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MPSK MODULATION BASED ENERGY EFFICIENT WIRELESS BODY AREA NETWORK

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Abstract-Energy efficiency is a key for wireless sensor nodes, especially for wireless body area networks (WBAN) in which sensors operate in close vicinity to, on or even inside a human body. WBAN provides a solution for the aging population in many developed areas and for the rising costs of medical care to improve medical health and quality of life. The sensing devices are used to measure the physiological parameters like heartbeat, body temperature, and ECG and the parameters are sent to the remote medical server for further real-time analysis and diagnosis. The energy efficiency of the WBAN with the MPSK modulation technique can be increased through the receive diversity. In the existing system, energy consumption is more as diversity is not used. In proposed system, the energy consumption can be minimized by using receive diversity. Hence the proposed system is an effective solution to improve energy efficiency by using diversity.

Keywords- Energy efficiency, Wireless body area networks, Receive diversity.

I. INTRODUCTION

In recent advances in wireless networks, low-power microelectronics, and mobile computing technologies, Wireless Body Area Network (WBAN) is a special purpose sensor network designed for various medical sensors and appliances, located inside and outside of a human bodytoconnectautonomously. A Wireless Body Area Network connects independent nodes that are situated on the body,in the clothes or under the skin of a person. The network typically expands over the whole human body and the nodes are connected through a wireless communication channel. According to the implementation, these nodes are placed in a star or multi hop topology. In the medical field, for example, a patient can be equipped with a wireless body area network consisting of sensors that measures specific biological functions constantly, such as temperature, blood pressure, heart rate, Electrocardiogram (ECG), respiration, etc. It improves the quality of life for the patient and reduces the hospital costs. In addition that data collected over a longer period and in the natural environment of the patient, offers more useful information, allowing for a more accurate and sometimes even faster diagnosis. However, sensor nodes in WBANs are powered by the limited-energy batteries, which results in the fact that energy efficiency becomes a key issue. Generally, in a sensor node, the total energy comprises circuit energy and transmission energy, which are consumed by circuit components and transmitted signal, respectively. In a sensor node, the total energy consumption comprises of two components-transmission energy and circuit energy (Cui S. et al., 2005), (Wang L. et al., 2013). Though the advent of low power Very Large Scale Integration (VLSI) technology made circuit power consumption increasingly smaller, it is comparable with the transmission energy due to smaller transmission distance in WBAN (Channel Model for Body Area Network, 2009). Therefore, in the recent past, a significant amount of research has been carried out in the improvement of energy efficiency in WBAN. In (Uysal-Bikikoglu E. et al., 2002), an energy efficient algorithm for the minimization of transmission energy by increasing transmission duration is presented. A hybrid transmission mechanism for optimizing the energy consumption in wireless sensor networks was proposed in (Jinfeng Dou et al., 2010). A method for the organization of energy efficient wireless sensor network is presented in (Zhu J. and Papavassiliou S., 2003) to improve the network lifetime. Although circuit energy consumption is increasingly smaller with development of low-power microelectronics, it cannot be ignored for WBANs in which the transmission distance is at most 3m or 5m. [6] discussed about a method,

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Optimality results are presented for an end-to-end inference approach to correct(i.e., diagnose and repair) probabilistic network faults at minimum expected cost. One motivating application of using this end-to-end inference approach is an externally managed overlay network, where we cannot directly access and monitor nodes that are independently operated by different administrative domains, but instead we must infer failures via end to-end measurements. We show that first checking the node that is most likely faulty or has the least checking cost does not necessarily minimize the expected cost of correcting all faulty nodes. In view of this, we construct a potential function for identifying the candidate nodes, one of which should be first checked by an optimal strategy.

II. PROPOSED SYSTEM

A. RECEIVE DIVERSITY

Receive diversity uses two separate, collocated antennas used for transmit and receive functions. Such a configuration eliminates the need for a duplexer and can protect sensitive receiver components from the high power used in transmit.Antenna diversity, also known as space diversity or spatial diversity is one of several wireless diversity schemes that uses two or more antennas to improve the quality and reliability of a wireless link system. Antenna diversity is especially effective at mitigating these multipath situations. Complex design requirements are needed as themultiple signals have a greater processing demand placed on the receiver. Typically, however, signal reliability is paramount and using multiple antennas is an effective way to decrease the number of drop-outs and lost connections.

