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WBAN Based Health Care Monitoring System using IOT

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ABSTRACT

Internet of Things (IoT) is considered as a new technological paradigm that can connect things from various fields through the Internet. For the IoT connected healthcare applications, the wireless body area network (WBAN) is gaining popularity as wearable devices spring into the market. This paper proposes a wearable sensor node with solar energy harvesting and Bluetooth low energy transmission that enables the implementation of an autonomous WBAN. Multiple sensor nodes can be deployed on different positions of the body to measure the subject's body temperature distribution, heartbeat, and detect falls. A web-based smartphone application is also developed for displaying the sensor data and fall notification. To extend the lifetime of the wearable sensor node, a flexible solar energy harvester with an output-based maximum power point tracking technique is used to power the sensor node. Experimental results show that the wearable sensor node works well when powered by the solar energy harvester. The autonomous 24 hours operation is achieved with the experimental results. The proposed system with solar energy harvesting demonstrates that long-term continuous medical monitoring based on WBAN is possible provided that the subject stays outside for a short period of time in a day.

KEYWORDS: Health Care, Monitoring, IOT.

INTRODUCTION

The life expectancy has been increasing in thisworld rapidly since the past few years which has drastically raised the number of elderly people living currently. United Nations has also predicted that by the year 2050 arrives the world will have about 2 billion older generation. And, according to statistics a major portion of the old people live on their own without much assistance. And, most of them suffer from at least one continual disease which increases the list of living alone for them. Providing a good health and a life balance to the old and elderly population has become a very vital aspect in the society today.

The advancements in technology is giving space to a lot of scope to develop better and appropriate solutions to various challenges faced by the people. Today, IoT, Internet of Things has turned out to be the most applied and efficient communication models in the present century. Various devices like micro controllers form an essential part of IoT environment due to their capabilities of computation and communication.IoT mainly allows us to interface different types of devices. Various sensors, cameras, additional devices can be used in this setup where the IoT is used.

This project is an application of Internet of things in the healthcare domain mainly targeting the elderly people. So, about healthcare we can use any combination of sensors depending upon the requirement of the patient.

And besides these basic benefits this setup can be widely used at any place and at any time. There are no spatial restrictions to this project. It mainly helps in enhancing the quality of life of the older people.

Body Sensor Network is a combination of very low-power and wireless nodes of a sensor that are essentially used to supervise the human body functions and the environment around the patient [1]. And in order to avoid errors strict mechanisms to implement security protocols are made available.

So, in this project we mainly talk about the various security needs in Body Sensor Network based healthcare system. We address the few security necessities in BSN based present day human services framework. At that point, we propose a protected IoT based human services framework utilizing BSN, called BSN Care which can ensure to productively finish those prerequisites [2].

In this way, whatever is left of the article is sorted out as takes after. In area II, we exhibit a rundown of security parameters which are required to be tended to in any IoT based medicinal services framework utilizing BSN. In segment III, we portray a portion of the related works in IoT based human services framework utilizing BSN. In segment IV, we exhibit our BSN-Care framework and consequently, in this area we additionally demonstrate to implement security in our BSN-Care model to accomplish all the basic security properties. Section V analyses the security of the proposed system [3].

Health is an important factor of a human life. The health problems should be first diagnosed and then prevented. In traditional approach the healthcare professionals should be on site to monitor medical parameters of a patient all the time and patient remains admitted in a hospital, wired to biomedical instruments.

A new modern healthcare monitoring system introduces wireless body sensors to monitor their medical parameters at any time in an economic and patient friendly manner. An IoT method is adapted to access the medical parameters of a patient in local and remote area [4]. The body sensor network system helps the people by providing healthcare services such as medical data access and communication with healthcare provider in emergency situations through SMS or GPRS [5].

The main objective of this paper is to transmit the healthcare parameters of a patient through wireless communication. This paper proposes multiple wearable sensor nodes with solar energy harvesting and ZigBee transmission to implement a wireless body area network (WBAN).The wearable sensor nodes are the key components of the WBAN.

