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A Review of Wireless Body Area Network

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ABSTRACT

In the age of today, technology pays attention to how it can be implemented in keeping people alive. It is clear that technology is offering the healthcare industry a much-needed upgrade to mobile apps from medical translation resources that help patients lead healthier lives. One of the dizzying innovations that could change the healthcare industry is the wireless body area network (WBAN).WBAN derives from the wireless sensor network (WSN) that deploys sensors over the human body. Wireless Body Area Network (WBAN) is a wireless networking system based on radio frequency (RF) that interconnects tiny nodes with sensor or actuator capabilities in, on, or around a human body. WBAN also links large and local area networks. As compared to WSN, WBAN has its own characteristics.

KEYWORDS: *WBAN, healthcare, routing, MAC, WSN etc*

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INTRODUCTION

Wireless Sensor Networks A wireless sensor network (WSN) is a network comprising a group of very small sensor nodes that are deployed in a field for autonomous monitoring of physical conditions. WSNs calculate many physical factors, such as tone, light, temperature etc. Then, the sensor nodes transfer the sensed data to a base station or sink. The new WSNs advance control sensor node operation and are bidirectional. Much of WSN 's developments occur in military applications. WSNs are deployed to track manufacturing processes, industrial controls and machine health monitoring in many industrial applications. The WSN's consist of 'sensor nodes,' which can be few in numbers, hundreds, or thousands. In WSN, a sensor node is linked to another sensor node or to multiple sensor nodes[1]. Sensor node components are a microprocessor or microcontroller to monitor node operation, to interface sensors with power source, to communicate with a radio transceiver and to use an electronic circuitry. Either energy is extracted from any available source, or the batteries in these sensors are usually used as power source. The size of the sensor node varies depending on the application, because the sensor node may be as small as dust grain or as big as a shoe box. The sensors likewise have variable expense. A sensor node's price can vary from a few dollars to hundreds of dollars because a node contains complex circuitry and advance features. Many of the topologies used in these networks are similar to simple topology for stars or advance multihop topologies.

A Wireless Body Area Network (WBAN) is basically a wireless network of computerized devices which a user can wear. WBAN devices may be implanted or installed within the body (Implants), placed on the surface of the body (Wearable Technology) or supported by devices that can be worn by patients in various places, such as in clothing pockets, etc.

Concept: WBAN is an area that would allow cheap and reliable web-based health monitoring with real-time Medical Account posts. A wireless body area network may include various types of physical sensors that could be used to identify multiple medical complaints. WBAN relies on the feasibility of embedding small biosensors on or within the patient's body which does not interfere with daily activities[2]. Such sensors capture different biological changes in the body and report the patient's data to the medical authority concerned no matter where the patient is.In the case of any emergency, the doctors must warn the patient immediately by transmitting a message through the net or suitable wireless systems. WBAN 's lifespan is a major problem for these wireless networks but work is under way to address these problems.

APPLICATIONS OF WBAN

The medical field is known to be the primary domain of wireless Body area networks. Constant supervision of patients is needed here either because of their age or because of the nature of their illness. However, WBANs can also cover other fields such as sports, military, and defense.

Health treatments: Networks of wireless body areas will turn the picture of medical services to a whole new level. Diseases which threaten life can be detected early and can be cured. In addition, heart attacks and other such complications can be identified and avoided by monitoring

the vital signs in the patient's body prior to their occurrence. In addition, one of the leading causes of death is linked with cardiovascular disorders, which are estimated to cause as many as 30% of deaths worldwide. Progress in technology (e.g. micro-electro miniaturization and assimilation, sensors, web and wireless interaction) would radically alter and simplify the delivery and analysis of health-care services[3].WBANs are required to improve health care systems and make it easier and treat and diagnose diseases more efficiently, and respond to calamities rather than just wellness.

Health systems are categorized according to:

1. **Wearable WBAN:** Such requirements can be further classified as: a) Disability aid b) Performance Monitoring of some kind.

