www.ijecs.in
*International Journal Of Engineering And Computer Science ISSN:2319-7242*
*Volume – 5 Issue -03 March, 2016 Page No. 15919-15923*

# Optimization of Dynamic Packet Length in Wireless Sensor Network

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***Abstract*— In wireless sensor network, packet size optimization is an important issue in energy constrained. We provide dynamic packet length optimization scheme to achieve best performance in terms of channel utilization, energy efficiency. The adaptation of dynamic packet length is 802.11 wireless system. We increase data delivery ratio, system throughput and decrease network conjunction, end to end delay. In the system, the packet delivery ratio keeps high i.e. 95% above and link estimated error within 10% for 95% link. The system provides accurate link estimation method which achieves best performances related to the previous works.**

***Index Terms*— Link estimation, network conjunction, packet size optimization, wireless sensor network.**

## I. INTRODUCTION

Wireless sensor network having a large number of small sensor nodes circulate in a field, which is called sensor field. Sensor field for exacting WSN application is responsible for acquiring environment information composed from different sensor nodes. Sensor node is a small device is able to sense environment, process the sensed data and broadcast it to other sensor nodes or to sink node. Sink node is special type of node that is responsible for collecting all the sensed/processed data from a sensor field and to pass it to any application for further processing. The basic architecture of a typical WSN is shown in Figure1.

The wireless sensor networks can be used for various application areas, for example military, health, home, education, space, commercial applications etc. Wireless sensor networks are different from other wireless and adhoc networks in many ways e.g.:

1. Number of nodes in WSN are very large than normal wireless networks.
2. Sensor nodes are resource unnatural as compare to other wireless networks.
3. Sensor nodes are prone to hardware failure.
4. Sensor nodes are broadcasted in environment and their topology varies regularly while this is not the case in most wireless and adhoc networks.

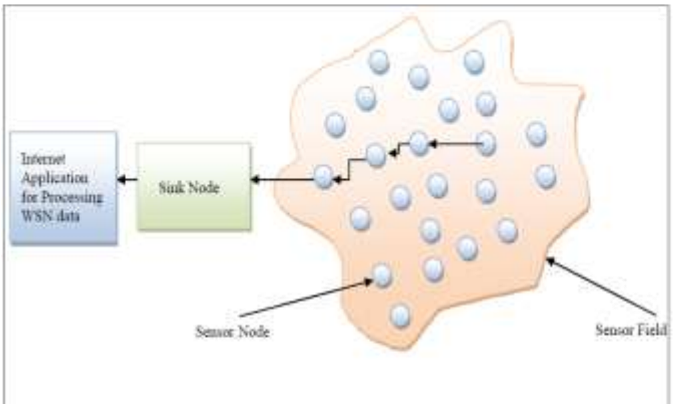



Figure1: Wireless Sensor Network Architecture

Wireless sensor networks typically contain thousands of sensors, which are arbitrarily and densely deployed. Each sensor has a light weight and a low cost with three technologies of sensing, on-board giving out and transmission. Sensor nodes have partial battery power which leads to inadequate coverage and communication range. Most of the applications in wireless sensor networks involve mostly data aggregation in which sensor node rarely produced data and transmitting to the sink node through the aggregated node where constant queries are posed and processed.[3]

A sensor network is an infrastructure comprised of sensing (measuring), computing, and communication devices that gives an administrator the ability to instrument, monitor, and react to events and phenomena in a specified environment.

These devices, each ready with central processing unit (CPU), battery, sensor and radio transceiver networked through wireless links provide unique potential for collection and transmission of data and can be used for monitoring and calculating environment, cities, homes, etc. In most cases WSNs are inactive or quasistationary, while node mobility can be ignored. There is no prearrangement statement about

DOI: 10.18535/ijecs/v5i3.08

specific role each node should perform. Each node makes its decision separately, based on the condition in the deployment region, and its knowledge about the network. [2]

A packet optimization scheme valid in sensor networks must have the following important features.

(i) *Dynamic* packet length adaptation. preceding work in sensor networks uses fixed packet length optimization schemes. These schemes are not preferred due to the spatial temporal variety of link qualities in WSNs.

(ii) *Accurate* link estimation. The performance progress of the packet length adaptation scheme is highly reliant on the link estimation accuracy. Prior work in wireless systems does not consider exceptional characteristics of WSNs, e.g., resource constraints of sensor nodes, thus leading to inaccurate link estimation in sensor networks.

