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MESSENGER BOTS IN SMART HOMES: COGNITIVE AGENTS AT THE FOREFRONT OF THE INTEGRATION OF CYBER-PHYSICAL SYSTEMS AND THE INTERNET OF THINGS

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Modern smart homes, functioning as integrated cyber-physical systems (CPS), are transforming our understanding of living space, providing it with intelligent capabilities for self-management and adaptation. This transformation has been made possible by the convergence of advanced technologies such as the Internet of Things (IoT), cloud computing, artificial intelligence (AI), and natural language processing (NLP). In this context, messenger bots based on cognitive computing methods act as intelligent agents that provide intuitive and efficient human interaction with these complex systems [1].

The cognitive architecture of a smart home is a multi-level system where messenger bots play a key role, acting as an interface between a person and other system components. They provide two-way communication, allowing users to control and receive information from the smart home. This interface is based on semantic analysis of natural language, allowing users to interact with the system using common language constructs rather than specialized commands [2].

The technologies underlying cognitive messenger bots include a wide range of methods and algorithms. Natural language processing (NLP) using transformational models (BERT, GPT), recurrent neural networks (RNN), and other methods allows analyzing the semantics and syntax of language, recognizing user intentions, and generating responses.

Machine learning (ML) with reinforcement learning (RL), supervised learning (SL), and other ML algorithms is used to train bots based on data, improve their performance, and adapt to user needs. Knowledge bases and ontologies that contain information about devices, functions, and usage scenarios of the smart home help to understand the context and ensure the relevance of responses. Application programming interfaces (APIs) enable the integration of messenger bots with various smart home components, cloud services, and other external systems.

Cognitive messenger bots provide users with a wide range of options for managing and interacting with their smart home. In addition to intuitive control, personalization, and proactive management, they are capable of contextual understanding, which allows them to take into account previous requests and the context of the conversation when executing commands. Integration with other systems, such as calendars, email clients, and social networks, extends the functionality of bots and provides users with additional features [3].

However, the implementation of cognitive messenger bots in smart homes is associated with a number of challenges. Ensuring data security and user privacy is a critical task that requires the development of reliable mechanisms to protect against unauthorized access, information leakage, and misuse of bots. Reliability and fault tolerance are important aspects that require the development of error handling, disaster recovery, and data backup mechanisms. The ethical aspects of using cognitive technologies in smart homes, related to system autonomy, responsibility for decision-making, and the impact on users' privacy, require the development of ethical principles and standards.

Further research and development in this area should be aimed at addressing these challenges and expanding the functionality of cognitive messenger bots. This includes improving NLP and ML algorithms, developing new methods to ensure security and privacy, and creating more efficient integration mechanisms with various systems and services.

Conclusions. Cognitive messenger bots have the potential to become a key element in the development of smart homes, providing intuitive, personalized, and efficient interaction with users. Further research and development in this area will create a new generation of intelligent systems that will make our lives more comfortable, safe, and efficient.

References:

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