

## ABSTRACT

*Internet of Things (IoT) is a future technology where many embedded devices have limited energy, energy use in embedded devices plays an important role in the performance of wireless sensor networks (WSN). 6LoWPAN (IPv6 over Low Power Wireless Personal Area Networks), is an IPv6-based protocol that allows devices with small power consumption such as sensors to remain connected and participate in IoT (Internet of things) with greater scalability. Routing Protocol for Low-Power and Lossy Networks (RPL) is a standard routing protocol specifically designed for low-power WSN devices, so that these devices can be connected directly to the Internet network. The performance of RPL affects energy use in WSN devices, so the performance of routing protocols and energy use are key parameters of the overall performance of WSN. Therefore, to find out how much the influence of RPL performance on energy use on embedded devices is carried out experimental studies measuring WSN performance based on the performance of the RPL routing protocol and its own energy use.*

*RPL Routing Protocol Performance is measured based on the average network packet received (APJR), the average network packet lost at each node (APJL), routing metric average (ARM), average Expected Transmission Count (AETX), average CPU power (ACPUP), average LPM power (ALPMP), average Listen Power (ALP), average Transmit Power (ATP) and average Power (AP) for all nodes.*

*This research was also conducted on the scope of the simulation with the Cooja network simulator, where in the simulation ten simulation scenarios were carried out with parameters based on network topology (Mesh, Star and Tree) and transmission ratio (Tx / Rx). The test results show that power consumption between network topologies (Mesh, Star and Tree) and Grid Network and Random Network node positions do not significantly affect the performance of the RPL routing protocol for WSN, but the transmission ratio can reduce the performance of routing protocols and increase energy use significantly in each test scenario.*

**Keywords:** Internet of Things, 6LoWPAN, WSN, RPL, Cooja Network Simulator

**MERCU BUANA**

## ABSTRAKSI

*Internet of Things (IoT) merupakan teknologi masa depan dimana banyak perangkat tertanam yang memiliki keterbatasan energi, penggunaan energi pada perangkat tertanam berperan penting terhadap kinerja dari wireless sensor network (WSN). 6LoWPAN (IPv6 over Low power Wireless Personal Area Networks), adalah protokol berbasis IPV6 yang memungkinkan perangkat dengan konsumsi daya kecil seperti sensor tetap dapat terkoneksi dan ikut berpartisipasi dalam IoT (Internet of things) dengan skalabilitas lebih besar. Routing Protocol for Low-Power and Lossy Networks (RPL) adalah protokol routing standar yang dirancang secara khusus untuk perangkat WSN berdaya rendah, sehingga perangkat tersebut dapat terhubung langsung dengan jaringan Internet. Kinerja dari RPL mempengaruhi penggunaan energi pada perangkat WSN, sehingga kinerja protokol routing dan penggunaan energi adalah parameter kunci dari kinerja keseluruhan WSN. Oleh karena itu, untuk mengetahui seberapa besar pengaruh kinerja RPL terhadap penggunaan energi pada perangkat tertanam dilakukan penelitian eksperimental pengukuran kinerja WSN berdasarkan kinerja dari protokol routing RPL dan penggunaan energinya itu sendiri.*

*Kinerja Protokol Routing RPL diukur berdasarkan rata - rata paket jaringan yang diterima (APJR), rata-rata paket jaringan yang hilang di setiap node (APJL), rata-rata routing metric (ARM), rata-rata Expected Transmission Count (AETX), rata - rata CPU power (ACPUP), rata - rata LPM power (ALPMP), rata - rata Listen Power (ALP), rata - rata Transmit Power (ATP) dan rata - rata Power (AP) seluruh node.*

*Penelitian ini juga dilakukan pada lingkup simulasi dengan network simulator Cooja, dimana pada simulasi tersebut dilakukan sepuluh skenario simulasi dengan parameternya berdasarkan topologi jaringan (Mesh, Star dan Tree) dan rasio transmisi (Tx/Rx). Hasil pengujian menunjukkan power consumption (konsumsi daya) antar topologi jaringan (Mesh, Star dan Tree) dengan posisi node Grid Network dan Random Network tidak mempengaruhi kinerja protokol routing RPL untuk WSN secara signifikan, namun rasio transmisi dapat menurunkan kinerja protokol routing dan meningkatkan penggunaan energi secara signifikan disetiap skenario pengujian.*

*Kata kunci:* Internet of Things, 6LoWPAN, WSN, RPL, Network Simulator Cooja

MERCU BUANA