Peer Response 1: OO Design for IoT

In reply to Oi Lam Siu

by Andrius Busilas - Thursday, 9 May 2024, 7:56 PM

Dear Oi,

Your description of Fortino et al.'s (2015) method for designing smart objects using metamodels at various levels of abstraction is thorough and well-organized. The explanation of the High-Level Smart Object Metamodel, ELDA Smart Object Metamodel, ACOSO Smart Object Metamodel, and JACOSO Metamodel for different phases of analysis, design, and implementation is clear and well-structured. The text effectively emphasizes the significance of metamodels in enhancing the object-oriented design of Internet of Things (IoT) systems and their advantages in terms of abstraction, standardization, reusability, flexibility, and extensibility.

The example of designing a smart model to support a driverless car's operation is relevant and effectively demonstrates how an object-oriented approach can be applied in practical settings. The comprehensive breakdown of components such as the Vehicle object, sensor objects, actuator objects, modules for perception, decision-making, control, communication, and user interface illustrates a complete view of designing autonomous functionalities within the IoT context.

Overall, your post is enlightening, well-written, and offers valuable insights into the use of metamodels in the development of smart objects and IoT systems. It effectively connects theoretical concepts with practical examples, making it accessible to readers with an interest in this topic. To enhance the credibility and depth of the text, it would be beneficial to further discuss the challenges and limitations of employing metamodels in IoT design, as well as potential future research directions in this area. Additionally, incorporating more references to support the claims made in the text would strengthen its validity.

Initial Post

by Oi Lam Siu - Tuesday, 7 May 2024, 11:21 AM

Number of replies: 1

Fortino et al. (2015) proposed an approach that introduces metamodels at different levels of abstraction to support the various stages of analysis, design, and implementation in the development of smart objects (SO). These metamodels include the High-Level Smart Object Metamodel for the analysis phase, which models the relevant aspects of the SO. Additionally, the Event-driven Lightweight Distilled statecharts-based Agent (ELDA) smart Object Metamodel and the Agent-based COoper-ating Smart Objects (ACOSO) Smart Object Metamodel are used for the design phase to model the functional components, relationships, and interactions of the system. Moreover, the ACOSO-based Smart Object Metamodel has been specialized for the JADE platform, resulting in the JACOSO Metamodel, which supports the implementation phase.

A metamodel that supports the object-oriented design of the Internet of Things (IoT) is a model that defines the structure, relationships, and behaviors of other models within the IoT domain. It offers a higher-level abstraction and serves as a template or framework for creating specific object models for IoT systems. The advantages of using a metamodel in this context include abstraction and standardization, promoting reusability, and allowing for flexibility and extensibility as the IoT landscape evolves. However, the development of a metamodel can be complex, and there may be a learning curve for designers and developers.

To design a smart model that supports the operation of a driverless car, an object-oriented approach can be followed. The model would involve a "Vehicle" object to represent the car, sensor objects (such as Lidar, Radar, Camera, GPS) for perceiving the environment, actuator objects (such as Steering, Accelerator, Brake) for controlling the car's movements, a perception module for processing sensor data, a decision-making module for planning paths and avoiding obstacles, a control module for executing actions, a communication module for vehicle-to-vehicle and vehicle-to-infrastructure communication, and a user interface for interaction and monitoring. By incorporating these components and their interactions, the smart model provides a framework for designing and implementing the autonomous functionalities of a driverless car within the IoT context.

References:

Fortino, G., Guerrieri, A., Russo, W. & Savaglio, C. (2015) Towards a Development Methodology for Smart Object-Oriented IoT Systems: A Metamodel Approach. 2015 IEEE International Conference on Systems, Man, and Cybernetics. 1297-1302. DOI: 10.1109/SMC.2015.231.