INTRODUCTION

Future communication systems are driven by the concept of being connected any-where at any time. This is not limited to even in medical area. Wireless medical communications assisting peoples work and replacing wires in a hospital are the applying wireless communications in medical healthcare. The increasing use of wireless networks and the constant miniaturization of electrical devices has empowered the development of wireless body area networks(WBANs).In these networks various sensors are attached on clothing or on the body or even implanted under the skin. These devices provide continuous health monitoring and real-time feedback to the user or medical personnel. The wire-less nature of the network and the wide variety of sensors offer numerous new, practical and innovative applications to improve healthcare and the quality of life. The sensor measures certain parameters of human body, either externally or internally. Examples include measuring the heartbeat, body temperature or recording a prolonged electrocardiogram (ECG).

PATIENT MONITORING

Several sensors are placed in clothes, directly on the body or under the skin of a person and measure the temperature, blood pressure, heart rate, ECG, EEG, respiration rate, SpO2 levels etc. Next to sensing devices, the patient has actuators which act as drug delivery systems. The medicine can be delivered on predetermined moments, triggered by an external source or immediately when a sensor notices a problem. The sensor monitors a sudden drop of glucose, a signal can be sent to the actuator in order to start the injection of insulin. Consequently, the patients will experiences fewer nuisances from his disease. An example of a medical WBAN used for patient monitoring is shown in figure 2.1

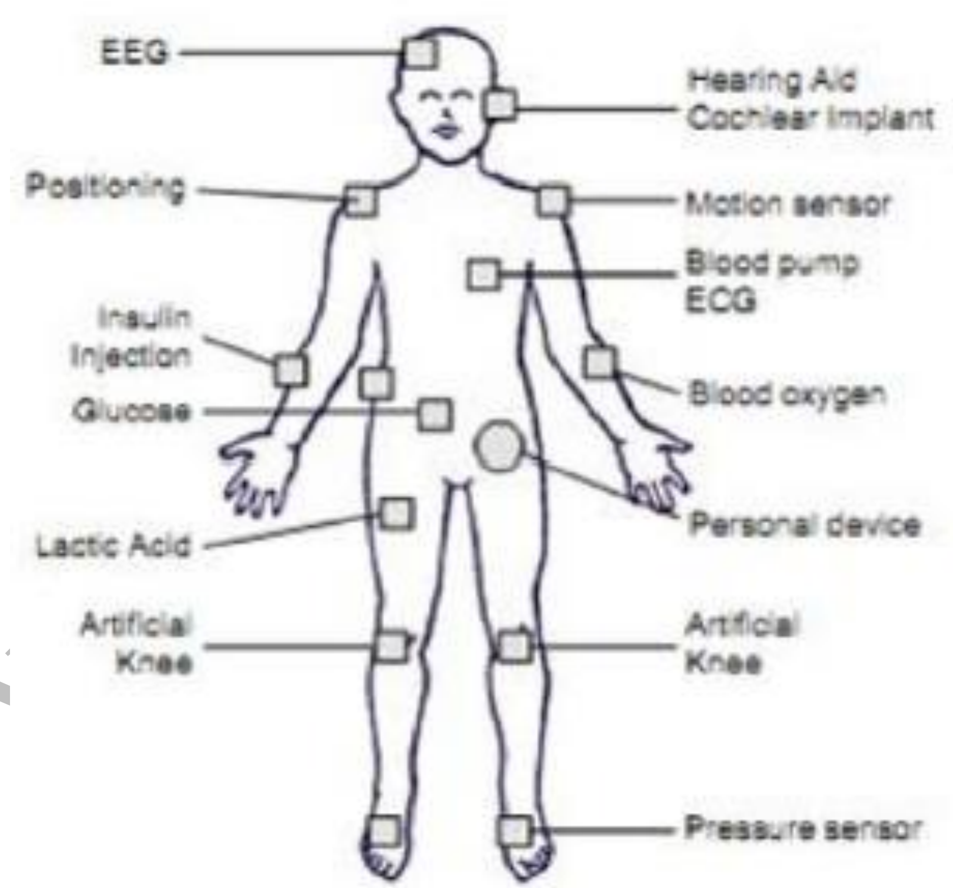

Figure 2.1: Patient monitoring in a Wireless Body Area Network

A WBAN can also be used to offer assistance to the disabled. For example, a paraplegic can be equipped with sensors determining the position of the legs or with sensors attached to the nerves. In addition, actuators positioned on the legs can stimulate the muscles. Interaction between the data from the sensors and the actuators makes it possible to restore the ability to move. Another example said for the visually impaired. An artificial retina, consisting of a matrix of microsensors, can be implanted into the eye beneath the surface of the retina. The artificial retina translates the electrical impulses into neurological signals. Another area of application can be found in the domain of public safety where the WBAN can be used by firefighters, policemen or in a military environment. The WBAN monitors for example the level of toxics in the air and warns the firefighters or soldiers if a life threatening level is detected. The introduction of a WBAN further enables to tune more effectively the training schedules of professional athletes.

