A Study on Interactive Logo Design Integrating AR Technology: A Case Study of the School of Art and Design at Zhengzhou University of Aeronautics

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Abstract. This paper explores the integration of Augmented Reality (AR) technology with logos, using the logo of the School of Art and Design at Zhengzhou University of Aeronautics as a case study. The paper elaborates on the specific design approach for combining AR technology with brand logos. Based on the existing logo of the school, virtual animations and effects are created using 3D and particle special effects technologies. Additionally, Unity and Vuforia engine technologies are used to develop an accompanying mini-program. This system combines technology and art in a novel way, adding more fun to the logo and achieving a deeper integration of technology and the cultural identity of the school, enhancing a more intuitive and profound understanding of the school's logo.

Keywords: Unity, Vuforia Engine, Logo, Augmented Reality (AR).

1 Introduction to the Study

Driven by the growing fusion of technology and design, Augmented Reality (AR) is increasingly expanding the expressive boundaries of visual design, transforming traditional static logos into dynamic media with interactivity and immersion. In recent years, AR has been widely applied in fields such as corporate visual identity and cultural communication, leveraging image recognition and 3D modeling technologies to dynamically integrate logos with brand information, thereby enhancing communication efficiency and user experience.

Based on this trend, this study takes the logo of the School of Art and Design at Zhengzhou University of Aeronautics as a case to explore the practical application of AR technology in university logo design. By constructing a comprehensive system that combines image recognition, 3D animation, dynamic visual effects, and touch-based interaction, the project achieves high-level visual integration and interactivity through platforms such as Vuforia and Unity. In terms of visual presentation, multi-layered animations and spatial effects are employed to reinforce the symbolic mean-

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ing and visual impact of the logo; on the interactive level, emphasis is placed on controlling the pacing and providing operational feedback to enhance user immersion and engagement. This research aims to expand the application of AR in logo design and offer new perspectives for educational communication and visual branding [1].

1.1 Current Status of Logo Development

In contemporary society, logo design has permeated various fields and plays a vital role. From bustling city streets to quiet corners of campuses, from the interior layouts of large commercial complexes to tour guidance systems in cultural attractions, logo design is ubiquitous, serving as an indispensable visual guide and medium for information transmission in daily life.

Driven by the digital wave, the presentation of brand logos is undergoing a paradigm shift from static symbols to dynamic and interactive media. According to Adobe's 2023 Digital Experience Trends Report, 83% of global consumers exhibit higher memory retention for brand logos with interactive functionality, whereas the visual appeal of traditional static logos on mobile platforms has declined by 27% year-over-year. This discrepancy has triggered a growing demand for deep integration between augmented reality (AR) technology and logo design [2].

1.2 Interpretation of the School Logo

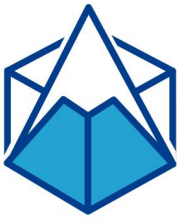

Fig. 1. Logo of the School of Art and Design

Zhengzhou University of Aeronautics, located in the culturally rich city of Zhengzhou, is the only full-time undergraduate institution in Henan Province specializing in aeronautics. The School of Art and Design originated from the Industrial Design program in 2001, became a department in 2008, and was officially established as a school in 2011. After a university-wide restructuring in 2024, it took its current form. Aligned with the aviation industry, the school conducts research in fields such as aircraft interior design and human factors engineering. In 2019, through a logo design solicitation, the school selected its current logo (see Fig. 1). The aircraft shape in the design reflects the university's aeronautical characteristics and symbolizes the school's upward momentum and rapid development. The cube shape represents stability and equality, as well as honesty and credibility. Its angular structure conveys order and rationality in design. The book shape symbolizes knowledge and educational

institutions. The combination of the aircraft and book shapes forms a pencil, highlighting the distinctive features of the school's design programs. In terms of color, the dark blue represents steadiness, rationality, and depth, while the lighter blue symbolizes innovation, vitality, and a pioneering spirit.

1.3 Overview of AR Technology

Augmented Reality (AR) is a technology that seamlessly integrates virtual information with the real world. By utilizing computer graphics, sensor technologies, and other means, AR overlays virtual images, sounds, 3D models, and other data onto real-world environments to enhance the user's perception of reality, offering a sensory experience that goes beyond the physical world. Technically, AR relies primarily on three core technologies: computer vision, 3D registration, and display technology.

Globally, mainstream AR platforms include Vuforia, known for robust image tracking; Facebook AR Studio (now Meta Spark), focused on social media effects; Metaio, an early AR innovator acquired by Apple; and ARToolKit, an open-source solution. In China, major platforms include NetEase Insight AR, Baidu AR, Tencent QAR, and Alipay AR, each tailored for localized applications such as marketing and mobile services.

This study uses Unity, a cross-platform engine with native Vuforia support, to build an AR-based logo display system. Vuforia offers reliable image recognition and multi-language APIs, enabling efficient deployment on both iOS and Android.

By integrating AR with the school's logo, the project creates a dynamic, interactive experience that reimagines traditional logo design, enhancing user engagement and offering new directions for innovation in visual identity [3].

