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Power-Aware IoT Based Smart Health Monitoring Using Wireless Body Area Network: A Review

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Abstract: *In Internet of Things (IoT), large amount of data are processed and communicated through different wireless sensor network technologies. For smart health-care application, Wireless Body Area Network (WBAN) which is based on IoT can connect wearable devices to monitor different biomedical signals. In order to ensure continuous monitoring of health over a long period of time in WBAN, power management is a key requirement. A power management technique for prolong and continuous ECG monitoring based on critical data and energy level of battery is proposed in this paper. To reduce the power consumption, a light-weight power management controller is introduced based on the present status of ECG data and battery. The proposed architecture saves up to 27% power consumption in WBAN compared to the conventional architecture without incurring significant overhead.*

Keywords: Internet of Things (IoT), Power Management, Wireless Body Area Network (WBAN), etc.

I. INTRODUCTION

IoT based smart health-care system enables remote and continuous monitoring of different physiological signals like electrocardiograms (ECG), electromyograms (EMG), electroencephalograms (EEG), blood pressure of individuals over a extended period of time. IoT-driven WBAN can significantly improve the health and wellness of individuals by detecting critical health conditions [1]. Developing tiny wearable devices integrated in WBAN demands low power nodes for sensing, processing and communicating data [2]. Power management controller architecture for WBAN has emerged in IoT for power-efficient solution in smart E-health. In order to monitor health of individuals over an extended period in WBAN, it is necessary to dissipate power optimally and efficiently based on available energy during transmission of physiological signals tracking of human body parameters has attracted significant interest in recent years due to its wide-ranging applications such as rehabilitation, virtual reality, sports science, medical science, surveillance, in recent times, wireless sensors and sensor networks have become a great interest tore search, scientific and technological community. Though sensor networks have been in place for more than a few decades now, the wireless domain has opened up a whole new application space of sensors. Wireless sensors and sensor networks are different from traditional wireless networks as well computer networks and, therefore, pose more challenges to solve such as limited energy, restricted lifetime, etc. The objective is to allow the person to be monitored in a natural environment. For monitoring outside the laboratory, a wearable system must not only display the parameters but also record the data; the proposed approach uses the wireless sensor network concept with all the sensor nodes communicated to the coordinator wirelessly using Wi-Fi network protocol. The coordinator acts as a router which makes connectivity between sensor nodes and end device via internet, end device may be computer or mobile. Each sensor node is may equipped with accelerometer, temperature sensor, pulse oximeter SpO2 & heart-rate sensor and galvanic skin response sensor. The sensor nodes are attached to the human body and operate completely untethered. They are powered by battery. The small form factor and lightweight feature of the sensor nodes allow easy attachment to the body.

II. LITERATURE REVIEW

In the paper entitled "POWER-AWARE IOT BASED SMART HEALTH MONITORING USING WIRELESS BODY AREA NETWORK" an important component of ubiquitous healthcare is wireless sensor network (WSN). WSNs are an emerging technology that is poised to transform healthcare. The WSNs promise to make life more comfortable by

