

A Theoretical Approach to Medical Diagnosis in Human Using Wireless Sensor Networks

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ABSTRACT: Wireless sensor network (WSN) technologies are considered as one of the key research areas in computer science and the healthcare application industries for improving the quality of life. The purpose of this paper is to provide a snapshot of current developments and future direction of research on wearable and implantable body area network systems for continuous monitoring of patients. The aim of this theoretical approach is to describe the applications of large scale Wireless Sensor Networks (WSN) and Wireless Body Area Networks (WBAN) working on medical diagnosis. We extend our research in near future to track and monitor humans in real time and mainly in emergency situations. Now a day's mobile phones are widely used by all. A person can be tracked and detected through GPS enabled mobile phones during any emergencies like faint due to low sugar, silent cardiac arrests, unexpected minor accidents etc., especially for an elder one. Through the mobile phones we can send an alarm to the nearby hospitals. The main feature of this WSN is its density and the fact that all sensors are in the same radio range. Our approach helps medical staff to diagnose diseases in an automatic way. In this context, each patient is equipped to a set of sensors. Each sensor is connected to a transducer dedicated to measure a specific health parameter. For this, we need a Wireless Body Area Network to recognize the health condition and also to monitor them furthermore. This paper explains the important role of applications of body sensor networks in medical diagnosis to minimize the need for caregivers and help the chronically ill and elderly people living an independent life, besides providing people with quality care.

KEYWORDS: Wireless Sensor Networks, Wireless Body Area Network, Global Positioning System.

I. INTRODUCTION

Healthcare is always a big concern, since it involves the quality of life a given individual can have. It is always better to prevent an illness than to treat it, so individual monitoring is required as a periodic activity. The aging population of developed countries present a growing slice of government's budget, and presents new challenges to healthcare systems, namely with elderly people living on independent senior housing. The paper provides several examples of state of the art technology together with the design considerations like unobtrusiveness, scalability, energy efficiency, security and also provides a comprehensive analysis of the various benefits and drawbacks of these systems. Current sensor network applications in ambient intelligence range from the environmental monitoring of ecosystems and industrial processes for tracking assets and people to the maintenance of buildings, etc.,. In addition, each application domain has different requirements and restrictions based on the nature of the problem. In this review, we will focus on one specific driver application, namely monitoring of humans based on wearable and human body implantable sensors to expand the role of such technologies in healthcare and to overcome new challenges from Nature on human health.

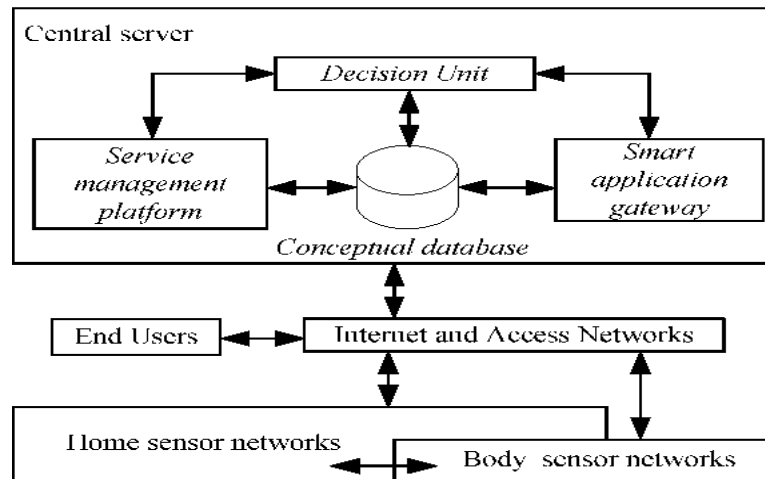


Figure 2. Architecture of the health-care system.

There are some important reasons for this choice. First, human monitoring is an extremely important field and important for all of us. Second, the scope of human monitoring application poses new challenges such as requisites for unobtrusiveness, security and low energy consumption, *etc.* Finally, this is one of the ambient intelligence application fields where research and development are the most active areas. We aim to research on human body monitoring through GPS enabled wearable and implantable devices.

The objective of this paper is to provide a theoretical approach for developing an effective application for Real Time Health Monitoring using GPS Tracking. The system will track, trace, monitor patients and facilitate taking care of their health, so efficient medical services could be provided at an appropriate time.

