2023 IPIN competition

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Why the IPIN competition

IPIN 2023
THIRTEENTH INTERNATIONAL CONFERENCE ON
INDOOR POSITIONING
AND INDOOR NAVIGATION
25th-28th Sep. 2023, Nuremberg Germany

An academic view: *uniquely* rigorous, transparent, open, fair **comparison of systems** in controlled conditions and realistic scenarios

- would need coordination of several research groups
- difficult, time consuming, boring

An industrial / market view: *uniquely* rigorous, transparent, open, fair **performance evaluation of systems** in controlled conditions and realistic scenarios

- gives much worse results than in papers and advertisements
- expensive to assess in a credible way

Onsite and offsite Tracks

Since 2021 we have used **EvaalAPI**, a web API, for **offsite Tracks**.

The EvaalAPI server provides competitors with sensor readings; it also gathers the competitor's position estimates.

In *offsite-online* Tracks, competitors provide a position estimate for the current emulated time, then receive a batch of sensor data (default 0.5 s), then the process repeats. The process is

- **causal** – competitors provide an estimate before seeing the next sensor reading
- **real-time** – estimates must be provided within time contraints
- **non-repeatable** – while the sensor data flow is provided, competitors provide a parallel flow of position estimates: time cannot be rewound

In *offsite-online* Tracks, competitors read the entire set of sensors data and provide estimates by a deadline.

Geographical distribution

Number of competitors

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Edition		On-site		Off-site		Overall	
Year	Location	Tracks	Competitors (submissions)	Tracks	Competitors (submissions)	Tracks	Competitors (submissions)
2014	Busan (KR)	1	7 (11)			1	7 (11)
2015	Banff (CA)	2	6 (8)	1	4 (4)	3	10 (12)
2016	Alcalá (ES)	2	12 (14)	2	7 (9)	4	19 (23)
2017	Sapporo (JP)	2	10 (18)	2	10 (11)	4	20 (29)
2018	Nantes (FR)	2	15 (17)	2	19 (22)	4	34 (39)
2019	Pisa (IT)	2	10 (16)	3	20 (26)	5	30 (42)
2020	online			5	22 (32)	5	22 (32)
2021	Lloret (ES)			3	13 (26)	3	13 (26)
2022	Bejing (CN)			6	26 (29)	6	26 (29)
2023	Nürnberg	1	3 (3)	6	29 (35)	7	32 (38)

Competitors at IPIN 2023

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- Track 1: Smartphone (**onsite**) ← welcome back!
- Track 3: Smartphone (offsite-online)
- Track 4: Foot-mounted IMU (offsite-online)
- Track 5: Smartphone (**offsite-offline**) ← new formula!
- Track 6: Smartphone on vehicle (offsite-online)
- Track 7: 5G CIR (offsite-online)
- Track 8: 5G ToF (offsite-online)

Competitors who	Track 1	Track 3	Track 4	Track 5	Track 6	Track 7	Track 8	Total
registered	3	10	5	9	3	5	3	**38**
competed	3	8	5	7	3	4	2	**32**
run to the end	3	7	5	7	2	4	2	**30**
are awarded	3	3	3	3	1	2	1	**16**

Realism in IPIN competition

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The **EvAAL framework** is a set of criteria guiding the set-up of Track rules:

Core criteria	Extended criteria
1. Natural movement of an actor	5. Secret path
2. Realistic environment	6. Independent actor
3. Realistic measurement resolution	7. Independent logging system
4. Third quartile of point Euclidean error	8. Identical path and timing

Some Tracks are *mature*: they mostly satisfy all criteria

- Track 1: Smartphone (**onsite**) — The flagship, 2014
- Track 3: Smartphone (offsite-online) — First offsiteTrack, 2015
- Track 4: Foot-mounted IMU (offsite-online) — Second offsite Track, 2016

Improving realism

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Younger Tracks are *evolving* towards increased compliance with the EvAAL framework:

Track 5: Smartphone (**offsite-offline**)
- New 2023 formula from a 2019 concept

Track 6: Smartphone on vehicle (offsite-online)
- Reducing outdoor parts, adding pedestrian and improving realism, 2020

Track 7: 5G CIR (offsite-online)
- From UWB to 5G, from fixed-height robot to actor, improving realism, 2020

Track 8: 5G ToF (offsite-online)
- From fixed-height cart to actor, increasing size and improving realism, 2022

Perspectives of IPIN competition

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Short term:

- Increase realism of younger Tracks by improving their compliance with the **EvAAL framework**
  - More realistic scenarios
  - More realistic actor movements
  - More realistic time and space resolution: 0.5 s, 25 cm
- Scalability of EvaalAPI server management
- Better year-long advance planning

Long term:

- Improve visibility and documentation
- Aim to measuring 95% (now 75%) as technology advancements grant it
- Account for repeatability of results