Energy efficient communication in wireless networks by using Ternary with silent symbol technique

Archana Pandurang Kumbhar[1], Dr. Lalit Wadhwa[2]
[1, 2] Department of Electronics and Tele-communication
[1] Dr. D Y Patil Institute Of Engineering And Technology,
[2] Savitribai Phule Pune University, Pimpri , Pune, India

Abstract- *Wireless sensor networks consist of number of sensor nodes which are having sensing, computation and wireless communication capabilities. These sensor node are used to collect, transmit and process data in monitored area. In WSN it is very difficult to replace the batteries, thus energy efficient communication is important part in WSN. As we know wireless sensor networks can work on very low power as well as can use low cost components. Due to this attributes of wireless sensor networks it can be used in radios with only simple modulation methods such as ASK, OOK and FSK. In this paper, we proposed an energy efficient communication system for wireless sensor networks that is based on the ternary number system encoding of data which is termed as Ternary with Silent Symbol. In this system silent symbol technique is used to convert data from binary2ternary. TSS saves the energy simultaneously both at transmitter and receiver.*

Keywords- Wireless networks, sensor networks, ternary encoding, silent communication, Energy-efficient communication

I. INTRODUCTION

Wireless sensor networks are collections of sensors that are equipped with a radio and form a wireless network together. Fast and easy deployment, and low maintenance cost are main advantages of wireless sensor networks. Energy is a scarce resource in such networks, which has a great impact on the design of hardware and software. The easiest way to reduce energy consumption is to turn the radio when it is not needed.

In most existing transmission schemes not only utilize non- zero voltage level for both 0 and 1. For the entire duration of transmission of data they keep switched on both transmitter and receiver. To reduce energy consumption researches focus on the MAC layer design [5], [6], [7], optimizing data transmission through intelligent selection of paths. The Proposed system for WSN on average require low cost devices and low power operations. Thus, modulation techniques such as ASK, OOK and FSK with radios are usually employ in such networks. We propose a energy efficient communication scheme for wireless sensor networks that is based on the redundant radix based number representation for encoding and transmitting data. RBNSiZeComm protocol communication scheme is parallel in concepts TSS.

Communication through Silence [6}is a new communication scheme, includes the use of silent periods opposite to EbT. In CtS a minimal amount of energy is used to deliver information between sensors along with use of silence. There are some drawbacks in CtS like exponential in communication time. So an alternative strategy, Variable Based Tactic Communication was design in [5], that uses a variable coding base to control the trade –off between network throughput and energy is saving. VarBaTac is used to minimize the delay introduced by CtS.

II. BASIC IDEA ABOUT TSS

TSS is based on ternary number system which encodes data for low power wireless sensor networks. TSS gives an efficient algorithm for conversion from binary2ternary and vice versa, it involves only addition. TSS not only saves energy at transmitter but also at receiver. As we know modulation techniques are several, applications requiring in radios with only simple modulation methods such as ASK, OOK and FSK. This proposed transceiver design uses a hybrid modulation scheme

To address the MAC protocols along with adequate physical layer awareness is needs for analysis of the energy-efficiency of a communication approach. However, in this work we do not address the issues related to MAC protocols and make an effort to improve the energy efficiency with physical-layer centric approach. We study the performance of the proposed ternary TSS protocol for noisy channels with a new transceiver design.

III. ALGORITHM

For binary2ternary conversion, starting from its msb position we scan every two bits of the binary message and convert the leftmost part of the binary message to its equivalent ternary symbol. To do this, we replace the currently scanned bit-pair by either a single ternary digit, and then add it to four times the so far obtained ternary number T from all the previous bit positions. This addition will be in ternary number system, and the multiplying factor four is to adjust the weight of T with respect to the currently scanned bit-pair. Since this addition will be in ternary number system, the weight of four be assigned to T by addition of two ternary number T0 and 0T. The equivalent ternary representation of the part of the binary message from its msb to currently scanned bit-pair will then be obtained as T0⊕0T⊕x.

