Abstract

## [Research Title]

## Development of Contactless Garbage Collection Systems and Scenarios Construction for Social Implementation

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Principal Investigator :	Onoda Hiroshi
(PI ORCID) :	ORCID0000-0002-6766-0682
Principal Institution :	WASEDA UNIVERSITY, Graduate School of Environment and Energy Engineering 513 Wasedatsurumaki-cho, Shinjuku-ku, Tokyo 162-0041, Japan Tel: +81-3-6457-3972 E-mail: onoda@waseda.jp
Cooperated by :	Daiei Kankyo Research Institute Co., Ltd.
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This study aimed to construct a contactless garbage collection system to reduce the risk of infection among garbage collection workers, develop elemental technologies, systemise them, and build scenarios for their social implementation. The processes involved in a contactless garbage collection system were classified into monitoring, transport, and reversing functions. The following elemental technologies were developed for each: "Contactless automatic refuse input system", "Smart garbage bin for automatic removal", and "Modular mobility system for automatic transport." Demonstration tests of the contactless garbage collection system using actual garbage were conducted in a theme park, a detached housing development block, and a public housing estate. Results showed that contactless garbage collection is possible and that the number of garbage collection workers can be reduced by one.

After typifying the forms of garbage collection in Japan, scenarios for the social implementation of the contactless garbage collection system were studied. The interview survey on the needs of municipal employees, collection and transport operators, and residents confirmed a need for contactless workload reduction through the automation of garbage collection and the improvement of resident services. Based on the results of this survey and demonstration, the social implementation scenarios of the contactless garbage collection system were divided into three from the perspective of legal regulations and systems, which are particularly problematic: (1) Real scenario, (2) Regional cooperation scenario, and (3) Innovation scenario, each of which was implemented from the perspective of X Readiness Level (XRL). A roadmap for the social implementation of these scenarios was drawn up from the XRL perspective.

The results of this study indicate that in addition to further technological sophistication, it is essential to review the safety standards for refuse collection vehicles and standardise the specifications of large refuse containers, which differ from one refuse collection point to another, to promote the spread of non-contact refuse collection systems.

## [References]

Ogawa A., Pandyaswargo, A. H., Tsubouchi, R., & Onoda, H. (2023). Demonstration of contactless waste collection system: A Japanese case study. IET Smart Cities, 5(4), 303-316. https://doi.org/10.1049/smc2.12065

Shan, C., Pandyaswargo, A. H., Ogawa, A., Tsubouchi, R., & Onoda, H. (2024). Japanese public perceptions on smart bin potential to support PAYT systems. Waste Management, 177, 278-288. https://doi.org/10.1016/j.wasman.2024.02.003

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