www.ijecs.in
International Journal Of Engineering And Computer Science ISSN:2319-7242
Volume 4 Issue 5 May 2015, Page No. 12171-12175

A Review Paper On The Performance Analysis Of LMPC & MPC For Energy Efficient In Underwater Sensor Networks

Supreet Kaur
2014ecb1422
Ece Department, Gndu Rc Jalandhar

ABSTRACT

Due to the use of acoustic channels with limited available bandwidth, Underwater Sensor Networks (USNs) often suffer from significant performance restrictions such as low reliability, low energy-efficiency, and high end-to-end packet delay. The provisioning of reliable, energy-efficient, and low-delay communication in USNs has become a challenging research issue. In this paper, we take noise attenuation in deep water areas into account and propose a novel layered multipath power control (LMPC) scheme in order to reduce the energy consumption as well as enhance reliable and robust communication in USNs. To this end, we first formalize an optimization problem to manage transmission power and control data rate across the whole network. The objective is to minimize energy consumption and simultaneously guarantee the other performance metrics.

Keywords

Underwater sensor networks, multipath communication, energy efficiency, packet delay, optimization

I. INTRODUCTION

UNDERWATER sensor networks (USNs) are the emerging and promising communication framework which enables a wide range of important applications, such as oceanographic data collection, scientific ocean sampling,

pollution and environmental monitoring, disaster prevention, assisted navigation, and distributed tactical surveillance. The characteristics of limited available bandwidth, large propagation delay, and high bit error rates (BER) have posed many fundamental challenges in the design and deployment of USNs [1]. Moreover, the use of acoustic channels in the deep water areas makes these challenges, especially energy efficiency, even more sophisticated.

In this paper, taking noise attenuation into account, we propose a novel Layered Multipath Power Control (LMPC) scheme which manages to establish the energy-efficient tree-based multiple paths from the source node (i.e., root of the tree) to the surface gateways (leaves) and controls hop- to-hop propagation power. In LMPC, USNs are divided into multiple layers vertically for efficient transmission. The energy consumption in the deep water areas is reduced owing to the noise attenuation. The multiple copies of a packet are sent to the leaves from the root of the tree via different paths. Once these copies of the packet reach the leaf nodes on the ocean surface using the acoustic channel, they can be relayed and forwarded to the same destination (i.e., the sink) through the radio channel. The destination node then combines the multiple copies of the packet to generate the original packet. The main objective of LMPC is to improve energy consumption and enhance communication reliability by diminishing or even eliminating packet retransmissions over the acoustic.

The proposed LMPC scheme possesses the advantage of reliability inherent in multipath communication by allowing packets to travel along various network paths. The key difference between LMPC and MPC [3] is that the topology of LMPC is tree-shaped, rather than line-shaped used in MPC. The novelty of this work lies in how to build an energy-efficient tree and also control energy consumption at different nodes in USNs

for the higher energy efficiency and reliability channels.

MISSING PAPER ORAGANISATION

II. Background and RELATED WORK

Many schemes have recently been proposed to improve energy efficiency in USNs. In [4], low-cost and low-power acoustic modems were designed for short-range commu- nications followed by the details of hardware and software development. In [5], an energy-efficient transmission optimization model was analyzed theoretically for USNs. A distributed CDMA-based Medium Access Control (MAC) protocol was presented in [6]. This protocol incorporates a novel closed-loop distributed algorithm to jointly set the optimal transmit power and code length. In [7], a shadow zone aware routing protocol (SZODAR) was proposed for USNs where sensor nodes can raise or lower their acoustic transceivers to a depth such that the shadow zones of the neighbouring nodes are avoided. However, all these studies have focused on the objective of energy efficiency, but not addressed the inherent disadvantage of serious packet delay in USNs [8]. In [9] and [10], routing protocols for energy efficiency in USNs were proposed according to the water pressure using machine learning methods. In [3], [11], [12], [13], and [14], energy optimization and power control mechanisms were proposed to reduce energy consumption. Furthermore, the mechanism of energy-efficient Multiple Path Communications (MPC) was developed in [3] for time- critical applications. In MPC, the requirement of packet retransmission is reduced because the multiple copies of the data packets are delivered along various paths and then are combined at the destination. Although this mechanism can address the serious problem of packet delay, the existing power-control mechanisms are mainly based on the assumption that the signal decays as the propagation distance increases, but ignore the noise attenuation in the deep water areas, which actually has significant effects on the design and performance of USN.

i. LAYERED MULTIPATH POWER CONTROL (LMPC)

LMPC adopts a tree-based transmission power control scheme. As aforementioned, the goal of this scheme is to minimize the total energy consumption and maintain the PER at an acceptable level. In this section, we first formalize an optimization problem to manage transmission power and control data rate across the whole network. Then two key problems including establishment of Energy-Efficient Tree (EET) and control of energy distribution in the tree are addressed for LMPC.

