Smart Health Monitoring System Based on IoT Using Red-Actaton

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Abstract — Human Body communication is a developing field through which data is transmitted and received using body channel communication. In Internet of Things (IoT), large amount of data are processed and communicated through Human body communication .Health monitoring and prediction is most important now a days since number of patients and diseases are increasing in recent years. Hence efficient smart health care equipment is required. Hence a power management technique for prolong and continuous ECG monitoring based on critical data and energy level of battery is proposed in this paper. In this Health Monitoring System which is based on IoT, wearable devices can be connected to monitor different biomedical signals such as ECG, Breathing level and Temperature. In order to ensure continuous monitoring of health over a long period of time in Wireless Body Area Network (WBAN), power management is a key requirement. 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, Human Body Communication (HBC), Wireless Body Area Network (WBAN)

I. INTRODUCTION

IoT application in the health sector are increasing now a days and proves to be very efficient and user friendly system. 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 HBC can significantly improve the health and wellness of individuals by detecting critical health conditions. Developing tiny wearable devices integrated in HBC demands low power nodes for sensing, processing and communicating data.

Human body Communication is a short-range wireless in the vicinity of, or inside a human body by using the human body as a propagation medium. Since HBC can transfer in high data rates while maintaining low power consumption, and provide high security and integration with in body worm device, HBC provide great potential for wearable device. For efficient utilization of power, lightweight protocols are used that can extend lifetime of IoT enabled system. These protocols communicate from source node to sink node with lowest number of intermediate devices to decrease power consumption

In Existing System, a power management technique based on critical data is implemented for prolong and continuous ECG monitoring. This architecture saves power consumption upto 27%. In proposed system, low power smart health monitoring system using human body communication is developed. The proposed architecture saves up to 50% power consumption in WBAN compared to the conventional architecture without incurring significant overhead.

Section II: To describe the Objective of the project, Section III: Literature survey of the project, Section IV: Methodology of the project, Section V: Advantages of the project, Section VI: Verification and Results, Section VII: Conclusion and Future Scope and Section VIII: References.

II. OBJECTIVE:

Human body communication is the medium used to transfer information about health using human body tissues. Routine monitoring of health parameters such as Temperature, Blood pressure, Heart rate etc., is essential in this pandemic period. Hence the Low power smart health care monitoring system is developed which is simple to handle, reliable and low cost. This prototype model uses various sensors to monitor the above mentioned health parameters. Wearable IoT devices have more demand in the market, due to the availability of Internet for a affordable rate and easy accessibility. IoT enabled devices act as efficient device for sharing and storing data.

Following are some important objectives of healthcare monitoring system:

- To get the information about human health in real time via IoT wearable device.
- Analysis and Prediction of chronic disorders in primary stage.
- To bring IoT-based healthcare monitoring solutions, anywhere, anytime.

III. LITERATURE SURVEY

J.Lavanya, N.Syed Suhail Ahmed, S.Sai Prakash, T.Divya, A.Manikandan designed a system as health monitoring system, where human body acts as a communication medium and the received data is stored in server or cloud platform which can be accessed anytime and anywhere. The energy from the human body acts as the transmission medium which enables the sensor to provide faster information with less noise and better efficiency. The main objective of the system is to produce cost effective system with real time implementation.

Mehmet Tastan proposed a wearable device is designed to measure vital values such as HR, HRV, CT and also the real time location of the patient is sent to the connected people.The pulse sensor on the device and the heart related data from the patient's fingertip are analyzed with the Arduino Pro Mini controller. The results of this analysis are transferred to the patient's Family member, Doctor, Patient’s mobile phone via Bluetooth connection.

Shovan Maity designed a Capacitive VM HBC based wearable health monitoring system, which enables low energy, secure communication necessary for such energy constrained systems. A COTS based implementation of such a system is represented and the key design challenges highlighted. The low BER and 8.2X power efficiency of the HBC based system shows its advantage over wireless system.

Z Shuang proposed proposed the idea of medical monitoring system of wireless and elaborated the systems principle of work. It promotes the development of medical monitoring system to provide health monitoring of the patient. The issues such as transmission safety security and control issues related to portable devices need to be further perfected.

R.Nivetha, S.Preethi, P.Priyadharshini, B.Shunmugapriya, B.Paramasivan, J.Naskath designed presented a low-power wearable IoT system for active and assisted living healthcare applications. The preliminary performance evaluation results have demonstrated the efficiency of the proposed system despite being a low-cost one. This makes the proposed system a good candidate for implementing a wide set of wearable healthcare systems. Our future work will include how to secure the access of the data and will develop a mobile application that allows access of the data on handheld devices.

