ARCinema: Enhancing Cinematic Memories and Emotions Through Augmented Reality with Miniature Dioramas*

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Abstract

The intersection between technology and artistic expression has continuously opened new and creative avenues for re-experiencing, reinterpreting, and emotionally re-engaging with the classic cinematic moments that have shaped collective memory across generations. This study introduces and explores augmented reality (AR) cinema, a system that integrates AR technology with miniature dioramas that faithfully represent symbolic or iconic elements from famous films such as Titanic. By using common digital platforms such as smartphones or head-mounted displays, the proposed system overlays key cinematic scenes onto these handcrafted physical miniatures, thereby generating a multidimensional experience that engages multiple senses simultaneously.

Through the combination of visual augmentation and synchronized auditory cues, including the original soundtrack and dialogue, AR cinema allows users to reconnect with the sensory and emotional atmosphere of the original movie. The ultimate goal of this approach is to evoke authentic emotional responses, enabling participants not merely to view but to relive and re-feel powerful filmic moments that have deeply influenced their imagination and sentiment. In doing so, AR cinema extends the boundaries of traditional film appreciation, transforming passive spectatorship into an active and immersive process that integrates technology, memory, and emotion into a single expressive medium.

Beyond its artistic contribution, the proposed framework also holds potential for integration into interactive cultural or commercial media platforms that seek to enhance audience engagement and experiential value through emotion-driven storytelling and immersive content.

1 Introduction

Cinema has long been regarded as one of the most influential narrative arts, capable of conveying complex stories and eliciting profound emotional reactions from audiences. Over time, as new forms of media and technology have emerged, the way people consume and emotionally respond to cinematic content has changed significantly. Each technological milestone, ranging from the transition of silent film to sound and from analog to digital production, to the development of fully immersive environments, has gradually expanded the potential for deeper audience engagement.

Among contemporary technologies, augmented reality (AR) presents a particularly compelling opportunity. By superimposing digital imagery and sound onto real-world environments, AR blurs the boundary between the physical and the virtual, enabling a hybrid experience in which audiences can see, hear, and interact with filmic representations within tangible space.

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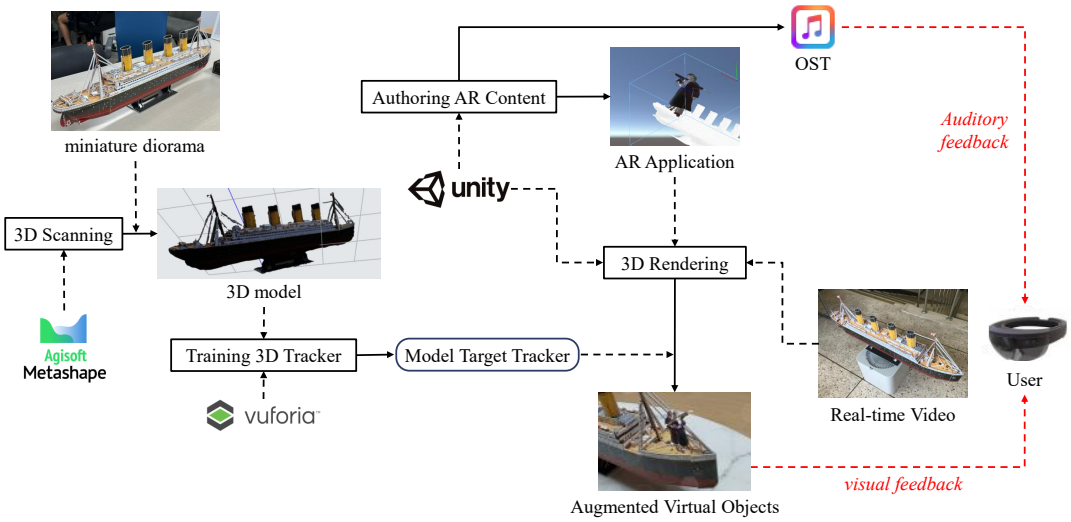

Figure 1: Development pipeline of the AR cinema system. The process includes 3D scanning of the miniature, training of the model-target tracker, and authoring of visual and auditory AR content. The final AR application synchronizes these components to deliver an immersive viewing experience.

