A SURVEY ON HEALTHCARE MONITORING SYSTEM USING WIRELESS SENSOR NETWORKS (WSN)

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Abstract: Wireless Sensor Network (WSN) has come into prominence because they hold the potential to modify and revolutionize our economy and life, from environmental monitoring to business asset management, from automation in transport and Healthcare industries. WSN is widely used in medical applications to monitor the activities of the human body periodically like blood pressure, glucose level, heart rate, sugar etc., let’s consider a pregnant woman. The parameters such as blood pressure and heart rate of the woman and movements of fetal are periodically checked to control their health condition. There are two types of sensors, they are Wearable and Implanted. Wearable units are used on the body surface of a human or just at close proximity of the user. The implantable units are inserted inside human body to measure the needs. The existing system has no facility to update our health condition to our doctors via any applications. It also has a drawback of low speed communication between sensor nodes. In this paper we present a monitoring system that has the ability to monitor physiological parameters from patient body. The nodes which are attached on the patient’s body will collect the signals from the wireless sensors and sends them to the base station. The sensors can sense the heart rate, blood pressure and so on and updates to the doctor periodically via an application. To overcome the issue of communication delay between the doctor and patient, this can be more beneficial and will yield a good performance in the future.

Keywords: Healthcare, Wireless Sensor, application, communication delay.

I. Introduction

A wireless sensor network (WSN) is a wireless network [15-28] consisting of spatially distributed autonomous devices using sensors to monitor physical or environmental conditions. A WSN system incorporates a gateway that provides wireless connectivity back to the wired world and distributed nodes. The wireless protocol you select depends on your application requirements. Some of the available standards are 2.4 GHz radios based on either IEEE 802.15.4 or IEEE 802.11 standards or proprietary radios, which are usually 900 MHz.

The major components of a typical sensor network are

- Sensor Field - A sensor field can be considered as the area in which the nodes are placed.
- Sensor Nodes - Sensors nodes are the heart of the network. They are in charge of collecting data and routing the information.
- Base Station - The base station is a centralized point of control within the network, which extracts information or data from the network and disseminates control information back into the network. It serves as a gateway to other networks, a powerful data processing and storage centre and an access point for a human interface. The base station is either a laptop or a workstation. Data is streamed to these workstations either via the Internet, wireless channels, satellite etc.
- User - User is the user of the data or information of wireless sensor network who uses to do desired task or take decision.

WSNs are composed of individual embedded systems that are capable of interacting with their environment [29-35] through sensors, processing information locally, and communicating this data wirelessly with their neighbors. There are different wireless technologies used in medical applications such as WBAN, WPAN, WWSN etc., the Wireless Body Area Network (WBAN) is a technology widely used in medical applications with continuously operating sensors. It measures the patient physiological signals such as mobility, blood pressure, heart rate and sugar levels, etc., This survey is presented with Wearable Wireless Sensor Networks (WSN). The performance analysis of the wireless sensors networks on how they perform in healthcare. Body sensor network (BSN) systems can help people by providing healthcare services such as medical monitoring, medical data access, and communication with the healthcare provider or the doctor in emergency situations via SMS or GPRS.
Continuous health monitoring with wearable or implantable body sensor networks will increase the detection of emergency conditions in case of risk patients. Also, these systems [36-45] provide some useful methods to acquire and monitor the physiological signals without the need of interruption of the patient’s normal life, thus improving life quality.

Figure 1 Architecture of WSN

Although present systems allow continuous monitoring of patient vital signs, these systems require the sensors to be placed bedside PCs, and limit the patient to his bed. Now, there is no relation between the sensors and the bedside equipment due to the wireless devices and wireless networks. These systems do not require the patient to be limited to his bed and allow him to move around but requires being within a specific distance from the bedside monitor. Out of this range, we can’t able to collect data. In an example of the application of this system is controlling a pregnant woman. A pregnant woman’s blood pressure should be the same as any other person’s normal blood pressure. It is very important to monitor the blood pressure during pregnancy, to watch for preeclampsia. These women need frequent BP checks. If BP goes too high, the women will be hospitalized. In the existing system, the patient’s physiological signals are detected by the sensors attached on the patient body, and are then transmitted to the base-station and also a PC for storing and analyzing. In addition, an emergency alert service using short message service (SMS) messaging has also added for emergency responses and rescues.

Figure 2 Wireless Technology in Healthcare Monitoring System

Figure 3. WSN Communication Architecture

II. Related Work

One of the very challenging processes in wireless sensor network is to distribute the data [46-50] to several nodes. The sensing the data, allocation of task, scheduling the task are the important consideration in wireless sensor networks. OS and middleware architectures for WSNs implement a several services for distribution of data. Using Wireless Sensor Networks (WSNs) in health care monitoring system has yielded a tremendous effort in recent years. However, in most of these researches, tasks like sensor data processing, health state decisions making and emergency messages sending are completed by a remote server. Transmitting and handling with a large scale of data from body sensors consume a lot of communication resource, bring a burden to the remote server and delay the decision time and notification time.

