# Survey on Wearable Wireless Body Area Network for Health Care.

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*Abstract* – *Looking at the past years a booming interest in the field of wire-less communication for the development of a monitoring system to observe human vital organs activities remotely. Wireless Body Area Network (WBAN) is such network that provides a continuous monitoring over or inside human body for a long period and can support transmission of real time traffic such as data, voice, video, ECG to observe the status of vital organs functionalities. In this paper an overview of WBAN technology and its requirements has been mentioned. The aim of this paper was to offer a suitable and appropriate wireless technology for deploying WBAN. The Several suitable short range wireless communication technologies that can be implemented in WBAN have also been discussed and planned. Finally numerous applications in the field of medical health care Sector and non-medical sectors using WBAN technology have been outlined.*

*Keywords – WBAN, ECG, BGL, ETS, WPAN, WSN, Wi-Fi.*

## INTRODUCTION:

In present day innovation remote correspondence gives a great deal of potential outcomes to have the option to share its data to one another at whenever and anyplace. Intelligent versatile correspondence organization and WLAN, Wi-Fi are applied to different areas like training; medical care administration and industry to give individuals a helpful method for speaking with one another. As the interest of pervasive organization is expanded, the gadgets for home, office and other information gadgets that can impart remote in short reach have been getting more consideration. The norm and procedure improvement of pervasive organization has quickly placed itself into the world market. Wireless Body Area Network (WBAN) is turning into an extraordinary use of such method. Wireless Body Area Network is a wireless network of devices which are wearable. These devices can be implanted inside or outside the human body. These are a type of body sensors mainly used for medical and healthcare systems. A WBAN can operate independently for the connection of various medical sensors and devices which are located inside or outside the human body. The idea of WBAN is developed keeping in mind the concept of WPAN (Wireless Personal Area Network) which is used for communication in a limited range around the human body. WBAN varies with other remote sensor network (WSN) for certain huge focuses. First contrast between a WBAN and WSN is portability. In WBAN client can move with sensor hubs with same portability design though WSN is for the most part used to be fixed. Energy utilization is significantly less in WBAN than other WSNs plan. Moreover, WBAN sensor gadgets are viewed as less expensive than WSNs. For unwavering quality, hub intricacy and thickness, WBAN hubs are anyway customary. WSNs don't handle explicit prerequisites related with the co-operation between the network and the human body. WBAN is planned with specific sensor which can autonomously associate with different sensors and devices, situated inside and outside of a human body.

Wireless body sensors comprise of the transducers for signal discovery, a power source, and the handset hardware for wireless linkages. WBAN utilizes battery-fueled wireless organic sensors to gauge and communicate imperative data over the remote media too far off wellbeing units. Because of the diminished size of the natural sensors, WBAN gadgets can't be installed without any problem. Likewise, the strength of the WBAN battery relies upon its size. Subsequently, a scaled down battery size compromise WBAN functional lifetime.

## LITERATURE SURVEY:

| Sr. No | Paper Title Publication Details | Pre - Processing | Feature Extraction and Classification | Accuracy | Post - Processing | Research Gap Identified |
|---|---|---|---|---|---|---|
| 1. | R. K. C. Billones, M. P. Vicmudo and E. P. Dadios, "Fuzzy inference system wireless body area network architecture simulation for health monitoring," 2015 International Conference on Humanoid, Nanotechnology, Information Technology,Communication and Control, Environment and Management (HNICEM), 2015, pp. 1-6, doi: 10.1109/HNICEM.2015.7393231. | The current healthcare infrastructure cannot cope with the projected increase in demands for health care monitoring. | Human capabilities of making sound decisions despite the imperfectness, and conflicting information | 85% | to monitor the heart rate, respiration rate, blood pressure, body temperature, and oxygen saturation of hemoglobin in the blood ($SpO_2$) is proposed in this study. | - |
| 2. | Z. Yi et al., "Ubiquitous healthcare system using emergency strategy based on wireless body area system," 2016 5th International Conference on Computer Science and Network Technology (ICCSNT), 2016, pp. 117-120, doi: 10.1109/ICCSNT.2016.8070131. | to effectively transmit and analyze the personal health information using wireless sensor terminal is the difficult task. | emergency event and non-emergency event can be considered for healthcare networks based on the priority strategy. | 89% | Extensive simulations are also conducted to evaluate the performance in terms of fault probability, throughput, and mobile healthcare network utilization. | - |
| 3. | S. Nubenthan and K. Ravichelvan, "A wireless continuous patient monitoring system for dengue; Wi-Mon," 2017 International Conference on Wireless Communications, Signal Processing and Networking (WiSPNET), 2017, pp. 2201-2205, doi: 10.1109/WiSPNET.2017.8300150. | to build up health care systems to empower the effective management and early detection of illness, and reaction to crisis rather than wellness | Early detection of suspected case, access to proper medical care and disease management can help in dramatically lowering the rate of fatal cases. | 79% | system can be used to monitor many patients' physiological signals simultaneously in the real-time hospital environment. | - |

