Need of WBAN: A Survey

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Abstract: **WBANs are widely getting flourished in today's world. WBANs are like normal Wireless Sensor Networks with the exception that in WBANs the sensor nodes are placed on the human body itself. The data, be it of any kind conserning body movements (sports and military purposes) and several body requirements (medicine or drugs etc) is send to the doctor or concerned authority through a main node and further action is taken in agreement with the data. In this paper we will discuss the need of WBANs in different fields.**

Keywords: Implants, Medical Devices, Remote Control, Wireless Body Area Network, WBAN, Wearable WBAN.

INTRODUCTION:

A Wireless Body Area Network (**WBAN**), is basically a wireless network of computerized devices that can be worn by a user. WBAN devices could be embedded or planted inside the body (Implants), could be surface-mounted on the body (Wearable Technology) or could be accompanied devices that patients can carry in different positions as in clothes pockets etc.

Concept: The WBAN is an area that would allow cheap and consistent health monitoring with real-time posts of medical accounts via the web. Different types of physical sensors can be incorporated in a wireless body area network that could be used for detection of several medical complaints. WBAN depends on the viability of embedding small biosensors on or inside the body of the patient that do not disrupt the daily activities. These sensors collect different biological changes in the body and inform the concerned medical authority of the patient's data no matter where the patient is. In case of any emergency, the doctors will instantly inform the
patient by conveying a message through the net or appropriate wireless systems. The lifetime of WBAN is a major concern for these wireless networks but work is going on to eliminate these problems.

Applications: The main domain of wireless Body area networks is considered to be the medical field. Here constant monitoring of patients is required either due to their old age or due to the nature of their illness. However,
other fields such as sports, military and security can also covered by WBANs.

Medical Applications: Wireless body area networks can transform the image of medical treatments to whole new level. Diseases that are life threatening can be diagnosed at an early stage and can be cured. Moreover, heart attacks and other such problems can be detected and prevented before their occurrence by measuring the vital signs in the patient's body. Also, one of the leading causes of death is related to cardiovascular ailments, which is likely to cause as much as 30 percent of deaths worldwide [12][5]. With the progress in technology (for example: micro-electro miniaturization and assimilation, sensors, the web and wireless interaction) the deployment and examining of health care services will be fundamentally changed and simplified. WBANs are anticipated to amplify health care systems to enable more effective management and detection of illnesses, and response to calamities rather than just wellness [3][5].

Medical applications are categorized as under:

1) Wearable WBAN: These applications can further be categorized as: a) Aid in any kind of Disability b) Performance Supervision.

Evaluating Soldier Exhaustion and Battleground Inclination – Any kind of tasks performed by soldiers on the battleground are closely monitored by WBANs. For this purpose the WBANs can consist of cameras, GPS devices, various biosensors etc. However, in order to avoid surprise attacks, a secure communication link should be existent amongst the soldiers [13]. WBANs can also be used by policemen and fire-fighters [1].

Sustaining Professional and Unprofessional Sport Training – The training programs of players are easily tuned through WBANs as these networks provide checking constraints, gesture apprehension and recuperation. Moreover, the real time feedback provided to the user in these networks

allows for performance improvement and prevents injuries related to incorrect training [4].

Asthma – Asthma is very common in today's world which is a result of so many impurities in the atmosphere. Dirt and other contaminations cause allergies to patients which result in an asthma attack.
Now the sensors in WBANs can easily detect these impurities and inform the patients and doctors of any real danger in the environment, thus helping persons suffering from asthma.

Wearable Health Monitoring – Real time health monitoring is provided by body area networks with the help of different biosensors. For example: a Gluco-cellphone (cellphone with glucose component) can be used by patients suffering from diabetes. This phone gets diagnostic data from the glucose unit which could be stored or conveyed to a doctor for examination [4].

2) Implant WBAN: In this case, the nodes are either embedded inside the human body or planted on the surface of the body.

Diabetes control –Diabetes is affecting millions of people today. Not only grown-ups but nowadays children are also suffering from this terrible disease.
If diabetes is not properly kept in check then it could cause serious long term issues. Therefore constant monitoring is required for diabetes which can be achieved by WBANs which would help to keep diabetes in full control and also reduce the risks of anything hazardous from happening.

Cardiovascular Diseases – Cardiovascular diseases are considered to be the highest life taking diseases every year on a large scale. WBANs help in reducing the risks to human lives by keeping a thorough check on all the vital signs that point towards any such ailment. Myocardial Infarction (MI) could be decreased by monitoring any abnormal episodes or changes in the human body by using Wireless body area networks.

Cancer Detection –Cancer diagnosis is a very complicated procedure as it requires several biopsies which cause quite pain to the patient. WBAN sensors will enable doctors to detect and treat cancer cells without any such trouble. Also constant knowledge of the progress of the treatment will be given by the sensors as well.

