



SE Seminar #8 Report

Introduction to Spatial Computing

01286391 Seminar in Software Engineering

Software Engineering Program

Faculty of Engineering, KMITL

By

65011277 Chanasorn Howattanakulphong

Introduction

In this seminar, Mr. Puchong Poomboontrik, a special speaker, discusses the topic " Introduction to Spatial Computing"

Spatial Computing

Spatial Computing, also referred to as Immersive Technologies, Extended Reality (XR), or AR/VR, is a technology that utilizes physical space as a platform for engaging with digital content. Instead of confining digital experiences to flat screens, it introduces a more immersive computer interface, revolutionizing the way individuals interact with technology.

Spatial Computing seamlessly integrates digital content into the user's physical environment, allowing for a heightened sense of immersion in digital realities. This innovative technology facilitates interactions that mimic physical experiences, breaking away from the limitations of traditional two-dimensional screens.

Virtual Reality (VR)

Virtual Reality (VR), which constructs a completely digital environment to immerse users entirely in a virtual setting, emphasizes the fusion of captivating digital surroundings with user engagement through the equation of Immersive Media multiplied by Interaction.

Augmented Reality (AR)

Augmented Reality (AR), on the other hand, overlays digital content onto the real world, enriching our perception of the surroundings. The AR formula multiplies Immersive Media by the Real World, showcasing the integration of digital elements into our physical environment.

Mixed Reality (MR)

Mixed Reality (MR) combines digital content with the real world, fostering interaction and integration between the two realms. In the MR framework, Immersive Media interacts with the Real World, demonstrating the dynamic blend of digital and physical elements for a seamless and interactive user experience. Essentially, MR can be understood as the sum of Virtual Reality and Augmented Reality, creating a comprehensive and integrated technological landscape.

How do Spatial Computing, Extended Reality (XR), and Immersive Technologies differ?

- Spatial Computing involves technologies that facilitate human-computer interaction in three-dimensional spaces.
- Extended Reality (XR) is the umbrella term encompassing Virtual Reality (VR), Augmented Reality (AR), and Mixed Reality (MR).

Immersive Technologies refer to a set of technologies that smoothly integrate digital content with the physical environment, resulting in an immersive user experience.

Device Spatial Tracking

An essential aspect of Spatial Computing involves a device's capability to determine its precise location within a given environment. This functionality, alternatively referred to as spatial awareness or device tracking, is typically accomplished through camera computer vision or LiDAR technology. These sensors empower devices to scan their surroundings in real-time, facilitating the calculation of their position in space.

Concerning spatial positioning, spatial tracking is divided into two categories:

- 3Dof (three degrees of freedom): This allows a device to track only its rotation.
- 6Dof (six degrees of freedom): This enables a device to track both its rotation and position.

Interaction Mechanisms

- **Controller Input**
 - Controllers emulate the physical presence of objects in our hands, such as a whiteboard marker or a lightsaber, providing a tangible interface for interaction. Additionally, these controllers incorporate self-tracking capabilities, ensuring precise virtual tracking.
- **Eye Tracking Input**
 - Once considered an optional feature, eye tracking has evolved into a crucial input mechanism for devices like the Apple Vision Pro. It enables the user's eyes to control the virtual cursor, offering a more intuitive interaction compared to traditional input devices.

- **3D Rendering Capabilities**

- The foundation of Spatial Computing relies on devices generating virtual objects within a three-dimensional space through real-time 3D rendering. This necessitates devices to redraw all visible objects up to 60 times per second, demanding significant computing power. As the industry trends towards smaller and lighter devices, accommodating this computing power becomes a challenge. Spatial Computing developers must continually optimize their visuals to achieve high levels of realism.

How Spatial Computing is Applied?

Spatial Computing is actively implemented across a diverse range of applications in various sectors and industries. Here are real-world instances highlighting the current utilization of Spatial Computing.

The Prospective Landscape of Spatial Computing

From fitness and healthcare to education and gaming, Spatial Computing is transforming industries by providing immersive experiences that captivate users in unprecedented ways. The distinction between the physical and virtual realms is becoming progressively indistinct, signaling just the initial phase of this transformative journey. Looking forward, the potential of Spatial Computing is vast. As these technologies evolve, they are poised to play a pivotal role in our daily lives, reshaping the way we experience and engage with the world.

What I Have Learned:

Spatial Computing is a revolutionary technology that utilizes physical space as a medium for interacting with digital content. It encompasses Extended Reality (XR) and Immersive Technologies, providing a more immersive computer interface and redefining our interaction with technology. Spatial tracking, involving 3Dof and 6Dof capabilities, allows devices to understand their position within a given environment through camera computer vision or LiDAR technology.

In terms of interaction mechanisms, controllers simulate physical object presence, while eye tracking has evolved into a key input mechanism for more intuitive interactions. The foundation of Spatial Computing lies in devices generating virtual objects within a three-dimensional space using real-time 3D rendering, requiring significant computing power. This technology finds applications across various sectors, transforming industries from fitness and healthcare to education and gaming.

Looking ahead, the future of Spatial Computing holds immense potential, with ongoing developments expected to play a crucial role in reshaping our everyday lives. The integration of physical and virtual realms is becoming increasingly seamless, and as Spatial Computing continues to evolve, it is poised to redefine the way we experience and engage with the world.