II. LITERATURE SURVEY

On a wireless body sensor network, a person wears biosensors to gather data, while doing their daily activities. [1] et al, shown that wireless sensor networks provide the technology to built wireless sensing and create a convenient infrastructure for multiple data gathering in healthcare applications. Together with real successful examples, we demonstrate the great usefulness of wireless sensor networks in healthcare promotion. [2] et al, explains the important role of body sensor networks in medicine to minimize the need for caregivers and help the chronically ill and elderly people live an independent life, besides providing people with quality care. [3] et al presented that the future will see the integration of the abundance of existing specialized medical technology with pervasive, wireless networks. They will co-exist with the installed infrastructure, augmenting data collection and real-time response. Examples of areas in which future medical systems can benefit the most from wireless sensor networks are in-home assistance, smart nursing homes, and clinical trial and research augmentation. [4] et al, proposed that their approach helps medical staff to diagnose diseases in an automatic way. In this context, each patient is equipped to a set of sensors. Each sensor is connected to a transducer dedicated to measure a specific health parameter. This WSN will perform some computations and run an alarm when some diseases are suspected. [9] et al, developed a real-time heart monitoring system in addition with considering the cost, ease of application, accuracy, and data security. The system is conceptualized to provide an interface between the doctor and the patients for two-way communication.

III. WIRELESS SENSOR NETWORKS

3.1. Background and Overview

Wireless sensor networks are usually considered one of the technological foundations of ambient intelligence. Agile, low-cost, ultra-low power networks of sensors can collect a huge amount of important information from the surrounding environment. Using a biological analogy, sensor networks can be viewed as the sensory system of the

intelligent environment of the human body. Sensor networks are irregular clusters of communicating sensor nodes, which collect and process information from onboard sensors, and they can share some of this information with neighboring or surrounding nodes or even with nearby data collection stations.

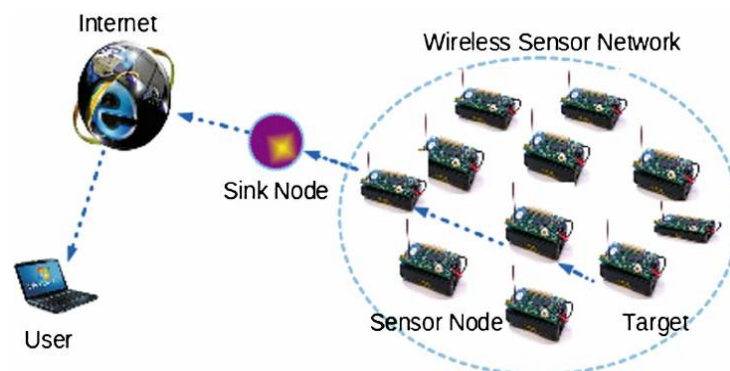


Fig. 3.1. Framework of WSN

A sensor network consists of a large number of sensor nodes, which are deployed either inside the phenomenon to be monitored or very close to it. Sensors can be located far from the actual phenomenon to be monitored. There is another unique feature of sensor networks that is the cooperative effort of sensor nodes. Sensor nodes are equipped with an on-board processor. The design, implementation, and deployment of WSNs requires input from a wide range of disciplines such as medicine, engineering, and computing, as mentioned earlier in the paper, in addition to consideration of the numerous application-specific constraints. In the last five years, significant progress has been made in the development of WSNs, and some WSN-based commercial products have already appeared on the market.

3.2. WSN Applications

Recent advance in the integration and miniaturization of physical sensors, embedded microcontrollers and radio interfaces on a single chip, wireless networking, and micro-fabrication have provided a new generation of wireless sensor networks suitable for many applications. Wireless sensor networks can be used for **military applications, habitat monitoring, machine health monitoring and guidance, traffic pattern monitoring and navigation, plant monitoring in agriculture and infrastructure monitoring**. One of the most exciting applications is *health monitoring*.

IV. WIRELESS BODY AREA NETWORK (WBAN)

In medical diagnosis, a disease is commonly detected if a set of symptoms is verified. These symptoms can be verified with the help of blood analysis results or by observing the patient behavior (for ex., vomiting, headache, etc.). In other cases, these symptoms rely on the fact that some health parameters (heart rate, electrocardiogram, temperature or blood sugar) have reach some improper values.

