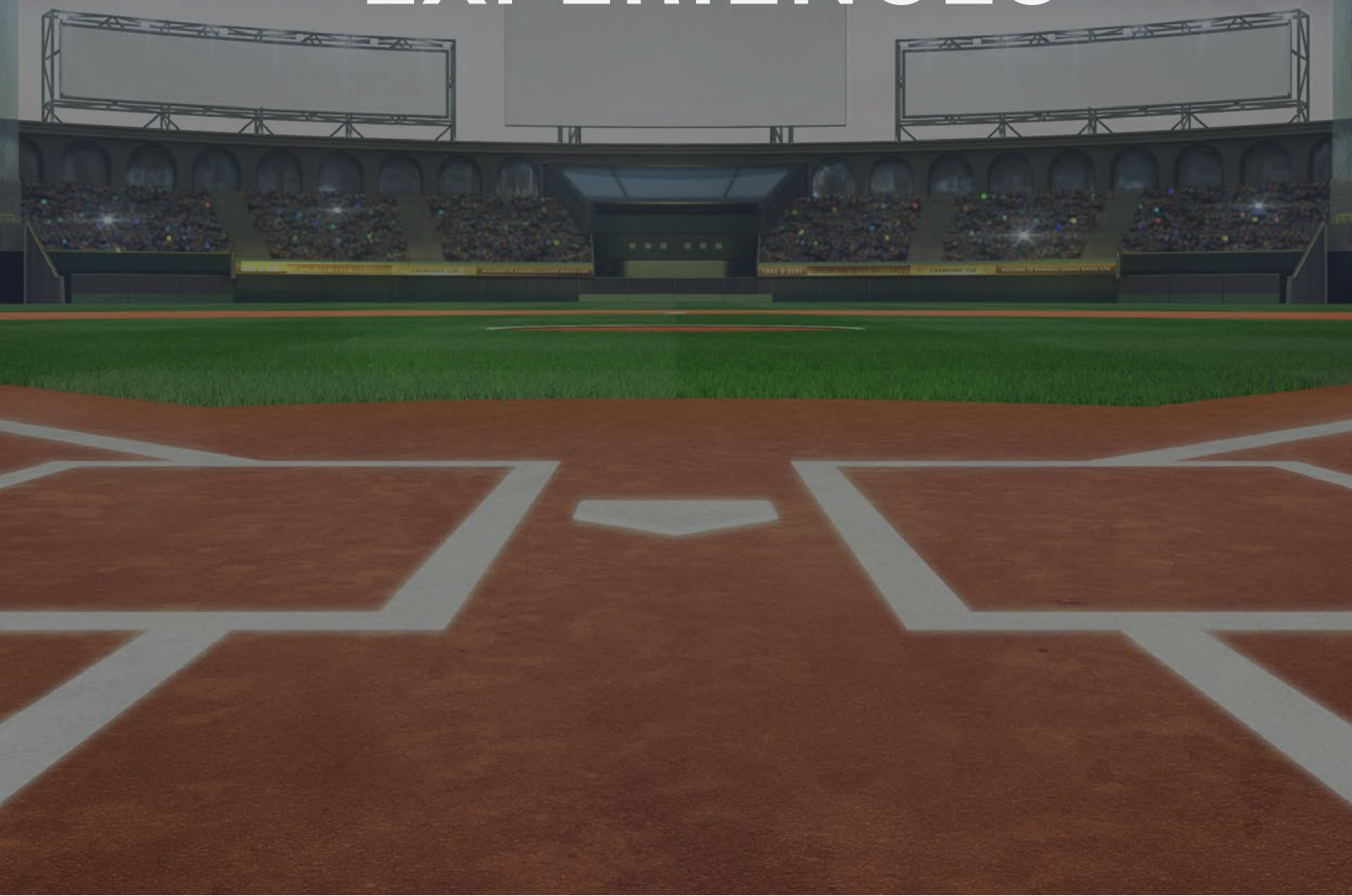


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# SPATIAL COMPUTING AND AR STADIUM APPS: REDEFINING FAN EXPERIENCES





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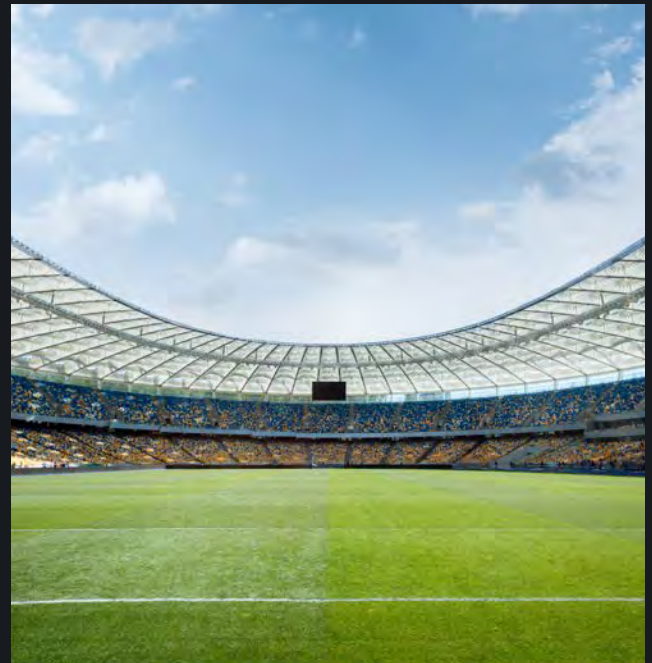


## Introduction

After the recent years of isolation and restrictions due to the pandemic, people are craving for in-person experiences. One marvellous in-person experience is going to stadiums for live events such as sport games and concerts. This is something people look forward to doing again. The demand for these experiences can be seen from sold out shows and games globally. Simultaneously, the interest for immersive and interactive experiences has also increased, hence combining the stadium environment with immersive and interactive technology provides the solution for both demands. With spatial computing we can combine those two.

Spatial computing is a revolutionary technology that blends the digital world with the physical environment in a seamless and interactive manner. It involves the integration of various technologies like augmented reality (AR), virtual reality (VR), mixed reality (MR), computer vision, and sensor-based data to create immersive experiences that understand and interact with the surrounding space in real-time. Immersal's Visual Positioning System (VPS) technology is part of spatial computing.

The core principle of Immersal's Visual Positioning System technology is to map and understand the physical environment accurately, enabling digital objects and information to be anchored to specific locations and interact with the real world. Localizing part of Immersal's VPS allows very accurate positioning of the user (or user's device). The spatial mapping and localization enable users to experience and manipulate digital content as if it were an integral part of their surroundings, enhancing the way they



perceive and interact with both the virtual and real worlds simultaneously.

One use case of VPS is enhancing stadium experiences for example through stadium applications that utilise the power of augmented reality (AR). These apps leverage VPS technology to enhance the overall in-stadium experience for fans and attendees in numerous ways, such as providing event-specific information, adding entertaining features to the event, and enabling social interaction in-between fans or other in-stadium attendees.