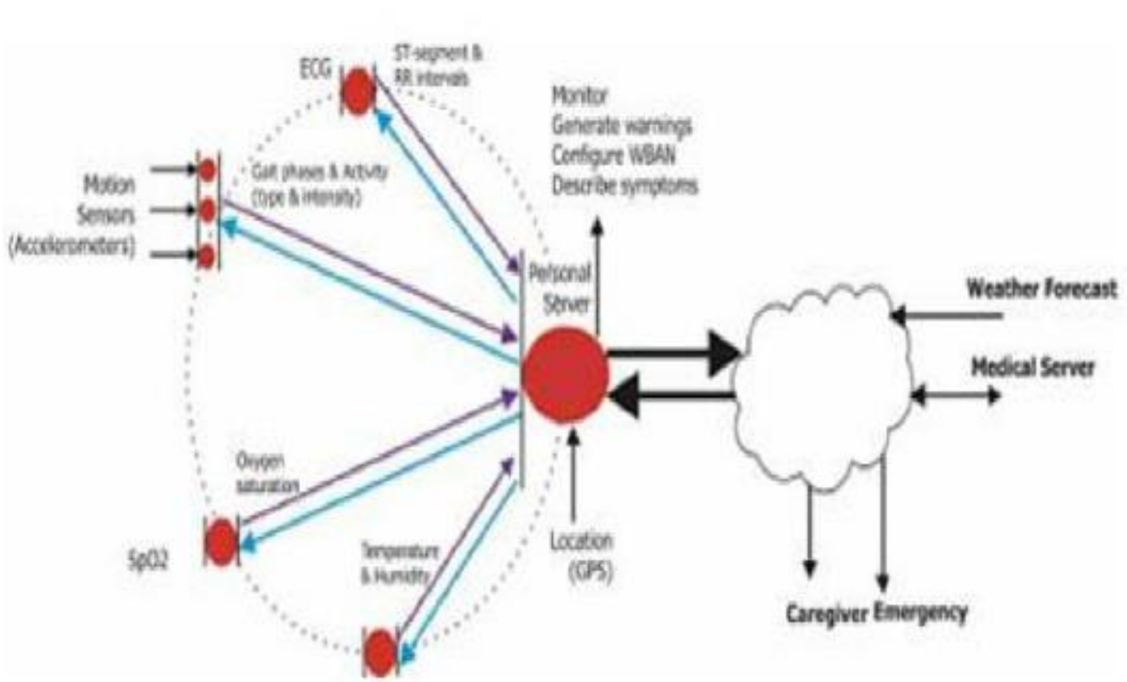

Figure 2.2: WBAN Architecture

The WBAN system is divided into three levels. The lowest level consists a set of intelligent sensors or nodes. These are the reduced function devise. These can only communicate with their parent device and cannot act as parent. The second level is the personal server (Internet enabled PDA, cell-phone, or home computer). These are full function devices. And they can communicate with the external network. The third level encompasses a network of remote server which is the remote application to which data or information is transferred.

Parameter	Range of Parameter	Signal Frequency
ECG signal	0.5-4mV	0.01 - 250 Hz
Respiratory rate	2-50breaths/min	0.1 -10 Hz
Blood Pressure (BP)	10-400mm Hg	0-50 Hz
EEG	3µV-300µV	0.5-60 Hz
Body Temperature	32-40 °C	0 - 0.1Hz
EMG(Electromyogram)	10µV-15mV	10-5000 Hz
GSR(Galvanic Skin Reflex)	30µV-3mV	0.03-20 Hz

Table 2.1: Physiological parameter range and signal frequencies

A sensor node electronics is designed to detect and transmit the physiological signals listed in table 2.1.Most physiological signals are low frequency in nature and occupy a small information bandwidth. At such low frequencies and low amplitudes, some problems inherent to circuits need additional attention. For reliable information transfer it is necessary that the interface in the sensor nodes detect physiological signals in the presence of noise and increase the signal to noise ratio of the detected signal for processing by subsequent blocks of sensor nodes.

POSITIONING WBANS

The protocols developed for WBANs can span from communication between the sensors on the body to communication from a body node to a data center connected to the internet.

