Extensive Journal of Applied Sciences
Available online at www.ejasj.com ©2025 EJAS Journal-2025 -12-18, 1-6

Utilization of Body Sensor Networks to receive Death Intimation of Residents Registered with Local National Health Services

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ABSTRACT: This paper presents new architectural model of utilizing BSN within the field of Medical heath care system & monitoring. The approach emphasizes the use of WSN together with BSN and to facilitate local NHS or Council health services. The system helps to identify death of local residents based on pulse detection in human body. Micro electro mechanical system (MEMS) is used in sensor nodes for generating rapid alerts. The system follows controlled mobility pattern to informs council health service utilizing the deployed resources It also triggers required measurements such as disposal of the dead bodies from old homes and private houses, where people live alone during their old age in countries like UK. Considering the working and performance metrics of network resources such as WSN & BSN, distance among sensor nodes and AP is considered to be a variable factor, which is scalable according to the radius measurement of resided local health services.

***Keywords*:** Body Sensor Network, Healthcare, Medical, Autonomous, Paralysis, Human Body, MEMS, Mobility, Mobile Health Care, WBAN.

INTRODUCTION

Body sensor networks (BSN) is a flavour of Wireless sensor networks, which curbs its focus towards providing medical health solutions via sensor network. The sensor networks may be used to monitor patient's physical state, health conditions, surrounding temperatures, gestures, cardio-measurements etc. Requirements may differ from place to place. Similarly, Body sensor network applications may include sensors for monitoring elderly patients, for monitoring disabled patients, for Ubiquitous movement monitoring etc.

Responsive to physical stimulus, a sensor is nowadays found in every other electronic device. (i.e. touchsensitive devices, handsets, gadgets, car sensors, etc). Sensors together with actuators, work by collecting information based on the stimulus response. Certain actions are performed by actuators for the response generated. These actions are based on the decisional logic designed for the infrastructure [1].

These sensors when hinged together may form a type of mesh. Such a network which consists of spatially distributed autonomous sensors interconnected with each other and combined with a Router/Gateway, form a Wireless Sensor Network. The distributed wireless network nodes (sensors) wirelessly collect information from the environment surroundings where they have been deployed and later communicate to a central gateway/router which provides a connection to the wired world. [5] The data collected then may be scrutinized, processed and measured according to requirement.

With the progresses in technological traits, the engineers and researchers are nascent to develop the gadgets and electrical devices which may constitute the daily needful accessories (i.e. watch, mobile

phone etc.) as well as body measured gadgets (i.e. blood pressure measuring sensor, Motion detection sensor, Location management based sensor) carried by a single device. It may be said that such amalgamation of devices would be a comfort for the people carrying reduced gadgets around with healthcare monitoring. A typical type of wearable body sensor embedded with a watch can be seen in the Figure 1. [6]



Figure 1. Wearable Armband sensor with Watch [6]

Wearable sensors are extended to work over different body parts based on the requirements. Either they may be designed to wear on the wrist, may they be in chest belts or worn over the shoulder. For every requirement, the sensor may be designed accordingly to meet the criteria.

Literature Review

The core concept behind Wireless body area networks is to remove all wires connecting sensors on the patient and developing wireless network between sensors. All these devices are connected without cables and without reducing patient comfort. Moreover, patient could be monitored remotely. Doctors are mostly interested in diagnostic of cardiogram, blood pressure, oxygen saturation, sugar level and cancer, which can be measured using a number of sensors nodes attached to the patient [1][7]. The goal of e-health approach is to empower the citizen to fight against diseases and reduce the logistic constraints for patients and doctors. This technology has potential to revolutionize the health care diligence by providing real time patient monitoring capabilities to the health care professionals. Implanted wireless body area networks (IWBN) have emerged as an important and growing area of research [4][8]. The healthcare servers keep electronic medical records of registered users and provide different services to patients, medical consultants and informal caregivers. The patient's consultant can access the data from office via Internet and examine the patients' history, current symptoms and patient's response to a give treatment. Once WBAN network is configured, the healthcare server manages the network, taking care of channel sharing, time synchronization, data retrieval and processing.

