Peer Response to Ruben Marques (Unit 9)

Ruben’s evaluation of the T-UFF metamodel demonstrates an excellent grasp of object-oriented (OO) design principles within Internet of Things (IoT) contexts. His identification of modularity, simplicity, and cost-efficiency as key strengths is persuasive and consistent with Baskara et al.’s (2024) aim of producing a lightweight Arduino-based prototype. Equally compelling is his recognition of weaknesses in environmental awareness and scalability, reflecting the limitations of fixed-infrastructure IoT systems in dynamic environments (Dang et al., 2023).

I particularly value Ruben’s proposed integration of LiDAR-based Simultaneous Localisation and Mapping (SLAM) and Edge AI processing, which enhance situational awareness and reduce dependence on the cloud. The inclusion of LoRaWAN for long-range, low-power communication (Mekki et al., 2019) further aligns with scalable IoT design. However, his post omits discussion of OO design patterns, which are vital for modularity and adaptability in resource-constrained environments. Applying patterns such as Strategy (for dynamic navigation algorithms) and Observer (for sensor-cloud synchronisation), as outlined by Romano and Kruger (2021, p. 187, Chapter 7), could optimise control flow and data handling.

Equally, in IoT architectures with limited processing capacity, maintaining low Cyclomatic Complexity (CC < 10 per module) is essential to ensure efficiency, testability, and maintainability while preventing algorithmic overhead (Schultz, 2021). Integrating such metrics alongside design patterns would strengthen long-term sustainability and support energy-efficient software development (Şanlıalp, Öztürk and Yiğit, 2022).

Ruben’s contribution is analytically rigorous and forward-thinking. How might these patterns and complexity metrics be incorporated to ensure the humanoid robot’s software remains efficient across multiple Edge nodes?

References

Baskara, W.P. et al. (2024) ‘T-UFF (Tracker stuff): Application development for warehouse tracking’, IOP Conference Series: Earth and Environmental Science, 1294(1), p. 012025.

Dang, L.M. et al. (2023) ‘Internet of robotic things for mobile robots’, Digital Communications and Networks, 9(6), pp. 1443–1459.

Mekki, K. et al. (2019) ‘A comparative study of LPWAN technologies for large-scale IoT deployment’, ICT Express, 5(1), pp. 1–7.

Romano, F. and Kruger, H. (2021) Learn Python Programming: An In-Depth Introduction to the Fundamentals of Python. 3rd edn. Birmingham: Packt.

Schultz, C. (2021) ‘Cyclomatic complexity defined clearly, with examples’. LinearB. Available at: https://linearb.io/blog/cyclomatic-complexity (Accessed: 4 October 2025).

Şanlıalp, İ., Öztürk, M.M. and Yiğit, T. (2022) ‘Energy efficiency analysis of code refactoring techniques for green and sustainable software’, Electronics (Basel), 11(3), p. 442.