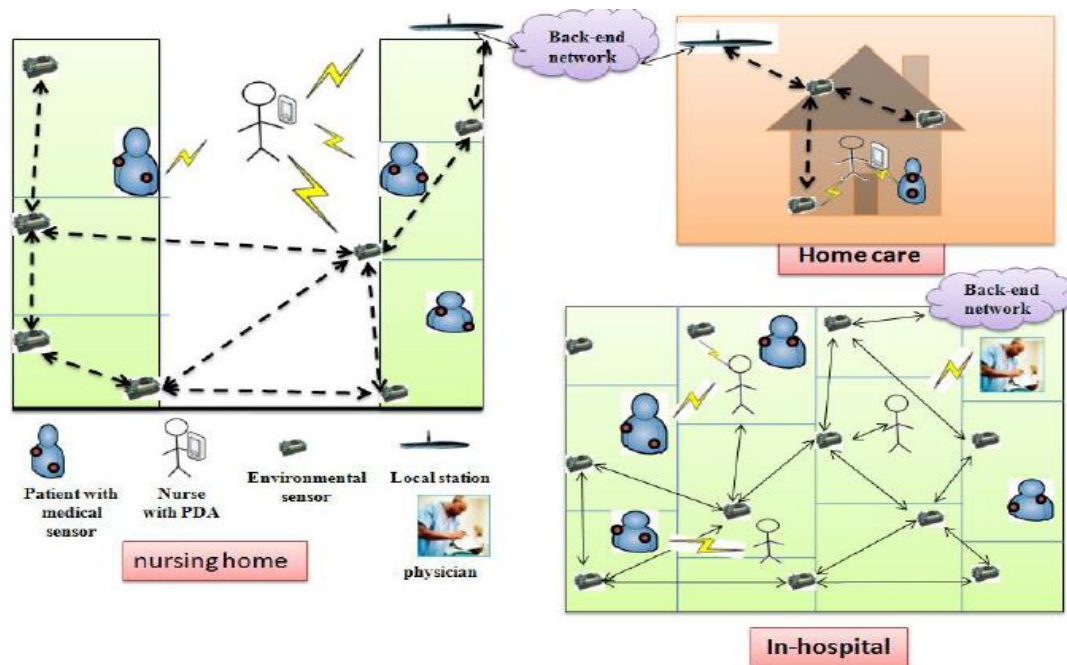


Figure 3: WBAN applications for different environments

Wireless healthcare devices employ medical sensing units and environmental sensors (ES), mobile devices and wireless communication protocols. For Physiological health care information storage, and for examination of PHI, back end server is employed. The privacy of patient information is particularly important because in wireless transmission various kinds of security attacks can occur. A patient always wants his medical information not to be generalized to others. So authenticity comes in play as wireless body transmission is considered.

