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Compressed sensing of ECG signals through zigbee sensor networks

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Abstract - *Zigbee Sensor networks are used for transferring data from one place to the other. In the field of medical science zigbee sensor networks are widely used for transmitting signals of patients to the doctor PDA's through nurse PDA's attached by various duty cycles. ECG signals are acquired through duty cycles with the help of zigbee sensor networks. ECG telemonitoring can be attained by: reduces the amount of data that should be transferred, compressed the data so the loss of bits should be reduced. The DWT is applied for transmitting data from sender to receiver. After that the IDWT is applied for converting the signals into its original form. Compressed sensing reduces the compression ratio so the energy efficiency of zigbee sensors with different duty cycles analyse data under various load conditions. The matrices used in performance evaluation are compressed in transmit mode and decompressed in receiver mode using MATLAB.*

Key Words: WBAN, Zigbee, compressed sensing, DWT, IDWT,AWGN

1.INTRODUCTION

Due to increasing medical technology, delivery of health care services also increased day by day. WBAN is the most widely used sensor networks used in the hospitals for monitoring the patients' medical conditions. Zigbee sensor networks are ultra-low power sensors that terminate signals from one place to another via internet. ECG signals are one of the most using signals for monitoring and analysing in the hospitals wards connected through nurse PDA's and doctor PDA's. As compared to Bluetooth, zigbee is the low cost, small range and low power sensor networks which have not any connectivity issues.

Energy consumption of WBAN divided into three main procedures:

Compressed Sensing

Wireless communication

Data Processing

WBAN allows user to store collected data on Phone, iPod, PDA (Personal Digital Assistant) or any portable device, then the user is able to transfer this information to any computer. So, WBAN is personalized medicine and home e-based e-Health. The energy required in transferring signals from transmitter to receiver consumes extra bits. So to reduces the loss of bits compressed sensing technique is used at both transmitter and receiver point. DWT and IDWT techniques are applied for converting the signals into proper form.

2. COMPRESSED SENSING

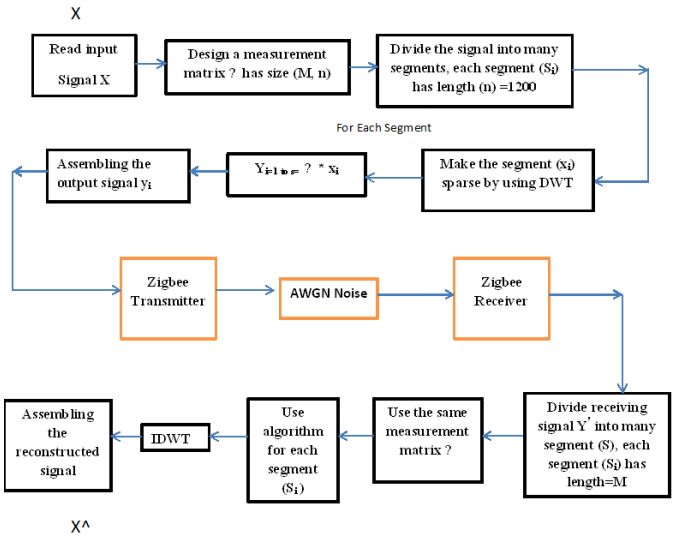
Compressed sensing is an innovative data compression pattern; it stands for a linear under determined problem, where the underlying sampled signal is sparse. The challenge in CS is to reconstruct this sparse signal from few measurements as possible as it could. The standard CS theorem is based on a sparse signal model and uses an undetermined system of linear equations.

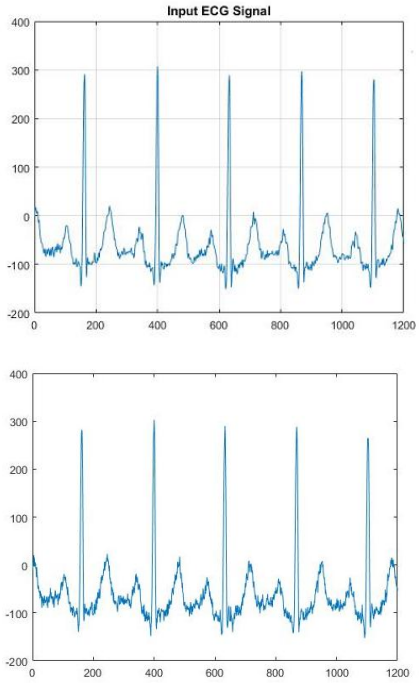
In this paper compressed sensing technique is used for transferring data from the transmitter to receiver with the help of AWGN channel.