2. **Evaluating Soldier Exhaustion and Battleground Inclination** –WBANs closely track any kind of activities performed by soldiers on the battlefield. To this end, WBANs may consist of cameras, GPS devices, different biosensors etc. However, there should be a safe communication connection among the soldiers to avoid surprise attacks. Policemen and fire-fighters can also use WBANs.

3. **Continuing instruction in professional and unprofessional sport** –Player training programs are easily adjusted by WBANs, as these networks provide constraints for screening, apprehension of movement, and recovery. In addition, the user's real-time feedback in these networks allows performance enhancement and avoids accidents that are associated with inappropriate training.

4. **Asthma** –Asthma is very popular in today's environment and is the result of too many atmospheric impurities. Dirt and other contaminations cause patients to have allergies which lead to an asthma attack. Such impurities can now be easily identified by the sensors in WBANs and warn patients and doctors of any real danger in the area, thus helping people with asthma[5].

5. **Wearable health surveillance** – Real-time health monitoring is provided by networks in the body region with the assistance of various biosensors. For example: Patients with diabetes can use a Gluco-cellphone (cellphone with glucose component). This phone gets diagnostic data from the glucose unit that could be saved for analysis or forwarded to a doctor.

6. **Implant WBAN:** In this case, nodes are either lodged within the human body, or placed on the body's surface. Diabetes management – Currently, diabetes affects millions of people. Not only adults but children nowadays also suffer from this awful disease. If diabetes is not held properly in check then it may cause severe long-term problems. Therefore, continuous monitoring is needed for diabetes that can be done by WBANs, which will help to keep diabetes under full control and therefore reduce the chances of happening something harmful.

Cardiovascular Diseases – Cardiovascular diseases are seen as the main life-taking diseases on a wide scale every year. WBANs help to minimize human life threats by keeping a comprehensive check on all the vital signs leading to any such ailment. By tracking any irregular events or changes in the human body using Wireless Body Area Networks, myocardial infarction (MI) can be minimized.

Detection of cancer–Diagnosis of cancer is a quite complex process because it involves multiple biopsies that cause the patient quite a lot of pain. WBAN sensors would allow physicians to detect and treat cancer cells with no such problems. The sensors will also be providing constant awareness of the progress of the procedure.

Remote Medical Equipment access: Body area networks' global network integration enables the interaction of home care equipment and facilities called Ambient Assisted Living (AAL), through which each WBAN links wirelessly to a medical back-end network.AAL seeks to provide self-management services for those patients who need to be helped at home, minimize dependency on demanding personal attention, increase the standard of life and reduce overall expenses. Ambient assisted living will also foster a new age of IT programs with features such as constructive behaviour, context alertness, sociability of patients and flexibility.

Monitoring patients–WBANs' most important application is to track any person's physiological changes, and then provide real-time data as input to the authorities concerned via the appropriate tools. Additionally, these networks may also induce drugs to those patients that need them immediately when in doctor's awareness. Consistent control and oversight is an integral part of WBAN systems. As WBANs can attach various devices, such as hearing aids, digitized specs etc., their application may include post-treatment follow-up, prescription testing, emergency care, remote injury assistance and chronic disease testing.

Telemedicine Technology– Current telemedicine systems have many drawbacks such as the use of standards such as Bluetooth which require a lot of power and trigger interference problems as well. There are also dedicated wireless connections for remote locations for data transmission but they too hinder continuous monitoring. WBANs can solve these issues which will provide clearer solutions for patient treatment in the medical sector.

CHALLENGES ASSOCIATED WITH WBAN

Security: Significant efforts will be needed to make WBAN transmission safe and accurate. It must be ensured that one patient's "safe" data is taken from the correct dedicated WBAN and not mixed with data from any other individual. Additionally, the records created by WBAN should have both secure and restricted entry. Given that WBANs are resource-constrained in capacity, memory, communication percentage, and computational capability relationships, security keys suggested for other networks may not be true for WBANs. The security necessities in WBAN [6] are confidentiality, honesty, authentication and novelty of data along with availability and safe organization.

