Health Monitoring Using Wearable Computers

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***Abstract* - MobiHealth also written as m-health, the term most commonly used with respect to devices such as mobiles, tablets, PDAs etc. While mhealth has applications for industrialized countries, the field has emerged in recent years as largely application for developing countries. As a part of health sector we develop a network called as Body Area Network(BAN).In this thesis we provide idea of mhealth using existing GSM technologies. Here we provide a prototype which is worn by patients which make it possible to locate patients when they are not in vicinity. This interaction with the health care center can be done using GPRS technology.**

Index Terms*— *BAN, MBU, SMS, GPRS, UMTS, ABSN, MBSN, EEG,ECG.

I. INTRODUCTION

The field of information processing is constantly evolving to process larger data sets and maintains higher levels of connectivity and at the same time, increased mobility and accessibility. A Body Area Network (BAN) is formally as a system of devices in close proximity to a person's body that cooperate for the benefit of the user. With the advancement of wireless technology, new applications in the healthcare sector become possible. The restrictions imposed by wires and cables enable patients to benefit from increased mobility and also psychologically. Thereby they would normally have to remain at a healthcare centre if they require regular health monitoring.With a wireless monitoring device it becomes possible for them to return to the comfort of their own home thus improving the patient's quality of life, but also benefits healthcare insurers when it comes to disease and care related costs. A healthcare centre saves costs by allowing patients to spend more of their time away from the Centre

II. BODY AREA NETWORK

A .Relative Studies:

The purpose of the BAN is to make it possible for patients who need permanent monitoring to be fully mobile. The objective is a personal lightweight monitor system that is created and completely customized to the patient's needs. The sensor is worn by a patient and basically consists of a set of lightweight devices that monitor and wirelessly transmit certain bio signals (vital signs) to a System which is basically a server. Healthcare centers can then retrieve this data over a reliable wired connection. The body area network will provide medical and lifestyle assisted functions to the patient.

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Concrete, the BAN consists of one or more sensors, depending on the patients' need, which measures specific data of the patient.This data is sent to a Mobile Base Unit (MBU), which can for example be a Mobile phone. The communication between sensor and MBU can be over a wire or via Bluetooth. Thereby, the mobile unit (MBU) is in contact with a Healthcare centre. Vital information is sent periodically or only when it has reached a critical value sent to a central server at the Healthcare Centre. For this, the wireless data transmission technologies such as Short Messaging services (SMS), Global Packet Radio Service (GPRS) are used. A monitoring health specialist can login on the server and ask for the patient information that will be represented on for example a simple PC.

At this moment a prototype of the BAN has been developed which satisfies the goals of the MobiHealth. However, research on the project goes on. One of the opportunities is to extend the BAN with location provision. The information that is send by the mobile unit(MBU) should contain bio information data as well as the data about the patient location

B. BAN prototype

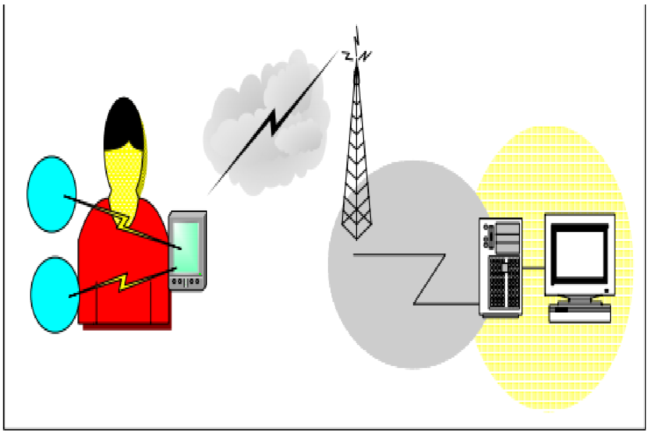

Fig. 1 Body Area Network, consisting of sensors and mobile phone, connected to healthcare centre.

The above figure explains about the prototype of Body Area Network (BAN) which consists of sensors which monitors the patient activity which is then sent to a mobile unit which can be PDAs or mobile phones or smart phones, the mobile unit which in then communicates with a nearest BTS. In our network central server is maintained. The BTS sends information to a central server at the health care center.

The doctor or medical agent can access the user information using a simple pc. The communication between server and pc can be wireless or wired.