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significantly improving and expanding the quality of care across a wide variety of settings and segments of the population.
In the paper entitled "POWER-AWARE IOT BASED SMART HEALTH MONITORING USING WIRELESS BODY AREA NETWORK" provides a brief introduction on applications of wireless sensor networks in healthcare [1].
This paper reviews the various types of wireless technologies used for medical applications such as WLAN, WPAN, WIMAX and WBAN and states their frequency, range standard etc., These wireless technologies are compared based on the factors such as energy consumption, security, routing protocols in order to increase the efficiency and effectiveness of the monitoring system [2].
In parallel to WSNs, the idea of internet of things (IoT) is developed where IoT can be defined as an interconnection between identifiable devices within the internet connection in sensing and monitoring processes [3].
Measurement of Elder Health Parameters and the Gadget Designs for Continuous Monitoring Improving the quality of life for the elderly persons and giving them the proper care at the right time is the responsibility of the younger generation a simple, compact and user-friendly electronic gadget for continuous monitoring of elder health parameters is the need of the hour.
Day by day the menace of weakening health and chances of skin related problems, bed sores etc are becoming critical in case of bed ridden patients. This paper analyses the old age diseases and the parameters to be monitored [4].
A Zigbee-Based Wearable Physiological Parameters Monitoring System can be used to monitor physiological parameters, such as temperature and heart rate, of a human subject. The system consists of an electronic device which is worn on the wrist and finger, by an at-risk person. Using several sensors to measure different vital signs, the person is wirelessly monitored within his own home. An impact sensor has been used to detect falls. The device detects if a person is medically distressed and sends an alarm to a receiver unit that is connected to a computer. This sets off an alarm, allowing help to be provided to the user [5].
Technology which is willing to existence and reduces cost of electrical wiring and uses the already available power line wires known as the power line communication. The intent of this work is to send the biomedical parameters like the heartrate, respiration rate and body temperature through PLC system [6].
Some of the elder care systems as mentioned in [7] monitor activities of the elders in their home. They embed a video system in the living environment of elders and continuously monitor their activities at home.
However, this system doesn't measure any of the vital parameters of the elderly patient. Measuring the vital parameters is in evitable if the elder person suffers from any sort of heart ailments, which are very common in individuals aged above 60 [8].
In mobile devices like Calyx (Complete Ambient Assisted Living Experiment) which can measure vital signs like ECG, pulse, Blood pressure, Movement and Fall detection. However, the design we have proposed can monitor vital parameters and fall detection along with tilt monitoring for the bed-ridden patients to monitor any case of bedsore.
Some devices as in [9] monitor only fall detection for the elderly patients based on the sensor readings from accelerometers and microphones attached to the body of the patients.
The system proposed in [10] is applicable to patients. And elders for activity monitoring and fall detection and also sports athletes exercise measurement and pattern analysis. [11]
A wearable wireless sensor network using accelerometers has been developed in this paper to determine the arm motion in the sagittal plane. The system provides unrestrained movements and improves its usability.

III. PROPOSED SYSTEM

Figure 3.1 shows the configuration of the system. It is observed that the system consists of a number of sensor nodes that wirelessly communicate to a central coordinator in a star network topology. Wireless sensor network is a promising field that integrates sensor technologies, embedded system and wireless communication together to produce small, low cost, low power and reliable system capable of monitoring specific events. For this system, wireless protocol suite used because it provides end-to-end connectivity. The coordinator acts as a router which makes connectivity between sensor nodes and end device via internet, end device may be computer or mobile. Each sensor node is may equipped with accelerometer, temperature sensor, pulse oximeter SpO2 & heart-rate sensor and galvanism in response sensor. The sensor nodes are attached to the human body and operate completely untethered.

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They are powered by battery.