Interoperableness: To facilitate data exchange and user collaboration, WBAN systems would need to confirm seamless data sharing between devices such as Bluetooth, Zigbee etc. The networks would also need to be available,

ensure efficient network-wide passage and suggest continuous connectivity. System devices: WBAN's sensors would need to be less complex, light weighted, power-efficient, user-friendly and reconfigurable. In addition, the storage systems must assist with remote storage and display of patient data as well as access via the Net to external processing and analysis facilities.

Privacy Reporting: If protection is not adequately protected then it may be difficult for individuals to preserve privacy, which is very important for most patients because it includes their personal information. For a wider understanding of WBAN systems, people need to recognize the technology.

Validation of Sensors: General sensing devices are based on characteristic communication and hardware constraints which include undependable wired / wireless network connections, interference, and limited power reserves. This can result in the transfer of faulty data sets back to the end user. It is critical that all sensor readings are certified particularly within a medical sphere. This helps to minimize false alarm generation and recognise possible faults within the design of the hardware and software.

Stable data: It is important to collect and analyze data from various mobile systems as well as wireless patient data in a smooth manner. In WBANs, a number of nodes and a number of networked laptops or machines split the patient datasets. However, if not all known facts are included in a physician's mobile network then the reliability of patient care could degrade. Interference: The wireless communication used for body sensors will minimize interference and increase the interaction of sensor node devices with other network devices in the environment. That is very important for large-scale WBAN service.

Supervising data: As WBANs generate vast quantities of data, the need to maintain and preserve the datasets is of utmost importance. In addition to the hardware-based challenges, the following human-cantered challenges for the realistic growth of WBAN need to be addressed**.** These consist of: Cost: People today opt for low-cost health surveillance responses that offer great functionality. WBAN applications need to be cost-effective in order to serve as good choices for clients who are health conscious.

Surveillance continued: Patients may need various rates of specialist treatment , for example, patients at risk of cardiac arrest may need their WBANs to function on an ongoing basis, whilst those at risk of falling may need WBANs only to track them as they travel or outside. The level of control affects the energy volume required and the WBAN's network life until the energy supply is depleted. Constrained deployment: The lightweight, light weighted and non-invasive WBAN is required. WBAN should not alter or impede the daily activities of the person[7].Ultimately the system should be open to the customer, that is, it should perform its monitoring jobs without being noticed by the user.

Stable performance: A WBAN has to work consistently. Even if the WBAN is switched off and on again, the data obtained by different sensors should be accurate and rectified. The wireless links should be robust and work in different circumstances.

LITERATURE REVIEW

Muhammad MoidSahndhu et al. [2015]'BEC: A novel routing protocol for controlled energy consumption in Wireless Body Area Networks' Wireless Body Area Networks (WBANs) are growing interest in a wide variety of medicinal and non-therapeutic applications because of their suitability. Such applications allow WBAN to remain operational for a longer period of time requiring activity that is capable of vitality. In this paper we suggest a more Balanced Energy Consumption (BEC) steering convention in WBANs. In BEC, hand-off hubs are selected taking into account a cost efficiency. The hubs are sending their information to their closest hand-off hubs to race it to the sink. The hubs nearer to the sink directly submit their information to it. Moreover, when their vitality turns out to be not exactly a particular edge, the hubs only submit simple information. Keeping in mind the end goal of consistently disseminating the heap, hand-off hubs are turned in each round considering a cost power. Reenactment comes about showing that BEC accomplishes an extended device lifetime of 49 per cent compared to OINL (On-Network Lifetime) estimate.