Previous studies have long explored the application of AR in both entertainment and education, highlighting its ability to enhance user engagement, learning retention, and emotional response in interactive environments [3]. Such works established the foundation for understanding how augmented reality can affect human perception and foster a sense of presence that goes beyond traditional screen-based experiences.

Building upon this early groundwork, more recent approaches have expanded the scope of AR research toward immersive storytelling and artistic installations, demonstrating how the technology can serve not only as an informational tool but also as a creative medium that connects sensory perception with narrative experience in dynamic, emotionally charged spaces [2]. Furthermore, comprehensive surveys of post-2021 AR developments have summarized the latest design strategies, noting a clear trend toward affective computing, embodied interaction, and the use of multimodal feedback to intensify emotional immersion and long-term memorability [1]. These research efforts collectively reveal a growing academic interest in emotion-centered AR systems and provide a theoretical foundation for this study, alongside broader perspectives from affective computing and media cognition that emphasize how carefully designed stimuli can shape users' emotional states and recall.

However, AR cinema distinguishes itself by focusing explicitly on emotional and nostalgic experiences rather than functional or educational purposes. While most AR systems emphasize interactivity, usability, or task performance, AR cinema instead seeks to restore the personal connection between viewers and the films that once moved them. It provides a novel method for stimulating remembrance and nostalgia while respecting the integrity of the original cinematic narratives.

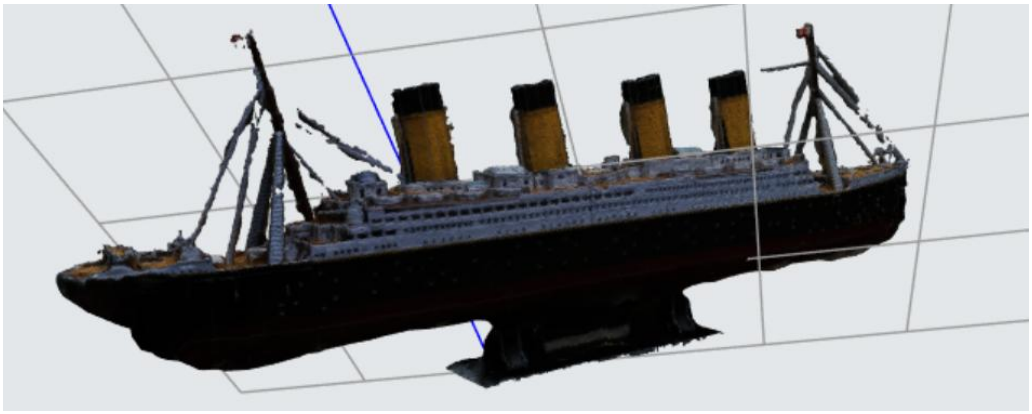

Figure 2: High-resolution 3D scan of the Titanic miniature created with Agisoft Metashape. The photogrammetric model provides accurate geometry for Vuforia's tracker, ensuring precise alignment between the digital and physical diorama in AR space.

2 Development Process

The development of the AR cinema system can be divided into three major stages: three-dimensional (3D) scanning, 3D tracking, and authoring of immersive AR content. These stages are visually summarized in Figure 1 and together constitute the complete workflow from the creation of the physical miniature to the projection of interactive AR content.

2.1 3D Scanning

To achieve accurate alignment between digital content and physical structures, it was first necessary to acquire a precise 3D representation of the miniature diorama. This step ensures that all virtual overlays correspond exactly to the spatial dimensions of the physical object. After comparing several candidate tracking solutions, Vuforia's Model Target Tracker was chosen for its consistent and high-quality real-time recognition performance[1].

To support the tracker, a detailed 3D model of the diorama was generated using Agisoft Metashape[2], a photogrammetric software that converts sets of digital photographs into accurate 3D reconstructions. This process involved capturing multiple angles of the diorama under controlled lighting and then computing a textured mesh that preserves its geometry and surface details. The resulting model, illustrated in Figure 2, provides the digital foundation for AR alignment and ensures that every visual element corresponds precisely to its real-world counterpart.

