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Analisis Perbandingan Performa Routing Gradient Based Routing Dan Ad-Hoc On-demand Distance Vector
Pada Sistem Pemantauan Kelembapan Tanah
Daffa Rizky Dewantara, Dr. Ronald Adrian, S.T., M.Eng., IPM.
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INTISARI

ANALISIS PERBANDINGAN PERFORMA *ROUTING GRADIENT BASED ROUTING DAN AD-HOC ON-DEMAND DISTANCE VECTOR* PADA SISTEM PEMANTAUAN KELEMBAPAN TANAH

DAFFA RIZKY DEWANTARA
22/498474/SV/21217

Sektor pertanian menghadapi tantangan perubahan iklim dan rendahnya minat generasi muda bertani, sehingga diperlukan solusi *Wireless Sensor Network* (WSN) untuk pemantauan kelembapan tanah dan irigasi otomatis. Protokol *routing* bawaan ZigBee Pro pada XBee S2, yaitu AODV, memiliki *overhead route discovery* yang menaikkan *delay* dan *packet loss*. Penelitian GBR sebelumnya umumnya hanya diuji pada simulator atau diterapkan pada domain lain seperti robotik dan jaringan seismik, belum divalidasi pada *hardware* WSN pertanian nyata. Penelitian ini mengimplementasikan GBR langsung pada Arduino Uno dan XBee S2 melalui tabel gradien berbasis ACK dan *decay* berkala di *application layer*, berdampingan dengan AODV bawaan ZigBee Pro. Pengujian dilakukan pada jarak 5–30 meter dan interval 1 serta 5 detik, tiga kali ulangan, mengevaluasi *packet loss*, *delay*, *jitter*, dan *throughput* terhadap standar TIPHON. Hasil menunjukkan *delay* dan *jitter* seluruh skenario masuk kategori sangat bagus dan bagus. GBR menghasilkan *packet loss* jauh lebih stabil, bahkan 0% pada interval 5 detik di jarak 5–25 meter, sementara AODV unggul di segi *throughput* namun *packet loss*-nya melonjak 12,06% di 30 meter. Keberhasilan implementasi GBR pada *hardware* nyata ini membuktikan kelayakan protokol tersebut di luar simulasi.

Kata Kunci: *Wireless sensor network, Gradient-Based Routing, AODV, Quality of service, ZigBee.*

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ABSTRACT

PERFORMANCE COMPARISON OF GRADIENT-BASED ROUTING AND AD-HOC ON-DEMAND DISTANCE VECTOR IN A SOIL MOISTURE MONITORING SYSTEM

DAFFA RIZKY DEWANTARA
22/498474/SV/21217

Indonesia's agricultural sector faces climate change challenges and declining youth interest in farming, motivating *Wireless* Sensor Network (WSN) solutions for soil moisture monitoring and automated irrigation. The default ZigBee Pro routing protocol on XBee S2, AODV, suffers from route discovery overhead that raises delay and packet loss. Prior GBR studies were mostly simulation-based or applied to unrelated domains such as robotics and seismic networks, without validation on real agricultural WSN hardware. This study implements GBR directly on Arduino Uno and XBee S2 hardware via an ACK-driven gradient table with periodic decay at the application layer, running alongside ZigBee Pro's built-in AODV. Testing covered distances of 5–30 meters and intervals of 1 and 5 seconds, each repeated three times, evaluating packet loss, delay, jitter, and throughput against the TIPHON standard. Results show delay and jitter in all scenarios met the very-good and good categories. GBR produced far more stable packet loss, reaching 0% at a 5-second interval within 5–25 meters, while AODV achieved higher throughput but its packet loss rose to 12.06% at 30 meters. This successful real-hardware GBR implementation confirms the protocol's viability beyond simulation.

Keywords: Wireless sensor network, Gradient-Based Routing, AODV, Quality of service, ZigBee.