Ilkyu Ha [2015] "Technologies and Research Patterns in Healthcare's Wireless Body Area Network: A Systematic Literature Review" This paper shows that WBAN has ecological properties which are not the same as current WSNs. The developments connected to existing WSNs are not connected to WBAN as remote sensors in BAN are linked to various parts of the human body as well as providing a completely different device setting and existing remote sensors.

Reza Khalilianet al.[2016]"An Effective Method To Strengthen WBAN Security," this paper proposes another approach that improves WBAN's security issues. The goal of this paper is to the multi-faceted nature of the necessary memory control packages, controlling cradle over stream and controlling the current harm by using high levels of information exchange between hubs. The protection is improved in this paper by the use of AES-256 program.

Anurag Tiwari et al.[2016]"Safety and privacy in e-healthcare monitoring with WBAN" are, to a great extent, crucial for those individuals suffering from ailments such as heart-related diseases, rationally furious patients, pregnant lady, and so on, requiring constant perception. This paper therefore addresses security and defense relevant matters.

AdwanAlanazi et al. [2016]"Optimized node selection mechanism for quality of service delivery over wireless multimedia sensor networks" Some service quality (QoS) routing approaches concentrate on improving the efficiency and end-to - end delays in remote sensor systems (WSNs).With the advancement of remote mixed media sensor systems (WMSNs), information operation can be separated into unwavering bundles of information demanding quality and time-delicate parcels of information. Under these circumstances, advancement of the hub and adjustment of the burden can improve the provisioning of QoS. The connection between lifetime of the system and guaranteeing the provisioning of QoS has thus been of central importance. This paper introduces the Optimized Node Selection Method (ONSP) approach for WMSN's heartfelt multipath QoS directive. This approach depends on the choice of the enhanced hub which helps to enhance the

QoS parameters in a flexible course disclosure. Determining streamlined hubs allows the solid chain for choosing courses using residual energy and has provided a signal efficiency pointer (RSSI).The second goal of this technique is to delay the lifetime of the system by presenting the heap adjustment calculation which determines the streamlined and interlaced ways. Such approaches maintain a strategic distance from bottlenecks and increase performance, end-to - end latency, on-time package conveyance and the lifespan of the network draws out.

Shihong Zou [2017] Wireless body area network (WBAN) is one of the most promising areas, integrating tiny sensors and wireless communication technology. For the collection of physiological data, wearable and implantable sensors are used to continuously track the physical conditions of people**.** However, due to the accessibility of the wireless environment and the nature and privacy of physiological data of people, WBAN is vulnerable to various attacks; hence, strict security measures are needed to allow a safe WBAN. In this article, we concentrate primarily on a survey of WBAN security issues, including protecting internal WBAN communication and maintaining contact between WBAN and external users.

Rahat Ali Khan [2018] Wireless sensor network for the body region is a sub-field of the wireless sensor network. Wireless body area sensor network emerged after the creation of wireless sensor network reached some maturity level. This has become possible due to the enormous technical progress that has led to easy-to-use wearable wireless devices and small-sized electronic components. Indeed, in recent times, this region has gained considerable prominence due to its applications, mainly to the healthcare sector. Today, tiny-sized sensors may be mounted on the human body to record different physiological parameters and these sensors are able to transmit data to other devices in order to take more required action.

Maali Said Mohammed et al. (2018): According to projections by the World Health Organization (WHO), by 2025 one in five adults worldwide will be obese. Since 1980 obesity has doubled worldwide. In reality, over 1.9 billion 18-year-old adults (39 percent) were overweight and over 600 million (13 percent) of those were obese in 2014.In 2014, 42 million children younger than five years were overweight or obese. Obesity due to its related morbidity and mortality, is a major public health concern. This paper discusses the key methods for calculating the level of obesity and the percentage of body fat, and describes the risks that can contribute to the quality of life, longevity and the considerable expense of health care systems.