VPS in AR stadium apps will transform the way fans experience live events, making it more engaging, interactive, and memorable. It can deepen the connection between fans and their favourite teams and artists, boost fan engagement, and enhance the overall stadium experience for all of the attendees. This article explores the VPS process at stadiums, highlights potential use cases and benefits of AR stadium apps, and concludes with real examples of implementing VPS technology powered by Immersal to stadiums.

## The Visual Positioning process at stadiums can be separated into 3 steps

A successful Visual Positioning at stadiums requires a structured process with testing and repetition. Of course, the process' difficulty is dependent on the project and what VPS will be used for, but the basic process behind Visual Positioning at stadiums is the same. The process can be divided into three phases: mapping, localizing, and overlaying of AR.

### 1. Mapping

Mapping is the most vital part of enabling VPS at stadiums. By mapping the whole stadium, a point cloud is created to which AR elements can be overlayed on. Mapping can be done with devices such as Leica's BLK2GO (handheld imaging laser scanner with several cameras), but also simply with a mobile phone. The point of mapping is to take pictures of the space from different angles. Those pictures combined create a visualised virtual map of the space that can then be utilised in stadium AR apps for example.

### 2. Localizing

Localization is the next step in the Visual Positioning process. After mapping of the space is completed, the successfulness of the virtual map needs to be examined with localization. Simply mapping a space does not guarantee perfect localization



and thus it needs to be tested. Localization refers to the map's ability to position the virtual map accurately and precisely on top of the real world. When the map is localized correctly and the virtual map corresponds to the real-life map, AR elements can be laid onto the map.

### 3. Overlaying of AR

Lastly, after mapping and localization of the map have been proved qualified and successful, the next step is to overlay AR content onto the point cloud. Regardless of the type of content wanted on display, the Immersal VPS enables the content to be placed with centimeter-precision where it is wanted to be placed. Thus, for example, if you want to see a mascot of the team on the field, it will be on the field exactly where it was placed instead of on the roof or in the air. The overlaying of AR content is often done in collaboration with a creative studio with a vision of the visuals for the project.