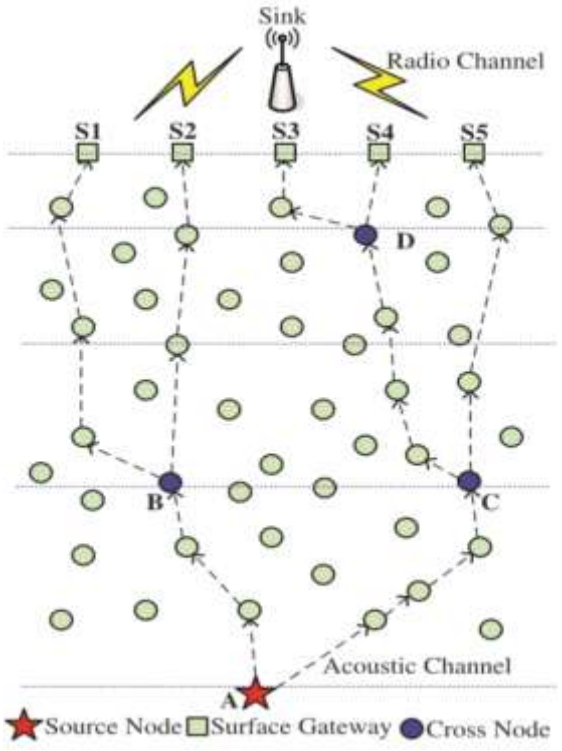


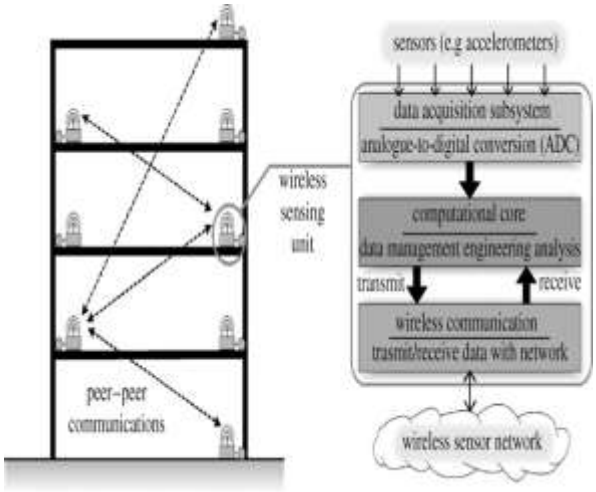
FIG-1 network architecture with lmpc

Why lmpc is used?

1. It provides reliable multipath communication from source to destination.
2. It improves the energy consumption at the destination end.
3. As binary tree based structure is used this helps in reducing interference.

ii. MUTIPATH POWER CONTROL (MPC)

Multipath power control scheme uses line shaped structure. multi -(MPC) scheme, path power-control transmission which can guarantee certain end-to-end packet error rate while achieving a good balance between the overall energy efficiency and the end-to-end packet delay. MPC smartly combines power control with multi-path routing and packet combining at the destination. With carefully designed power control strategies, MPC consumes much less energy than the conventional one-path transmission scheme without retransmission.



Missing figure caption

DRAWBACKS OF MPC

1. Packet retransmission is reduced at the destination side.
2. Signals decays as the propagation distance increases.
3. As the distance increases the delay occurs in the packet transmission from source to destination process.
4. Hence noise interference is more at the destination side.

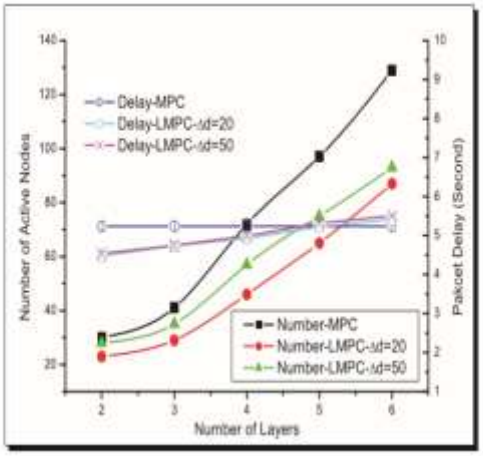
TABLE-1 PARAMETERS FOR UNDERWATER NETWORKS

Option	Value	
	Scenario-1	Scenario-2
Area	2000m*2000m	4000m*4000m
Ship	0.2	0.8
Wind	5 m/s	20 m/s
Number of Nodes	150	500
Simulation Period	1000s	
CPThresh_	10	
CSThresh_	20 dB	
RXTresh_	30 dB	
Pt_	197 dB re Pa	
freq_	914e+6 Hz	
Initialized energy	1000J	
txPower	0.66 mWatts	
rxPower	0.395 mWatts	
idlePower	0.035 mWatts	