B. DESIGN MODEL

The proposed model of Energy efficient WBAN receive diversity (EEWBANRD) is implemented with the model consisting of one transmitting antenna and many number of receiving antenna. The energy model for WBAN, in the sensor nodes are defined as implant, body surface, and external nodes (*C*hannel Model for Body Area Network *(*BAN), 2009). Based on these node definitions, the IEEE 802.15.6 devices can be operated at the identified scenarios, which can be grouped into different classes by the same Channel Models (CM), together with their description and frequency band. For example, CM3 is a radio communication link from body surface to body surface covering the frequency band 13.5, 50, 400, 600, 900MHz, 2.4, 3.1–10.6GHz, whereas CM1 is a link for implanted nodes operating in frequency band 402 − 405MHz, by which, the data sensed by implanted biosensor is transmitted to external Central Processing Unit (e CPU) across tissues in the human body. CM3 is applied from body surface to body surface between a wearable biosensor and the e-CPU The half-duplex operation is thus adopted in this work because of many other advantage (J.Abouei,et.al.,2011). Our main purpose is to reduce the biosensor energy consumption for achieving a significant energy saving. Once receiving the control information from the e-CPU before the uplink transmission period, the biosensor is wake up to Active-mode (denoted by T_{act}) from Sleep mode (denoted by T_{sleep}) after a short-time TRANSIENT-mode (denoted by $T_{sleep\rightarrow act}$). During the ACTIVE-mode, the weak raw signal sensed by the wearable biosensor is passed through amplification and filtering processes, then the filtered signal is modulated by a modulation scheme and is transmitted to e-CPU across the communication link around the human body. When finishing transmitting the sensed data, the biosensor would switch to SLEEP-mode with duration T_{sleep}after a short-time TRANSIENT mode (denoted by $T_{act\rightarrow sleep}$) for energy saving, and at this time, most of the circuits of the transceiver are powered off. Such process comes round full circle.

Therefore, the duty-cycling covers ACTIVE-, SLEEP-, and TRANSIENT-modes to make biosensor keep on or off. At the TRANSIENT-mode, the transient duration denoted as T_{tr} consists of the switching time from sleep mode to active mode ($T_{sleep\rightarrow act}$) and the reverse process ($T_{act\rightarrow sleep}$). It is worth noting that, the transition duration $T_{tr}= T_{sleep\rightarrow act}+ T_{act\rightarrow sleep}$ is an order of magnitude smaller than the ACTIVE-mode duration T_{act}, which results that the transient energy can be assumed negligible(S. Cui ,et al., 2005). On

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the other hand, for future generation CMOS circuits which would be built with the smaller geometries, but the power consumed in SLEEP-mode cannot beapproximated(Y. Li, et al.,2011).

In addition, the ACTIVE-mode power Pac is mainly composed of the power amplifier (PA) power $P_{PA}$and circuit power $P_{circuit}$in the whole signal path, where $P_{circuit}$ could be assumed as a constant. The PA power P_{PA}consists of the transmission power $P_{tr}$and the amplifier circuit power with the PA drain efficiency ρ and the peak-to-average ratio (PAR). The link CM3 is applied with frequency band and thus the corresponding path loss model E_ loss and B_ loss are coefficients of linear fitting, d is the Tx-Rx distance in mm, and F_ loss is a normally distributed variable with standard deviation N_1Assume MPSK modulation is employed by IEEE 802.15.6 standard [15].

It shows that the total energy $E_T$comprises circuit energy $E_C$and transmission energy E_{Tr}.As for this case, it can optimize the transmission datarateR to reduce the total energy consumption. Based on the trade -off between the transmission energy and the circuit energyand the threshold distance $d_{thre}$by the derivative of $E_{bit}$with respect to R at the minimum transmission data rate R_{min}.
To minimize the total energy, we should determine the range of transmission data rate to make $R \in [R_{min}, R_{max}]$with the maximum rate R_{max}(E. Uysal-Biyikoglu, et al., 2002).Since the WBAN devices operate in the vicinity to a human body, they should transmit lower power when possible in order to reduce interference to other devices and systems, and to protect the safety of the human body.
So the energy consumption model is very important to build up the channel characterization from medical and or non-medical devices, which are placed on, close to, or inside the human body is analysed.

IV. SIMULATION RESULTS

The tool is mat lab simulator is used to check the proposed protocol and to compare the without and with diversity to improve the energy efficiency.

A. ENERGY CONSUMPTION ANALYSIS

In the energy consumption analysis to discuss relationship among E_T, E_C, E_{Tr}, d and data rate R. we have considered the channel mode 3covering some frequency band.In the figure 4.1 shows the energy per bit (J) over data rate R with distance d=50mm. It can be observed from the figure when the data rate increases and energy per bit decreases.

whereP_{act}, P_{slp} are the power consumed in the ACTIV

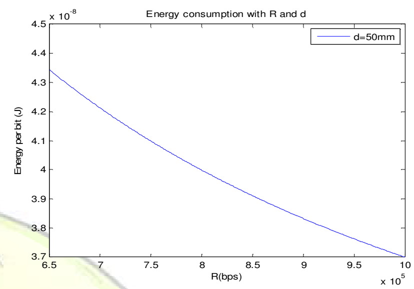

Figure 1 Energy consumption data rate versus distance

In the figure 2 shows that the effect of $E_{bit}$with respect to R for different values of distance d. It is seen that the energy consumption is convex with data rateand not a monotonically increasing function of R. It can be observed that, when data rate and distance increases becomes optimized at some point.

