Collaborative Discussion 2: OO Design for IoT

Making reference to the article by Fortino et al. (2015), consider the strengths and weaknesses of designing a metamodel to support object-oriented design of the IoT. Design a smart model equivalent to that presented in Figure 6 which would instead support operation of a driverless car.

Peer Response 1:

Dear Oi,

Thank you for your post. Your entry provides a comprehensive and detailed overview of the metamodeling approach for the development of smart objects (SO) and its application to the design of driverless vehicles based on the Fortino et al. (2015) paper. This structured approach ensures that each phase of development—analysis, design, and implementation—is well-supported and clearly defined.

I found your smart model for the operation of the driverless car noteworthy. Particularly:

1. Detailed Component Breakdown:

- The model's breakdown into specific objects such as "Vehicle," "Sensor," and "Actuator" is well-articulated. This granularity ensures that each component's role is clearly understood and can be independently developed and tested.
- The inclusion of various sensor objects (LIDAR, RADAR, Camera, GPS) highlights the comprehensive approach to environmental perception, which is crucial for the safe operation of autonomous vehicles.

2. Modular Design:

- The modular approach, with distinct modules for perception, decision-making, control, communication, and user interface, promotes a clear separation of concerns. This not only enhances the maintainability of the system but also allows for easier updates and integration of new technologies.

- The decision-making module's role in path planning and obstacle avoidance is critical for the dynamic and unpredictable nature of real-world driving scenarios.

3. Interoperability and Communication:

- The communication module for vehicle-to-vehicle (V2V) and vehicle-to-infrastructure (V2I) communication is a forward-thinking inclusion. It aligns with the broader vision of smart cities and connected transportation systems, ensuring that the driverless vehicle can interact seamlessly with its environment.

In conclusion, your discussion post effectively highlights the strengths of using a metamodeling approach for the design and implementation of driverless vehicles within the IoT context. The detailed breakdown of components and the emphasis on modularity, interoperability, and user interaction provide a robust framework for developing autonomous vehicle systems. The advantages of abstraction, standardisation, and flexibility further underscore the value of this approach, despite the inherent challenges. Thank you!

References:

Fortino, G., Guerrieri, A., Russo, W. & Savaglio, C. (2015) Towards a development methodology for smart object-oriented IoT systems: A metamodel approach. In *2015 IEEE international conference on systems, man, and cybernetics* (1297-1302). IEEE.

Peer Response 2:

Dear Alexandr,

Thank you for your contribution to the discussion. I particularly appreciated the clear approach towards mapping the structure for an autonomous vehicle. It covers all key aspects and the discussion on strengths and weaknesses are relevant and apply well.

To emphasise in more detail:

1. Comprehensive Abstraction:

- Your highlight on abstraction is well-placed. By focusing on essential concepts, metamodels simplify the understanding and communication of complex systems. This is particularly beneficial for autonomous cars, which involve numerous interconnected components and functionalities.

2. Standardisation and Interoperability:

- Highlighting standardisation as a benefit is crucial. Establishing standard practices through metamodels promotes interoperability and component reuse, which are essential for the collaborative development of driverless vehicle technologies. This could lead to more efficient and cohesive system designs.

3. Scalability:

- Your point on scalability is particularly relevant. As driverless vehicle systems evolve and expand, the ability of metamodels to scale with system complexity ensures that they can handle future advancements and integrations seamlessly. This is equally a weakness, as initial overhead and on-going maintenance efforts are required, as you rightly discussed.

4. Complexity in Definition:

- While defining clear and concise concepts for complex systems like driverless vehicles requires significant effort, your structured approach to identifying key components (e.g., sensors, smart services) and mapping these to the key SO attributes Fortino et al. (2015) highlight helps mitigate this challenge.

In conclusion, your discussion post effectively demonstrates the strengths of using a metamodel approach for designing complex systems like autonomous vehicles. I gained additional considerations for my work through your analysis. Thank you!

References:

Fortino, G., Guerrieri, A., Russo, W. & Savaglio, C. (2015) Towards a development methodology for smart object-oriented IoT systems: A metamodel approach. In *2015 IEEE international conference on systems, man, and cybernetics* (1297-1302). IEEE.