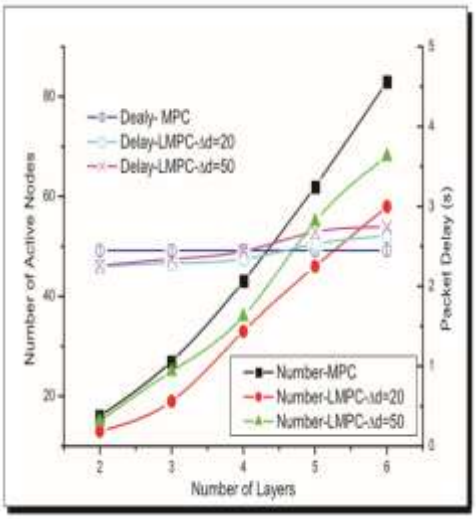
III. RESULTS AND ANALYSIS

Scenario-1

Fig-1 Number of active nodes vs number of layers



Scenario-2

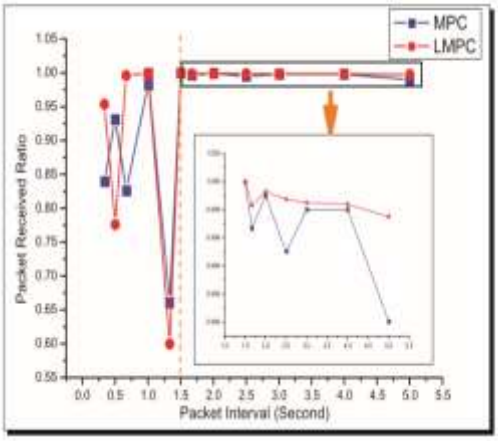


Missing figure caption

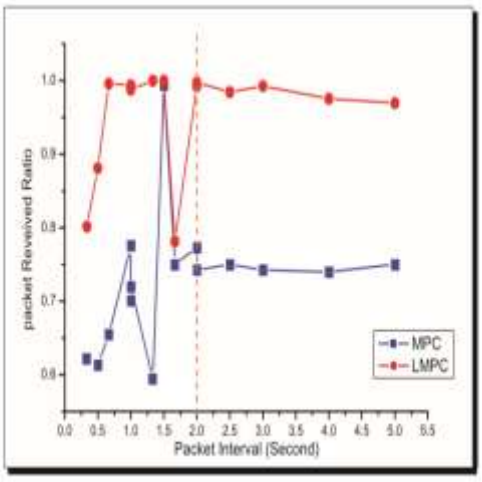
In the above two graphs, we have evaluate the number of active nodes and packet delays of mpc and lmpc with different number of layer. In scenario 1 and 2, as we increase the number of layers, the of active node increases. In lmpc their are less numbers of nodes participating as compared to mpc. Hence the delays are determined by increasing distance from sorce to destination.

Fig-2 packet received ratio vs packet interval

Scenario-1



Scenario-2

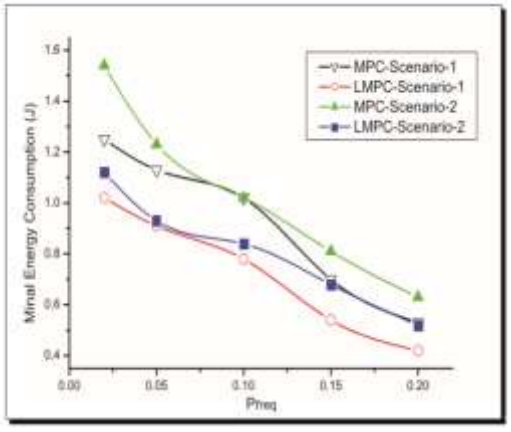


Missing figure caption

In the above two graphs, the scenario-1 shows that the packet interval over at 1.5s and in scenario-2 the packet interval over at 2 s which gaurantee the steady communication. The packet interval has an important effect on packet collision. Lesser number of active nodes results in lesser number of collision in packets.