(iii) *Easy* to use. To the best of our knowledge, no prior work addresses the application programmability issues of packet length adaptation scheme in sensor networks. Without important programming labors, there is still a huge gap between imaginary optimality and practically possible gains.

The rest of the paper is organized as follows. In section II, related work is described. In section III research design is explained. In section IV simulation is explained. Finally dynamic packet optimization scheme it proposesd.

## II. Related work

Techniques Used For Packet Size Optimization for Wireless Sensor Networks :

Various techniques by different researchers have been proposed for the packet size optimization in wireless sensor networks. Mainly those approaches are also fixed size packets approach or variable size packets approach.

1. *Fixed Size Packets in Wireless Sensor Networks*:

The fixed size data packets to be used in a wireless sensor network. According to them, while variable packet size will increase the channel throughput and improve the wireless sensor networks' transmission mechanism but simplicity of such autonomous system is also compromised, and these resource constrained networks will lastly suffer from overhead of resource management while having variable size data packets. So they have chosen fixed sized data packets for energy efficient wireless sensor networks. There are basically three fields in a data packet:

1. Packet Header
2. Payload/Data Segment
3. Packet Trailer

They identified each field and recognize that as packet header contains many fields that are usually less important for wireless sensor network's nodes and removing those will ultimately shorten the packet size in a WSN. Those fields include current segment number, total number of segments, packet identifiers and source and destination identifiers [4].

In [6] they have recognized an optimal packet size for a wireless sensor network and measured its efficiency in terms of overall energy consumption and throughput and other network performance parameters as well. In figure 2 below the overall proportion of packet size and retransmission rate is depicted that took place in a wireless sensor network. Hence increased retransmission will affect the network performance like it reduces the overall throughput of a link, so we can say that packet size also affects the overall network performance parameters as well.

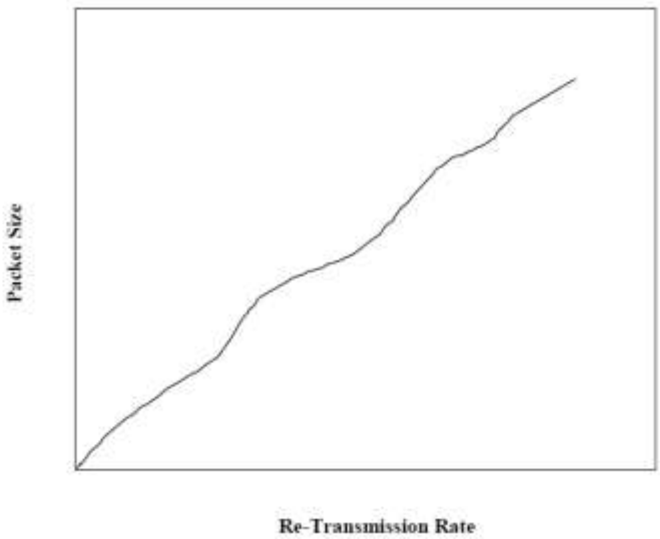



Figure 2: An observational graph showing proportion of packet size with re transmission rate in WSN

2. *Variable Size Packets in Wireless Sensor Networks:*

According to [5] variable packet size in wireless sensor networks plays an important role and they have developed a scheme DPLC (Dynamic Packet Length Control) in this observe. DPLC technique uses variable length packets for a wireless sensor network. It works cleverly and will create variable sized packets based on channel condition. If channel is noisy (means it is congested having a lot of packets) it will generate shorter packets. While in a quiet channel (i.e. it is almost empty) larger sized packets will be generated. In this way their technique enhances overall throughput and efficiency.

## III.RESEARCH DESIGN

In this section, we present the design of DPLC, a dynamic packet length control scheme for WSNs. Below, we identify the major design goals.

• Dynamic adaptation. DPLC should provide a dynamic adaptation scheme to achieve performance improvements in dynamic, time-varying sensor networks.

• Accurate link estimation. DPLC should implement an accurate link estimation method that can capture both physical channel conditions (due to channel fading, mobility, or power degradation) and interferences (from exposed and hidden terminals).

• Ease of programming. DPLC should provide easy-to use services to facilitate upper-layer application programming.

• Lightweight for implementation. DPLC should be lightweight for resource constrained sensor nodes.

