Wireless Biomedical Sensor

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Abstract: A wireless sensor network with a large number of sensor nodes can be used as an effective tool for gathering data in various situations. Wireless sensor networks empower the development of new applications and services to improve the quality of medical care provided to the citizens. In biomedical, wireless sensors networks plays vital role. During the network operation, it is crucial to monitor the network to evaluate its performance and manage the admission of new nodes. Another important cause related with biomedical sensor networks is the network lifetime, designed to be as long as possible. The WSN is one of the major technologies of this century and hence it assumes importance in areas such as health, psychology, fire prevention, security and even in military. The great advantage of this technology is the ability to track, monitor, study, understand and act on a particular event. The primary purpose of a wireless health system is reliable data transfer with lowest delay. This work is a synthesis of research done as Wireless Biomedical Sensor Networks (WBSN), including experimental and non-experimental investigations. These systems are already being marketed, some are under still investigation. It is also the aim of this study to indentify the characteristics of WSN applied to health. In day today life, wireless sensors made human life easier as compared from past decades.

Keywords: Wireless Sensor Network, Wireless Biomedical Sensor Network, Biosensors, Health Telementary System, Ad Hoc Network, Global Positioning System, Biotechnology.

I. INTRODUCTION

Overall, the elderly population are growing and generally getting older. Life continues to increase with the new advances in healthcare. Today, worldwide 850 million people suffer from chronic diseases and spend upto 85% of their savings in healthcare plants. It is always better to prevent a disease than to treated, so that individual monitoring is required as a periodic activity.

Due to the increase of research in the area of wireless sensor networks, this have new opportunity in medical devices. The WSN are seen as one of the most important advances in technology of this century and hence its importance in areas as diverse as health, psychology, fire prevention, security and even in the military. The advantage of this technology is the ability to track, monitor, study, understand and act on a particular phenomenon or events.

Traditionally, healthcare monitoring is performed on a periodic check basis where patients are constantly updated on their symptoms, the physician checks and makes a diagnosis, then when possible monitors the patients progress during the treatment. In most cases, the health monitoring is done by wireless network infrastructures. But the coverage of these networks infrastructure has limitations for bandwidth. It is not always possible to send emergency signals from patients to healthcare workers. With WSN, patients can get continuous health monitoring using wireless AD HOC networks which can transmit vital signs over short distances. In most systems, the health data of multiple patients may be recent using the wireless multi-jump routing scheme for a base station. Wireless sensors can be placed on patients in a hospital or homecare setting to gather physiological signals. The correct WSN design on accurate traffic models, the selection of the correct model is essential for the correct management of network traffic, network congestion, interference between nodes and the energy expended by each node. Currently, there are no traffic models that represent medical WSN applications.

II. NODE SENSOR WIRELESS SENSOR NETWORK

Over the last years there has been a significant increase in the number of various wearable health monitoring devices, to measure physiological signals. However these systems are limited and they have important restrictions. For example, Holter monitors are used only to collect data, and the data processing and analysis are performed offline, because that limitation, the device became impractical for continued monitoring and early detection of medical disorders.

The most recent technology advances in integration and miniaturization of physical sensors, embedded microcontroller and radio interfaces on a single chip; wireless networking; and micro-fabrication have enabled a new generation of wireless of sensors networks suitable for many applications which arouses great interest in health monitoring and rehabilitation.

	WSN
Scale	Wide are coverage (m/km)
Node number	Huge number of nodes for coverage
Function	Multiple sensors, each perform dedicated tasks
Accuracy	Compensated by the redundancy
Size	Small size preferable but not a major limitation
Dynamics	Exposed to extremes in weather, noise, and asynchrony
Event detection	Early adverse event detection desirable; failure often reversible
Variability	Much more likely to have a fixed or static structure
Data Protection	Lower level wireless data transfer security required
Power supply	Accessible and likely to be changed more easily and frequently
Energy Scavenging	Solar, and wind power
Failure	Nodes often disposable
Access	Sensors more easily replaceable or even disposable
Biocompatibility	Not a consideration in most applications
Context Awareness	Not important with static sensors
Wireless technology	Blueetooth, Zigbee, GPRS, Wireless LAN, RF
Data transfer	Loss of data during wireless is compensated by number of sensors used

