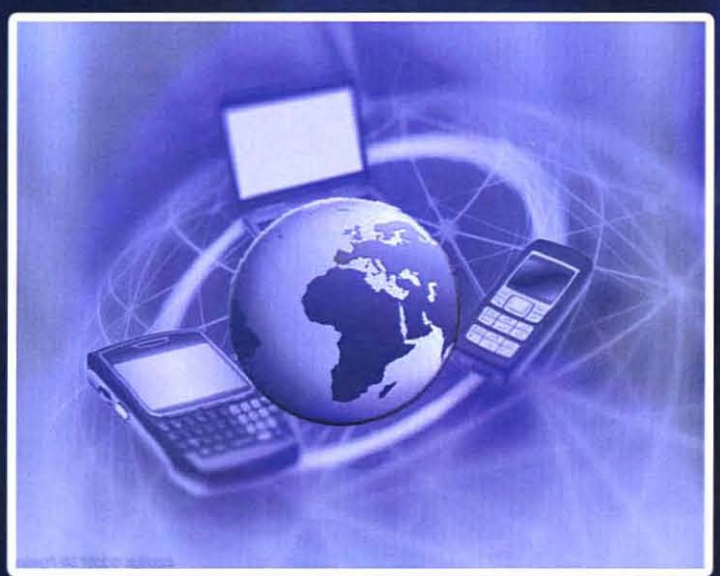
Research Issues in Wireless

Communications and Networking

Farhat Anwar
Wajdi Al-Khateeb



IIUM Press
INTERNATIONAL ISLAMIC UNIVERSITY MALAYSIA

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Published by:
IIUM Press
International Islamic University Malaysia

First Edition, 2011

Perpustakaan Negara Malaysia Cataloguing-in-Publication Data

Farhat Anwar & Wajdi Al-Khateeb: Research Issues in Wireless Communications Networking

ISBN: 978-967-418-149-9

Member of Majlis Penerbitan Ilmiah Malaysia – MAPIM
(Malaysian Scholarly Publishing Council)

Printed by :
IIUM PRINTING SDN.BHD.
No. 1, Jalan Industri Batu Caves 1/3
Taman Perindustrian Batu Caves
Batu Caves Centre Point
68100 Batu Caves
Selangor Darul Ehsan
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CHAPTER 35

TRANSMISSION POWER CONSUMPTION MANAGEMENT FOR ZIGBEE HEALTHNETS

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35.1 INTRODUCTION

In clinical diagnostics and patient's treatment, many physiological parameters, referred to as emergency vital signs or EVS such as blood gas, invasive blood pressures, pulse rate, temperature, electrocardiogram (ECG), etc, have to be detected, measured and monitored. Wireless ZigBee networks utilize digital data to enable such novel clinical applications. With the use of small portable computers at other locations within the hospital or elderly nursing home, medical staff would be able to monitor a patient regardless of her position as long as she is connected to the network. Sometimes battery operated sensors are embedded into the patient's body, hence replacing the sensor's battery is done by a surgical operation. In such scenarios, it is important to prolong the battery's life as much as possible. In This paper, a simple yet effective method that can be used to reduce power consumption of wireless sensor nodes is presented. Power consumption is measured while doing data transmission, reception or in idle state. Depending on the estimated distance calculated from the averaged received signal strength Indicator (RSSI), the transmission power needed were computed and used for each packet transmission. Hence, instead of transmitting in full power regardless of the location of the receiving node, the transmission power is carefully controlled depending on the estimated distance.

35.2 PROPOSED ALGORITHM & IMPLEMENTATION

35.2.1 Propagation Model Distance Estimation

The primary energy consumer in any sensor node is its radio transceiver. The exact amount of energy dissipated per transmitted or received bit is a function of distance, bit rate and transmission duration, among other factors. In order to quantify the performance of power-aware protocols, the behavior of radio wave propagation must be accurately modeled. This is a limiting factor in many network simulators, as such physical layer concerns have not been a factor in protocol design although increasingly complex models exist, which are useful in certain scenarios [1].

In embedded devices, a received signal strength indicator (RSSI) is defined using equation (35.1) where the reference power P_{ref} typically represents an absolute value of P_{ref}=1mW.

$$RSSI=10log(P_r/P_{ref})\ (dBm) \tag{35.1}$$

The detected signal strength P_r is defined according to the log-normal shadowing model given by equation (35.3).