Ahmed Harbouche et al presented the The WBSN is a wireless network that is designed to allow communication through sensor nodes that are attached to a human body to monitor body’s vital signals, parameters and environment. The design and development of such WBSN systems for health monitoring have received a large amount of attention in research and industry. This attention is mainly motivated by costly health care and by recent advances in the development of miniature health monitoring devices as well as emerging technologies,
such as the Internet of Things contribute the main challenges of 5G. The existence of an explicit approach to address the required software design and verification should be very beneficial for the construction and maintenance of such systems. This paper presents a preventive health care system that has a flexible design. The proposed system is based on an architecture that has heterogeneous nodes and it provides both daily continuous monitoring as well as controls. An important aspect of this work is that they propose a model-driven engineering (MDE) approach to address the derivation of each node’s behaviour in the WBSN from the WBSN global behaviour. This approach allows developers to obtain a system design from the global specification of its requirement. To ensure the conformance of this design to its specification, the derived behaviours should be validated and verified before their deployment. In fact, formal methods are powerful tools for software engineers to verify the logical correctness of concurrent software at different levels of its life cycle. In their work, they make use of a model checking approach that is based on a model transformation to validate the automatically derived behavior of a WBSN for health monitoring. This model driven approach will check whether the derived system behaves correctly according to its global specification, while the objective is to increase the system’s performance and QoS. This approach allows the developer to reason about a model of the global system rather than about the system itself.

D Mahesh Kumar presented a prototype of a smart gateway which is an interconnection and services management platform especially for WSN health care systems. By building a bridge between a WS and public communication networks, and being compatible with an onboard data decision system and a lightweight database, their smart gateway system is enabled to make patients' health state decisions in low-power and low-cost embedded system. It also used to get faster response time of the emergencies. They have also designed the communication protocols between WSN, gateway and remote servers. Additionally Ethernet, Wi-Fi and GSM/GPRS communication module are integrated into the smart gateway in order to report and notify information to care-givers. This new technology has potential to offer a wide range of benefits to patients, medical personnel, and society through continuous monitoring in the ambulatory setting, early detection of abnormal conditions, supervised rehabilitation, and potential knowledge discovery through data mining of all gathered information. This system can be placed in a hospital or a patient’s house, through this wireless sensor network the sensor nodes collect some physiological indexes of the patients or monitor the running state of the medical devices and transmit data to the sink node or the local computer. The wireless sensor network can connect to the remote central server by several means. 

An even bigger, more widely used remote medical service system can be built by connecting the wireless sensor networks to the Internet. This thinks it is very important to serve the patients better. Certainly, some kind of special wireless sensor networks can be developed for special medical use to perfect the remote care system based on wireless sensor networks. Tasks like sensor data database, DDS and real-time report are conducted in a low power embedded system. Hardware and software design of the gateway are presented and transmit protocols are designed for this gateway central system. Optimizing the interconnection by employing GPRS communication between gateway and remote server to extend the available coverage of the health care system and upgrade the DDS. Then, it may consider for integrating internet-base webpage and voice call function in the gateway.

Hande Alemdar and Cem Ersoy introduced a concept on same WSN for healthcare. The pervasive healthcare systems provide context-sensitive information and alerting mechanisms against odd conditions with continuous monitoring. This minimizes the need for caregivers and helps the chronically ill and elderly to survive an independent life, besides provides quality care for the babies and little children whose both parents have to work. Although having benefits, the area has still major challenges which are investigated in this paper. They provide several state of examples together with the design considerations like unobtrusiveness, scalability, energy efficiency, security.

WSN technologies have the potential to change the way of living with many applications in entertainment, industry, medicine, care of the dependent people, and emergency management and many other areas. Wireless sensors networks, pervasive computing, and artificial intelligence research together have built the interdisciplinary concept of ambient intelligence (AmI) in order to overcome the challenges we face in everyday life. One of the challenges of the world for the last decades has been the continuous elderly population increase in the developed countries. Population Reference Bureau forecasts that in the next 20 years, the 65-and-over population in the developed countries will be nearly 20% of the overall population. Hence the need of delivering quality care to a rapidly growing population of elderly
while reducing the health-care costs is an important issue. One promising application in that area is the integration of sensing and consumer electronics technologies which would allow people to be constantly monitored [3]. In-home pervasive networks may assist residents and their caregivers by providing continuous medical monitoring, memory enhancement, control of home appliances, medical data access, and emergency communication [4,5]. Constant monitoring will increase early detection of emergency conditions and disasters for at-risk patients and also provide wide range of healthcare services for people with various degrees of cognitive and physical disabilities [6]. Not only the elderly and chronically ill but also the families in which both parents have to work will derive benefit from these systems for delivering high-quality care services for their babies and little children. Researchers in computer, networking, and medical fields are working together in order to make the broad vision of smart healthcare possible. The importance of integrating large-scale wireless telecommunication technologies such as 3G, Wi-Fi Mesh, and WiMAX, with telemedicine has already been addressed by some researchers. Further improvements will be achieved by the coexistence of small-scale personal area technologies like radio frequency identification, Bluetooth.

III. Research Direction

To address the issue of low hope and end application for the users. If our algorithm is tested efficiency response increases. If our algorithm is tested using this tool performance increases . To quantify this algorithm better to conduct test bed or bench mark.

IV. Conclusion

Given the importance of addressing ways to provide the smarter healthcare for the people. In this study we have evaluated the examples of how people could benefit from homes using wireless sensor technologies for betterment of life. We have also presented a monitoring system that has the ability to monitor physiological parameters from patient body and report to the end user using an application.

References


[29] Amudhavel, J., Jayabharathi, A., Kumarakrishnan, S., Malarvizhi, M., Gomathy, H., Prem Kumar, K.,


