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INTISARI

RANCANG BANGUN *AUTOMATIC WEATHER STATION* MENGGUNAKAN TELTONIKA RUT956 UNTUK SISTEM *MONITORING* SECARA *REAL-TIME*

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Sistem *Automatic Weather Station* konvensional dan berbasis mikrokontroler standar memiliki keterbatasan pada keandalan perangkat keras serta jangkauan konektivitas saat diimplementasikan di wilayah minim infrastruktur jaringan. Penelitian ini bertujuan untuk merancang bangun sistem AWS berbasis *Internet of Things* menggunakan router industrial Teltonika RUT956 sebagai *gateway*, sekaligus mengevaluasi performa *Quality of Service* komunikasi data berdasarkan standardisasi TIPHON. Akuisisi data dilakukan menggunakan sensor meteorologi FST100-2201 dan FST200-205 melalui protokol komunikasi serial Modbus RTU RS485. Data diproses menggunakan *custom shell script* berbasis *edge computing* dan ditransmisikan secara *real-time* ke server Node.js menggunakan metode HTTP POST. Evaluasi QoS dilaksanakan selama 18 hari berturut-turut melalui variasi interval pengiriman 5, 10, dan 30 menit dengan total hasil pengujian sebanyak 2.952 paket data. Hasil pengujian menunjukkan bahwa sistem AWS mampu beroperasi secara otonom dengan tingkat keandalan transmisi yang sangat baik. Nilai *Packet Loss* mencapai tingkat efisiensi 0% pada interval 5 dan 0,26% pada interval 30 menit, sedangkan degradasi sebesar 7,78% pada interval 10 menit teridentifikasi murni akibat gangguan catu daya eksternal. Rata-rata *Latency* transmisi tercatat sebesar 730 ms, meskipun angka ini melampaui indeks ambang batas 350 ms pada standar TIPHON, nilai tersebut dievaluasi sangat layak dan andal untuk transmisi data telemetri cuaca yang tidak bersifat *time critical*. Lebih lanjut, penelitian ini mengidentifikasi adanya anomali 465 paket redundan yang dipicu oleh fenomena *process overlapping* pada siklus pengeksekusian menit ke-00 dan ke-30. Secara keseluruhan, arsitektur sistem terbukti tangguh dalam menunjang pemantauan dinamika cuaca waktu nyata untuk skala industrial.

Kata Kunci: *Automatic Weather Station, Internet of Things*, Modbus RTU, *Quality of Service*, Teltonika RUT956.

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ABSTRACT

DESIGN AND CONSTRUCTION OF AN AUTOMATIC WEATHER STATION USING THE TELTONIKA RUT956 FOR REAL-TIME MONITORING

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Conventional and standard microcontroller-based Automatic Weather Station systems exhibit limitations in hardware reliability and connectivity range when deployed in regions with minimal network infrastructure. This research aims to design and develop an Internet of Things based AWS system utilizing the Teltonika RUT956 industrial router as a gateway, while concurrently evaluating its data communication Quality of Service performance based on the TIPHON standardization. Data acquisition is carried out using FST100-2201 and FST200-205 meteorological sensors via the Modbus RTU RS485 serial communication protocol. The data is processed using an edge-computing-based custom shell script and transmitted in real-time to a Node.js server using the HTTP POST method. The QoS evaluation was conducted over 18 consecutive days across varying transmission intervals of 5, 10, and 30 minutes, resulting in a total dataset of 2,952 tested data packets. The experimental results demonstrate that the AWS system is capable of operating autonomously with a high degree of transmission reliability. The Packet Loss achieved an efficiency rate of 0% at the 5-minute interval and 0.26% at the 30-minute interval, whereas a 7.78% degradation at the 10-minute interval was identified as being solely caused by external power supply disruptions. The average transmission latency was recorded at 730 ms; although this figure exceeds the 350 ms threshold index of the TIPHON standard, this value is evaluated as highly acceptable and reliable for weather telemetry data transmissions that are not time-critical. Furthermore, this study identified an anomaly involving 465 redundant packets triggered by a process overlapping phenomenon during execution cycles at the 00 and 30-minute marks. Overall, the system architecture proved robust in supporting real-time monitoring of weather dynamics for industrial-scale applications.

Keywords: *Automatic Weather Station, Internet of Things, Modbus RTU, Quality of Service, Teltonika RUT956.*