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| 4. | H. Yoo, "Wireless body area network and its healthcare applications," 2013 Asia-Pacific Microwave Conference Proceedings (APMC), 2013, pp. 89-91, doi: 10.1109/APMC.2013.6695200. | ultra-low-power wireless communication among devices placed in, on, and around the human body is the key technology for continuous monitoring of physiological. | filter is proposed to fulfill the tight spectral mask requirement without using external components. | - | 6 HBC transceiver implemented with CMOS technology, including a world–first WBAN transceiver satisfying all of the specifications for IEEE 802.15.6 standard. | - |
| 5. | H. Wang, M. Daneshmand and H. Fang, "Artificial Intelligence (AI) Driven Wireless Body Area Networks: Challenges and Directions," 2019 IEEE International Conference on Industrial Internet (ICII), 2019, pp. 428-429, doi: 10.1109/ICII.2019.00079. | SCH utilizes sensing, communication networks and AI to enable ubiquitous healthcare services | the network environments could have significant impact on the network performance | 90% | the possibility of exploring AI techniques for WBANs to improve network performance and enhance health services | - |

**ALGORITHMIC SURVEY:**

| Sr. No | Paper Title | Algorithm Used | Time Complexity | Space Complexity | Accuracy | Advantages/ Disadvantages |
|---|---|---|---|---|---|---|
| 1. | Fuzzy inference system wireless body area network architecture simulation for health monitoring | Mamdani Fuzzy Inference Systems | - | - | 85% | Intuitive Well-suited to human input More interpretable rule base Have widespread acceptance |
| 2. | Ubiquitous healthcare system using emergency strategy based on wireless body area system | the multi-dimensional state transmit model | $O(n*m)$ | $O(N \lg^{(k-1)} N)$ | 89% | It is workable on complex systems and applications. |

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| 3. | Use of Blockchain Technology in Wireless Body Area Networks | Blockchain algorithm | O(mn2). | O(mn) | 90% | technology are decentralized network, transparency, trusty chain, |
| 4. | GRDT: Group-based Reliable Data Transport in wireless body area sensor networks | Group-based Reliable Data Transport (GRDT) protocol | - | - | - | GRDT provides mobility and scalability support |
| 5. | Artificial Intelligence (AI) Driven Wireless Body Area Networks: Challenges and Directions | Genetic algorithm | O(g(nm + nm + n)) | - | - | A supports multi-objective optimization. GA use probabilistic transition rules, not deterministic rules |
| 6. | An Efficient hierarchical Routing Algorithm to Detect DoS in Wireless Body Area Networks, | hierarchical Routing algorithm | O(K*n) | - | - | allow easier changes to the network, in much the same way afforded by the traditional hierarchical design comprised of the Core |
| 7. | Energy-aware routing protocols in wireless body area networks, | Energy-aware routing algorithm | O(n) | O(1) | - | better performance in terms of energy efficiency because their load balances the energy usage among SNs |
| 8. | Public key cryptosystem based security in wireless body area network | public-key algorithm | O log 2 | - | - | users never need to transmit or reveal their private keys to anyone. |

| 9. | Improving Energy Efficiency and Quality of Service in Wireless Body Area Sensor Network using Versatile Synchronization Guard Band Protocol | Versatile Synchronization Guard Band algorithm | - | - | - | propagation delay effects a guard band |
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| 10. | Temperature and Reliability-Aware Routing Protocol for Wireless Body Area Networks | Temperature and Reliability-Aware Routing algorithm | - | - | - | Cost effective, unobtrusive, and unsupervised continuous monitoring |

## CONCLUSION:

WBAN is an emerging technology which is expecting to have a great impact on our society as well as in the field of medical and non-medical sector. The aim of this work was to offer a suitable and appropriate wireless technology in order to deploy network. For this reason, we have described several short-range wireless communication technologies that can be adopted in WBAN.