The multiple sensor nodes such as accelerometer, temperature sensor, pressure sensor, plug in PPG sensor and ECG sensor with an onboard is integrated on a flexible solar panel [6]. Multiple nodes can be attached on different positions of the body to measure the temperature distribution.

LITERATURE REVIEW

- **Service Virtualization of Internet-of-Things Devices:**

Service virtualization is an approach that uses virtualized environments to automatically test enterprise services in production-like conditions. Many techniques have been proposed to provide such a realistic environment for enterpriseservices. The Internet-of-Things (IoT) is an emerging field which connects a diverse set of devices over different transport layers, using a variety of protocols.

DRAWBACK:

IoT developers in enabling them to continuously testtheir IoT applications in an automated fashion without requiring access to the physical devices.

- **Design and Simulation of Energy Efficiency in Node Based on MQTT Protocol in Internet of Things:**

Internet of Things define a global environment where entities are able uniquely diagnosed and allowing systems to administer, footmark and supervise them. Systems have plausibleness with self-configuring based on secure standard communication protocol, so that unauthorized users can't access the data. MQTT components help different software applications to interact with each other so that they can act in a connected manner.

DRAWBACK:

MQTT is one the critical protocol which can be idealfor interconnecting the physical world to the real work.

- **A Technique for convalescent MPPT Performances of Double-Stage Grid-Connected Photovoltaic Systems:**

In double-stage grid-connected photovoltaic (PV) inverters, the charismatic interactions among the dc/dc and dc/ac stages and the maximum power point tracking (MPPT) controller may reduce the system performances. In this paper, the detrimental effects, particularly in terms of system efficiency and MPPT performances, of the oscillations of the PV array voltage, taking place at the second harmonic of the grid frequency are evidenced. The use of a proper compensation network acting on the error signal between a reference signal provided by the MPPT controller and a signal that is proportional to the PV array voltage is proposed.

DRAWBACK:

Low-frequency oscillations of the voltage across thebulk capacitor.

METHODOLOGY

This system implements an IoT based healthcare monitoring system with wireless body sensor area network. The system architecture consist of three major parts 1) Flexible solar energy harvester 2) Wearable sensor nodes with a ZigBee module and 3)Smartphone application act as IoT gateway. In this paper the proposed method uses Atmega 328 microcontroller as a gateway to communicate with various sensors such as temperature, pressure, pulse, ECG and accelerometer. The sensors are made small and power efficient so that their energy storage can last for long time. The data's detected by these sensors can be accessed by doctors, family members and emergency health care centers at any time. The proposed system is differing from other Implemented ones because the monitoring of several parameters from many patients simultaneously represents a real time implementation in hospitalenvironments.

- **Flexible solar energy harvester**

A flexible solar panel is taken as the power source for the wearable sensor nodes in the proposed system. In this system the solar panel used is MPT3.6-75 from Sundance solar of 7.2*6.0 cm. The main reason for using this energy harvester is due to its flexibility. Hence it can be easily attached to the clothes of human body for wearable applications. An output based multiple point tracking technique is introduced along with the solar energy harvester to extract maximum power from the solar harvester. In the system the flexible solar panel uses a super capacitor to store the harvested energy. It is used instead of a rechargeable battery. Because it has a higher efficiency of charging and discharging than that of a battery and has unlimited charging cycles. An efficient buck boost converter and a voltage regulator is connected to the super capacitor. The input range of voltage regulator is from 2.4V to 25V and output voltage is 3.3V to power up the wearable sensor nodes.