3) Remote Control of Medical Devices: The global net connectivity of Body area networks permits for interacting of the devices and services in house care called Ambient Assisted Living (AAL), in which each WBAN wirelessly connects with a back-end medical network [10]. AAL aims at providing the self-lead care of those patients which have to be supported at homes, reducing the dependence on demanding personal attention, improving the quality of living and lowering general expenses. Also, ambient assisted living will nurture a new era of IT systems having

features like proactive behavior, context alertness, patient sociability and flexibility [6].

Patient Monitoring – The most promising application of WBANs is monitoring the physiological changes in any person and then providing real time data as feedback to the concerned authorities through the proper devices. Moreover drugs can also be induced by these networks to those patients who require them immediately while in knowledge of the doctor. Consistent supervision and monitoring is an essential part of WBAN systems. As WBANs can connect different devices like hearing aids, digitized specs etc their usage could include post-treatment follow-up, pharmaceutical research, trauma care, remote assistance in accidents and research in chronic diseases.

Telemedicine Systems – Current Telemedicine systems have many drawbacks such as the use of standards like Bluetooth that require a lot of power and also cause interference problems. Also there are wireless dedicated links for remote locations for transferring data but they too restrict persistent monitoring. These problems can be solved by WBANs that can provide better answers in the medical field for patient care.

CHALLENGES ASSOCIATED WITH WBAN

Security: Substantial efforts will be mandatory to make WBAN transmission secure and precise. It has to be made sure that the "secure" data of one patient is taken from the required dedicated WBAN and is not mixed with any other person's data. Furthermore, the records produced from WBAN should have secure as well as restricted admittance. As WBANs are resource-constrained in relations of power, memory, communication percentage and computational ability, security keys suggested for other networks may not be valid to WBANs. Confidentiality, integrity, validation, and newness of data along with availability and secure organization are the security necessities in WBAN.

Interoperability: WBAN systems will have to confirm seamless data transfer between devices such as Bluetooth, Zigbee etc. to support data interchange and device collaboration. Also, the networks will have to be accessible, guarantee effective passage across networks and propose continuous connectivity.

System devices: The sensors present in WBAN will have to be less complex, light weighted, power proficient, easy in usage and can be reconfigured. Moreover, the storage devices must assist remote storage and showing of patient data as well as admittance to external processing and analysis tools through the Net.

Privacy: If security is not properly maintained then it may be difficult for people to maintain privacy which is quite essential for most of the patients as it contains their personal details. People need to accept this technology for a wider recognition of WBAN systems.

Sensor validation: General sensing devices are focused to characteristic communication and hardware restraints that include undependable wired/wireless network links, interference and restricted power reserves. This could end in flawed datasets being transferred back to the end user. It is important specially within a medical sphere that all sensor readings are certified. This assists in reducing false alarm generation and to detect potential faults within the hardware and software design.

Data stability: Data belonging to multiple mobile systems as well as wireless patient data, is required to be collected and examined in a smooth manner. In WBANs, the patient datasets are broken over a number of nodes and through a number of networked Laptops or Computers. However, if a doctor's mobile network doesn't include all known facts then the value of patient care could degrade.

Interference: The wireless connection used for body sensors have to decrease the interference and surge the existence of sensor node devices with other network devices existing in the setting. This is very important for operation of WBAN on large scale.

Data Supervision: As WBANs create bulky data, the necessity to manage and conserve the datasets is of supreme significance.

Along with hardware based challenges, the following human-centric challenges have to be discussed for the practical WBAN growth. These consist of:

Cost: Today people opt for low cost health monitoring answers that deliver great functionality. WBAN applications are required to be cost effective so that they could appear as good options to health conscious customers.

Continuous monitoring: Patients may need different levels of specialist care, for eg, people at risk of cardiac arrest would need their WBANs to work continuously, whereas those at risk of falling would only require WBANs to monitor them when they are moving or outdoor. The extent of monitoring effects the volume of energy needed and the network life of the WBAN before the energy source is exhausted.

Constrained deployment: The WBAN is required to be wearable, light weighted as well as non-invasive. WBAN should not change or hinder the person's routine activities. The technology should eventually be transparent to the consumer, that is, it should execute its monitoring jobs without the user recognizing it.

Steady performance: The performance of a WBAN has to be consistent. The data measured by different sensors should be precise and rectified even if the WBAN is turned off and on again. The wireless links should be stout and operate under different situations.

CONCLUSION AND FUTURE SCOPE

In this paper, emphasis is given on the need and importance of WBAN in several fields. Moreover the challenges that WBANs are facing are also covered here. WBANs will help for continuous monitoring of patients in medical fields, and also responsible for early detection of anomalous conditions. Also, measurement of elementary signs like heart rate and blood pressure will enable patients to involve in outdoor activities instead of being entrapped at home or near medical services. To summarize, the research on this valuable technology has substantial importance in enhanced usage of available resources that will truly affect our future well-being.

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