C BAN communication architecture

Compared with existing technologies such as WLANs, BANs are used to enable wireless communications in or around human body by means sophisticated pervasive wireless Computing devices. Figure 1.1 illustrates a general architecture of aBAN-based health monitoring system which sends data to nearby personal server (PS) devices or mobile devices. Then, through a Bluetooth or Wireless connection, these data are streamed remotely to a medical doctor's site for real time diagnosis, and maintenance of record in a medical database for record keeping, in case of an emergency alert. In this paper, we separate the BAN communications architecture into three components:Tier-1-Comm design (i.e., intra-BAN communications),Tier-2-Comm design (i.e., inter-BAN communications),and Tier-3-Comm design (i.e., beyond-BAN communications).These components cover multiple aspects that range from low-level to high-level design issues, and leads to the creation of a component-based,BAN system for a wide range of applications. By customizing each design component, specific requirements can be achieved according to specific application contexts and market demands.

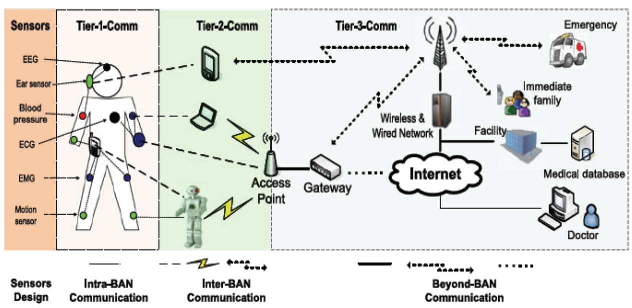

Fig 1.1 A 3 tier architecture based on a BAN communication system.

D. Recommendations

One of the opportunities is to extend the BAN with position provision. The information that is sent by the mobile unit (MBU) should not only contain bio information, but also data about the patient location.

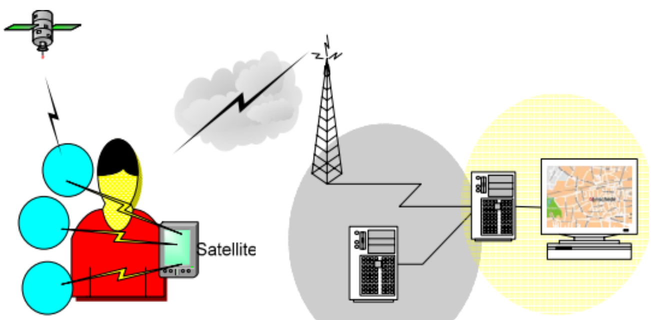

Fig. 2 Body Area Network, consisting of sensors and mobile phone, connected to healthcare centre, which shows the location of the patient

Integrating BAN with the position provision sensors which will be a GPS transceiver can be integrated with a mobile unit. Data communication between sensor and mobile unit is done using Bluetooth. The communication between mobile unit and central server at health care center can be GPRS or 2G. The position information matches the exact geographical location of the patients.inertial sensors are a low-cost, low-power solution which can be worn to track gestures and the movements of a person. The implementation of a body-centric network by keeping inertial sensors has been explored in many fields. They are the Examples shown in context-aware applications and monitoring of patient activity in the medical field.

A combination of different sensors are to be worn by users and has been applied to help indoor navigation and to determine the user's location. Many research studies usually focus on hybrid sensor networks or sensor fusion techniques. The sensing elements are distributed all along the body and data processed both off-line or in real-time. Even if these solutions are suitable for very specific applications, they are not tailored to applications requiring high wearability and very-low power consumption.

If we refer to previous gesture recognition solutions, our system has many elements of novelty and is easily implementable. First of all, being based upon wireless nodes, it overcomes other solutions where sensors are connected through cables. Our module provides better accuracy with respect to traditional orthogonally mounted accelerometers [6, 2], thus reducing re-calibration frequency.

E. Application Example

a)Module setup and orientation :

To assess the capability of the mobile body area sensor network, we can design a test application by equipping a user with three sensing modules placed along the body, precisely on the trunk, on the shinbone and the thigh-bone as shown in Figure 5. The axis relative to each module is as shown. In the leftmost part of this figure the user is represented equipped with sensor A on the trunk, sensor B on the thigh-bone and sensor C on the shinbone. The projection on this plane of the axis is relative to each sensor module is shown in the right part of Figure 3.

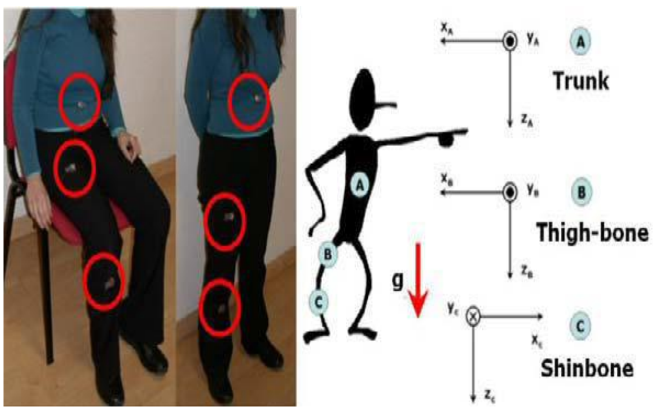

Figure 3 : Picture and schema of the user and the module setup and orientation along the body

b) Autonomous Body Sensor Networks:

Autonomous body sensor networks (ABSN) and MBSN share the same goals and they accomplish them in different ways, whereas a MBSN will rely on reading sensor information and delivering it to a third party for decision making and intervention and the ABSN takes a more proactive approach.