Thus communication in WBAN is divided into:

1. Intra body communication

2. Extra body communication

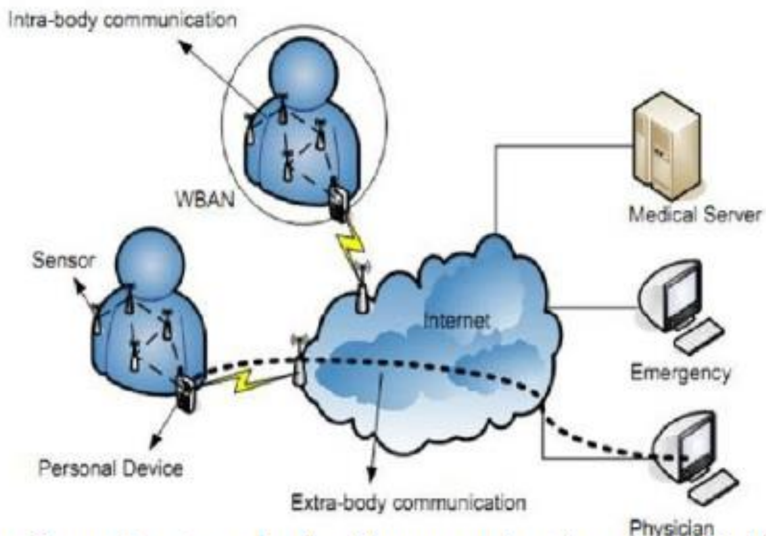

Figure 4.1: Intra-body and extra- body Communication in WBAN

Intra body communication controls the information handling on the body between the sensors or actuators and personal device. And extra body communication ensures communication between the personal devices and an external net-work . This segmentation is similar to the one defined in where a multi-tiered telemedicine system is presented. Tier 1 encompasses the intra-body communication, tier 2 the extra-body communication between the personal device and the Internet and tier 3 represents the extra-body communication from internet to the medical server. To date development has been mainly focused on building the system architecture and service platform for extra-body communication. Much of these implementations focus on the repackaging of traditional sensors (e.g. ECG, heart rate) with existing wireless devices. They consider a very limited WBAN consisting of only a few sensors that are directly and wirelessly connected to a personal device. Further they use transceivers with a large and large antennas that are not adapted for use on a body.

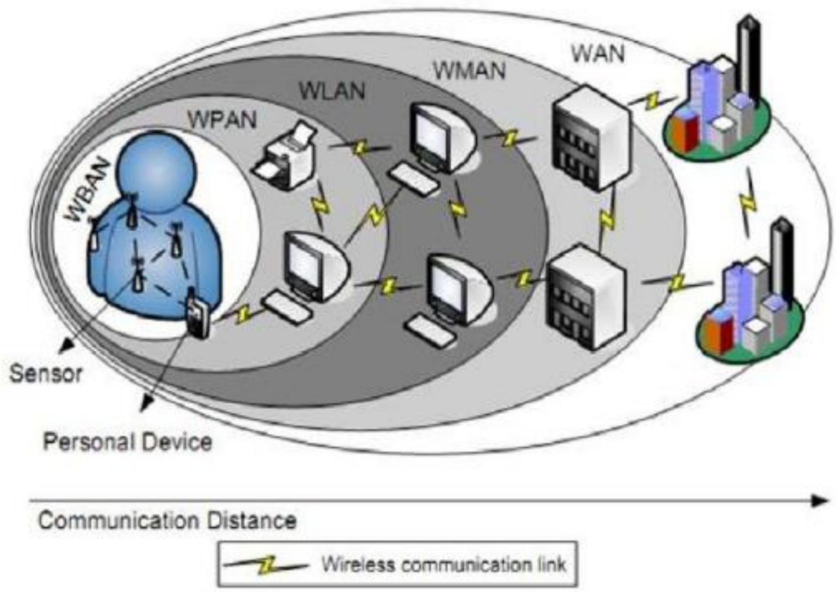

Figure 4.2: Positioning of a Wireless Body area Network in the realm of wireless networks

WBAN is compared with other types of wireless networks, such as Wireless Personal (WPAN), Wireless Local(WLAN), Wireless Metropolitan(WMAN), and Wide area networks(WAN). A WBAN is operated close to human body and its communication range will be restricted to a few meters, with typical values around 1-2 meters. While a WBAN is devoted to interconnection of one person's wearable devices, a WPAN is a network in the environment around the person.

CONCLUSION

A WBAN is expected to be a very useful technology with potential to offer a wide range of benefits to patients, medical personnel and society through continuous monitoring and early detection of possible problems. With the current technological evolution, sensors and radios will soon be applied as skin patches. Doing so, the sensors will seamlessly be integrated in a WBAN. Step by step, these evolutions will bring us closer to a fully operational WBAN that acts as an enabler for improving the Quality of Life.