This simple 3-step process of VPS enables outstanding and groundbreaking location-specific projects that can revolutionize the way we experience entertainment in a stadium environment. The same applies to other buildings and spaces too.

## AR Stadium Apps can be used in various ways

As mentioned, AR Stadium apps can refine in-stadium fan experiences. But how? AR stadium apps can improve the in-stadium experience for fans in various ways; interactive wayfinding, immersive entertainment, augmented information, and services like food ordering and online store for jerseys and other merchandise.

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**Interactive Wayfinding and Navigation Assistance** in AR can provide real-time guidance to help fans or in-stadium attendees. In fact, finding specific seats, concession stands, restrooms, or other facilities within a large stadium can be challenging. AR apps can help with this by offering interactive wayfinding through AR markers or navigation guides. This way users can reach their desired destinations easily.

AR stadium apps can also be used for **Immersive and Enhanced Entertainment**. AR stadium apps can deliver interactive and engaging content during breaks or halftime, such as AR mini-games, mascot interactions, or 3D visualisations of historical moments related to the team, sport, artist, band, or event. These can keep fans engaged during the game or event, but even attract them to come to the stadium early. Spending more time at the stadium typically creates more business for the food, merchandise and other services. Furthermore, AR-based fan engagement activities, interactive challenges, or even AR filters for sharing fun moments on social media can enable fans to connect with each other in the stadium, fostering a sense of community.

**Augmented information** is also a way in which the AR stadium apps can improve the in-stadium experience. AR stadium apps can provide real-time, location-based information to fans in the stadium, which may enhance the fans' understanding and engagement with the game or event. For instance, when pointing their smartphones or AR glasses towards the field, fans can see player statistics, live game data, and instant replays overlaid onto the actual players on the field.

The AR Stadium App can also improve the fans' convenience at the stadium through services such as **food ordering**. Food ordering can happen directly from the seat and be delivered to the same seat with the least amount of inconvenience. An online store for Jerseys and other merchandise can also be a feature of the app, customers can have their chosen ones delivered to their seats.

## Key Challenges of VPS Mapping

VPS Mapping relies heavily on the accuracy and precision of the map. Thus, delivering that can pose a huge challenge for the supplier of the technology. In stadium environments, the dynamic nature of the environment affects the accuracy a lot. For example, the changes in weather conditions, grass patterns, crowd density and lighting can affect VPS mapping and localization. Furthermore, for VPS to work accurately and in real-time, network connectivity is vital.

## Overcoming VPS Mapping Challenges

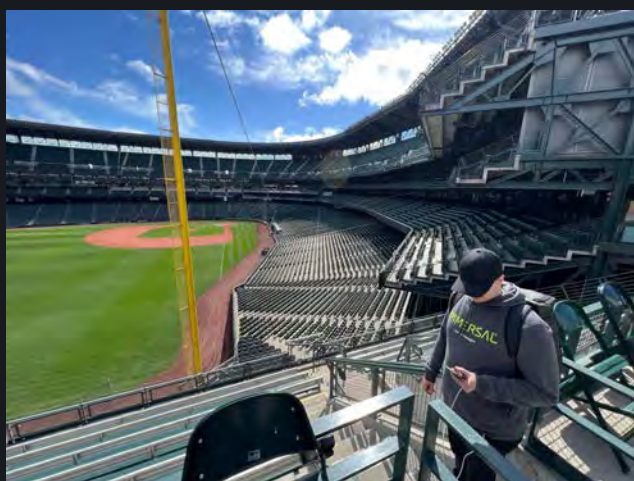
Although delivering accurate VPS mapping may have challenges, they can be overcome to deliver exceptional accuracy and precision that is needed for in-stadium AR experiences. Many of the challenges described above can be solved by focusing more on static objects and structures in the stadium, like the pitch, building structures and other objects in each individual stadium. In addition, the computer vision algorithms - which are used to create the VPS map - can be taught to focus on specific characteristics



at the stadium. Immersal VPS has shown its robustness and adaptability in recent stadium projects and has overcome the challenges mentioned above.