2.2 3D Tracking

After the digital model had been prepared, the next step was to implement reliable 3D tracking that would allow the AR content to remain fixed to the physical miniature as users move around it. This process draws conceptually on prior AR alignment and recognition methods that emphasize real-time stability, accurate spatial mapping, and user-centered responsiveness

[1] https://library.vuforia.com/objects/model-targets
[2] https://www.agisoftmetashape.com

in immersive systems [2]. By adopting a similar design mindset, the AR cinema framework helps maintain both the aesthetic and emotional coherence of a scene as users interact with it in real time. Initially, the system required users to manually align the digital 3D model with the physical diorama before tracking could begin. While this manual step ensured initial accuracy, it also introduced inconvenience, as it demanded the user's focus on orientation and positioning.

To address this limitation, the system was improved using the training module available in Vuforia's tracker. This feature enables recognition from a wide range of viewing angles and orientations, meaning that tracking can begin automatically without user intervention. By removing the need for manual alignment, usability was significantly improved, and users can now engage directly with the experience in a more natural and uninterrupted manner. This enhancement also ensures that the emotional flow of the cinematic scene remains continuous, which is important for maintaining immersion.

2.3 Authoring AR Content

Once stable tracking was achieved, attention shifted to the authoring of the AR content that would be superimposed on the miniature. The objective of this phase was to integrate digital assets that represent key characters, objects, and cinematic elements from the film, thereby achieving a consistent fusion between the real and virtual worlds.

Each model was carefully adjusted to match the scale of the physical diorama so that the illusion of depth and realism could be maintained. For instance, when recreating a large-scale setting such as the Titanic ship, human figures were proportionally enlarged to preserve visual coherence. The models were then rigged and animated to depict movement and interaction, reproducing the motion that viewers remember from the original film.

Furthermore, the original soundtrack (OST) and relevant lines of dialogue were incorporated and synchronized with the animation. This auditory integration was essential to strengthening the user's emotional engagement, since music and spoken words often serve as the strongest triggers for cinematic memory. The resulting combination of motion, sound, and spatial context produces an experience that resonates closely with the emotional intensity of the original movie.

In addition, this authoring stage demonstrated the adaptability of the proposed system to various film genres and scales of production. By modularizing the workflow from asset preparation to AR deployment, the same pipeline could be extended to other cinematic contexts, for example in exhibition-oriented settings. This flexibility highlights the potential of AR cinema not only as an artistic medium but also as a reusable technical framework for emotion-centered mixed reality storytelling.

3 Demonstration

To demonstrate the practical application of the AR cinema system, the film Titanic was selected as a case study. This choice was made because of the film's strong emotional impact and its instantly recognizable visual motifs. Users were able to experience the demonstration through a range of devices, including tablets, smartphones, and AR headsets such as Microsoft HoloLens.

When the user directs a device toward the miniature Titanic diorama, the AR system activates and overlays animated digital content that reconstructs specific moments from the film. One of the most memorable examples is the "I'm the king of the world!" scene, in which the characters Jack and Rose stand at the ship's bow with the ocean stretching before them.

Figure 3: Demonstration of the Titanic AR cinema experience. When users view the miniature, the "I'm the king of the world!" scene and the song "My Heart Will Go On" are overlaid. Real-time tracking lets viewers move freely while maintaining spatial and emotional immersion.

The original theme song, "My Heart Will Go On," plays in the background, accompanying the visual scene and reinforcing its nostalgic tone.

Users can physically move around the diorama, and as they do, the AR content automatically adjusts to their viewpoint. This dynamic response creates a heightened sense of realism and immersion. The resulting experience, captured in Figure 3 and the demonstration video[3], shows how AR cinema can transform a static miniature into a vivid, emotionally engaging representation of a film's most iconic moment.

4 Conclusion

In summary, AR cinema represents a novel and creative fusion of cinematic art and digital technology that enables audiences to reconnect with their favorite films through direct, interactive experience. By combining augmented reality with carefully crafted miniature dioramas, the system bridges the sensory gap between physical and digital media, offering a new way to relive emotionally significant cinematic scenes.

The Titanic demonstration illustrated that users can experience powerful scenes by physically moving around the diorama, with AR content dynamically adapting to their position. This interaction allows them to re-experience the same emotional depth they felt during their first viewing of the film. The seamless integration of visual imagery, synchronized audio, and physical craftsmanship provides a renewed approach to film appreciation, one that transforms

[3]Demonstration video available at: https://youtu.be/d6dJIh5ytp0

passive watching into active participation.

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