CONTEXT-AWARE MODELING OF AI ASSISTANT FOR SMART HOME ENERGY MANAGEMENT AND SUSTAINABILITY OPTIMIZATION

Konstantin Rusev, Todorka Glushkova

Abstract. *The increasing demand for energy efficiency and sustainable living requires sophisticated systems that can adapt to household consumption patterns, renewable energy availability, and dynamic pricing structures. This study presents a context-aware AI assistant model for smart home energy management and sustainability optimization, utilizing the Calculus of Context-aware Ambients (CCA) formalism. The proposed model represents key entities as distinct ambients that interact dynamically based on real-time energy consumption data, weather conditions, and user preferences. The model demonstrates how context-aware interactions optimize energy consumption patterns, manage renewable energy integration, coordinate smart appliance scheduling, and maximize cost savings while minimizing environmental impact. By enabling continuous adaptation to changing contexts such as occupancy patterns, weather fluctuations, and grid load conditions, the system provides personalized energy management that reduces household energy costs.*

Key words: AI Energy Assistant, Smart Home Automation, Energy Optimization, Sustainability Management, Calculus of Context-Aware Ambients, CPS, CPSS, ViPS

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Konstantin Rusev[1], Todorka Glushkova[1,*]
[1] Paisii Hilendarski University of Plovdiv,
Faculty of Mathematics and Informatics,
236 Bulgaria Blvd., 4027 Plovdiv, Bulgaria
Corresponding author: glushkova@uni-plovdiv.bg