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IMPLEMENTASI *WEBSITE* JARINGAN IOT MENGGUNAKAN LORA *POINT-TO-POINT* (P2P) UNTUK PEMANTAUAN RADIASI LINGKUNGAN PADA *RADIATION PORTAL MONITOR*

Aryaguna Abi Rafdi Yasa

ABSTRAK

Keamanan material nuklir dan radioaktif telah menjadi isu global yang semakin mendesak. *International Atomic Energy Agency* (IAEA) mencatat ribuan insiden terkait perdagangan ilegal atau pencurian material radioaktif, khususnya di negara dengan posisi geografis strategis seperti Indonesia. Meski *Radiation Portal Monitor* (RPM) berperan penting dalam deteksi di wilayah perbatasan, efektivitasnya kerap terkendala infrastruktur komunikasi yang terbatas. Penelitian ini merancang dan menguji sistem komunikasi *Point-to-Point* (P2P) berbasis LoRa untuk menghubungkan *Centralized Alarm System* (CAS) dengan *gateway* pemantauan berbasis *Raspberry Pi*. Pengujian dilakukan pada tiga lokasi berbeda dengan tingkat halangan fisik yang bervariasi. Evaluasi mencakup parameter teknis utama seperti kekuatan sinyal *Received Signal Strength Indicator* (RSSI), latensi, dan kehilangan paket. Hasil menunjukkan sistem mampu beroperasi secara andal, meskipun pada kondisi paling ekstrem terjadi kehilangan paket hingga 34,72% dan latensi maksimum 1,48 detik, tanpa menyebabkan kegagalan sistem. Sistem ini berhasil menyajikan data pemantauan secara *near real-time* melalui antarmuka web, membuktikan bahwa LoRa P2P merupakan solusi potensial untuk pemantauan radiasi di wilayah tanpa jaringan konvensional. Studi ini memberikan bukti kelayakan awal untuk penguatan sistem keamanan berbasis *Internet of Things* (IoT).

Kata kunci : LoRa, *Point-to-Point* (P2P), *Internet of Things* (IoT), *Radiation Portal Monitor* (RPM)

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IMPLEMENTATION OF AN IOT NETWORK WEBSITE USING LORA POINT-TO-POINT (P2P) FOR ENVIRONMENTAL RADIATION MONITORING ON A RADIATION PORTAL MONITOR

Aryaguna Abi Rafdi Yasa

ABSTRACT

The security of nuclear and radioactive materials has become an increasingly urgent global issue. The International Atomic Energy Agency (IAEA) has recorded thousands of incidents related to the illegal trade or theft of radioactive materials, particularly in countries with strategic geographic positions like Indonesia. While Radiation Portal Monitor (RPM) are vital at border checkpoints, their effectiveness is often limited by poor communication infrastructure. This study designs and evaluates a LoRa based Point-to-Point (P2P) communication system connecting a Centralized Alarm System (CAS) to a Raspberry Pi-based monitoring gateway. Field tests were conducted at three locations with varying physical obstructions. Key performance metrics Received Signal Strength Indicator (RSSI), latency, and Packet loss were analyzed. Results indicate stable system performance, despite encountering up to 34.72% Packet loss and a maximum latency of 1.48 seconds in the most challenging environment, without system failure. The system successfully delivered near real-time monitoring data via a web interface, demonstrating the viability of LoRa P2P for radiation monitoring in areas lacking conventional network access. This study provides a foundational proof of concept for developing IoT based national security technologies.

***Keyword** : LoRa, Point-to-Point (P2P), Internet of Things (IoT), Radiation Portal Monitor (RPM)*