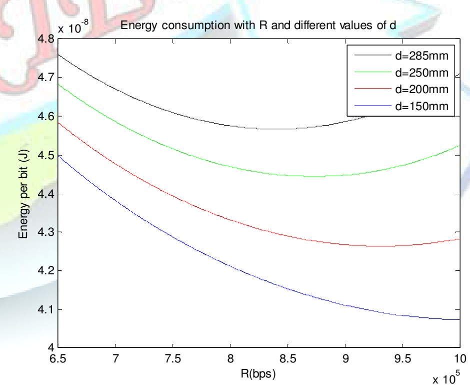

Figure 2 Energy consumption data rate R versus different values of d

B. ENERGY CONSUMPTION PER BIT WITHOUT DIVERSITY

In the Figure 3 shows the performance of the energy consumption of chenfu optimized scheme and baseline scheme. From the figure, it is clearchenfu optimized scheme consumes less energy than baseline scheme for all distance values considered.

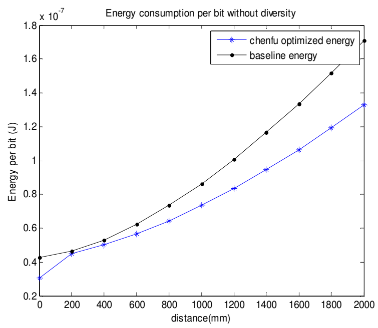

Figure 3 Energy consumption per bit without diversity

C.ENERGY CONSUMPTION PER BIT WITH DIVERSITY

In the figure 4 shows compares the energy consumption per bit of proposed EEWBANRD with Mr=2 and baseline scheme. The proposed EEWBANRD consumes lesser energy than baseline scheme at all distances values considered.

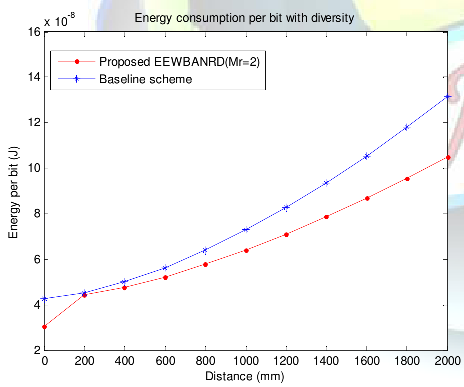

Figure 4 Energy consumption per bit with diversity (Mr=2)

Thus the comparison of without and with diversity of modulation technique (MPSK) in WBAN was done.

IV. CONCLUSION

In the paper an energy model for M-PSK based WBAN is proposed and its energy efficiency is investigated. Two schemes-Rate Optimized scheme and Optimum Energy Consumption using Receive Diversity scheme are proposed. In Rate Optimized scheme, data rate is varied according to transmission distance to ensure minimum total energy consumption. In Optimum Energy Consumption using Receive Diversity scheme, receive diversity is utilized along with rate optimization to minimize the total energy consumption further. An EEWBANRD algorithm is implemented to improve the energy efficiency. Simulation results substantiate that the presented receive diversity can improve the energy performance for wireless body area networks.

V. FUTURE WORK

The future work includes proposing a technique to minimize the delay, improve throughput and the network lifetime by employing MQAM (M-ary Quadrature Amplitude Modulation).

VI. REFERENCES

[1]Aravind Kailas, Lakshmi Thananyankizil and Mary Ann Ingram (2008), 'A simple cooperative transmission protocol for energy-efficient broadcasting over multi-hop wireless networks', in Journal of communications and networks, Vol. 10, No. 2.

[2] Cui S., Goldsmith J.A. and Bahai A. (2004), 'Energy-efficiency of MIMO and cooperative MIMO techniques in sensor networks', in IEEE J. sel. areas communication, Vol. 22, No.6.

[3] Cui S., Goldsmith .J.A. and Bahai A. (2005), 'Energy-constrained modulation Optimization' in IEEE Transactions on wireless communication, Vol. 4, No. 5.

[4] Gai Y., Zhang L. and Shan X. (2007), 'Energy efficiency of cooperative MIMO with data aggregation in wireless sensor networks' in Proc. IEEE Transactions on wireless communication networks Vol. 12, No. 5.

[5] HadyAbdelSala S., Syed Rizvi and Stephan Olariu R. (2009), 'Energy-Aware Task Assignment and Data Aggregation Protocols in Wireless Sensor Networks', in IEEE Transactions on wireless communication, Vol. 16, No.6.