Fig-3 energy consumption with diffrerent

required packet error ratio



In this graph we have taken the minimal energy consumtion with different required packet error ratio. In scenario-1 lpmc saves 20-30 percent of energy than mpc. In scenario-2 lmpc saves 30-40 percent of energy than mpc . hence lmpc technique is more efficient energy consumption than mpc.

IV. CONCLUSION

Motivated by the noise attenuation in the deep water area, this paper has proposed a Layered Multipath Power Control (LMPC) scheme for USNs in the underwater environment. In this new scheme, the communication plate is divided into multiple layers where the crossed nodes near the layer borders multicast data packets to the next hops and each node can control transmission power itself. Thus, the network can achieve the lower energy consumption, less collision than the traditional multiple communication methods. We have formalized an optimization problem for LMPC which aims to minimize the consumed energy but also comprehensively considers other performance metrics such as the required packet error rate, maximum power of nodes. Moreover, the extensive simulation experiments have been conducted to evaluate the performance of LMPC. The results have revealed that the proposed LMPC scheme outperforms the traditional multiple path communication scheme.

COMPARISON TABLE

PARAMETERS	LMPC	MPC
1.Scheme used	Tree based structure	Line based structure
2.steady packet interval time	2sec	2.5 sec
3. packet collision during	less	More

transmission		
4. no of active nodes	lesser	More
5. packet error ratio	lesser	More

REFRENCES

[1] D. Pompili and I. Akyildiz, "Overview of Networking Protocols for Underwater Wireless Communications," IEEE Comm. Maga- zine, vol. 49, no. 1, pp. 97-102, Jan. 2009.

[2] "Man-Made Noise in the Ocean," http://www.underwaternoise. org.uk, 2009.

[3] Z. Zhou and J. Cui, "Energy Efficient Multi-Path Communication for Time-Critical Applications in Underwater Sensor Networks," Proc. ACM MobiHoc, pp. 221-230, 2008.

[4] J. Wills, W. Ye, and J. Heidemann, "Low-Power Acoustic Modem for Dense Underwater Sensor Networks," Proc. First ACM Int'l Workshop Underwater Networks, pp. 79-85, 2006.

[5] H. Yang, B. Liu, F. Ren, H. Wen, and C. Lin, "Optimization of Energy Efficient Transmission in Underwater Sensor Networks," Proc. IEEE GLOBECOM, pp. 1-6, 2009.

[6] D. Pompili, T. Melodia, and I.F. Akyildiz, "A Cdma-Based Medium Access Control for Underwater Acoustic Sensor Net- works," IEEE Trans. Wireless Comm., vol. 8, no. 4, pp. 1899-1909, Apr. 2009.

[7] S. Nguyen, E. Cayirci, L. Yan, and C. Rong, "A Shadow Zone Aware Routing Protocol for Acoustic Underwater Sensor Networks," IEEE Comm. Letters, vol. 13, no. 5, pp. 366-368, May 2009.

[8] I.F. Akyildiz, D. Pompili, and T. Melodia, "Challenges for Efficient Communication in Underwater Acoustic Sensor Networks," ACM SIGBED Rev., vol. 1, no. 2, pp. 3-8, 2004.

[9] U. Lee, P. Wang, Y. Noh, L.F.M. Vieira, M. Gerla, and J. Cui, "Pressure Routing for Underwater Sensor Networks," Proc. INFOCOM '10, pp. 1-9, 2010.

[10] T. Hu and Y. Fei, "QELAR: A Machine-Learning-Based Adaptive Routing Protocol for Energy-Efficient and Lifetime-Extended Underwater Sensor Networks," IEEE Trans. Mobile Computing, vol. 9, no. 6, pp. 796-809, June 2010.

[11] A.O.B. Sik, C. Christian, and G. Francois, "Performance of Optimum Combining in a Poisson Field of Interferers and Rayleigh Fading Channels," IEEE Trans. Wireless Comm., vol. 9, no. 8, pp. 2461-2467, Aug. 2010.

[12] D.E. Quevedo, A. Ahlen, and J. Ostergaard, "Energy Efficient State Estimation with Wireless Sensors through the Use of Predictive Power Control and Coding," IEEE Trans. Signal Processing, vol. 58, no. 9, pp. 4811-4823, Sept. 2010.

[13] R. Srivastava and C. Koksal, "Energy Optimal Transmission Scheduling in Wireless Sensor Networks," IEEE Trans. Wireless Comm., vol. 9, no. 5, pp. 1550-1560, May 2010.