## **Our experience with Spatial Computing and AR Stadium Apps**

### **Baseball fans get real-time stats in AR - Immersal VPS use case from the US**



The MLB All-Star Week in 2023 was held in July in Seattle, US. For the MLB All-Star Week, a mobile application was developed by Major League Baseball (MLB), T-Mobile, Nexus Studios, Immersal and other partners to enhance the in-stadium fan experience. Based on Immersal Visual Positioning technology the application had features such as 3D visuals over the field. Those visuals included ball distance, launch angle, and player information. This groundbreaking application also included features such as a 3D Strike Zone visualisation with replays, a 3D bird's eye view of the field, and 5G-enabled low-latency audio of the live ESPN and FOX broadcasts which was powered by Mixhalo. The application was accessible to every visitor in the stadium and was used by many to make their in-stadium experience more fun and engaging.

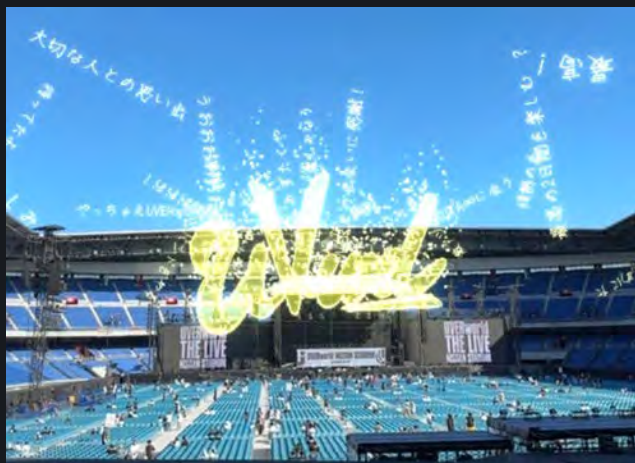
Immersal was given the opportunity to be part of this project 3 months before the event, thus the execution timeline was very short. Immersal team scanned the stadium multiple times under various conditions. The team was working in multiple locations to ensure the success of the VPS tech in this project; mapping of the stadium happened in Seattle, and the back-end development of the technology was done in Finland, Estonia, and the US. Team mapped the stadium with multiple devices such as Leica's BLK2GO and Immersal Mapper on mobile phones to ensure the accuracy and precision of the VPS. The mapping took approximately 10 hours over two days.

There were multiple challenges in mapping the stadium, which we managed to adapt and respond to. Changes in weather, lighting, and the field's grass patterns were factors that we had to take into consideration when mapping and developing our VPS technology. The stadium also looks alike from multiple different locations due to similarity in seats and grass pattern, which affected the localization of our tech. To overcome this challenge, the team improved Immersal's computer vision algorithm, which is the basis of our VPS technology. In a few weeks, we were able to deliver an optimized version of our VPS technology to power the groundbreaking interactive AR experience for in-stadium baseball fans that was highly praised on social media.

### **Fan community cheers for the band in AR in Japan**

The second interesting use case and experience of mapping a stadium for an interactive AR experience is mapping the

Yokohama Nissan Stadium in Japan. The rock band UVERWorld played there on 29-30 July 2023 and the stadium was filled with 70 000 people. Immersal collaborated with Realize Mobile Communications delivering a VPS-based AR experience. The audience was able to share messages in AR from every seat of the stadium, which were then gathered together to form the logo of the rock band. This created a sympathetic experience by visualising the emotions and passion of the audience gathered at the stadium. A very positive statistic from the event was that there were more than 3000 concurrent users of the AR experience at the same time. The spectacle was also heavily praised online. The experience was based on webAR, which means that fans were able to access the AR experience on their mobile phone browsers, no separate app was needed. This also lowered the barrier to test AR.



## Conclusion

In conclusion, Immersal's VPS technology can revolutionize entertainment as we know it. With 3 simple steps - mapping, localizing and overlaying of AR - our Visual Positioning process enables outstanding and groundbreaking location-specific

projects that can revolutionize the way we experience entertainment in a stadium environment. This can happen through stadium applications that utilise the power of augmented reality (AR) in ways such as interactive wayfinding, immersive entertainment, augmented information, and services like food ordering and online store for jerseys and other merchandise. As VPS Mapping relies heavily on the accuracy and precision of the map, challenges may occur depending on the project. However, our adaptable and robust VPS technology (and the manpower behind it) is able to respond and adapt to those challenges to deliver the precision and accuracy needed for each project. We already have experience in enhancing in-stadium experiences for fans in the US and Japan, but are eager to implement our technology in more stadiums to improve the stadium experience for all. We believe that merging the physical and digital world will upgrade the daily lives of everyone in ways that we have not even thought of yet.

## Contact us

Have a question, want to hear more, or just feel like a chat? Get in touch.

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