3. EXPERIMENTS

The experiments are performed on MATLAB. We used compressed sensing technique for compressing ECG signals because it works well on sparse signals. MATLAB 2016 is used for simulation results.

CS provides approaches for reconstructing a input signal x ∈ RN that is the read input signal. The ratio of these input signals is 1:1200. The input ECG signal is grid into DWT technique and the length of the input signal X is load into the code. After that the conversion of decimal signals into binary signals is done. We used 16 bit data for each. The conversion of signals is done from the ts from workplace that is the time space into simout5 to workplace. The cc variable is carried out as the output simout5. The value of the d1 is 5.0000e-07 from time1. The new time series is created as a name ts2. From the time series ts2 from work space the input data is carried by the zigbee transmitter and passes through AWGN channel and received by the zigbee receiver.





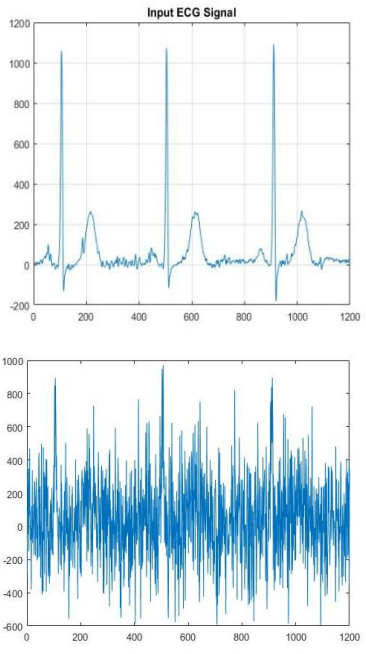
Person 1 ECG signals out main= 1496

PSNR= 32.9424

Zigbee receiver receives the demodulated data and the output is carried out as out main(i)=ecgout (output1(i,:)); The value of the output signal is 1496. IDWT is applied for changing the signals into original form. The decompression of signals is done in the IDWT technique. The basis pursuit is used in the coding which is the in built function. The value of the PSNR is carried out which is 32.9424

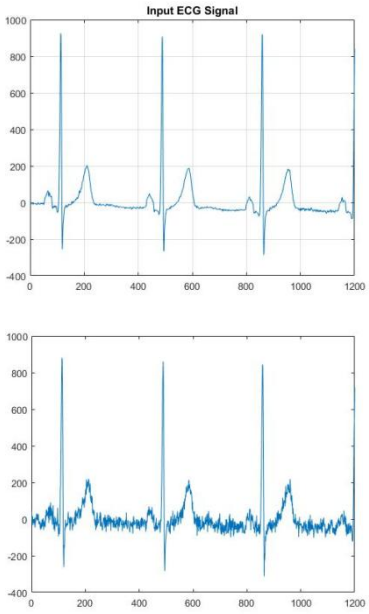
4. SIMULATION RESULTS

Simulation results are carried out in the graphical form. There are 3 persons ECG report that are used in the research work. The main output is carried out in the form of out main value. The PSNR value is also obtained in the result report.



Person 2 ECG signals out main= 4995

PSNR= 13.2735



Person 3 ECG signals out main= 32377

PSNR= 31.0644

5. CONCLUSION AND FUTURE SCOPE

ECG telemonitoring through zigbee sensor networks introduces numerous experiments, which stimulate the design of ECG compression schemes, with reduced compression and reconstruction computational require-ments at both the transmitter and receiver. The application of the theory of Compressed Sensing (CS) to the problem at hand, can achieve those requirements. We showed via extensive simulations that the exploitation of the block structure of ECG signal in the TD, and more importantly in a specific UD can lead to significant savings in the amount of data that should be transmitted from the biosensor in order to achieve an accurate signal reconstruction at any receiver in the WBAN (i.e., smart phone or remote terminal). The proposed algorithms for ECG signal recovery at the destination, achieve improved reconstruction capabilities with significant gains in both compression ratio and computational cost. Although, the focus was the wireless ECG telemonitoring, the proposed algorithms are applicable to other telemedicine applications. The future scope of this research is to apply the hardware of the zigbee sensor networks to the patient's ECG signals with different routines.