*A. Flow chart:*

The flowchart of dynamic packet length optimization approach is described with the following diagram:

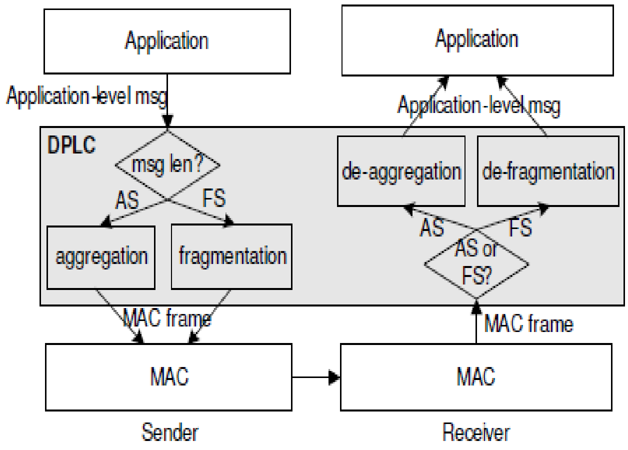



**Figure 3: DPLC Overview**

*Proposed Methodology*

The DPLC scheme works as follows. The application passes an application-level message for communication. The DPLC module at the sender decides whether to use the aggregation service (AS, if the message length is small) or the fragmentation service (FS, if the message length is larger than the maximum packet length supported by the radio, i.e., 128 bytes for CC2420). The link estimator within DPLC dynamically estimates the appropriate packet length for transmission. Based on this, the DPLC module at the sender decides how many messages should be aggregated (for AS), or how many frames the message should be fragmented into (for FS). When a frame is ready for transmission (enough messages have been aggregated or time is out in AS), DPLC transmits it out via the MAC layer. When the DPLC module at the receiver receives a MAC frame, it deaggregates or defragments the frame in order to obtain the original message. When the message is ready (all frames in the message have been received or the receive buffer is full in FS), the DPLC module at the receiver notifies the upper layer for further handling. The DPLC scheme provides two services for upper-layer applications, i.e., the aggregation service (AS, for small messages) and the fragmentation service (FS, for large messages).

## IV. SIMULATION RESULT

To test result we use the NS-2 simulation package. The simulation shows the efficient utilization of energy, increasing packet delivery ratio, minimum network conjunction and minimum end to end delay with the help of graph to increase system performance and accurate link estimation method.
In the scenario we described various techniques to send data from source to destination and minimum error rate while sending packets.

1. *Packet loss during transmission:*

There are 25 sensor nodes are deployed in the simulation.
More number of packet loss during transmission shown in following figure. The error rate is so high which degrade the system performance. Hence we improve all the parameters which is helpful to achieve our goal. The MAC 802.11 is used to configure all the parameters.

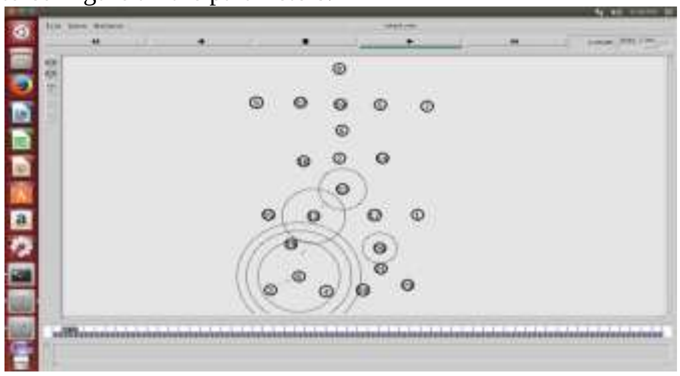


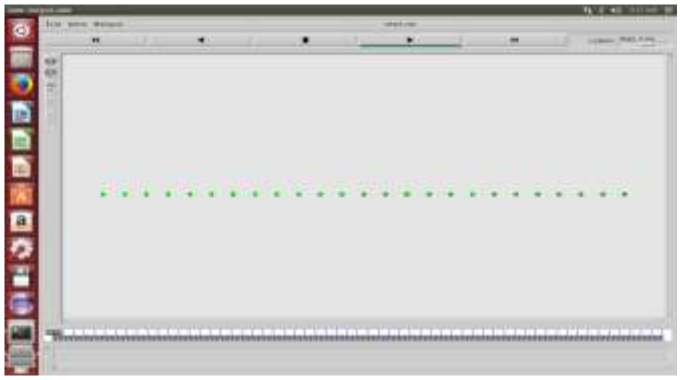
Figure 3. Packet loss during transmission.