AmiraMeharouech[2019] Recent developments concentrate on the possibilities of coexistence and connectivity between a group of WBANs, which will transfer sensing data, using people as network relays, until a remote analytics server or cloud server is reached through the Internet, thus creating a body-to-body network (BBN).Such new-style networks, to name a few, support a variety of creative and exciting technologies, including universal healthcare (U-health), immersive sports, and military ones. In this paper we present the evolution of the single WBAN concept to the cooperative network of multiple WBANs for the first time , giving rise to the idea of BBN.

Rajeev Sharma [2019] Updated low-power, ultra-slim, lightweight, smart devices are the result of recent technological advances. Wireless Body Area Network (WBAN) is a replacement technology that can be used to integrate these tools, and thus provide applications for health monitoring in healthcare**.** In recent years further advancement of wireless communications has led to the use of low-priced networks of sensing components. Such networks come with a broad variety of applications. Researchers around the globe are addressing various technological problems in these application fields. Those networks of sensing components play a major role in healthcare. These networks have deep roots in various industries, i.e. engineering, medicine & research, and even under harsh climatic conditions may display good efficiency.

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Proposed Work

Wireless Body Area Sensors are used with minimal energy resources to monitor the human health. Specific energy efficient routing schemes are used to forward data to medical servers from body sensors. It is critical that sensed patient data are obtained consistently for further review by the medical specialist. Proposed scheme enables mobility at low latency costs and additional relay node hardware costs. At the wrist they deploy sink. Whenever sink node departs from node transmission range, it uses a relay node that collects data from sensor nodes. In opportunistic protocol the wireless link between sink and sensor nodes disconnects if the patient moves his hands. Link failure consumes more power of the sensor nodes and relay node also causes more packets to drop, resulting in loss of sensitive and essential data.

We are proposing a new scheme to reduce the energy usage and increasing the throughput. Our proposed scheme provides a longer period of stability. Nodes should stay alive for longer periods and consume reduced energy and large period of stability and low node energy consumption lead to a high throughput.

Objectives

1. Study various wireless body area network techniques and algorithms.
2. Design wireless body area sensor network.
3. Analysis of network lifetime, throughput, packet drop, path loss etc.
4. Performance evaluation of proposed algorithm.

Methodology

Numerous papers have been published on the wireless sensor body area network first and foremost analyse all the

previous technologies used in the wireless sensor network and design new wireless body area network for simulation.

Thirdly, the deployment node at various parts of the body such as Calf, hip, lactic acid, temp, ECG etc. Ultimately, assess the efficiency of the wireless body sensor network based on the lifespan of the network and the number of living nodes.

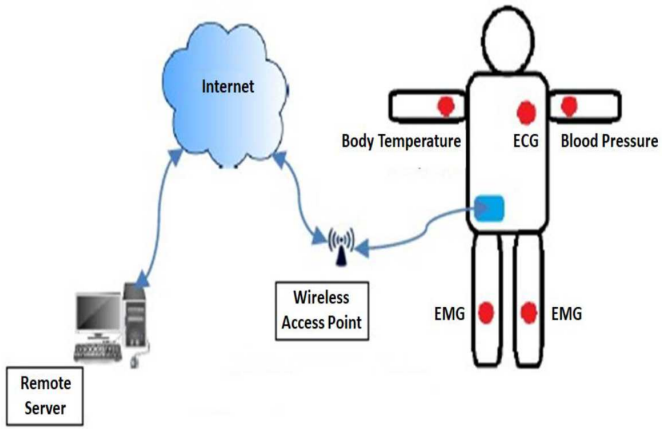

Fig1. Wireless Body Area Network [8]

Conclusion

The focus in this paper is given to the need and value of WBAN in several fields. In addition the issues faced by WBANs are also discussed here. WBANs will help to track patients in medical fields on a continuous basis and will also be responsible for the early identification of anomalous conditions. Measuring basic signs such as heart rate and blood pressure would also allow patients to participate in outdoor activities rather than being stuck at home or near medical services

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