

Exploring IoT's Potential for Risk Management in Prefabricated Construction: A Preliminary Study Towards the Physical Internet

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Conference Domain Fitness:

Our study humbly contributes to the themes of IPIC 2024, aiming to modestly enhance how physical objects, specifically in prefabricated construction, are managed for societal, economic, and environmental benefits. By integrating Internet of Things (IoT) technologies, we seek to offer a small step towards the broader vision of the Physical Internet, focusing on the potential for improved risk management within construction projects. This effort aligns with the conference's call for leveraging technological advancements to foster more connected and sustainable supply chains, hoping to add to the collective knowledge and practices in this evolving domain.

Physical Internet (PI) Roadmap Fitness: Select the most relevant area(s) for your paper according to the PI roadmaps adopted in Europe and Japan: ☒ PI Nodes (Customer Interfaces, Logistic Hubs, Deployment Centers, Factories), ☐ Transportation Equipment, ☐ PI Networks, ☐ System of Logistics Networks, ☐ Vertical Supply Consolidation, ☐ Horizontal Supply Chain Alignment, ☒ Logistics/Commercial Data Platform, ☐ Access and Adoption, ☐ Governance.

Targeted Delivery Mode-s: ☐ Paper, ☐ Poster, ☐ Flash Video, ☒ In-Person presentation

Research Contribution Abstract

Addressing the critical challenge of progress management in prefabricated construction, this paper introduces a novel IoT-enabled schedule risk alert approach within a prefabricated housing construction (PHC) management framework. Built upon the A* algorithm and incorporating the worst-fit resource allocation strategy, our approach provides early warnings of schedule risks by analyzing dynamic changes in prefab states and resource allocations. Moreover, we propose a method for abstracting workflow into a unified data structure, enhancing the algorithm's adaptability across different project types. Our methodology not only demonstrates a substantial improvement in schedule risk management—evidenced by the proactive detection of the first significant project delay—but also exemplifies a scalable, real-time responsive risk management solution, embodying the Physical Internet's goals. Specifically, our research contributes to developing PI Nodes and Logistics/Commercial Data Platforms by ensuring seamless, transparent,

and efficient information flow throughout the construction process, thereby facilitating a robust framework for risk-sensitive progress management. This integration heralds a significant step forward in applying PI principles within the construction sector, offering enhanced efficiency, security, and transparency in logistics and supply chain networks.