# REDUCE ENERGY CONSUMPTION IN THE WIRELESS SENSOR NETWORK BY USING EEL-MAC PROTOCOL

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# Abstrak

Nod Rangkaian Pengesan Tanpa Wayar (WSN) digunakan secara meluas dalam pelbagai sektor. Selama ini, WSN telah muncul sebagai penggerak untuk mengumpul dan memproses data dari lokasi yang jauh atau kawasan bencana. WSNs bergantung kepada kesederhaan perkakasan untuk membuat lapangan pengesan bersifat mampu milik dan tahan lama tanpa sokongan penyelenggaraan. Walau bagaimanapun, nod WSN mengalami banyak masalah seperti lampau dengar, perlanggaran, terminal tersembunyi, dengaran terbiar dan kependaman tinggi, yang mengakibatkan penggunaan tenaga yang tinggi, dengan itu menghadkan hayat nod. Selain itu, nod WSN amat bergantung kepada kuasa bateri yang terhad, tetapi sukar untuk menambah semula kuasa. Oleh itu, kajian ini mengkaji protokol Kawalan Capaian Medium (MAC) cekap tenaga yang direka untuk melanjutkan hayat kedua-duanya dengan pengurusan tenaga yang berkesan melalui penurunan masa terbiar dan peningkatan masa tidur untuk nod menjimatkan tenaga. Kajian ini juga bertujuan untuk mengurangkan kependaman antara nod dan nod tenggelam. Protokol hidbrid EEL-MAC bermula dengan fasa penyegerakan menggunakan TDMA untuk menyegerakkan semua nod dalam lapangan pengesan. Dalam fasa kedua, skim ini menggunakan mekanisme CSMA untuk komunikasi antara nod dan nod tenggelam. Kajian ini memberi dua sumbangan besar kepada rangkaian pengesan tanpa wayar. Pertama, protokol EEL-MAC menawarkan penjimatan tenaga penting dan memanjangkan jangka hayat rangkaian. Sumbangan kedua adalah pengenalan sambutan tinggi, dengan mereka bentuk komunikasi satu-hop untuk mengurangkan kedua-dua kelewatan dan kependaman hujung ke hujung.

**Kata kunci:** Penggunaan tenaga, Kependaman, Protokol, Memanjangkan hayat rangkaian.

# Abstract

Wireless Sensor Network (WSN) nodes are broadly used in various sectors. Over the years, WSN has emerged as an enabler to collect and process data from remote locations or disaster areas. WSNs rely on hardware simplicity to make sensor field deployments both affordable and long-lasting without maintenance support. However, the WSN nodes experience a lot of problems such as, overhearing, collision, hidden terminal, idle listening and high latency, which resulted in high energy consumption, thus limiting the lifetime of the node. Moreover, WSN nodes are strongly dependent on their limited battery power, and replenishing them again is difficult. Therefore, this research investigates the energy-efficient Medium Access Control (MAC) protocols designed to extend both the lifetime by effective energy management through a reduction in idle time and increased sleep time for nodes to save energy. This study also aims to reduce the latency between nodes and sink node. The EEL-MAC hybrid MAC protocol starts by a synchronization phase using TDMA to synchronize all nodes in the sensor field. In the second phase the scheme uses the CSMA mechanism for communication between nodes and the sink node. In this study makes two significant contributions to wireless sensor networks. First, the EEL-MAC protocol offers significant energy savings and prolongs network lifetime. The second contribution is the introduction of high response, by designing a one-hop communication to reduce both end-to-end delay and latency.



**Keywords:** Energy consumption, Latency, Protocol, Prolongs the network lifetime.

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# List of Abbreviations

| | |
|---|---|
| AAS | : Automatic Active and Sleep |
| AM-MAC | : Adaptive Mobility-Supporting MAC |
| BN-MAC | : Boarder Node MAC |
| CFP | : Contention-Free Period |
| CSMA | : Carrier Sensing Multiple Access |
| CSMA/CA | : Carrier Sensing Multiple Access/Collision Avoided |
| CTS | : Clear To Send |
| DBNSP | : Dynamic Boarder Node Selection Process |
| DM-MAC | : Distribute Moving-MAC |
| EEL-MAC | : Enhance Energy and Latency MAC protocol |
| IDM | : Intelligent Decision-Making |
| LDSNS | : Least Distance Smart Neighboring Search |
| LLC | : Logical Link Control |
| LPL | : Lower Power Listening |

| | |
|---|---|
| LPRT-MAC | : Low Power Real Time-MAC |
| MAC | : Medium Access Control |
| MH-MAC | : A Mobility Adaptive Hybrid MAC |
| MS-MAC | : Mobile Sensor-MAC |
| NS2 | : Network Simulator 2 |
| ODFF | : Optimized Data Frame Format |
| OS | : Operating System |
| OTCL | : Object Oriented Tool Command Language |
| QoS | : Quality of Service |
| RF | : Radio Frequency |
| RTS | : Request To Send |
| S-MAC | : Sensor-MAC |
| TDMA | : Time division multiple access |
| WSN | : Wireless Sensor Network |
| Z-MAC | : Zebra-MAC |

# CHAPTER ONE
# INTRODUCTION

## 1.1 Introduction

Wireless Sensor Network (WSN) has attracted tremendous attention from researchers in the recent years (Meng, Xie, & Xiao, 2013). Consisting of sensor nodes and a sink node, WSN is used to sense parameters such as temperature, pressure and radiation from the surroundings. The data is then relayed to the sink node, and a server (Suriyachai, Roedig, & Scott, 2012).

A sensor node consists of several modules, namely the sensing, processing and communication module. These modules are highly dependent on the scarce battery supply. Therefore, a major challenge in a WSN is its short network lifetime. Power replenishment is a challenging task as these nodes are scattered randomly (Cano, Bellalta, Sfairopoulou, & Oliver, 2011). Although there has been enormous development in WSN technology. However, the progress of battery technology has been slow, and researchers are seeking new ways to prolong the lifetime of the network (Corke et al., 2010).



A wireless sensor network is composed of a number of sensor devices and sink(s). Sensor nodes communicate with their neighbors through shared channels. As these nodes compete for channel access, a mechanism is needed to ensure that the sensor nodes are able to effectively send data to the sink node. Figure 1.1 illustrates the general architecture of a WSN deployment (Kabara & Calle, 2012).

The contents of the thesis is for internal user only

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