6. REFERENCES

[1] Prof. Pravin R. Lakhe (Department Of Computer Engineering, Vidyavardhini's College Of Engineering and Technology International Journal of Engineering Research and Applications (IJERA) ISSN: 2248-9622

[2] Wen-Tsai Sung, Kuo-Yi Chang," Health parameter monitoring via a novel wireless system" published in Applied Soft Computing 22 (2014) 667–680

[3] Mohamed FEZARI, Rachad Rasrasb and Ibrahiem M. M. El Emary," Ambulatory Health Monitoring System Using Wireless Sensors Node" published in Procedia Computer Science 65 (2015) 86 – 94

[4] Satyam Srivastava, Shashikant Sadisatp," Development of a low cost optimized handheld embedded odor sensing system (HE-Nose) to assess ripeness of oranges" published in Food Measure (2016) 10:1–15 DOI 10.1007/s11694-015-9270-3

[5] Aamir Hussain, RaoWenbi, Aristides Lopesda Silva, Muhammad Nadher, Muhammad Mudhish," Health and emergency-care platform for the elderly and disabled people in the Smart City" published in The Journal of Systems and Software 110 (2015) 253–263

[6] Marco Giammarini1, Daniela Isidori, Marco Pieralisi, Cristina Cristalli, Matteo Fioravanti1 · Enrico Concettoni," Design of a low cost and high performance wireless sensor network for structural health monitoring" published in Microsyst Technol DOI 10.1007/s00542-016-2859-6

[7] Aris S.Lalos, LuisAlonso, ChristosVerikoukis," Model based compressed sensing reconstruction algorithms for ECG telemonitoring in WBANs" published in Digital Signal Processing 35 (2014)105–116

[8] Huanjia Yang," Integrated ZigBee RFID Sensor Networks for Resource Tracking and Monitoring in Logistics Management," Loughborough University Institutional Repository 2010

[9] Jin-ling Zhang, Sheng Zhang, Ying-bo Guo, Xiong-zhi Zhu, Fei-xue Meng" A ECG And Oxygen Saturation Monitoring System Based On ZigBee Mesh Network," Beijing University of Posts and Telecommunication Beijing, 100876, P.R. China

[10] Jae Yeol Ha, Hong Seong Park, Sunghyun Choi, Wook Hyun Kwon, EHRP: Enhanced Hierarchical Routing Protocol for ZigBee Mesh Networks, IEEE COMMUNICATIONS LETTERS, Vol. 11, No. 2, pp. 1028-1030,2007.

[11] Shih-Jung Wu, Kuo-Feng Huang, The Sleep Control Strategy for Wireless Sensor Networks, AISS: Advances in Information Sciences and Service Sciences, Vol. 3, No. 11, pp. 282 -290, 2011.

[12] Wang Weiya, Lu Zhanfeng, Gao Li, Hu Gui, Research on Wearable ECG Monitoring System Based on ZigBee, 2011 Cross Strait Quad-Regional Radio Science and Wireless Technology Conference, Vol. 2, No. 1, pp. 929-932, 2011

[13] Shashwat Pathaka, Mayur Kumara, Amrita Mohanb, Basant Kumara," Energy Optimization of ZigBee based WBAN for Patient Monitoring," published in Procedia Computer Science 70 (2015) 414 – 420

[14] M. Wcislik, M. Pozoga, P. Smerdzynski," Wireless Health Monitoring System," published in IFAC Papers Online 48-4(2015) 312-317

[15] M. Magnoa, C. Spagnolc, L. Beninia, E. Popovicic," A low power wireless node for contact and contact less heart monitoring" published in Microelectronics Journal45(2014)1656–1664

[16] Yo-Ping Huang, Chao-Ying Huang, Shen-Ing Liu," Hybrid intelligent methods for arrhythmia detection and geriatric depression diagnosis" published in Applied Soft Computing 14 (2014) 38–46

[17] Puneet Kumar Jain," Heart Monitoring Systems" published in Computers in Biology and Medicine 54(2014)1–13

[18] Shane A. Lowe," Monitoring human health behaviour in one's living environment: A technological review" Medical Engineering & Physics 36 (2014) 147– 168

[19] Alexandros Pantelopoulos, "A Survey on Wearable Sensor-Based Systems for Health Monitoring and Prognosis" IEEE transactions on systems, man, and cybernetics-part C: Applications and review, VOL. 40, NO. 1, January 2010

[20] P.Rohitha," Wireless Networking Through ZigBee Technology" International Journal of Advanced Research in Computer Science and Software Engineering Volume 2, Issue 7, July 2012 ISSN: 2277 128X

[21] Kanchan Kaushal ,"ZigBee based Wireless Sensor Networks" et al, (IJCSIT) International Journal of Computer Science and Information Technologies, Vol. 5 (6) , 2014, 7752-7755

[22] Aamir Shaikh and Siraj Pathan," Research on Wireless Sensor Network Technology" International Journal of Information and Education Technology, Vol. 2, No. 5, October 2012

[23] Nidhi Patel, Hiren Kathiriya, Arjav Bavarva," WIRELESS SENSOR NETWORK USING ZIGBEE IJRET: International Journal of Research in Engineering and Technology ISSN: 2319-1163