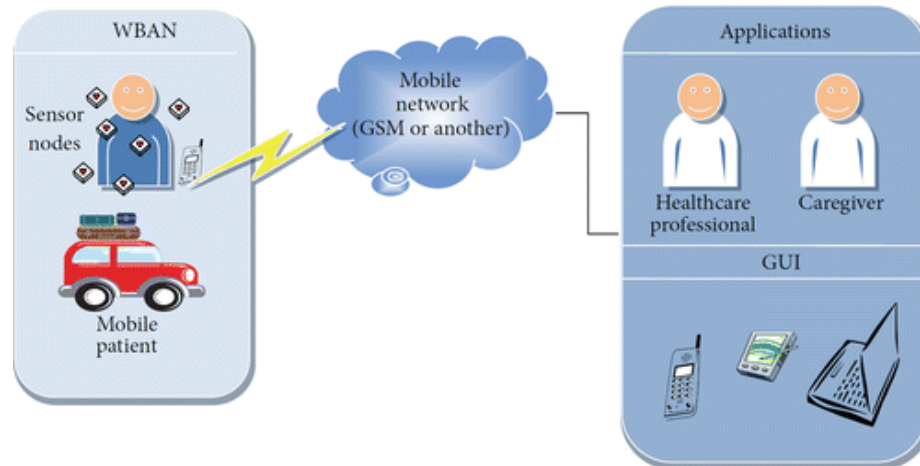


Fig.4.1 Typical WBAN Approach

Wireless Body Area Networks (WBANs) are application-dependent, being generally classified into two different types: event detection and periodic event. In the first, the nodes send data only when an event occurs (e.g., when a patient falls), while in the second the nodes send data at periodic intervals (e.g., sending blood pressure, body temperature, or heart beat).

BAN communication architecture is classified into three main tiers. Such as;

- (i) intra-BAN communications, ii) inter-BAN communications, and
- iii) beyond-BAN communications.

4.1. VARIOUS IMPLEMENTATIONS OF WBAN:

1. Body inertial-sensing network is a project that uses a new method of gestures of body segments to estimate the knee joint angle and identify gait cycles.

2. The LOBIN project is an e-textile and Wireless Sensor Network (WSN) based healthcare platform that aims to both monitor several physiological parameters (e.g., ECG, HR, inclination, activity index, and body temperature) and track the location of a group of patients within hospital facilities.

3. Unobstructive Body Area Networks are a system that collects and transmits data from sensor nodes to a control center capable of analyzing and processing the information.

4. Code Blue is referred to as a prototype healthcare Wireless Sensor Network that defines the architecture for hardware and a framework for software. The framework provides protocols for device discovery, subscribing a routing layer and a simple query interface that allows for requesting data from groups of nodes.

5. The MEDiSN architecture includes a number of Physiological Monitors (PMs) to collect patient's physiological data. Relay Points (RP) aggregate and forward data from PMs.

6. Low power Medical Ad hoc Sensor Networks (MASN) consists of low-cost ECG sensors that are attached to the patients' bodies. They involve a cluster based, energy-aware ECG collection scheme whereby the ECG data are reliably relayed to the sink node in the form of aggregated data packets.

7. A Wireless Sensor Enabled by Wireless Power (WPWS) presents RFID system architecture.

From these implementations, each project has some special characteristics to promote it. Star and many-to-one communications are the topologies most frequently used by these projects to solve routing or aggregate data problems.

4.2. RESERACH ISSUES

For quality life healthcare is always a big concern for an individual. The growing population of developed countries presents a raising slice of government's budget, and presents new challenges to healthcare systems, particularly with elderly people. Generally, health monitoring is performed on a periodic check basis, where the patient must remember its symptoms; the doctor performs some tests and plans a diagnostic, then monitors patient progress

along the treatment. Healthcare applications of wireless sensor networks allow in-home assistance, smart nursing homes, clinical trial and research augmentation. There are many challenges in WBAN such as, power challenge, security and interference, robustness, continuous operation, material constraints and regulatory requirements. Apart from these challenges, many people with health issues could not be able to equip with high-cost, wearable and implantable devices to monitor their health. We are going to extend our research on implementing a GPS enabled hand held devices that every people can be used within an affordable cost. In that research we would overcome the above mentioned challenges in WBAN.

V. PROPOSED THEORITICAL APPROACH

The aim of this theoretical approach is to describe the applications of large scale Wireless Sensor Networks (WSN) and Wireless Body Area Networks (WBAN) working on medical diagnosis. We extend our research in near future to track and monitor humans in real time and mainly in emergency situations. Now a day's mobile phones are widely used by all. A person can be tracked and detected through GPS enabled mobile phones during any emergencies like faint due to low sugar, silent cardiac arrests, unexpected minor accidents etc., especially for an elder one. Through the mobile phones we can send an alarm to the nearby hospitals. The main feature of this WSN is its density and the fact that all sensors are in the same radio range. Our approach helps medical staff to diagnose diseases in an automatic way. In this context, each patient is equipped to a set of sensors. Each sensor is connected to a transducer dedicated to measure a specific health parameter. For this, we need a Wireless Body Area Network to recognize the health condition and also to monitor them furthermore.

