

Comparison of Visual Positioning Services (VPS) and Spatial Anchors for Enterprise AR

Categories: Tool Assessments/Comparisons and Interoperability/Standards

Relevant AREA Research Agenda topics:

<https://thearea.org/area-research-agenda/opportunities-for-ar-cloud-technologies-in-enterprise/>
<https://thearea.org/area-research-agenda/visualization-of-routes-risks-and-transit-time-in-ar/>
<https://thearea.org/area-research-agenda/authoritative-information-and-source-validation-in-ar/>

Visual Positioning Systems or Services (VPS) determine a device's location and position/orientation based on features in images captured by the user's device rather than GPS signals. VPS systems create a 3D spatial map of a space by taking a series of images that have a known location and analyzing them for key visual features to create a fast, searchable index of those visual features.

To localize the user, the VPS compares the features received from the device in real time with those in the VPS' feature index. The accuracy of localization through a VPS is greatly affected by the quality of both the imagery indexed and sent when locating, and the location associated with it.

Executive Summary: This project will identify commercial and open source Visual Positioning Services that create an index of visual features in a space, use or provide anchors on which AR experiences can be triggered, and study, compare and contrast at least four of the platforms (those most likely to suit enterprise requirements) for indoor enterprise AR use cases. The question of how to manage spatial data (e.g., limiting the spatial map to only those spaces relevant to the user) and the options for premise-based deployments should be in scope.

Problem statement

- Many modern AR experiences must be manually initiated by the user and are not sensitive to the user's location/position and orientation. This is in part due to the fact that the device is unable to accurately position itself (and to detect visual anchors) in a user's indoor environment.
- It is not possible to use GPS for reliable user positioning in most enterprise AR workplaces. Beacons and other technologies (e.g., markers) are not always easy to install and maintain or are unsuitable in some settings.

- Having an indexed visual map of a space on a user's AR display device requires expensive memory and may be computationally complex for the device, resulting in low battery life and/or latency.

Desired outcomes of the research project/problem resolution

Successful completion of this project will result in the following benefit for AREA members:

- Inform AREA members of capabilities and shortcomings of VPS and anchor recognition environments or platforms, enabling members to make informed decisions about adoption of VPS for indoor positioning to make their projects more flexible (where experiences are triggered by the user's location, rather than the user needing to start).
- Improve or offer an alternative to beacons, markers or other indoor positioning technologies which the enterprise may be considering or have implemented.
- Highlight weaknesses and/or roadblocks AREA members may encounter in creating and maintaining 3D spatial maps for VPS for AR use cases, enabling members to prepare for and mitigate these factors.
- Identify areas within VPS ecosystems and pipelines to AR where providers may be able to add value and enhance existing commercial or open source VPSs.

Technologies of interest/focus

- 3D mapping for visual positioning/localization of user's device
- Recognition of visual features for localization
- Management of spatial data (on device or in cloud?)
- Cloud-based VPS

Inputs

The following inputs will be required for the successful completion of this project:

- Access to and use of at least four VPS that allow for 3D visual mapping of an indoor space and then the use of the VPS in an AR experience, including but not limited to:
 - Apple
 - Magic Leap
 - ARWAY
 - Augmented Pixels
 - Sturfee
 - HERE
 - Sensetime
 - Niantic Lightship VPS
 - Immersal SDK
 - Augmented City
 - Google Maps VPS and [Geospatial Creator](#)
 - Auki Labs
- Access to AR-capable devices such as HoloLens, Magic Leap, Meta Quest, iPhone/iPad, Android devices for testing
- At least one, ideally two, spaces representative of indoor enterprise AR workplaces.

- Example navigation/route for testing the VPS accuracy, latency, bandwidth or computational load requirements and other metrics.
- AREA member interview identifying VPS platforms or services they are using or have evaluated and any positives or negatives they encountered with development, deployment, or adoption of said tools.

Deliverables

Successful completion of this project will result in the following AREA member exclusive deliverables:

- A detailed report comparing VPS solutions or services suitable for enterprise indoor use cases based on a standard set of metrics, requirements and features
- A feature comparison matrix, permitting adopters to view high-level differences between the current commercial and open source VPS offerings.
- Interactive or multimedia content such as detailed comparison videos or running apps demonstrating observable differences in selected VPS platforms.
- A step-by-step methodology for AREA members to follow when evaluating VPS platforms or services.
- Recommendations for deployers of VPS for indoor localization

A webinar and executive summary for public audiences are two additional deliverables.