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Information technology — Computer graphics, image processing and environmental data representation — Benchmarking of integrated indoor localization and tracking methods using dead reckoning

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Foreword

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Introduction

In the development of location-based service and application such as navigation, traffic line analysis, one of the most important parts is the localization and tracking method (LTM) used for estimating the position of the target people or objects. In contrast to the outdoor, global navigation satellite systems cannot be used in indoor environment because the signals from the satellite cannot be reached. In order to provide the solution for localization and tracking in indoor environment, the research and development on integrated indoor LTMs is flourishing and many new algorithms are proposed every year. Especially, dead reckoning technologies (xDR) such as pedestrian dead reckoning (PDR) can contribute integrated indoor localization, because of their capability of relative tracking without any infrastructure in the target environment.

Therefore, this document intends to foster objective evaluation and comparison of diverse LTMs, especially for targeting integrated LTMs using dead reckoning.

The target audience of this document includes stakeholders of benchmarking activities. The following are examples of how this document can be used directly or indirectly:

— by a benchmarking service provider, a benchmark provider or a benchmarking competition organizer who wishes to align their benchmarking activities including self-benchmarking and open or closed competitions to be consistent with this document;

— by a technology developer or supplier who wishes to estimate and evaluate the performance of an indoor localization and tracking methods appropriately with a benchmarking service provider, a benchmark provider or a benchmarking competition organizer who aligns their benchmarking activities to be consistent with this document; or

— by a technology user who wishes to obtain benchmarking results based on a benchmarking activity, which is consistent with this document, or to compare the existing indoor localization and tracking methods in terms of their performance.

The main targets of the benchmarking framework are integrated indoor LTMs using dead reckoning, which are assumed to be running on the mobile devices such as smartphones.

a) Master sets and test environments:

   The framework defines reference master sets and test environments, where integrated indoor localization methods using dead reckoning is assumed to be utilized. The reference master sets include dataset designed for evaluating individual contribution of dead reckoning method.

b) Benchmark metrics:

   The framework defines benchmark metrics consisting of indicators for dead reckoning and other indicators evaluation practical performance of indoor localization methods.

c) Benchmarking process:

   The framework defines benchmarking process which can evaluate each elemental performance of the contents of the integrated indoor localization methods and generalization performance.

d) Conformance.

   The framework defines conformance check list which can clarify how each benchmarking activity conforms to the benchmarking framework.

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Information technology — Computer graphics, image processing and environmental data representation — Benchmarking of integrated indoor localization and tracking methods using dead reckoning

1 Scope

This document specifies the reference framework for the benchmarking of integrated indoor localization and tracking methods (LTMs) using dead reckoning in areas of:

— master sets and test environments;

— benchmark metrics;

— benchmarking process;

— conformance.

2 Normative references

There are no normative references in this document.

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Bibliography

[1] ISO/IEC 18305, *Information technology — Real time locating systems — Test and evaluation of localization and tracking systems*

[2] ISO/IEC 18520, *Information technology — Computer graphics, image processing and environmental data representation — Benchmarking of vision-based spatial registration and tracking methods for mixed and augmented reality (MAR)*

[3] Ichikari, R., Kaji, K., Shimomura, R., Kourogi, M., Okuma, T., and Kurata, T.: Off-site indoor localization competitions based on measured data in a warehouse. Sensors. 2019, 19(4), article 763, doi: 10.3390/s19040763

[4] Abe M., Kaji K., Hiroi K., Kawaguchi N. PIEM: path independent evaluation metric for relative localization. *Proceedings of International conference on Indoor position and Indoor Navigation*, 2016, doi: 10.1109/IPIN.2016.7743587

[5] Competition in IPIN conference. 2023 [viewed 2024-06-23]. Available from: https://evaal.aaloa.org/2023/call-for-competition

[6] xDR Challenge 2023 [viewed 2025-10-01]. Available from: https://unit.aist.go.jp/harc/xDR-Challenge-2023/

[7] xDR Challenge 2020 [viewed 2025-10-01]. Available from: https://unit.aist.go.jp/harc/xDR-Challenge-2020/

[8] xDR Challenge 2019 [viewed 2025-10-01]. Available from: https://unit.aist.go.jp/harc/xDR-Challenge-2019/

[9] xDR Challenge 2018 [viewed 2025-10-01]. Available from: https://unit.aist.go.jp/harc/xDR-Challenge-2018/

[10] Challenge P.D.R. 2015 [viewed 2025-10-01]. Available from: https://ubicomp.org/ubicomp2015/challenge.html

[11] IPIN 2024 Competition Track 3 [viewed 2025-10-01]. Available from; https://competition.ipin-conference.org/2024/call-for-competition

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