## REFERENCES:

1. R. K. C. Billones, M. P. Vicmudo and E. P. Dadios, "Fuzzy inference system wireless body area network architecture simulation for health monitoring," 2015 International Conference on Humanoid, Nanotechnology, Information Technology, Communication and Control, Environment and Management (HNICEM), 2015, pp. 1-6, doi: 10.1109/HNICEM.2015.7393231.

2. Z. Yi et al., "Ubiquitous healthcare system using emergency strategy based on wireless body area system," 2016 5th International Conference on Computer Science and Network Technology (ICCSNT), 2016, pp. 117-120, doi: 10.1109/ICCSNT.2016.8070131.

3. S. Nubenthan and K. Ravichelvan, "A wireless continuous patient monitoring system for dengue; Wi-Mon," 2017 International Conference on Wireless Communications, Signal Processing and Networking (WiSPNET), 2017, pp. 2201-2205, doi: 10.1109/WiSPNET.2017.8300150.

4. H. Yoo, "Wireless body area network and its healthcare applications," 2013 Asia-Pacific Microwave Conference Proceedings (APMC), 2013, pp. 89-91, doi: 10.1109/APMC.2013.6695200.

5. H. Wang, M. Daneshmand and H. Fang, "Artificial Intelligence (AI) Driven Wireless Body Area Networks: Challenges and Directions," 2019 IEEE International Conference on Industrial Internet (ICII), 2019, pp. 428-429, doi: 10.1109/ICII.2019.00079.

6. R. Pawar and D. Kalbande, "Use of Blockchain Technology in Wireless Body Area Networks," 2020 3rd International Conference on Intelligent Sustainable Systems (ICISS), 2020, pp. 1333-1336, doi: 10.1109/ICISS49785.2020.9316005.

7. D. Geng et al., "GRDT: Group-based Reliable Data Transport in wireless body area sensor networks," IET International Conference on Wireless Sensor Network 2010 (IET-WSN 2010), 2010, pp. 385-392, doi: 10.1049/cp.2010.1084.

8. K. Devisri, K. S. Indrani, A. L. Gayathri, K. Dedeepya, A. Roshini and M. Kommineni, "An Efficient hierarchical Routing Algorithm to Detect DoS in Wireless Body Area Networks," 2021 7th International Conference on Advanced Computing and Communication Systems (ICACCS), 2021, pp. 644-647, doi: 10.1109/ICACCS51430.2021.9442020.

9. C. H. W. Oey, S. Salim and S. Moh, "Energy-aware routing protocols in wireless body area networks," 2012 8th International Conference on Computing and Networking Technology (INC, ICCIS and ICMIC), 2012, pp. 159-162.

10. A. S. Sangari and J. M. L. Manickam, "Public key crypto system-based security in wireless body area network," 2014 International Conference on Circuits, Power and Computing Technologies [ICCPCT-2014], 2014, pp. 1609-1612, doi: 10.1109/ICCPCT.2014.7054788.

11. S. Murugeswari and K. Murugan, "Improving Energy Efficiency and Quality of Service in Wireless Body Area Sensor Network using Versatile Synchronization Guard Band Protocol," 2019 IEEE International Conference on Clean Energy and Energy Efficient Electronics Circuit for Sustainable Development (INCCES), 2019, pp. 1-5, doi: 10.1109/INCCES47820.2019.9167738.

12. S. Memon et al., "Temperature and Reliability-Aware Routing Protocol for Wireless Body Area Networks," in IEEE Access, vol. 9, pp. 140413-140423, 2021, doi: 10.1109/ACCESS.2021.3117928.