# Location-based navigation and services

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# Introduction

**The aim** - To give an overview of location-based services, fields where these services are used, current location-tracking technologies and possible improvements.

- Definition of research questions
- Data search
- Study selection and quality assessment
- Data extraction
- Results

# Research Questions

**RQ1:** For what kind of services is location-based technology used?

**RQ2:** Which fields and domains have applications of location-based navigation and other services?

**RQ3:** What are the different location-tracking technologies and devices?

**RQ4:** What are the proposed potential location-tracking technologies or solutions that have not yet been widely implemented?

# Database

IEEEXPLORE

## SEARCH STRING

location

AND tracking

AND technology

AND (sensor OR device)

AND (internet of things OR asset tracking OR object detection OR indoor navigation)

**= 72 results**

# Exclusion Criteria

**EC1:** Papers that are not conference materials or academic journals (69 remaining)

**EC2:** Papers published before 2016 (28 remaining)

# Inclusion criteria

**IC1:** Journals discussing services that use location-based technology

**IC2:** Journals mentioning fields and domains that have applications of location-based navigation and other services

**IC3:** Journals reviewing different location-based technologies and devices

**IC4:** Journals proposing potential location-tracking technologies or solutions that have not yet been widely implemented

**= 17 papers chosen**

# Quality assessment

**QC1:** Is the title and abstract clear in their aim and their connection to the current paper?

**QC2:** Is the full text of the paper written in correct English?

**= 16 total papers remaining**

# Data Extraction Table Structure

| Data Item | Value | RQ |
|---|---|---|
| Article link | Link to the IEEEXPLORE article page | |
| Article Title | Name of the article | |
| Author(s) | Name(s) of the author(s) | |
| Services | Services that use location-tracking technology | RQ1 |
| Fields and domains | Fields and domains where location-based services are used | RQ2 |
| Technologies and devices | Location-tracking technologies and devices | RQ3 |
| Future solutions | Not widely implemented proposed technologies or solutions for location-tracking | RQ4 |

# RQ1: Services

For what kind of services is location-based technology used?

| Service | Occurrences |
|---|---|
| Indoor localisation | 9 |
| Indoor location tracking | 8 |
| Asset tracking | 7 |
| Path generation | 3 |
| Vehicle tracking | 2 |
| Outdoor location tracking | 2 |

# RQ2: Fields and domains

Which fields and domains have applications of location-based navigation and other services?

| Field or domain | Occurrences |
|---|---|
| Asset management | 7 |
| Healthcare | 5 |
| Care facilities | 3 |
| Wearables | 3 |
| Navigation | 3 |
| Marketing | 3 |
| Law enforcement | 2 |
| Smart home | 2 |
| Smart city | 2 |
| Social networking | 1 |
| Activity monitoring | 1 |

# RQ3: Technologies and devices

What are the different location-tracking technologies and devices?

| Field or domain | Occurrences |
|---|---|
| Wi-Fi | 9 |
| Radio Frequency Identification Device (RFID) | 9 |
| Bluetooth Low Energy beacons (BLE) | 7 |
| Global Positioning System (GPS) | 7 |
| Visual image processing | 3 |
| Ultra-Wideband (UWB) | 2 |
| Infrared | 2 |
| Ultrasound | 2 |
| Inertial sensors | 2 |
| GLONASS | 1 |
| GALILEO | 1 |
| Zigbee | 1 |

# RQ4: Future solutions

What are the proposed potential location-tracking technologies or solutions that have not yet been widely implemented?

| Field or domain | Source |
|---|---|
| Time difference of arrivals of ultrasonic reflections | [4] |
| Magnetic field identification | [6] |
| Device-free passive indoor system (DfP) | [8] |
| Kalman-LULU in signal processing stage | [9] |
| Amazon Echo voice interface with ultrasonic sensors | [10] |
| Action recognition system with BLE | [11] |
| RSG matrix for enhanced Wi-Fi fingerprints | [13] |
| Deanonymisation of Wi-Fi traces for efficient tracking | [14] |
| Auxiliary observation nodes determining signal strengths | [16] |
| Correcting error tracking by image tracker and UWB device | [17] |

# Reflection

- Could have defined a more general search string to find more results

- Could have used an additional data source for broader results

- Conducting the mapping study was very insightful

# References

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