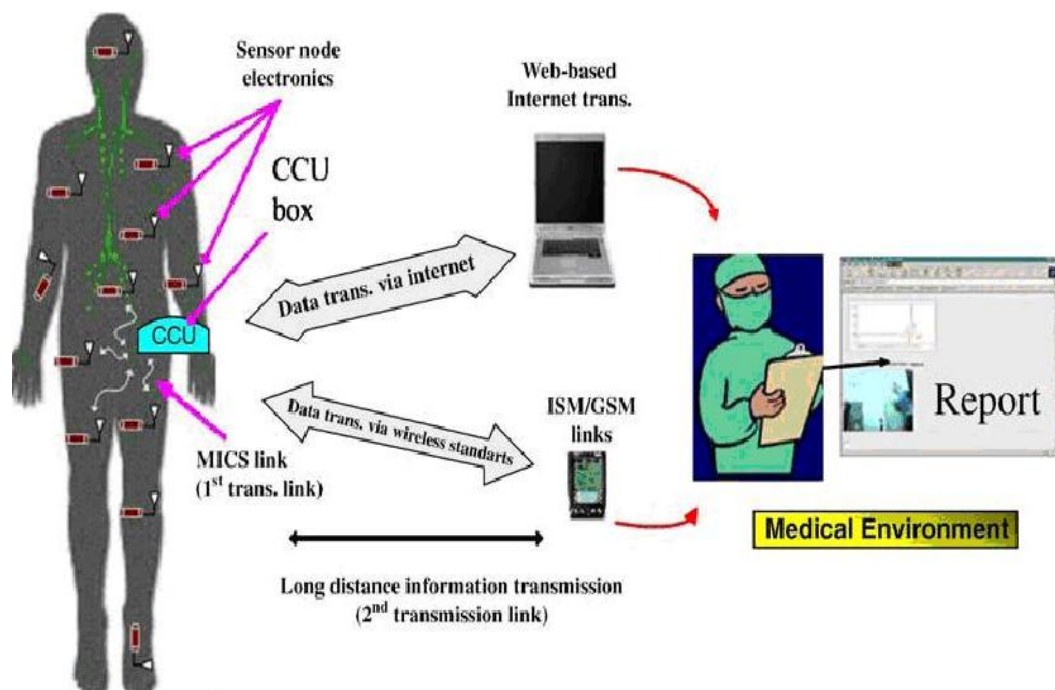


Figure 4: Application in healthcare

The most significant requirement of WBAN is monitoring of the patient medical information in health care atmosphere. The researches in the medical turf also fetch new special instruments of dissimilar area in the health care. The capability for remotely tracking patient's information can allow clinics a particular picture for better operation. The patient information received will help in better perception of the results patient receive with different medical approaches and techniques. Hospitals, ambulatory services, Maternity/Ob, ER/Trauma units, Rescue operations, and clinics are some the health care environment where Wireless Body Area Networks can be utilized.

- Chronic Diseases Patients Monitoring
- Aged Patients Monitor
- Hospitals Patients Monitor

CONCLUSION

There is continuous advancement in WBAN technique due to research in WSN technology. WBAN is an emerging field of research within the domain of healthcare. It combines various small sensors and wireless transmission techniques. Due to advancement in technology many low weight slimmer, low power consuming devices are being developed. WBAN is a great technique that can be utilized for incorporating all these devices. It can also help in health monitoring appliances. Both WBAN and WSN have major key differences. Traditional WBAN has several limitations but with time WBAN architecture modified and limitations are tackled proficiently. In this paper a detailed survey carried out on WBAN along with privacy and security issues and application of WBAN in different domains. With new technologies like blockchain, EH and SDN came into existence and these technologies must be integrated with WBAN to get optimized results.

REFERENCES

- [1]. Anil Kumar Sagar, Shivangi Singh, Avadhesh Kumar, "Energy-Aware WBAN for Health Monitoring Using Critical Data Routing (CDR)", Wireless Personal Communications, 14-01-2020, Issue 1/2020
- [2]. Rajeev Sharma, Sandeep Singh Kang, "Challenges and Applications of Wireless Body Area Networks", International Journal of Innovative Technology and Exploring Engineering (IJITEE) ISSN: 2278-3075, Volume-8, Issue-9S, July 2019, DOI: 10.35940/ijitee.I1086.0789S19
- [3]. Deying Yuan, Guoqiang Zheng, Huahong Ma, Jiaqing Shang, Jishun Li, "An Adaptive MAC Protocol Based on IEEE802.15.6 for Wireless Body Area Networks", Hindawi, Wireless Communications and Mobile Computing, Volume 2019, Article ID 3681631, Doi.org/10.1155/2019/3681631 International Journal of Advanced Science and Technology Vol. 29, No.4, (2020), pp.9443 – 9450 ISSN: 2005-4238 IJAST
- [4]. Subba Reddy Chavva, Ravi Sankar Sangam, "An Energy Efficient Multi Hop Routing Protocol for Health Monitoring in Wireless Body Area Network", Network Modeling Analysis in Health Informatics and Bioinformatics volume 8, Article number: 21 (2019), 05 September 2019
- [5]. Md. Taslim Arefin, Mohammad Hanif Ali, A. K. M. Fazlul Haque, "Wireless Body Area Network: An Overview and Various Applications", Journal of Computer and Communications, 2017, 5, 53-64, ISSN Online: 2327-5227, ISSN Print: 2327-5219, DOI: 10.4236/jcc.2017.57006 May 17, 2017
- [6]. Movassaghi, S., Abolhasan, M., & Lipman, J., "A review of routing protocols in wireless body area networks", Journal of Networks, 2013, 8(3), 559–575.
- [7]. Ababneh, N., "Energy-balanced rate assignment and routing protocol for body area network" In 26th international conference on advanced information networking and applications workshops (WAINA) 2012, IEEE.
- [8]. Tsouri, G. R., Gill, R., Prieto, A., & Argade, N., "On increasing network lifetime in body area networks using global routing with energy consumption balancing", Sensors, 12(10), 2012, 13088–13108.
- [9]. Latre, B., "A low-delay protocol for multihop wireless body area networks", In Fourth annual international conference on mobile and ubiquitous systems: Networking and services, 2007, IEEE.
- [10]. Quwaider, M., & Biswas, S., "On-body packet routing algorithms for body sensor networks", In First international conference on networks and communications, 2009. NETCOM'09, IEEE
- [11]. Ehyae, A., Hashemi, M., & Khadivi, P., "Using relay network to increase lifetime in wireless body area sensor networks", In IEEE international symposium on world of wireless, mobile and multimedia networks, and workshops, 2009, IEEE.
- [12]. Nabi, M., "A robust protocol stack for multi-hop wireless body area networks with transmit power adaptation.", In Proceedings of the fifth international conference on body area networks 2010.