Medical Parameter Monitoring For Multiple Patients Using Multiple Sensor

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Abstract-*Practical usability of most of the wearable body sensor systems for multiple parameter physiological signal observation is limited by the multiple physical connections between sensors and the data-acquisition modules. In order to avoid this we propose a wireless body sensor system that consist of multiple sensors on a single node. The data from the sensor nodes are collected, processed and then transmitted to user interface. A unit attached to the patient's chest and is capable of performing simultaneous measurements of parameters such as body motion, activity intensity, tilt, respiration, cardiac vibration, cardiac potential (ECG), heart rate, and body surface temperature. The main objective of this paper is to provide a long term data acquisition with less power consumption.*

Keywords-Gateway, Zigbee, Wifi, Sensors, Iot server

I. INTRODUCTION

Most patients stay in hospital not for that he or she actually needs active medical care but they want continual observation. By the clinical techniques, body parameters, such as ECG, heart-rate, cardiac vibration, blood oxygen level, blood pressure, respiration, body temperature, body movement can be obtained. From a clinical research , the heart rate has been combined with body movement intensity based on acceleration of multiple accelerometers attached to different parts of the body which helps to estimate energy expenditure during different physical activities[2]. There are many techniques for measuring energy expenditure, that includes the measurement of oxygen consumption.

The continuous body check up will help us to find whether a person has any diseases or not. The long term ECG recording in patient's home helps to find and diagnose chronic heart diseases[1]. It can be achieved by means of medical technology with the help of IOT. So here we propose a remote monitoring system which provides long term monitoring of multiple patients in residential environments without assistance.

This system consist of different sensors for sensing data such as ECG, heart rate, body movements , blood pressure etc. Here, sensors are connected to a data recorder and transmits the data via conductive fibers integrated into a wearable shirt. These are wireless sensor network structure to monitor patients condition with chronic diseases in their own homes through a remote monitoring system. Wireless sensor networks for monitoring signals consist of large part including the signals recording process using sensors, communications protocol to facilitate data transmission, analysis of the received data and area of low-power networks.The commonly used monitoring systems capture signals from body surface by placing wet electrodes on patient's body, in which conductive gels are used for getting measurements easily[6].This technique cause the application time consuming and could cause allergic reactions.

Using this system, we can monitor multiple patients at a time and thereby it reduces cost by minimizing individual component for every patients. Recently, some portable point-of-care and mobile personal health monitoring devices consists of multiple sensor inputs to record multiple body parameters to bring additional medical value to the of health care instruments are used. Sensors are then connected to a portable tabletop monitoring unit through cables. For multiparameter body activity and vitals monitoring, a small, lightweight, thin, flexible, wireless multisensor node and its receiving system are developed here. In this approach we use three types of sensors: 1) biopotential 2) vibration and 3)temperature, will provide measurements of ECG, heart rate, respiration rate, body position, movement intensity, cardiac vibration and body surface temperature[2].This system is suitable for continuous observation of the above parameters without any replacement in power source. The advantages of this multisensor platform over previous systems include : it incorporates multiple sensors in a single node and it eliminates wire between sensor and the transmitting /receiving node, it allows the multiple physiological signals to be extracted and recorded from a particular point location on subject body ,combines signal conditioning, processing and radio-communication electronics in a small form factor with low power consumption.

The multisensor node platform used here is demonstrated as part of a monitoring system using a standard mobile phone as a display and global communication device. This basic system architecture of the monitoring platform is followed by the multisensory node[1]. The ECG sensors and other sensors collect data and send them in real time via a wireless protocol (ZigBee, Bluetooth, WiFi) to a gateway. This gateway converts the packets of the sensors in a universal format which preserves all the information present in the native format. Then sensors send messages in their native format to the IoT server, where the data management unit extracts information and stores it in a "universal" format into the sensor database. If sensors need to be configured or interrogated, the configurator unit provides a command to the target sensor protocol[1]-[5].The IoT serverconverts the raw payload into a universal format, containing object identifier, object type, measurement unit, data field, geographical position etc. And then, the data can be available to applications and users. In this way, data visualization and processing is separated from measurement and data collection. The message dispatcherhelps the bidirectional communication withthe sensor networks**.** The entire system can be configurable and controllable by a web interface from any computer, smart phone or tablet connected to the internet. In the IoT server, health data can be combined with other data,and processed by users or clinicians.