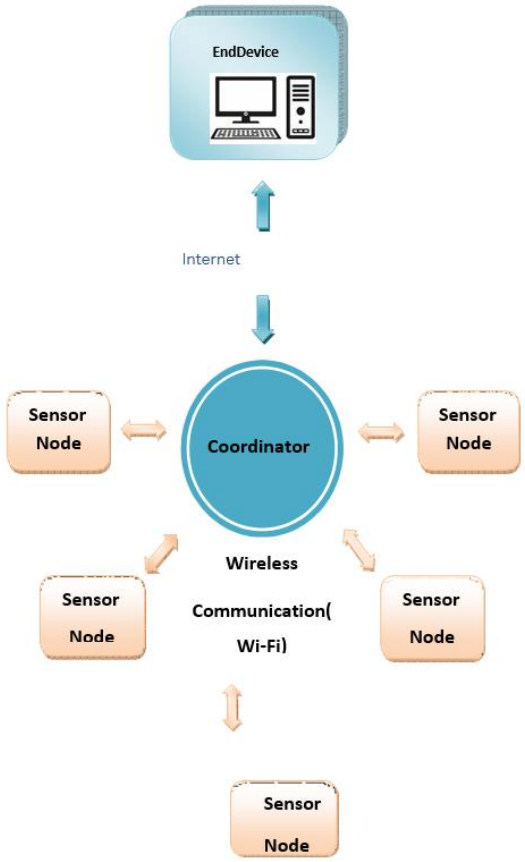

Figure 3.1: General Configuration of the System

IV. FUNCTIONAL BLOCK DIAGRAM OF SYTEM DESIGN

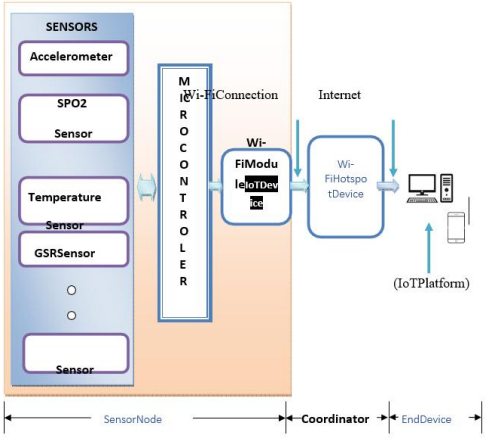

Figure 4.1: Functional Block Diagram of the System

Figure 4.1 shows the functional block diagram of the system. The system has been designed to take several inputs from sensors to measure physiological parameters of human body such as temperature sensor for body temperature,

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SPO2sensor for monitoring of Heart rate and Blood Oxygen level, Accelerometer that can be either used to detect body position, muscle movement and motion, Galvanic skin response sensor to measure skin response. The inputs from the sensors are integrated& processed by microcontroller, then microcontroller send processed data to Wi-Fi IoT device. The IoT device forward received data from microcontroller towards the end device with the help of coordinator via internet and finally we can monitor all the parameters on IOT platform running on the end device computer or mobile.

V. ADVANTAGES

- It is a multi-purpose so that overall conditions are easily measured.
- Easy to operate.
- Compare with compact sensor it gives better performance.
- Modern technologies have developed
- Promotes comfortable and better life which is disease free
- Prevention is better than cure.

VI. APPLICATION

- Medical Science: -Patient monitoring undergoing physiotherapy and patient surveillance. As we need of proper counselling for health. And this need must be satisfied, because this entire database stored in one place which can be used for further patient's recovery as early as possible. So, it provides the most medical help to patient and doctor as well as to the family members of patient.
- Sports Science: -For analysis of sport rehabilitation exercises, Recognition of physical activities and the intensities.
- For Military: -Military the most important for nation development, here we can also use this project for monitoring the soldier to know the day-to-day routine of them and this database use for the improvement of soldier and health therefore increase efficiency of nation's military.
- And Other: -Human motion capture and analysis, For interactive dance performance, Human motion tracking for rehabilitation, For exercise.

VII. CONCLUSION

A new approach for remote measurement and monitoring of the human body parameters based on a wearable wireless sensor network has been presented. The proposed design will be able to effectively measure and monitor human body parameters collectively. The system uses wearable sensors, Wi-Fi standard wireless communication protocol for data transfer between the sensors node and coordinator. The coordinator allows transfer of data from sensor nodes to the IoT cloud environment, which will allow monitoring of all human body parameters on IoT platform effectively. In this paper, we propose a power-aware IoT based smart health monitoring using WBAN technology based on the present status of data and battery/source. The solution proposed is a generic for different subsystems involved in the architecture. The results obtained contribute significant power saving to the state of the art work. The proposed architecture saves the power consumption in WBAN up to 27% compared with the conventional architectures. The most important part of the project is that it monitors a moving patient rather than a stationary or a bedridden patient. This system ensures that the patient receives medical attention in the nick of time before it is too late.

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