Table 1: Different Challenges faced by WSN

III. WIRELESS BIOMEDICAL SENSORS BIOMEDICAL

Information technology companies are aware of the increasing interest and a demand for this technology and they are designing m-health solutions such as eWatch or LifeShirt. As a result, wireless sensor network application to Healthcare presents effective commercial solutions for the general public and for not only hospital research facilities.

A. Importance measure to Medical Applications

Nowadays the early detection is important, diseases or monitoring patient's is vital for human survival in extreme situations.

There are several parameters/diseases that can be measured or detected, such as :

- Cancer detection: Today, there is no conclusive evidence on how to prevent cancer, but it's detection is possible and it is important. Studies have some that cancer cells exude nitric oxide, which affects the blood in the area surrounding a tumour.
- Glucose Level Monitoring: can be measure by a biomedical sensor, which will be monitoring the glucose level. This method can provide a more consistent, accurate, and less invasive.
- Asthma: the sensor detect the allergens in the air and report the status continuously to the physician or to the patient and also collects information from the network of national monitoring stations of air quality.
- Cardiovascular diseases and heart rate: sensors which are placed discretely allowing the physician to receive the patient's vital information and so prepared treatment while monitoring their patients health.
- Alzheimer and depression: In these situations it is possible to detect abnormal situations, such as falls, and it can alert neighbours, family or the nearest hospital. It can work with accelerometer to detect this movements and may use the ZigBee protocol or by GSM provide real-time information.it is also use RFID readers to control the inputs and outputs of the patients; sound sensor can detect the motion and request assistance and the light to check opening of refrigerator to monitor how often patient can food.
- Artificial retina: 100 micro sensors are used which are implanted inside the eye, this sensor produced electrical signals, then the underlying tissue converts the signals into a chemical response, reproducing the behavior of normal retinal light stimulation.

These are some parameters that can be measured in the medical applications, however all of these measurements can be applied in various situations. It is one of the areas still under development to better the quality of life.

B. The comparison of technologies used in WSN inMedical Applications

In this area the WSN has a wide application and can be used in almost all applications, and all the technologies used in WSN can be applied to health, including sensors and positioning systems such as GPS. For example, the wireless data communication is a bidirectional radio frequency communication with ad-hoc routing,which allows each patient'snode to send the data to a base station, even if they are not within its direct radio range. As shown in figure:

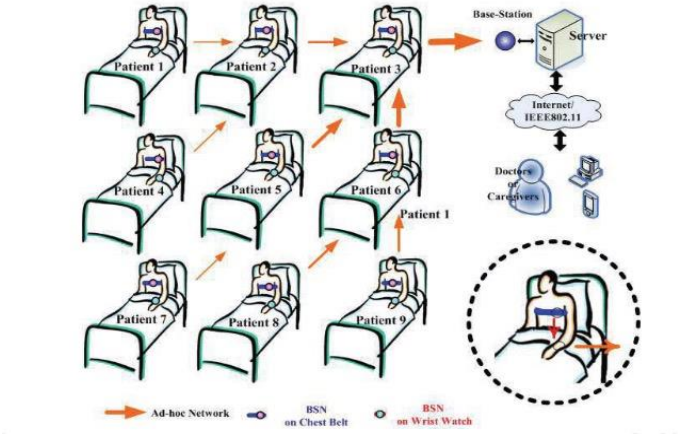

Fig 1: Healthcare system based on a WSN

Aminian and his team designed a prototype of a ubiquitous health system for hospitals, which is the concept of ubiquitous, placing wireless sensors and unobtrusively in a person's body to form a wireless network that can communicate the state of