IV. METHODOLOGY:

The proposed system is designed using the architecture PIC Microcontroller. The sensors such as Temperature sensor, Heart rate Sensor and Respiratory sensor provide required inputs to PIC Microcontroller. Temperature sensor measures the temperature of its environment and converts the input data into electronic data to record monitor or signal temperature changes. Respiratory sensor is high-quality sensors in respiratory devices measure minute flow rate around the zero point of the respiratory flow. An Heart rate sensor is used to measure the Pulse waves. A transreceiver named Red-Taction is used for Human Body Communication. The TTL to RS-232 converter is an isolated module. It has receive and transmit LED indicators on the module. It operates on 5V supply. These components are connected into personal computer and the cloud. The Medical server, emergency monitoring and doctors are connected to the IoT. Through cloud, the health condition of the person will be monitored continuously and in case of any emergency/critical situations, the patient will be given medical service immediately.

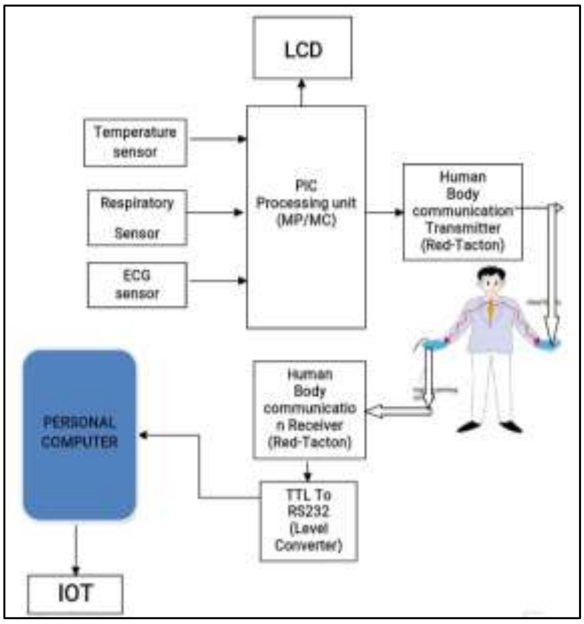

Fig. 1. Block Diagram of the system

A. PIC Microcontroller:

PIC (usually pronounced as "pick") is a family of microcontroller made by Microchip Technology, derived from the PIC1650 originally developed by General Instrument's Microelectronics Division. The name PIC initially referred to Peripheral Interface Controller, and is currently expanded as Programmable Intelligent Computer. The first parts of the family were available in 1976; by 2013 the company had shipped more than twelve billion individual parts, used in a wide variety of embedded systems.

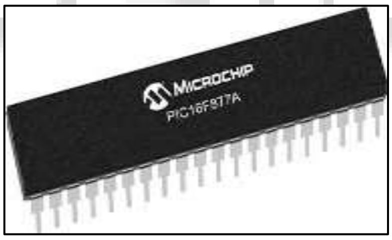

Fig. 2. PIC Microcontroller

B. Temperature Sensor:

A temperature sensor is an electronic device that measures the temperature of its environment and converts the input data into electronic data to record, monitor, or signal temperature changes.

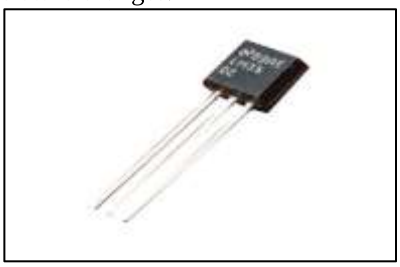

Fig. 3. Temperature Sensor

C. Respiratory Sensor:

The respiration sensor is a sensitive girth sensor worn using an easy fitting high durability woven elastic band fixed with a length adjustable webbing belt. It detects chest or abdominal expansion/contraction and outputs the respiration waveform.

Fig. 4: Respiratory Sensor

D. ECG Sensor:

The electrocardiography or ECG is a technique for gathering electrical signals which are generated from the human heart. When someone experiences physiological arousal then the ECG sensor allows us to recognize the level, however, it is also used for understanding the psychological state of humans. So an AD8232 sensor is used to calculate the electrical activity of the heart. This is a small chip and the electrical action of this can be charted like an ECG (Electrocardiogram). Electrocardiography can be used to help in diagnosing different conditions of the heart.

Fig. 5: ECG Sensor

E. LCD Display:

A liquid-crystal display (LCD) is a flat-panel display or other electronically modulated optical device that uses the light-modulating properties of liquid crystals combined with polarizers. Liquid crystals do not emit light directly, instead using a backlight or reflector to produce images in color or monochrome. LCDs are available to display arbitrary images (as in a general-purpose computer display) or fixed images with low information content, which can be displayed or hidden, such as preset words, digits, and seven-segment displays, as in a digital clock. They use the same basic technology, except that arbitrary images are made from a matrix of small pixels, while other displays have larger elements. LCDs can either be normally on (positive) or off (negative), depending on the polarizer arrangement. For example, a character positive LCD with a backlight will have black lettering on a background that is the color of the backlight, and a character negative LCD will have a black background with the letters being of the same color as the backlight. Optical filters are added to white on blue LCDs to give them their characteristic appearance.