During packet transmission more number of energy required due to packet drop which degrade the data delivery performance.

2. *Sensor Node deployment in various topology:*

We are using three different topology to send packet in various conditions and then check the system performance.

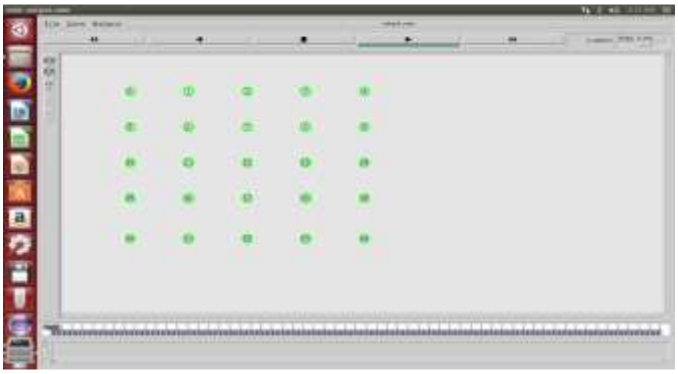
a. Linear:



b. Matrix:

c. Random:

**DOI: 10.18535/ijecs/v5i3.08**

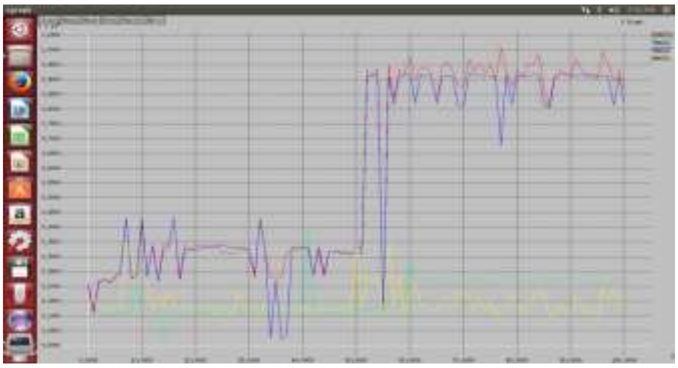


To increase system performance and accurate link estimation method we shown different graph to all necessary parameter is improved. Here we compare routing protocol and we improve our chosen routing protocol.

In the graph we compare routing protocol which is more efficient than three protocol.

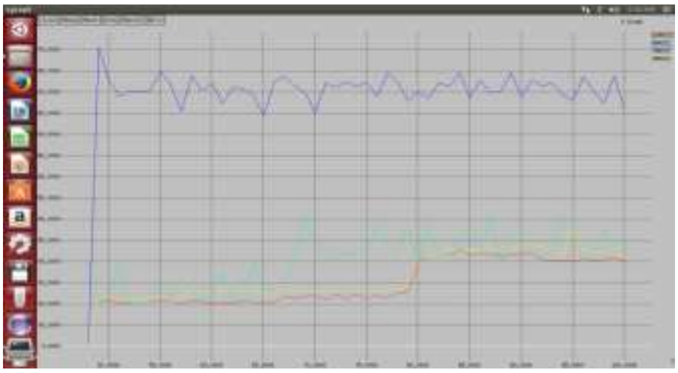
i. Throughput graph:

The graph is plotted between Receive packets vs Simulation Time.



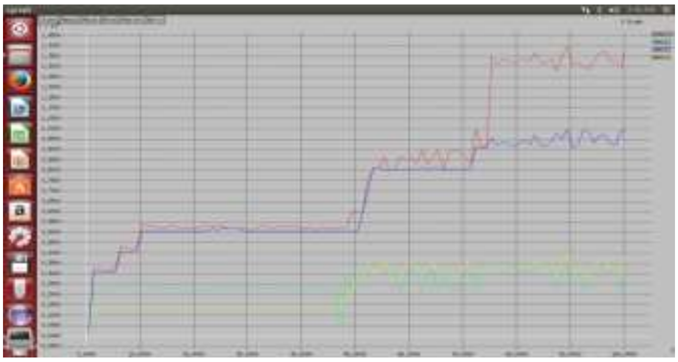
ii. Network conjunction graph:

The graph is plotted between Network Conjunction vs Simulation Time.



