



SISTEM SMART HOME BERBASIS CONTEXT-AWARE MENGGUNAKAN ONTOLOGY

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INTISARI

Internet of Things (IoT) mendorong perkembangan sistem *smart home* untuk meningkatkan kenyamanan dan keamanan penghuni. Namun, sebagian besar sistem *smart home* masih bersifat reaktif terhadap data sensor dan belum mampu memahami konteks aktivitas pengguna secara komprehensif, terutama pada ruang dengan aktivitas kompleks seperti dapur. Penelitian ini bertujuan mengembangkan sistem *smart home* berbasis *context-aware* menggunakan *ontology* untuk menafsirkan aktivitas secara lebih cerdas dan adaptif. Metode penelitian meliputi perancangan sistem IoT berbasis *context-aware* dengan *ontology* sebagai representasi pengetahuan. *Ontology* dikembangkan menggunakan *Web Ontology Language* (OWL) dan aturan *Semantic Web Rule Language* (SWRL), serta divalidasi menggunakan *Pellet Reasoner*. Untuk mendukung pemrosesan *real-time*, aturan *reasoning* diimplementasikan dalam bentuk *reasoning* berbasis JavaScript. Sistem mengintegrasikan sensor, aktuator, *backend* server, dan penyimpanan data semantik berbasis Apache Jena Fuseki, dengan komunikasi melalui protokol HTTP dan *query* SPARQL. Hasil pengujian menunjukkan sistem mampu mendeteksi dan menafsirkan konteks aktivitas, meliputi memasak, mencuci, keluar/masuk, dan kondisi peringatan secara otomatis. Analisa log menunjukkan *reasoning time* berada pada kisaran puluhan hingga ratusan milidetik, *backend time* stabil, serta *end-to-end response time* berada di bawah 300 ms, sehingga memenuhi kebutuhan *real-time*. Hasil ini membuktikan bahwa integrasi *ontology* dan *context-aware reasoning* mampu meningkatkan kecerdasan sistem *smart home* dibandingkan pendekatan berbasis sensor tunggal.

Kata kunci: *Context-aware, Smart home, Ontology.*



CONTEXT-AWARE BASED SMART HOME SYSTEM USING ONTOLOGY

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ABSTRACT

The Internet of Things (IoT) has accelerated the development of smart home systems aimed at improving occupant comfort and safety. However, many existing smart home solutions remain primarily reactive to raw sensor data and lack the capability to infer user activity context in a comprehensive manner, particularly in environments with complex activities such as kitchens. This paper presents the development of an ontology-based context-aware smart home system designed to enable more intelligent and adaptive activity interpretation. The proposed system employs ontology as a knowledge representation model, developed using the Web Ontology Language (OWL) and Semantic Web Rule Language (SWRL), and validated using the Pellet reasoner. To support real-time operation, the reasoning mechanisms are implemented through JavaScript-based reasoning. The system integrates heterogeneous sensors, actuators, a backend server, and semantic data storage using Apache Jena Fuseki, with communication conducted via the HTTP protocol and SPARQL queries. Experimental evaluation demonstrates that the system is capable of automatically detecting and interpreting activity contexts, including cooking, washing, entering/leaving, and alert conditions. Performance analysis shows that the reasoning time ranges from tens to hundreds of milliseconds, while the end-to-end response time remains below 300 ms, indicating suitability for real-time smart home applications. The results suggest that ontology-driven context-aware reasoning can enhance smart home intelligence beyond conventional single-sensor-based approaches.

Keywords: *Context-aware, Smart home, Ontology.*