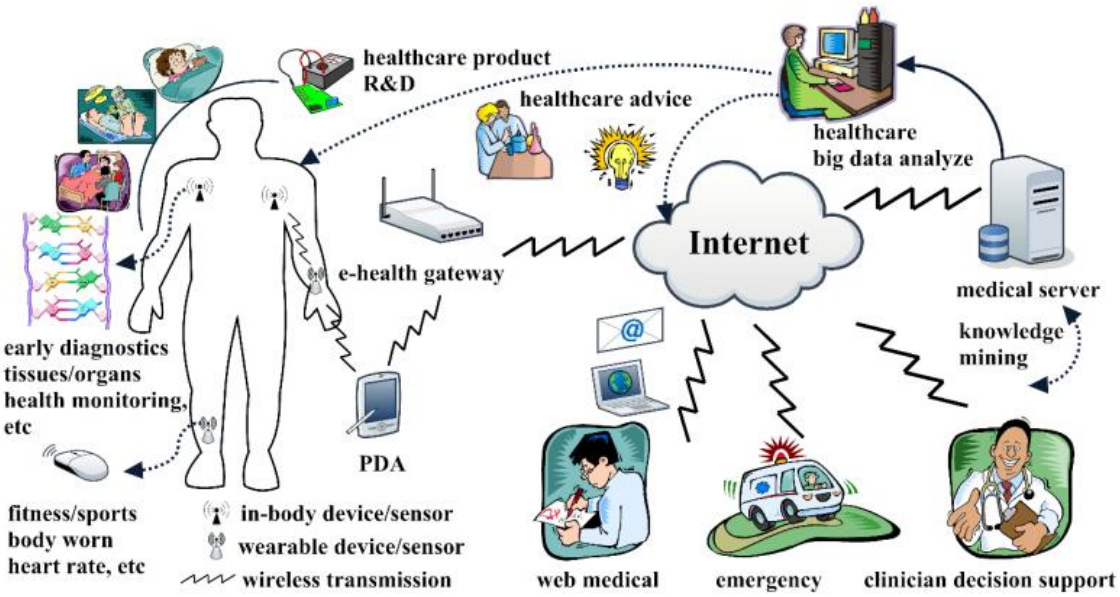

Figure 1. The proposed typical structure of the health IoT system

- **Wearable sensor node**

The main component implemented in the wearable sensor node is the microcontroller unit. In this system the controller used is Atmega 328 and the five sensors for subject data and processing.

MCU

The core part of the wearable sensor node is the microcontroller unit, which collects and process the sensor data and act as a power management to reduce the overall power consumption. The system uses a microcontroller in the sensor node is the ATmega328P from Atmel because of its low power, low cost and high performance. The speed of CPU in ATmega is designed to 8 MHz a t3.3 V and can be throttled down to 1 MHz for 1.8 V in extremely low power applications. The MCU has a 32 KB flash memory consisting of 2 KB SRAM, 6 Analog input and 14 digital I/O pins. So, the proposed wearable sensor node can relate to other sensors such as EEG and GSR for other human body vital signals measurement in future developments in wearable sensors.

TEMPERATURE SENSOR

The temperature sensor used in the system is MAX30205 from Maxim. It is taken due to its several advantages over other temperature sensors such as LM35. It has high accuracy ranging from 0.1C from 37C to 39C, high resolution of 16-bit and low power consumption ranging from 600 micro ampere at 2.7 V to 3.3 V. The MAX30205 temperature sensor can also provide an indication of alarm when over temperature occurred and communicate with the MCU through an I2C-compatible 2-wire serial interface. The temperature sensor helps to measure the body temperature distribution when the wearable sensor node is placed at different parts of the body.

PRESSURE SENSOR

The pressure sensor use in the system is 26PC SMT (Surface Mount Technology) Series pressure sensor offered by Honey Well. The small, low-cost, high-value pressure sensing solution has overcome the difficulty of a health care professional having to place a stethoscope under the pressure cuff to hear the noise of the rushing blood. This sensor measures the blood pressure faster and more accurately than manual devices. Based on the long-established reliability and accuracy of Honeywell's 26PC pressure sensor, the 26PC SMT offers reduced size with true surface-mount capability. The 26PC SMT is easy to use and works in conjunction with Honeywell's functional switches.

