

Time Walk: Blending Presence and History through AR Visualization

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ABSTRACT

We designed an interactive augmented reality (AR) visualization artwork, titled “Time Walk,” to transport the visitors through different times, conveying a profound sense of collective celebration and companionship. Through our design of digital overlays, which are the timeline, trail flowers, and balloons, the artwork transforms the physical space into a dynamic and visually captivating vicinity. Visitors can actively participate and explore the artwork, witnessing the visual representation of an institution’s history and the presence of other visitors. By blending real and virtual elements, we proposed a unique and interactive way for people to engage with history and connect with fellow visitors from the past. The user study involved eight participants who rated the design elements positively, expressing a strong sense of celebration and connection with others.

Index Terms: Human-centered computing—Visualization—Visualization application domains—Information visualization

1 INTRODUCTION

In anniversary events and exhibitions, visual timelines are commonly used as a means of guiding reflection on significant historical moments. However, these timelines often fail to foster a sense of connection among individuals who are unfamiliar with one another. To address this limitation, we propose utilizing AR to visualize a more immersive experience and enhance engagement with the timeline. Our goal is to not only prompt reflection on the past but also cultivate anticipation for the future, thereby fostering the creation of lasting memories. By visualizing the presence of other timeline visitors, we seek to evoke a natural curiosity and instill a profound sense of communal connection as individuals navigate the timeline.

Prior AR visualization research [3,4] predominantly focused on presenting historical events or scenes by effectively recreating and overlaying them onto present-day spaces or ruins. Although existing approaches can guide signage design, they often lack visualization capabilities to handle the substantial amount of user-generated data resulting from interactions with AR products. Merely displaying digital information to visitors in AR can be monotonous. To better engage the visitors, many researchers [1] endeavor to enhance the richness of interaction through strategies like gamification and customization, enabling personalized augmented experiences. Nonetheless, a recent study [2] has underscored the importance of social presence in tour experiences, emphasizing its pivotal role in visitor retention and return rates. Thus, we aim to pioneer the visualization of user-generated data from AR product interactions to enhance engagement by showcasing social presence.

We crafted three key design elements for our visualization artwork, “Time Walk”: the use of translucent glass banners to enhance physical reality, the visualization of visitor footprints as blossoming flowers along the timeline, and the inclusion of an interactive

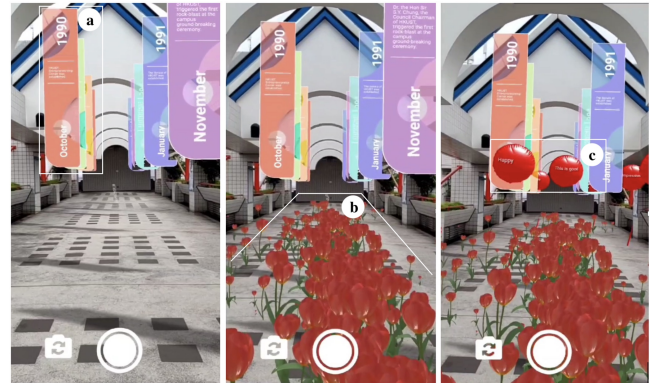


Figure 1: “Time Walk” Screenshots: (a) translucent glass banners, (b) footprints as blossoming flowers, (c) interactive comment balloons.

platform for expressing thoughts and emotions through comment balloons. These elements collectively fostered an immersive and interconnected experience, bridging the gap between different times and individuals. In the subsequent sections, we will delve into the detailed description and implementation of our design, discuss the implications, and outline future directions for further development.

2 AR VISUALIZATION DESIGN ELEMENTS

Our artwork provides three interactive experiences: walking along the timeline, sensing footprints, and leaving a voice on the timeline. The screenshots of “Time Walk” showcasing its interactive design elements are shown in Figure 1.

Walking among the timeline. Our first challenge was to design banners that conveyed information about a historical moment while evoking a strong sense of physical reality through the AR camera. To achieve this, we created glass banners adorned with colorful circles to depict a vibrant institute. The primary color utilized has an opacity of 100%, while the secondary colors have an opacity of 65%. In instances where the primary color intersects with a secondary color, the overlapping section is rendered with a lighter shade that incorporates white. The translucent nature of the glass material allows for a realistic representation in the AR camera, particularly when illuminated by physical light.

Our artwork was designed to enable individuals to physically traverse the timeline, providing them with a unique sensation of time-traveling and a nostalgic experience of “walking down memory lane.” This concept surpasses traditional 2D timeline designs, offering visitors an embodied and immersive encounter.

Sensing footprints. Our visualization artwork aims to foster a sense of connection and excitement among individuals across different times and spaces. To achieve this, we collected footprints left by the visitors while navigating the timeline and designed an artistic visual effect to convey the footprint data. By capturing the moments when visitors engaged with specific historical event banners and tracking their movement timestamps, we created an immersive experience. The artwork showcases blooming flowers at the visitor’s footprint positions, inviting them to walk on a path adorned by the collective footprints of others, symbolizing the blessings of receiving

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more love and positive experiences.