[6] Christo Ananth, Mona, Kamali, Kausalya, Muthulakshmi, P.Arthy, "Efficient Cost Correction of Faulty Overlay nodes", International Journal of Advanced Research in Management, Architecture, Technology and Engineering (IJARMATE), Volume 1,Issue 1, August 2015,pp:26-28

[7] Jayaweera K.S. (2006), 'Virtual MIMO-based cooperative communication for energy-constrained wireless sensor

networks', in IEEE Transactions on wireless communication, Vol. 5, No. 5.

[8] Keong C.H., Thotahewa S.M.K. andYuce R.M. (2013), 'Transmit-only ultra wide band body sensors and collision analysis', in IEEE Transactions on wireless body area networks Vol. 13, No. 5.

[9] Li H., Yi C., and Li Y. (2013), 'Battery-friendly packet transmission algorithms for wireless sensor networks', in IEEE Sensors J., Vol. 13, No. 10.

[10] Muhammad Kamran Naeem, Mohammad NuruzzamanPatwary, Abdel-Hamid Soliman and Mohamed Abdel-Maguid (2014), 'Cooperative transmission schemes for energy-efficient collaborative wireless sensor networks', in IET Science, Measurement and Technology, Vol. 8, No. 6.

[11] Pate M. and Wang J. (2010), 'Applications, challenges, and prospective in emerging body area networking technologies', in IEEE Transactions on Wireless Communication, Vol. 17, No. 1.

[12] Poon Y.C.C., Zhang T.Y. and Bao D.S. (2006), 'A novel biometrics method
to secure wireless body area sensor networks for telemedicine and m-health', in IEEE Communication, Vol. 44, No. 4.

[13] Raveendranathan N. et al., (2012), 'From modeling to implementation of virtual sensors in body sensor networks', in IEEE Sensors J., Vol. 12, No. 3.

[14] Uysal-Biyikoglu E., Prabhakar B., and ElGamal A. (2002), 'Energy-efficient
packet transmission over a wireless link', in IEEE/ACM Trans. networks, Vol. 10, No. 4.

[15] Wang L., Wang P., Yi C. and Li Y. (2013), 'Energy consumption optimization based on transmission distance for wireless on-body communication', in Proc. IEEE Int. conf. wireless communication signal process, Vol.34, No.6.

[16]Weiwei Fang, Feng Liu, Fangnan Yang, Lei Shu, and ShojiroNishio (2010), 'Energy-efficient cooperative communication for data transmission in wireless sensor networks', in IEEE Transactions on consumer electronics, Vol. 56, No. 4.

[17] Wu D., Cai Y., Zhou L., and Wang J. (2012), 'A cooperative communication scheme based on coalition formation game in clustered wireless sensor networks', in IEEE Transactions wireless communication, Vol. 11, No. 3.

[18] Zhang J., Cai L., Gao Q., and Peng X. (2011), 'Energy efficient multihop cooperative MISO transmission with optimal hop distance in wireless adhoc networks', in IEEE Trans. Wireless Communication, Vol. 10, No. 3.

[19] Zhu J. and Papavassiliou S. (2003), 'On the energy-efficient organization and the lifetime of multi-hop sensor networks', in IEEE Communication Letts., Vol. 7, No. 11.

[20] Senthil Kumar K., Amutha R ., 2015, 'Energy efficient cooperative communication in wireless sensor networks using turbo codes', Australian Journal of Electrical and Electronics Engineering, vol. 12, no. 4, pp. 293-300, ISSN: 1448-837X, (Annexure II). IF - 0.028.

[21]K. Senthil Kumar, R. Amutha, and TLK. Snehapiriya, "Energy Efficient V-MIMO using Turbo Codes in Wireless Sensor Networks," in Second IEEE International Conference on Computing and Communication Technologies (ICCCT'17), pp. 1-6, 23rd – 24th February 2017, Sri Sai Ram Engineering College, Chennai.

[22]Senthil Kumar K., Amutha R ., 2016, 'Delay efficiency analysis of turbo coded cooperative communication in wireless sensor networks', Australian Journal of Basic and Applied Sciences, vol. 10, no. 1, pp. 451-456, ISSN: 1991-8178.

[23] Senthil Kumar K., Amutha R., 2016, 'Energy efficient cooperative communication using QOSTBC in wireless sensor networks', International Journal of Advanced Engineering Technology, vol. 7, no. 1, pp. 244-251, E-ISSN:2309-8414, (Updated list).

[24] Senthil Kumar K ., Amutha R ., 2016, 'An algorithm for energy efficient cooperative communication in wireless sensor networks', KSII Transactions on Internet and Information System vol. 10, no. 7, pp. 3080-3099, ISSN: 1976-7277, (Annexure II). IF - 0.365.