BSN Architecture

Architectural Design [1]

The architectural components of a Bio sensor usually consists of:

Microboard[1]

Micro-Processor supported with a flash memory whose data holding capacity may differ from situation

to situation, [1] [4]

RAM (usually 2KB in size) [4]

ADC (Analog to Digital converter) which supports connectivity of up to 6 sensors [1] [4]

Wireless modulator which generates a throughput of around 250 kbps with a range over 50 meters.[1]

Sensor Interface- Interface with sensors and other devices[1]

Power Supply (power source) of the sensor node

The above mentioned architectural elements form a Microelectro mechanical system (MEMS) oriented sensor.A typical Bio sensor node is shown below in Fig 2. [5]



Figure 2. BSN Node [5]

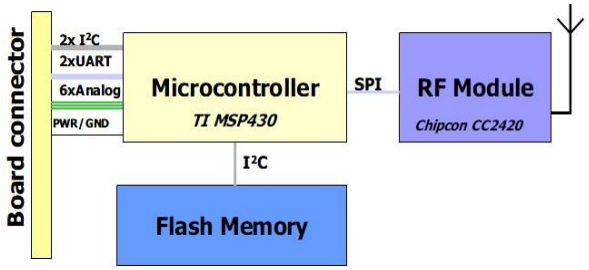


Figure 3. BSN Architectural Design [5]

Software Design

The proposed software for the sensor works with TinyOS operating system. Common software architecture components for a BSN node can be seen in the Fig 4 shown below:

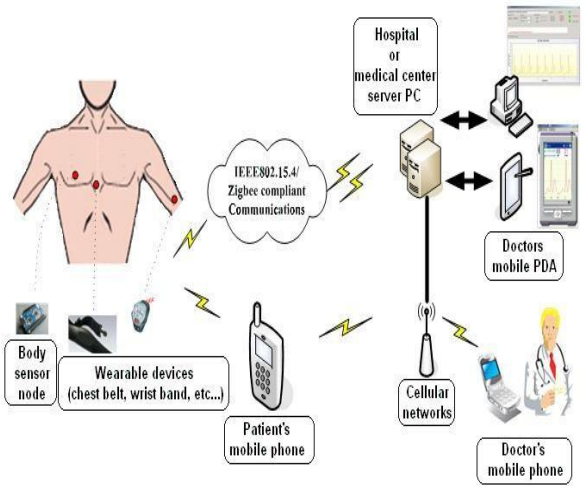


Figure 4. Components of a BSN based home network

Problem Areas

Issues arise when the mobility feature is to be backed up by power supply. As for wireless is concerned, better battery lifetime of a sensor or miniaturization of power consumption[8] means a good prolonged sensor life and increased working hours.[8][9] Others may be as sensor size, biocompatibility, better design, low power radio transmission, context awareness, secure data [10] transfer, integration

with therapeutic systems etc. [1][2] This paper confines its attention to provide a motion detection based sensor network solution to the paralyzed patients keeping in view the above problem areas.

Motivation

This idea emerged as a solution to overcome the problems faced while monitoring the paralyzed patients who are liable to move once in many years or may be not even once. This somehow restricts some medical personnel to be available every time for the patient care although such intensive care may not be required in this case. This turns out to be unusual resource restriction and can prove costly in monetary terms. A number of merits have somewhat been a motivation for the initiation. They are:

1. **Autonomous monitoring**
2. **Human Resource utilization**
3. **Financial utilization**
4. **Highly responsive**

Proposed Logic

The proposed idea revolves around providing unremitting working of a body sensor network for medical purpose. Aimed to be designed for monitoring the body movements **of paralyzed or immobile patients,** *a* wearable biocompatible sensor would be designed for the patient. The patient would be made to wear a sensor either on a wrist.