A. Algorithm Binary to Ternary

procedure Binary2Ternary(IN **bit vector** *B*, **integer** *n*, OUT **ternary number** *T*)
/* Initialization */
if *bn*−1*bn*−2 = 00 **then**
T ← 0;
end if
if *bn*−1*bn*−2 = 01 **then**
T ← 1;
end if
if *bn*−1*bn*−2 = 10 **then**
T ← 2;
end if
if *bn*−1*bn*−2 = 11 **then**
T ← 10;
end if
for *i* = *n* − 3 **downto** 1 **step -2 do**
if *bibi*−1 = 00 **then**
T ← *T*0 ⊕ 0*T*;
end if
if *bibi*−1 = 01 **then**
T ← *T*0 ⊕ 0*T* ⊕ 1;
end if
if *bibi*−1 = 10 **then**
T ← sT0 ⊕ 0*T* ⊕ 2;
end if
if *bibi*−1 = 11 **then**
T ← *T*0 ⊕ 0*T* ⊕ 10;
end if
end for
end procedure

By using ternary to binary algorithm reconversion of received ternary message to binary form is done. Our proposed TSS communication strategy combines these two strategies to derive an energy efficient communication scheme

B. Algorithm Ternary to Binary

procedure ternary2binary(IN **ternary number** *T*, **integer** *m*, OUT **binary number** *B*)
/* Initialization */
if *tm*−1 = 0 **then**
B ← 00;
end if
if *tm*−1 = 1 **then**
B ← 01;
end if
if *tm*−1 = 2 **then**
B ← 10;
end if
for *i* = *m* − 2 **to** 0 **step -1 do**
if *ti* = 0 **then**
B ← *B*0 + 0*B*;
end if
if *ti* = 1 **then**
B ← *B*0 + 0*B* + 1;
end if
if *ti* = 2 **then**
B ← *B*0 + 0*B* + 10;
end if
end for
end procedure

IV. IMPLIMENTATION

For noisy networks the hypothetical examination of the energy savings created at the transmitter. Here, we undertake that the channel noise is additive white gaussian noise. We assume that the transmitter uses FSK modulation with two frequencies -fc and fc + Δf, corresponds to symbol 1 and 2, respectively and is switched off during 0's. Here, as shown in figure 2, we use a non-coherent detection based receiver with a schematic structure.

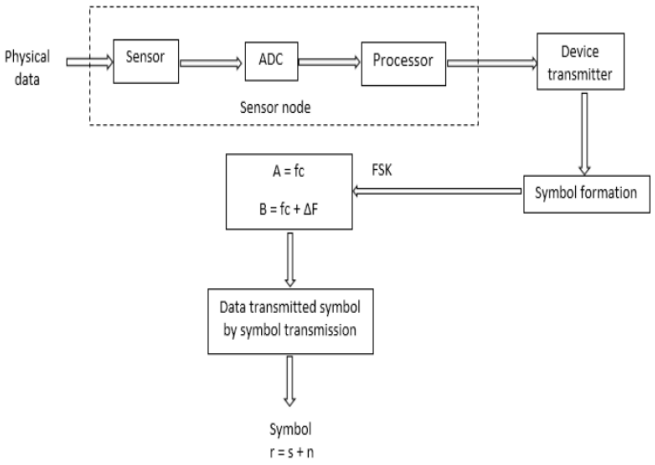

Figure 1. Representative Transmitter for TSS scheme

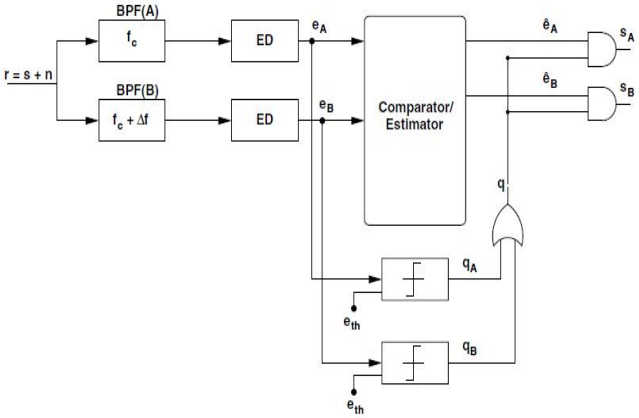

Figure 2. Representative receiver for TSS scheme

As shown in fig. 1, r = s + n , r is the signal received at the input of the receiver which consists of the transmitted signal s and the channel noise n. This signal r is first passed through two band pass filters, shown in fig.2.

V. APPLICATION SCENARIOS

Due to the evolution in 3G cellular telephony has lead to many new applications, such as remote healthcare systems. Smartphone is the choice for wireless remote healthcare. A medical sensor is attached to the body to create body area network. The information over the cellular network to a central processing center is relay through smartphone.