As more people engage with the artwork, an increasing number of flowers bloom, mirroring the growth in communal connections. Similarly, the duration of one’s presence in a particular spot is mirrored by the height of the flourishing flowers, further accentuating the presence of different visitors.

Leaving a voice on the timeline. We aimed to provide visitors with an avenue to express their emotions and thoughts regarding their involvement in these historical moments. To accomplish this goal, we implemented an interactive feature that allows visitors to upload their comments next to the historical event banners that they are browsing. During the formative design testing, we observed that many visitors expressed positive feedback (e.g., “Great!”) and some indicated their firsthand experience as witnesses (e.g., “I was there!”). To create a sense of collective presence and solidarity, we devised a captivating visualization technique that manifests the visitor’s comments as floating comment balloons. These whimsical balloons gracefully ascend, carrying the visitor’s remarks towards the sky, ultimately converging and harmonizing as a symbol of shared experiences and connections.

Reducing AR Visual Occlusion Impact. We reduced the issue of visual element occlusion by dividing the design into ground and aerial parts. In the future, we may utilize AI to analyze space so that auto-generated visual artwork can avoid congested areas.

3 SYSTEM FRAMEWORK AND IMPLEMENTATION DETAILS

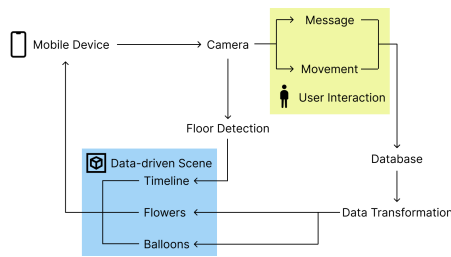


Figure 2: Overview of the “Time Walk” Operational Process

Figure 2 provides an overview of the sequential stages involved in the functioning of “Time Walk”. The diagram depicts a person at the center, utilizing a mobile phone camera to detect the floor, enabling the phone to visualize the historical moments’ timeline. The mobile phone records both messages and movement, which are subsequently stored in a database. “Time Walk” processes this data, converting movement into trails of flowers and messages into balloons. As more individuals engage with “Time Walk”, the data accumulates, leading to an aggregation of experiences.

To validate our design framework, we embarked on an anniversary celebration project to showcase the historical achievements of a university since its foundation, spanning the past three decades. Our web application seamlessly incorporates augmented reality functionality on any mobile phone using 8th Wall, eliminating the need for ARKit and ARCore dependencies.

4 USER STUDY AND RESULTS

To conduct an initial assessment of our designs’ effectiveness, we conducted a pilot study involving eight participants affiliated with the university for which our design was created (four males and four females from 23 to 29 years old; referred to as P1 to P8). They were invited to experience our artwork installation, complete a survey, and provide feedback on the three design elements.

Figure 3 presents the user study findings. Notably, all users rated Q1 five points and above, and rated Q2 four points and above, indicating a strong sense of celebration and connection with unfamiliar

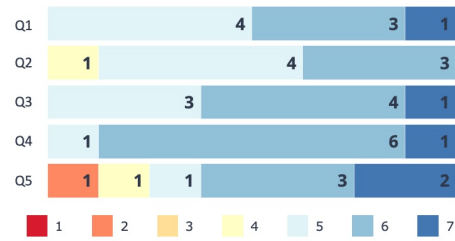


Figure 3: User study results (1=“strongly disagree” and 7=“strongly agree”) on key ratings: (Q1) I feel like I’m celebrating our university’s anniversary with my fellow classmates. (Q2) I feel accompanied by classmates even though I don’t know them. (Q3) I feel like I’m walking with other classmates among blooming flowers. (Q4) I can sense the happiness and excitement of other classmates through comments on balloons. (Q5) I believe my memory of this immersive timeline will outlast reading a traditional timeline.

individuals during the anniversary event. Participants described their experiences as “romantic” and “immersive.” All users rated Q3 and Q4 five points and above, showing their appreciation for the flower and balloon designs. Specifically, P7 compared AR and real-life experiences, expressing enjoyment and a sense of safety while interacting with floating balloons through AR technology. Furthermore, seven users agreed that the immersive timeline would be more memorable than a general timeline (Q5). P2 wrote, “The colorful banners reflected the colorful historical events of our university and made me memorize the events.”

5 CONCLUSION AND FUTURE WORK

Our research introduces “Time Walk”, an AR visualization artwork that offers interactive experiences through timeline navigation, footprint sensing, and message leaving. We crafted three design elements that enhance realism and foster a sense of social presence. By leveraging mobile phone cameras, our implementation effectively visualizes the timeline while processing user movements and messages. The user study results demonstrate positive feedback, emphasizing the celebratory atmosphere, immersive nature, and appreciation of design elements. Moving forward, we aim to expand the range of interactive elements by AI-driven analysis of the vicinity to further enhance user experiences in interactive AR visualization artworks.

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¹cgtrader id: red-tulip-low-poly-game-ready-pbr

²cgtrader id: balloon-19d26808-6701-49b8-9dc5-52857739b789