# **Classification of Products Based on Tracking Technology**

## **1. IMU-Only Tracking Systems**

These products use only inertial sensors (accelerometer, gyroscope, sometimes magnetometer) for motion tracking. They are portable and low-cost but lack absolute position and are prone to drift over time without correction.

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|  | SlimeVR2 | SlimeVR | [Vive](https://www.vive.com/us/accessory/tracker3/) | [Tundra](https://www.kickstarter.com/projects/tundralabs/tundra-tracker) | [Amethyst](https://k2vr.tech/) | [Haritora](https://ja.shiftall.net/products/haritorax2) | [mocopi](https://electronics.sony.com/more/mocopi/all-mocopi/p/qmss1-uscx) |
| Developer | SlimeVR | SlimeVR | HTC | Tundra | K2VR Team | Shiftall | Sony |
| Form factor | 5x 50 g trackers | 5x 50 g trackers | 3x 75 g trackers | 3x 50 g trackers | Central camera | 6x 17g trackers | 6x 8g trackers |
| Battery Life | 20 h | 15 h | 7.5 h | 7 h | ∞ | 50 h | 10 h |
| Base station | No (Wi-Fi) | No (Wi-Fi) | SteamVR Lighthouse | SteamVR Lighthouse | Kinect | No (Bluetooth or own 2.5Ghz dongle) | No (Bluetooth) |
| Prone to occlusion | No | No | Yes | Yes | Yes | No | No |
| Coverage | 360° | 360° | 360° | 360° | 360° | 360° | 360° |
| Precision | 1-10 cm **¹** | 1-10 cm **¹** | < 1 mm | < 1 mm | 1-10 cm | 1-10 cm **¹** | 1-20 cm |
| Latency | ~15 ms | ~15 ms | ~15 ms | ~15 ms | ~20 ms | ~15 ms (with dongle), >15 ms (Bluetooth) | 50+ ms |
| Update rate | 100 Hz | 100 Hz | 90-144 Hz | 90-144 Hz | 30 Hz | 50-100 Hz | 50 Hz |
| Range | Wi-Fi coverage | Wi-Fi coverage | 10 m | 10 m | 2-4 m | Bluetooth / dongle coverage | Bluetooth coverage |
| Can track any object | No | No | Yes | Yes | No | No | No |
| Open Source | SW + HW | SW + HW | No | No | SW | No | No |
| Price | $185 | $195 | $390 + ~$400 Lighthouse | $360 + ~$400 Lighthouse | ~$30 (used Kinect) | $299 | $450 |

## **2. Optical-Only Tracking Systems**

These products rely entirely on external cameras and active or passive visual markers (usually IR LEDs or reflectors). They are highly accurate for position tracking but cannot detect orientation without additional sensors.

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| No | Product Name | Tracking Type | Setup Components | Price | Notes |
| 6 | Vicon Active Crown | Optical only (IR LED) | IR LEDs tracked by Vicon IR cameras (Valkyrie, Vero) | Approx. 4000 EUR or more | No IMU. Only works with full Vicon camera setup. High accuracy. |
| 7 | HTC Vive Tracker 3.0 | Optical only (Laser) | Tracker and SteamVR base stations | 140 EUR plus approx. 200 EUR for base stations | Accurate and widely used in VR. No IMU included. |
| 8 | OptiTrack Active Tag | Optical only (IR LED) | LED tag and OptiTrack cameras (Prime series) | 300 to 500 USD+ | Similar to Vicon Crown. No IMU. Industrial-grade tracking. |

## **3. Hybrid IMU + Optical Tracking Systems**

These systems combine inertial sensors (IMU) with optical tracking to compensate for drift and provide both orientation and absolute position. They are more robust but typically more expensive or require custom design.

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| No | Product Name | Tracking Type | Setup Components | Price | Notes |
| 9 | Vive Mars CamTrack | Hybrid (Optical + Sync) | Vive Trackers with SteamVR base stations and sync hub | Over 6000 EUR | Designed for virtual production camera tracking. Not wearable. |
| 10 | XSens MVN Link | Hybrid (IMU + Optical) | Full body IMU suit plus optional optical anchors | 2000 to 6000 EUR+ | Used in high-end motion capture. |
| 11 | Your Proposed Tracker | Hybrid (IMU + Optical) | MPU9250 or similar IMU, IR LED, microcontroller, optional camera | 25 to 50 EUR (estimated BOM) | Low-cost DIY system. Fusion of IMU and optical tracking. |

## **4. AI, Vision, and UWB-Based Studio Tracking Systems**

These systems use advanced computer vision, ultra-wideband (UWB), or encoded mechanical positioning to track people, cameras, or objects. Most are high-end and used in professional studio or event environments.

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| No | Product Name | Tracking Type | Setup Components | Price | Notes |
| 12 | Vizrt Object Tracker | AI Vision Tracking | Video analysis and object labeling | Contact required | Used in broadcast for automated tracking and graphics insertion. |
| 13 | Pixotope CamTrack | Marker and camera sync | Camera encoder, markers, and vision pipeline | Contact required | Used in AR, virtual studios, Unreal Engine pipelines. |
| 14 | Mo-Sys CamTrack | Optical and mechanical | Encoded tripod head and camera position | Contact required | Live broadcast and virtual studio production. |
| 15 | EZtrack Hub | Hybrid optical and encoder | IR LED tags, lens encoders, sync controller | 5000 to 7000 EUR | Real-time studio camera tracking system. |
| 16 | BlackTrax | Optical and UWB | Wearable tags tracked in 3D space | Over 20000 EUR | Real-time tracking for lighting, audio, and stage automation. |
| 17 | Zactrack (Lawo) | UWB and IR hybrid | UWB anchors and tags integrated with AV control | Over 15000 EUR | Used for theater and stage automation including sound and video. |
| 18 | L-Acoustics StageTracker | RF tag positioning | RF tags and real-time spatial processing | Contact required | Used in immersive spatial audio environments. |
| 19 | Datavideo PTZ Tracking | AI body tracking | Auto-tracking PTZ cameras with face detection | 1000 to 1500 EUR | For conference rooms and education streaming setups. |

**Market Trend and Opportunity**

The market for real-time tracking systems spans from simple inertial trackers to complex optical and AI-enhanced solutions. Most low-cost solutions suffer from drift (IMU-only), while high-precision systems like Vicon and BlackTrax are prohibitively expensive for smaller studios or independent developers.

There is a noticeable **gap in the market** for:

* A **modular, hybrid solution** combining **IMU data for orientation** and **optical IR markers for position**.
* A **cost-efficient alternative** for spatial audio object tracking, camera motion capture, and virtual production.
* A system that is **DIY or semi-professional**, with open-source or configurable hardware/software pipelines.

Our idea directly addresses this gap by offering a **robust, affordable, and flexible tracking solution** that could serve multiple industries: audio engineering, live production, AR/VR, and research.