Fig. 6: LCD Display

F. Red-Tacton:

RedTacton is a Human Area Networking technology/Wireless Network, which is developed by Robin Gaur Jind that uses the surface of the human body as a safe, high speed network transmission path. It is completely distinct from wireless and infrared technologies as it uses the minute electric field emitted on the surface of the human body. A transmission path is formed at the moment a part of the human body comes in contact with a RedTacton transceiver. Communication is possible using any body surfaces, such as the hands, fingers, arms, feet, face, legs or torso. RedTacton works through shoes and clothing as well. When the physical contact gets separated, the communication is ended.

Fig. 7: Red-Tacton

G. TTL-RS232:

TTL to RS-232 is a bi-directional port powered RS-232 to 5V TTL converter in a 9 pin format. It can convert any standard full duplex RS-232C port to a 5V TTL signal and vice versa. The unit is powered from the RS-232 data lines. It also supports data direction auto-turnaround. Therefore, no external power or flow control is required. The data direction auto-turnaround automatically enables the TTL driver when data is present on the RS-232 side making the device plug-and-play, requiring no software drivers. The TTL-232-5P has a DB9 female connector on the RS-232 side and either a DB9 male connector or 5-way terminal block on the TTL side. Separate terminal block is included in package.

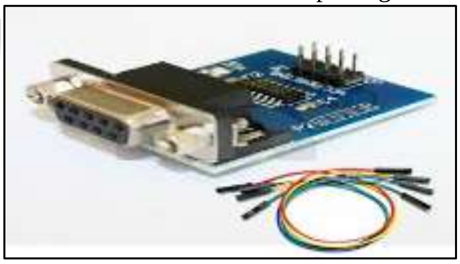

Fig. 8: TTL-RS232

V. VERIFICATION AND RESULTS

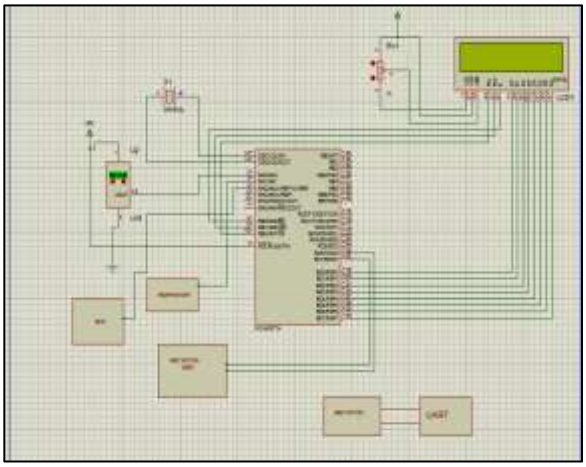

Fig. 9: Schematic Diagram of the system

In the Schematic diagram the ECG, Respiratory, Temperature Sensor are connected as transmitter in the PIC Microcontroller to verify the Heart rate, Temperature and Respiratory level. Then the received data is shown in the LCD Display.

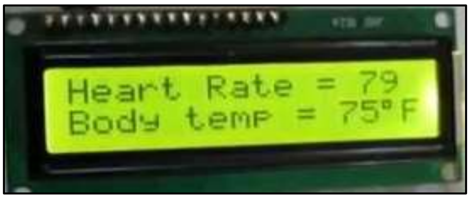

Fig. 10: Output of the system

The output is shown or displayed in the LCD Display as Heart rate, Body Temperature and the Respiratory level by the sensor and through the HBC.

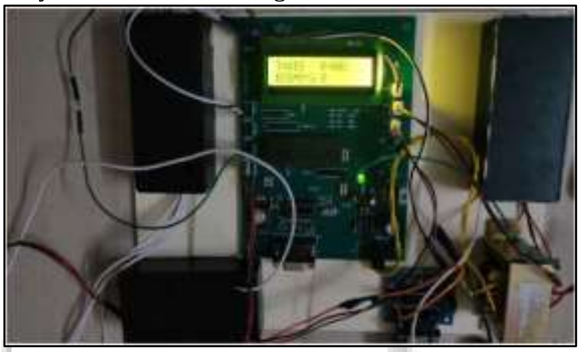

Fig. 11: Phototype of Smart Health Care Unit

Fig. 12: Simulation Output

VI. ADVANTAGES

- Low cost
- Better patient experience
- Improved outcome of Treatment
- Better management of drugs and medicine adherence

VII. CONCUSSION AND FUTURE SCOPE

In this paper, we propose a power-aware smart health monitoring system based on IoT using HBC technology based on the data. A Proposed HBC based on Wearable Health monitoring system tracking method provides low power consumption and protected communication is achieved. The proposed architecture saves the power consumption in WBAN up to 50% compared with the conventional architectures. A detailed implementation and evaluation of controller with multi-level voltage shifter are provided. Also, the impact of using power saving technique like adaptive voltage scaling for communicating critical data in WBAN is discussed.

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