II. RELATED WORKS

A wearable sensor consists of a battery-powered chestbelt helps to obtain the the measurement. This belt has two dry plastic electrodes and the electronic printed circuit board. The circuit extracts, filters, amplifies and digitizes the signal and then acquired by the microcontroller and wireless sent to the IoT server. In ZigBee communication protocol the wireless monitoring system consists of a small low cost, low-power, wearable multisensor node and a larger pocket-sized universal receiver-controller. The controller provides data display, storage, processing, and communication capabilities. It consists of one or multiple wireless multisensor nodes attached to one or multiple subjects and acquiring data. Then a data receiver, display, control, and communication unit are implemented on a standard mobile phone. A small radio interface bridge attached to the phone, serving as the interface between different radio standards also used here. The data gathered by the wearable node are then transmitted by using the ZigBee protocol to the bridge, and it communicates with the phone using the Bluetooth wireless standard. Control messages that initiate monitoring sessions, data type recorded, and operation mode, are generated by the phone and are sent to the node[5]-[7].

In this method wireless multisensor node implements many tasks:

Acquire signals from multiple sensors, perform signal processing using both analog and digital filters, assess the bio-signals recorded to obtain secondary parameters such as heart rate value, transmit application-specific data to the receiver. The multisensor node electronics consists of: 1) the sensors 2) the signal acquisition and conditioning module; 3) the microprocessor and radio module and 4) the device powering module. The multiple sensors provides set of selectable analog filter chains to reduce component count and reduce device size. The set of filter chains provides each sensor channel options with different data modes. To each sensor channel to support any species of the entire selection of filter chains have to be made available to every sensor channel[5]. Considerably a large number of analog filter components is needed if each set of filter chains is repeated for each sensor channel.

The early studies focus on examining the function and efficiency of the ECG signal only and all the data transmitting back to center computer for processing and detection, and not consider their power consumption .And they adopt an interrupt service routine (ISR) to reduce power consumption. Then send detected event to master node for action[11]. But the wireless transmission operations consume a lots of battery power as comparing with other operations in the sensing node or microcontroller. There are some factors which cause power consumption during the use of embedded devices: (1) sensors / embedded hardware module, analog to digital (A/D) converter, and radio frequency (RF) transmitter chip (2) data communications methods and wireless network protocol(3) data processing module, and (4) environmental factors such as weather or skin temperature. This testing environment is similar to the medical cyber physical systems used in other recent studies. Here the results can helps us to provide a practical guideline for designing the wearable ECG device and selecting algorithms in terms of energy efficiency[11]-[12]. To verify the actual performance of ECG prototype ,here developed an integrated simulation environment with a virtual patient to interact with the integrated physical environment. It consist of the filtering process, feature extraction and the detection algorithms on an embedded microcontroller.

III. PROPOSED SYSTEM

This wireless monitoring system consists of a small, inexpensive, low-power, wearable multisensor node like a chest belt and a universal receiver-controller that provides data display, storage, processing, and communication capabilities.

The main elements of the wireless monitoring system are: multiple wireless multisensor nodes (coordinated using the ZigBee wireless protocol), attached to one data receiver, display, control, and communication unit (using Bluetooth wireless connectivity); a small radio interface bridge attached to the phone, serving as the interface between different radio standards[1]. The figure 1 shows the proposed model consist of a multisensor platform and the sensors placed at the patients body collects data then processed and using suitable protocol data are passed through the gateway. The data collected through the wearable node are transmitted by using the ZigBee protocol to the bridge, then it communicates with the phone using the Bluetooth wireless standard. The only component aware of the local sensor network protocol is the gateway. It helps to transmit data to the Iot server.