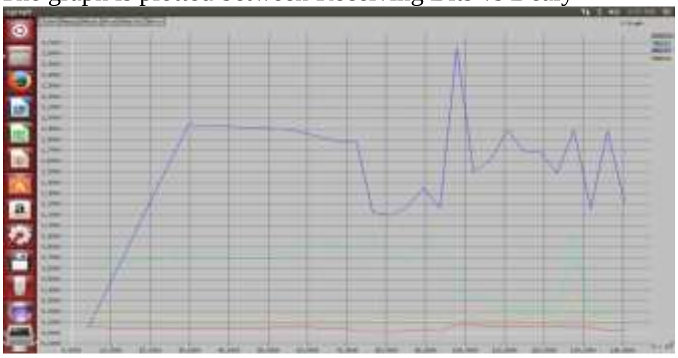
iii. Data delivery ratio graph:

The graph is plotted between Sending packets vs Simulation Time



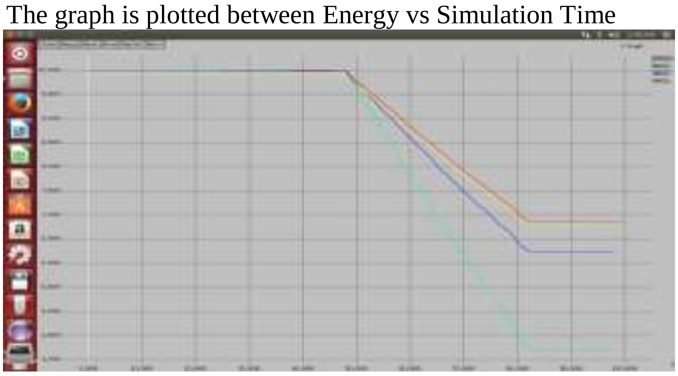
iv. End to End delay graph:

The graph is plotted between Receiving Bits vs Dealy



v. Energy efficiency graph:

The graph is plotted between Energy vs Simulation Time



In this way we are increase necessary parameter which improves the system performance. The above graph shows increasing throughput, to minimize network conjunction, to increase data delivery ratio and to minimize end to end delay and utilizes more energy.

In this way we can say that more number of packets can be send from source to destination and it utilizes more energy as compared to previous experiments.

## V. FUTURE WORK

The dynamic packet length optimization will provide accurate link estimation method and efficient energy utilization to increase system performance as compared to previous work.

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## VI. CONCLUSION

This proposed dynamic packet length optimization approach will provide accuracy in link estimation that capture physical channel condition, increase packet delivery ratio, increase system throughput and efficient energy utilization.

DOI: 10.18535/ijecs/v5i3.08

VII. ACKNOWLEDGEMENT

I am currently pursuing M.E in Mobile Technology and the work in this paper is under process. The dynamic packet length optimization approach will be implemented using the software modules. Further, dynamic packet length optimization approach will be used for accuracy of link estimation, efficient channel utilization and increase system throughput.

References

[1] Wei Dong, Chun Chen, Xue Liu, Yuan He,Yunhao Liu, Jiajun Bu, Xianghua Xu, " Dynamic Packet Length Control in Wireless Sensor Network," in Proc. 2014 IEEE Transactions.

[2] Murat DENER, " Optimum Packet Length Over Data Transmission for Wireless Sensor Networks," Proceedings of the 8th International Conference on Sensing Technology, Sep. 2-4, 2014, Liverpool, UK.

[3] VAISHALI VISHWAS PATIL, SHIV OM TIWARI, "DYNAMIC PACKET SCHEDULING SCHEME FOR WIRELESS SENSOR NETWORK," Proceedings of 12th IRF International Conference, 29th June-2014, Pune, India, ISBN: 978-93-84209-31-5.

[4] M. N. Krishnan, E. Haghani, and A. Zakhor, "Packet length adaptation in WLANs with hidden nodes and time-varying channels," in Proc. 2011 IEEE GlobeCom.

[5] W. Dong, X. Liu, C. Chen, Y. He, G. Chen, Y. Liu, and J. Bu, "DPLC: dynamic packet length control in wireless sensor networks," in Proc.2010 IEEE INFOCOM.

[6] B. Chen, Z. Zhou, Y. Zhao, and H. Yu, "Efficient error estimating coding: feasibility and applications," in Proc. 2010 ACM SIGCOMM.