ABSN introduces actuators in addition to the sensors to allow the BSN to effect change on the user's body. In addition to the actuators, ABSN contains more intelligent sensors that contain enough intelligence to complete their own tasks independently.

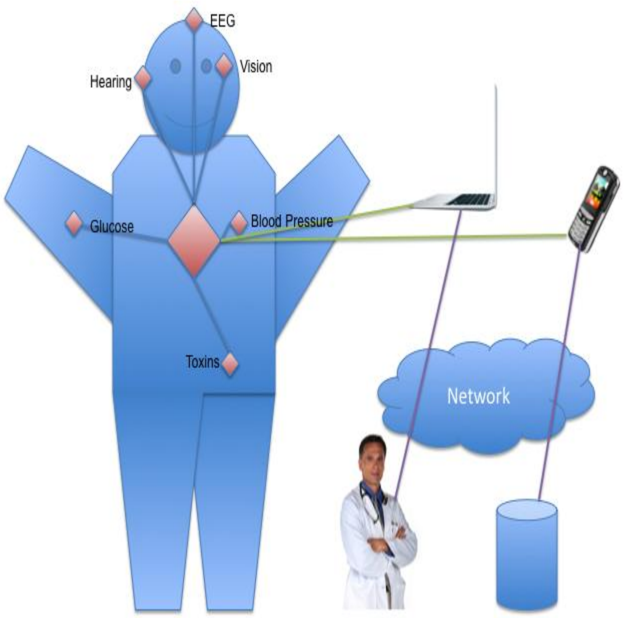

Figure 4 : ABSN Network

III Sequence of movements

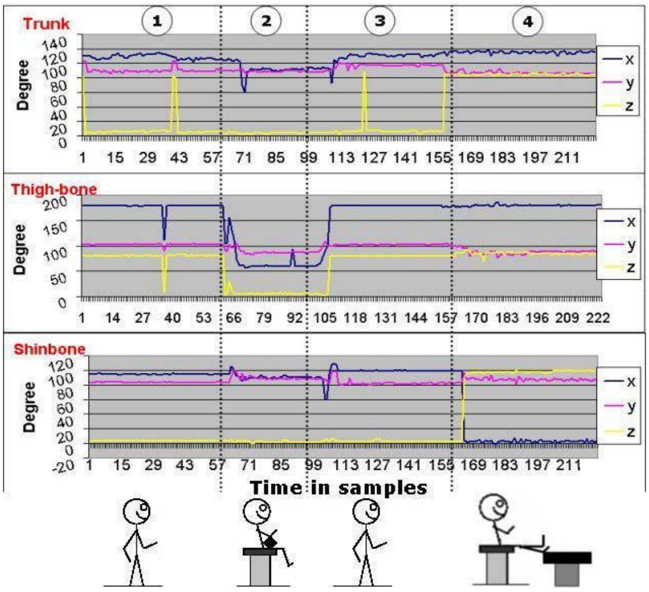

Figure 5: sequence of movements that may be shown on our mobile device.

In Figure 5 we can show the inclinations data coming from the three accelerometers corresponding to the following sequence of movement: 1)standing 2) seated 3) standing4)seated with legs extended (as laying on a table). The plot reports the angle degrees versus time (expressed as a number of samples). Acceleration values must be collected from the 3 modules as shown in Figure 5 and must be elaborated in order to obtain the angle of each axis with respect to the gravity.

III. CONCLUSION

BAN can be implemented using existing GPRS and 3G technologies since the data transmission when implemented can reach at the speed of 171.0 KBPS transmission speed. Packet transmission is done using IP protocol so it overcomes 160 characters placed on short messages using asymmetric data transmission this methodology can be implemented. Thus when this methodology is implemented it can revolutionize in the field of mobile health

In this paper we also presented the design and implementation of BAN, a wireless sensor node based on tri-axial integrated accelerometers, aimed at detecting human gesture and postures to implement a human computer interface system. We also introduce the concept of wireless body area sensor network. The sensor network enables the implementation of a distributed recognition system to detect combined body postures and movements.

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