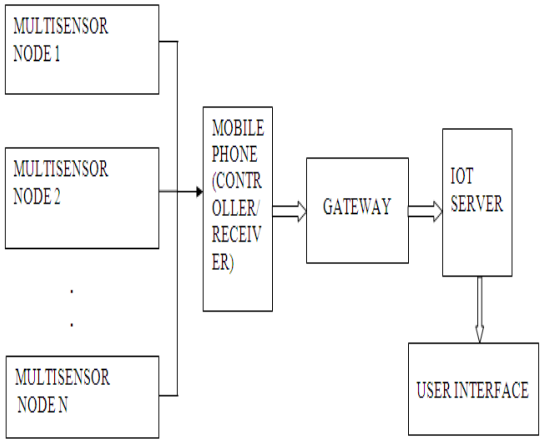

Figure 1: Block diagram of proposed system

The data stored in the Iot server in a universal format containing object identifier, object type, measurement unit, data field, geographical position, and timestamp. Then, the data will be available to the users.The most of mobile-phone devices, PDAs, and personal computers in today's markets consist of Bluetooth standard radio communication[2].The Bluetooth provides reliable high-data-rate wireless communication. The gateway convert the data into a universal format and then stored to the Iot server. The Iot server consist of several devices which stores the data in a message dispatcher which manages the bidirectional communication with the sensor networks, using no information on the network protocol. The data management unit is a collection of software modules interprets data from sensors and stored it in a universal format in the sensor database

Multisensor nodes

Wireless Body Sensor Networks (WBSNs) are a subset of wireless sensor networks that allow continuous monitoring of health related data. They collect and analyze vital signs data using different types of miniaturized wireless sensors called biosensors such as body temperature, heartbeat, blood pressure, electro cardiogram ECG, Electro encephalogram EEG, etc. WBSNs are commonly used for in home monitoring.

Gateway

Gateway devices helps data communication between main data network and wireless field devices and enables application level access to the field devices from central monitoring station.These devices are used as protocol converter, command/data forwarder and also it can be used as Security Manager, Synchronizer in network. In this method, the Ethernet gateway has been designed to collect data from wireless sensor network .

Iot server

This is the network of physical devices, vehicles, home appliances, and other items embedded with electronics, software, sensors, actuators, and network connectivity which enable these objects to connect and transfer data. Each thing is uniquely identifiable through its embedded computing system and is is able to inter-operate within the existing Internet infrastructure. The main operation of the server application is collecting of measured waveforms from connected mobile devices or computers, which act as a relay point for transferring data from ECG devices or any other devices to this server.

User interface

The user interface unit will enable to display output. Here the user can display output through the mobile phones, PC etc. The system provides the data of multiple patients from different locality under the same PC. This application can be run on iOS, Android, Linux and Windows platform. When a new ECG device is connected to the server, this event is automatically recognized and patient information is downloaded to this client application and his heart activity being displayed without any user intervention.

IV. CONCLUSION

The proposed system can monitor multiple patients using a multisensor platform. It consists of sensors such as temperature sensors, ECG monitoring sensors, vibration, biopotential etc. The mechanical flexibility of the sensor will improves the comfort of use and the reliability of the acquired data thanks to better attachment to the body. These sensors

helps to get the signals or data of the patients efficiently and the data are sent to storage devices such as a server data base through the gateway and then it is transmitted to the user interface ie, a system composed of a very small, flexible multisensor node communicating with a mobile phone, serving as a user interface, control, data management, and global communication device. This system helps a continuous observation of those people suffering any chronic diseases. Using this proposed system we can reduce the physician and emergency room visits, reduced hospitalization and nursing care at home. And it allows to monitor multiple patients on a relatively large area , building, nursing home, etc.

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