[7] J. Huang, G. Xing, G. Zhou, and R. Zhou, "Beyond co-existence: exploiting WiFi white space for ZigBee performance assurance," in Proc. 2010 IEEE ICNP.

[8] O. Gnawali, R. Fonseca, K. Jamieson, D. Moss, and P. Levis, "Collection tree protocol," in Proc. 2009 ACM SenSys.

[9] S. Ganeriwal, I. Tsigkogiannis, H. Shim, V. Tsiatsis, M. B. Srivastava, and D. Ganesan, "Estimating clock uncertainty for efficient duty-cycling in sensor networks," IEEE/ACM Trans. Netw., vol. 17, no. 3, pp. 843–856, 2009.

[10] P. R. Jelenkovi´c and J. Tan, "Dynamic packet fragmentation for wireless channels with failures," in Proc. 2008 ACM MobiHoc.

[11] G. Hackmann, O. Chipara, and C. Lu, "Robust topology control for indoor wireless sensor networks," in Proc. 2008 ACM SenSys.

[12] F. Zheng and J. Nelson, "Adaptive design for the packet length of IEEE 802.11n networks," in Proc. 2008 IEEE ICC.

[13] K. Jamieson and H. Balakrishnan, "PPR: partial packet recovery for wireless networks," in Proc. 2007 ACM SIGCOMM.

[14] S. Kim, R. Fonseca, P. Dutta, A. Tavakoli, D. Culler, P. Levis, S. Shenker, and I. Stoica, "Flush: a reliable bulk transport protocol for multihop wireless networks," in Proc. 2007 ACM SenSys.

[15] L. Sang, A. Arora, and H. Zhang, "On exploiting asymmetric wireless links via one-way estimation," in Proc. 2007 ACM MobiHoc.

[16] X. Liu, Q. Wang, W. He, M. Caccamo, and L. Sha, "Optimal real-time sampling rate assignment for wireless sensor networks," ACM Trans. Sensor Netw., vol. 2, no. 2, pp. 263–295, 2006.

[17] H. Zhang, A. Arora, and P. Sinha, "Learn on the fly: data-driven link estimation and routing in sensor network backbones," in Proc. 2006 IEEE INFOCOM.

[18] K. Srinivasan and P. Levis, "RSSI is under appreciated," in Proc. 2006 EmNets.

[19] M. Buettner, G. Yee, E. Anderson, and R. Han, "X-MAC: a short preamble MAC protocol for duty-cycled wireless sensor networks," in Proc. 2006 ACM SenSys.

[20] J. Polastre, R. Szewczyk, and D. Culler, "Telos: enabling ultra-low power wireless research," in Proc. 2005 ACM/IEEE IPSN.

[21] H. Dubois-Ferrière, D. Estrin, and M. Vetterli, "Packet combining in sensor networks," in Proc. 2005 ACM SenSys.

[22] J. W. Hui and D. Culler, "The dynamic behavior of a data dissemination protocol for network programming at scale," in Proc. 2004 ACM SenSys.

[23] T. He, B. M. Blum, J. A. Stankovic, and T. Abdelzaher, "AIDA: adaptive application-independent data aggregation in wireless sensor networks," ACM Trans. Embedded Comput. Syst., vol. 3, no. 2, pp. 426–457, 2004.

[24] Y. Sankarasubramaniam, I. F. Akyildiz, and S. W. Mclaughlin, "Energy efficiency based packet size optimization in wireless sensor networks," in Proc. 2003 IEEE International Workshop Sensor Netw. Protocols Applications.

[25] I. F. Akyildiz, W. Su, Y. Sankarasubramaniam, and E. Cayirci, "Wireless sensor networks: a survey," Comput. Netw., vol. 38, pp. 393–422, 2002.

[26] E. Modiano, "An adaptive algorithm for optimizing the packet size used in wireless ARQ protocols," Wireless Netw., vol. 5, no. 4, pp. 279–286, 1999.

[27] P. Lettierri and M. B. Srivastava, "Adaptive frame length control for improving wireless link throughput, range, and energy efficiency," in Proc. 1998 IEEE INFOCOM.

[28] J. D. Spragins, J. L. Hammond, and K. Pawlikowski, Telecommunications: Protocols and Design. Addison Wesley Publishing Company,1991.

[29] C. K. Siew and D. J. Goodman, "Packet data transmission over mobile radio channels," IEEE Trans. Veh. Technol., vol. 38, no. 2, pp. 95–101,1989.