WIRELESS SENSOR NETWORKS USED FOR PATIENT MONITORING

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The main point of the paper is to present the advantages of using a Wireless Sensor Network (WSN) for patient monitoring. In the same time is presented such a system of monitoring and it is made an explanation of the functionalities with the ways of collecting data sensed by the sensors. One of the most advantages of the WSN is the fact that the wires are eliminated. The patients have the possibility to move free. From every patient are collected different or the same type of information (e.g. body temperature, blood pressure, pulse, oxygen level from the blood). This all information is stored into a database and it can be viewed, analyzed and processed. Analyzing the information recorded at one or many patients can help the medical persons to determine the cause of the medical problems.

Keywords: wireless, sensor, network, patient, monitoring

1. INTRODUCTION

After many research on the domain of the WSN we can conclude that the most benefits of this technology is represented into the medical domain. It's a new domain of research which has many directions of applicability. The heath is the most important think into a human life. To have the possibility to monitor the health status and to react when the problems appear, without inconvenience the human patient, represent a great realization. To facilitate research and development in this domain a hardware and software platform is presented into this paper.

2. DESCRIPTION OF THE SYSTEM

The most important advantage of this type of system is that the sensors attached to the human body present no wires [2][3]. It's easier for the human patient to move and interact with the near world. The sensor devices become more and more reduced in size thanks to the evolution of technology [5]. The little sensor devices can be attached to a watch, by example, and the human is not perturbed by them. This version, without wires, is also cheaper. There are no wires which to broke during functioning time and need to be replaced. Using Wireless Sensor Networks, it can be sensed and recorded different types of human body parameters, like: body temperature, blood pressure, pulse, or oxygen level from the blood [4]. In present days, it exists created special types of sensors which allow to be recorded the EKG of any patient [6]. Also, in the same time, it can be recorded and some parameters of the real world in which the patient lives, like: temperature, humidity, and pressure. This allows, when the data analyze is done, to make a connection between the patient health status and the external conditions. Some health problems can be determined by some specific combinations of temperature, humidity or pressure at characteristic levels [4]. Determining this kind of combinations of parameters will permit to the person who monitors the patient to reacts before those combinations of parameters to appear again.

The little sensors which are part of the system are specialized for different data monitoring. The best solution found for attaching them to the human body should be that one which inconvenience the patient the least [7][8]. On example of attaching the sensors is presented into the figure 1.



Fig. 1. The sensors attached to the human body

The hardware part of the system is represented by the acquisition board, the sensor nodes which form the network and which communicate with the acquisition board, and by the devices (mobile or not) used for data storing, data analyze and data view. The communication between the sensor nodes and the acquisition board is realized using RF signals. The optical communication is not possible due the obstacles which could appear between the sensor nodes and acquisition board receiver. For data storing is preferable to be used a powerful PC Server characterized by an increased computing speed, a large capacity for data storing, stability and with backup possibilities. The acquisition boards are installed on computers connected into a LAN. At this LAN must be connected and the PC Server. For data analyze and view can be used any computer which can be connected to the PC Server and mobile devices like Pocket PCs, or mobile phones compatible Java or which present Symbian SO preinstalled.

The hardware architecture of the system [1] is presented into the figure 1. In this figure the acquisition board is installed directly on the PC Server.



Fig. 2. The architecture of the WSN system

The software part is represented by the applications developed which permit data acquisition (from the wireless sensors), data processing and specific applications for different types of devices needed for data visualization and analyze.

On every computer which presents an acquisition board installed we have a specific application developed and implemented which have the role to take the information recorded by the sensors and send it to the Server application. The Server application reads all the information received and stores it into a database. The Server application also have the role to expect requests from the client applications, analyze and process them, and then send the response back to the application which makes the request.

The client applications are accessible on every computer which is connected into the LAN or Internet and on different types of mobile devices (if it was installed before). Due to security reasons the client application should implement and an authentication mechanism. Also the communication from the sensors to the acquisition board should be protected by possible attacks.

The information recorded into a database, provided from different patients, can be analyzed for determine the health status of each of them. At patients with the same ill can be determined, by analyze, some similar aspects of the ill evolution, and in this way, the possibilities of treatment. Into the Server application it is a specialized thread which analyzes the current information about every patient for determining the patients with health problems. When a health problem is detected the person which is treating that patient is announced by mail or sms. In this way the intervention could be done in the shortest time possible.

Also it is a thread which verify if exists sensors which doesn't transmit

information. It is possible that the energy of the sensor to be consumed completely or a hardware failure have been occurred.

3. CONCLUSIONS

The Wireless Sensor Network is a new domain with implication in almost all the areas of activities. The evolution of the technology permits the reduction of the sensor size and so the WSN domain becomes more powerful. Also, the energy consume is reduced and the life of the sensors increase.

4. **References**

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