Steps of Working

The sensor functionality for this proposed idea of autonomous pulse detection system works as:

i. A patient wears the designed sensor.
ii. **Sensor State:** Upon turning the sensor on, it connects itself with the main server utilizing the RF resources.
iii. **Connection Establishment**: Once the connection is established, the server contains the sensor's current location, state, battery power, surrounding temperature and synchronizes accordingly as per the time interval set for update procedure.
iv. **Pulse Detection:** After the connection establishment, the sensor node connected to the patient body sends a trigger to the server and updates the information about pulse detection from the human body.
v. **Architecture**: Keeping the power miniaturization factor into account, no complex architecture is developed for the sensor. The pulse detection may be represented by a certain variable factor within the sensor node.
vi. Sensor then starts working in MONITORING mode, and seeks for pulse counts per minute according to the patient's age or in case of any pulse absence, it generates the trigger.
vii. Once generated, the trigger is an apprehension to the pulse in the patient's body. This trigger initially is in the form of a beep. Once successful, as a future extension, the same trigger can be protracted in the form of generating a SMS alert on the concerned doctor's mobile handset/ any attended terminal , from where the concerned medical care could be accessible
viii. From then onwards, the patient may continuously be monitored by a medical personnel to be taken intensive care of.
ix. With the span of time, post deployment work can be done to capably utilize the formulated proposition of monitoring paralyzed patients' validation.

The proposed idea validation has been taken into account by using simulation techniques in NS2 (Network Simulator) as well as *Test Check of Sensor Node* keeping in view the different parameters. All possible circumstances and situations were taken into account. Several test conditions including climatic parameters, power consumption parameters, accuracy of motion sensing detection and the beep triggering elements were tested in all possible ways to check accuracy. The screen interfaces

showed graphical movement plotted over the sensor which was synchronized with the server, once the motion wave was detected over any object/person. Similar to as shown in Fig 5.



Figure 5. Interface for a Sensor Node [7]

The detected waves were considered as a motion detection apprehension over the deployed BSN and triggered a beep whenever motion detected.

Future Enhancements

As a future enhancement in the devised logic, a number of key milestones can be achieved by the following beset work approaches:

i. **Trigger Alert**

In current scenario, the trigger alert is just a mere beep, which would alarm the motion detection. As a future work, the same beep may can be facilitated in the form of SMS trigger on the doctor's cell phone as well as PC screen as a high priority interrupt, generated in the form of a pop up bubble message which would allow him to be informed about the patient's body motion.

ii. **Graphical Simulation:**

In addition a graphical simulation shall be produced which keeps records of the movement of patient's body, so that it shall be available for the doctor to be seen at later hours .The movement not only to be detected, but also be recorded in such a way that it shall be able to represent the exact body stimulations with recorded altitude, height & direction of that body part, where motion has been detected.

iii. **Devising optimized and low powered algorithm for accuracy and precision of results.**

Functionality Enhancement

As functionality enhancement, this idea is for limited area only (i.e. for home based patient care system). Later it can be extended from Hospital to Home connectivity, broadening its scope.

REFERENCES

Benny P.L. Lo, SurapaThiemjarus, Rachel King, Yang, BODY SENSOR NETWORK- A WIRELESS SENSOR PLATFORM FOR PERVASIVE HEALTHCARE MONITORING,Department of Computing, Imperial College London. [5]

B. Otal, L. Alonso, Ch. Verikoukis, Towards Energy Saving Wireless Body Sensor Networks in Health Care Systems. [9]

Chiu C Tan, Haodong Wang, Sheng Zhong, Qun Li, 2008, Body Sensor Network Security: An Identity-Based Cryptography

Approach, Alexandria, Virginia ,USA. [10]

D C Hoang, YK Tan, HB Chng and S. K.Panda, Thermal Energy Harvesting From Human Warmth For Wireless Body Area

Network In Medical Healthcare System. In:PEDS 2009. [8]

Guang-Zhong Yang, 2006, Body Sensor Networks: Springer. [1]

Huan-Bang L., Kamya Y.Y. and Bin Zhen, Wireless Body Area Networks: River Publishers' Series in InformationTechnology: [3]

Joonyoung Jung , Kiryong Ha, Jeonwoo Lee, Youngsung Kim and Daeyoung Kim Wireless Body Area Network in a Ubiquitous Healthcare System for Physiological Signal Monitoring and Health Consulting, In: International Journal of Signal Processing, Image Processing and Pattern Recognition (Pg 47-53). [4]

M Quwadir, S Biswas, 2010, Wireless Body Area Networks: River Publishers. [2]

Sensor Interface, Benny Lo Website [online] Available at:http://vip.doc.ic.ac.uk/benlo/m775.html. [7]

Telehealth in a watch, , 2011, Bodymedia[online] Available at:http://www.dailywireless.org/2010/10/12/telehealth-in-a-watch/.[6]