Farms, vineyards are the Another application of energy efficient wireless sensor networks deployed in[8]., the collected information through sensor networks consist of various data such as temperature, relative humidity, solar radiation and soil composition, etc. TSS is beneficial for farmer because it provides the saving of energy both at transmitter and reception.

VI. CONCLUSION

In this paper we presented TSS is a energy efficient communication scheme which saves energy not only at transmitter but also in receiver. The algorithm only require addition for the conversion of binary2ternary and vice versa. The usefulness of TSS for low power wireless sensor networks, particularly for multihop communications.

VII. ACKNOWLEDGEMENT

I would like to take opportunity to express my depth of gratitude to my Project Guide Dr. Lalit wadhwa , our M.E. coordinator Prof. S. D. Chavan, our H.O.D. Dr.. S. R. Jog for their consistent encouragement in the preparation of this paper.

REFERENCES

[1] Hemant H. Mutha, Dr. Abhay Wagh, "Implementation of Energy Efficient scheme for wireless communication network", International Journal of Modern Trends in Engineering and Research e-ISSN No.:2349-9745, 4 July 2015.

[2] Koushik Sinha, "A New Energy Efficient MAC Protocol based on Redundant Radix for Wireless Networks", Honeywell Technology Solutions, Bangalore, 15 June 2016.

[3] Josna Jose, Joyce Jose, "Asymmetric Concealed Data Aggregation Techniques in Wireless Sensor Networks: A Survey", I.J. Information Technology and Computer Science, MECS 5 April 2014.

[4] Harmanjit Kaur, " Survey on Routing Protocols of Wireless Sensor Networks", International Journal of Advanced Research in Computer Science and Software Engineering, Volume 5, issue 4 April 2015.

[5] Yuanzhu Peter Chen, Dan Wang and Jian Zhang, "Variable-Base Tacit Communication: A New Energy Efficient Communication Scheme for Sensor Networks", Memorial CS technical report, December 2005.

[6] Y. Zhu and R. Sivakumar, "Challenges: communication through silence in wireless sensor networks," Proc. Intl.Conf. on Mobile Comp. and Networking (MobiCom), pp. 140–147, 2005.

[7] Eleazar Chukwuka1 and Kamran Arshad, "Energy efficient MAC protocols for wireless sensor network : A

survey", 10 September 2013.

[8] Jenna Burrell, Tim Brooke, and Richard Beckwith, " Vineyard Computing: Sensor Networks in Agricultural Production", IEEE Pervasive Computing, February 2004.

[9] Koushik Sinhaa¤, Suranjan Ghoseb, Pradip K. Srimani, "Fast Deterministic Broadcast and Gossiping Algorithms for Mobile Ad hoc Networks", J. of Par. & Dist. Comp. (JPDC), vol. 68(7), pp. 922–938, 2008.

[10] J. Polastre, R. Szewczyk and D. Culler, "Telos: enabling ultralow power wireless research," Proc. Intl. Symp. on Inf. Processing in Sensor Networks, pp. 364–369, 2005.

[11] I. F. Akyilidiz, W. Su, Y. Sankarasubramaniam and E. Cayirci, "Wireless sensor networks: a survey," Computer Networks, vol. 38, no. 4, pp. 393–422, March 2002.

[12] C. Enz, A. El-Hoiydi, J.-D. Decotignie and V. Pereis, "WiseNET: an ultralow-power wireless sensor network solution," IEEE Computer, vol. 37, no. 8, pp. 62–70, 2004.

[13] J. N. Al-Karaki and A. E. Kamal, "Routing techniques in wireless sensor networks: a survey," IEEEWireless Communications, vol. 11, no. 6, December 2004.

[14] Prachi Pandey1, Somesh Kumar Devangan, " A High Speed, Delay Tolerant Hybrid MAC for Collision Free, Reliable Communication in Wireless sensor network", International Journal of Science and Research (IJSR) , Volume 4, 6 June 2015.

[15] Y. P. Chen A. L. Liestman and J. Liu, "Energy-efficient data aggregation hierarchy for wireless sensor networks," Proc. 2nd Int. Conf. on Quality of Service in HeterogeneousWired/Wireless Networks (QShine '05), Orlando, Florida, 2005.

[16] K. Sinha, "An energy efficient communication scheme for applications based on low power wireless networks," to appear in Proc. 6th IEEE Consumer Communications and Networking Conference (CCNC), Las Vegas, USA, Jan. 10–13, 2009.

[17] J. G. Proakis, Digital Communication, McGraw-Hill, 4th ed., 2000.