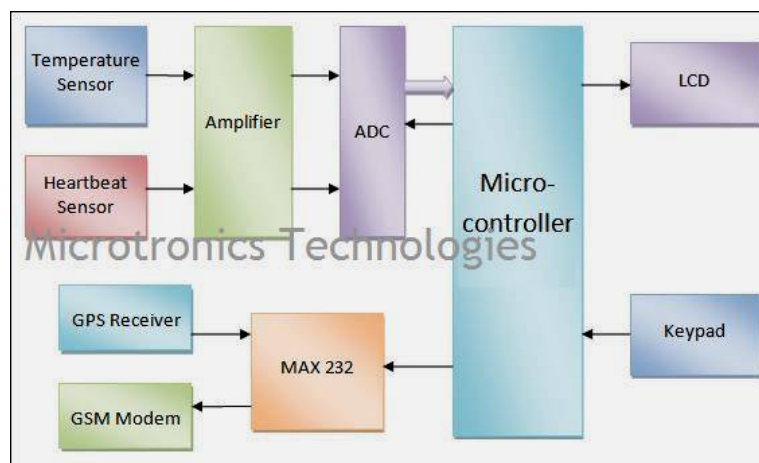


Fig. 5.1. Representation of Real time Tracking & Monitoring

VI. CONCLUSION

This paper proves that wireless sensor networks can be widely used in healthcare applications and that this research area is in a high activity phase. It surveyed a big set of systems and applications for healthcare, and as well as described the major challenges and evaluating metrics of wireless body area networks. Remote patient monitoring is not a new goal. We believe that the role of wireless sensor networks in medical diagnosis can be further enlarged. In the near future, smart phones enabled with GPS can sense environmental conditions and take preventive actions based on the human needs. This will be a real time health monitoring and tracking the user in emergency situations.

REFERENCES

- [1] Application of Wireless Sensor Networks to Healthcare Promotion, Paulo Neves, Michal Stachyra, Joel Rodrigues.
- [2] Wearable and Implantable Wireless Sensor Network Solutions for Healthcare Monitoring Ashraf Darwish^{1,*} and Aboul Ella Hassanien²
- [3] Wireless Sensor Networks for In-Home Healthcare: Potential and Challenges, J. A. Stankovic, Q. Cao, T. Doan, L. Fang, Z. He, R. Kiran, S. Lin, S. Son, R. Stoleru, A. Wood, Department of Computer Science, University of Virginia.
- [4] Simulation of large scale WSN for medical care, N. Dessart, Université des Antilles et de la Guyane, France, H. Fouchal, CReSTIC, Université de Reims Champagne-Ardenne, France, Hunel, Université des Antilles et de la Guyane, France, C. Rabat, CReSTIC, Université de Reims Champagne-Ardenne, France.
- [5] Medical Applications of Wireless Body Area Networks Pervez Khan, Md.Asdaque Hussain, Kyung Sup Kwak Graduate School of IT and Telecommunications, InhaUniversity.
- [6] Wireless Body Area Networks for Healthcare Applications: Protocol Stack Review, Luis Filipe, Florentino Fdez-Riverola, Nuno Costa, António Pereira.
- [7] On using a distributed approach for help in medical diagnosis with wireless sensor networks N. Dessart, H. Fouchal, P. Hunel, N. Vidot.
- [8] A review of wearable sensors and systems with application in rehabilitation, Patel, Hyung Park, Paolo Bonato, Leighton Chan and Mary Rodgers.
- [9] A Real-Time Health Monitoring System for Remote Cardiac Patients Using and Wearable Sensors, Priyanka Kakria, N. K. Tripathi, and Peerapong Kitipawang.
- [10] Smart Real-Time Healthcare Monitoring and Tracking System using GSM/GPS Technologies, Saed Tarapiah, Kahtan Aziz, Shadi Atalla, Salah Haj Ismail.
- [11] Remote Patient Tracking and Monitoring System Mohammed Baqer M. Kamel¹, Loay E. George².
- [12] Health Monitoring System with Real Time Tracking Ms. P Sravani, Dr.B.K.Madhavi, Ms. Giligittha Swetha.