health of the patient with the base station connected to the PC monitor. However, the relay modes in the middle do not require use of a high frequency band and can transmit the data over a short range frequency module (RFM). But it is 402-405 MHz frequency band coverage that can be used for body area network applications because of their low power transmission. Tolentino and his team presented an architecture of a health system ubiquitous for continuous monitoring of patients in their natural psychological conditions or elderly patients with chronic diseases, the biggest difference it is designed to monitor the elderly who lived in remote areas or in small nursing home without enough health technical supports, instead of monitoring patients in a large hospital environment. These WSN ad hoc is used integrated with existing medical practices and technologies in realtime remote monitoring to provide medication and a patients status monitoring system assisted by incorporated the wireless sensor.

The system transfers the data wirelessly to a base station connected to a server on an ad hoc network using IEEE 802.15.4 or LR-WPAN. In these WSN, profiles of a patients are updated with a information processed in the central database. The central computer is responsible for sending e-mails or messages in case of emergencies. Mbakop and his team developed a monitoring of patients in realtime system, which is made up by a system of two nodes where vital signs are collected and transmitted wirelessly to a base station and then the data can be stored and presented on a continuous base station. The great innovation in this design is the correct operation, but the biggest challenge is its actual use in the future of the movements of the patients to produced energy of sensors.

An area that is still challenging is the detection of epileptic seizures and convulsions; however,researchers at the Medical Center of the University of Chicago developed a device called a Mobi to detect abnormal brain activity, broadcast signals of abnormal electrical activity warning the receiver.

The artificial retina, which is intelligent sensors integrated microsystems(SSIM) retinal prosthesis of the chips which are formed of 100 microsensors, constructed and implanted a human eye. Wireless communication is used to meet the need of control, Image identification and validation, as these sensors produce electrical signals, the underlying tissue converts the signals into a chemical response,and thus simulates the retinal behavior with simulation by light.

IV. APPLICATION IN HEALTHCARE

For the detection of vital signs and various physiological data various technologies have been developed: Vital Signs Monitoring System, LifeShirt, Fireline, UbiMon, Satire, SMART, HealthGear, Mobicare, CareNet, Secure Mobile Computingf using Biotelemetrics and SenseWear Armband.

One of the areas which shows more interest among researchers is the area of babies, not only for being a lucrative area, but also as a concern and a need to help prevent the sudden infant death syndrome (SIDS). From that the invention of SleepSafe monitors the child's sleeping position and alert parents. Another solution is the Baby Glove, tjis project is to protect premature infants, as they are subject various health risks.

V. CONCLUSION

After reviewing several articles and sesearch, that has been conducted that: there is still a long way to go in the area of wireless sensor network. Existing medical applictions based on sensor networks are in the first-line potential research for use in the future of WSNs and their medical device looks extremely promising, Security issues are significant area, and there are still a number of challenges to overcome.

The future should include specialized medical technology with WSN, where with the existing infrastructure enhances the collection of data in real time, in which the medical care at home and smart homes will be improve. Also the constant collection of clinical data of patients will reduce the costs of tests and regular visit to the physicians. Another important point in the future will is the relationship between bioscience, biotechnology and nanoscience (nanotechnology) in the development of sensors.

VI. REFERENCES

[1]. A. Minaie, A. Sanati-Mehrizy,P. Sanati-Mehrizy,and R. SanatiMehrizy, "Application of Wireless Sensor Networks in HealthCare System".
[2]. M. Aminian and H. Naji, "A Hospital HealthCare Monitoring system using wireless", Health and Medical Informatics, vol. 4,2013.
[3]. G. G. Messier and I. G. Finvers, "Traffic Models for Medical Wireless Sensor Networks".
[4]. P. Honeine, F. Mourad, M. Kallas, H. Snoussi and C. Francis, "Wireless Sensor Networks in biomedical: Body Area Networks".
[5]. J. Stankovic, A. D. Wood, and T. He, "Realistic Applications for Wireless Sensor Network".
[6]. S. Stankovic, "Medical Applications Based on Wireless Sensor Networks".