PULSE SENSOR

In this system a pulse sensor is adopted for subject heartbeat monitoring. The pulse sensor used is a plug-in PPG sensor, which can only be connected to the sensor node deployed at the subject's wrist. The pulse sensor implemented in the system is SEN-11574 which consists of a low power light photo sensor (APDS-9008) and an amplifier (MCP6001) with typical current supply range of 42 micro ampere and 100 micro amperes, respectively. With proper configuration, the pulse sensor can used to measure the heartbeat of radial artery at the wrist instead of the fingertip, thus it will doesn't interfere with the daily life subjects.

ECG SENSOR

The ECG sensor used in the system is AD8232 Module which is integrated on board. ECG are used to analyze the electrical activity produced by the heart muscle depolarizations, which propagates in pulsating electrical waves towards the skin surface. ECG electrodes are wet; hence it requires the use of a conductive gel to increase conductivity between skin and electrodes. ECG electrode were sticked to patient's chest to pick up the ECG signals. The module is connected to AD8232 Single head heart rate monitor using wires. This is done to reduce noise in the signal received by AD8232 acting as an OP-AMP. These sensors are cost effective and gives signals in form of PR and QT intervals.

ACCELEROMETER

In the proposed system the accelerometer is used for fall detection and is widely used in WBAN applications. The accelerometer selected for the function is ADXL362 from Analog Devices and is soldered on the flexible PCB in the wearable sensor node. It consists of a 3-axis MEMS accelerometer with ultralow power consumption, which consumes less than 2 micro ampere when the output data rate is 100 Hz and only 270 nA when it is under the motion triggered wake-up mode. The most important feature of this accelerometer is its motion triggered wake-up mode, and it has an adjustable threshold of sleep/wake motion activation. Whenever a fall is detected, the ADXL362 wakes up the microcontroller and an emergency notification will be transmitted to the smartphone for getting an alert to the medical assistant through the ZigBee module.

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SMART PHONE APPLICATION AND ZIGBEE TRANSMISSION

To access the data's from wearable sensor nodes to help the healthcare professionals, family members and others for the analysis of patient's current status a ZigBee module is used to transmit the sensor data to a smartphone. ZigBee Module has several advantages over other transmission technology.it has low-cost, low-power, wireless mesh networking standard. The low cost allows the technology to be widely implemented in wireless control and monitoring applications, the low power-usage allows longer life time with smaller batteries, and its mesh networking provides high reliability and larger range. The ZigBee module can communicate with most of the iOS and Android smartphone application. For the visualization of sensor data, the smartphone application uses aEvothings platform.it consist of a platform which enables wrapping up the CSS, HTML5 and JavaScript code depending upon the device platform. Internet of things is implemented to connect various observers to analyze the sensor data from remote and local area. It is defined as Things having identities and unique personalities operating in smart spaces using intelligent interfaces to communicate within social, environmental, and user contexts. It is considered as the Future of Internet, where every object is connected to other. This allows remote access of devices through the network at any time at any location.

CONCLUSION AND FUTURE SCOPE OF WORK

This paper presents a healthcare monitoring system with wireless body area network (WBAN) using internet of things (IOT) and the system is able to carry a long-term monitoring on patient's condition. The proposed wearable sensor nodes can be attached to different positions of the human body to measure physical signals like the temperature, pressure, pulse rate, ECG and also detects fall condition using the accelerometer sensor node by providing a emergency notification. In the future development, the wearable sensor node can accommodate more signal detections to cover many areas of health detection in WBAN applications.

A web-based smartphone application is designed and used to display the sensor data and transmits emergency notification through ZigBee. In order to extend the lifetime of wearable sensors, a solar energy harvester with MPPT technique is used as the power source. The MPPT technique is used to extract the maximum power from the flexible solar panel. The wearable sensor node woks more efficiently when it is exposed to more sunlight. The 24 hours operation of the sensor node can be achieved by setting a 10 min wake-sleep mode to the sensors. The proposed system can be improved in terms of usability and wear ability of sensor nodes by the shape of the sensor redesigned to make it more wearable, like a wrist band. More sensors can be integrated, and a secondary battery may also be used as a backupenergy storage.

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