2 Interactive Design of Animations and Visual Effects

2.1 3D Animation Production

3D modeling and animation production are key components in AR system development. All 3D models and animations in this study were created using Blender software. The main design concept focuses on the cube shape and airplane elements within the logo. Using Blender's path animation feature, the airplane is animated to fly from a distance toward the top of the cube, gradually forming the complete logo shape (see Fig. 2). Finally, the animation is exported in Alembic (.abc) format. In Unity, materials are added to the models, and a custom shader is written to trigger a dissolve effect when the airplane and cube merge (see Fig. 3), Trigger the logo special effect after it is dissolved. This sequence is designed not only for visual impact but also with user experience in mind—ensuring smooth transitions, intuitive flow, and a sense of progression that keeps users engaged throughout the interaction.

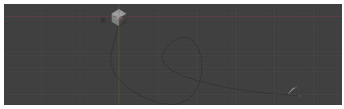

Fig. 2. 3D Animation Production

Fig. 3. Logo Dissolve Effect

2.2 Visual Effects Design

In the final stage of the AR animation, visual effects were created using Unity's particle system. By adjusting parameters like emission, shape, direction, and speed, a mystical "magic circle" atmosphere was crafted. At its center, the school's logo is embedded and always faces the camera, ensuring clear visibility from any angle. Around and behind it, flickering logo elements resemble arcane runes, adding motion and enchantment. Beneath the circle, English letters forming the academy's name rise slowly alongside light particles and lines, enhancing the ethereal, immersive feel (see Fig. 4). The entire visual sequence is designed for intuitive understanding and aesthetic appeal, offering users a smooth, engaging interaction. This design metaphorically portrays faculty and students as creative wizards whose imagination and talent bring beauty and wonder to the world.

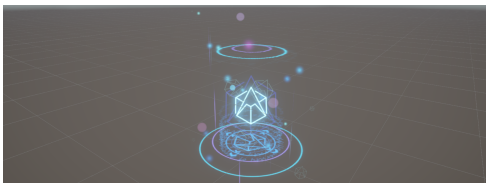

Fig. 4. Visual Effect of the Magic Circle

2.3 Vuforia Engine Configuration

The Vuforia component built into Unity greatly facilitates AR project development. Before starting an AR project, it is necessary to register the project on the official Vuforia website and upload the target recognition data. Vuforia supports a wide variety of data types for recognition, including images, cylinders, text, multi-targets, and virtual buttons.

In this study, three target images were uploaded for recognition (see Fig. 5). If the target design is relatively simple, it may receive a lower recognition rating. This rating reflects the image's recognizability: the higher the rating, the faster and more accurate the recognition will be during system operation. Conversely, a low rating may lead to unstable performance.

After uploading, the recognition data package is downloaded and imported into the Unity project. Subsequently, proper configuration of the ARCamera and License Key is required. Once these preparations are complete, the project is ready for AR image recognition [4]. The system workflow of the Vuforia engine (see Fig. 6).

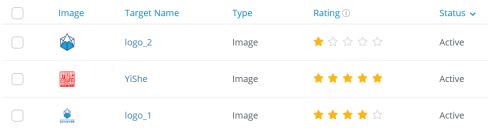

Fig. 5. Uploading Target Image Data for Recognition

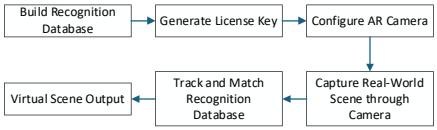

Fig. 6. Workflow Diagram of the Vuforia Engine System (Image Source: Internet)

2.4 Interaction Design

Real-time interaction is one of the core features of augmented reality (AR), enabling immediate, dynamic engagement between users and virtual content. Modern AR systems incorporate various interaction methods—eye tracking, voice commands, gesture control, and touchscreen input. Among these, touchscreen interaction is particularly effective due to its low implementation threshold and high intuitiveness. Simple gestures like tapping and swiping align with Don Norman's principle of natural mapping, allowing users to easily understand and control the interface [5] .

This system adopts a user-centered interaction flow grounded in Norman's seven stages of action and Shneiderman's Eight Golden Rules of Interface Design. When the target image is recognized, the logo animation plays automatically, followed by a dissolve effect that triggers the particle-based visual effects. This sequence provides immediate feedback and visible system status—supporting the principle of informative feedback. If the target is lost, the system resets and restarts the animation upon re-detection, maintaining consistency and predictability, which are critical for a positive user experience [6].

Ultimately, by applying the Vuforia engine, the system enables physical AR cards to trigger corresponding animations and effects upon scanning (see Fig. 7).The overall interaction flow (see Fig. 8).

During the interaction implementation, a C# script was used to control the dynamic transition of shader properties and object activation based on time. The airplane animation lasts approximately 3.5 seconds. By monitoring the system time at runtime, the script triggers a coroutine once the threshold of 3.5 seconds is reached, linearly interpolating the shader property from its initial value (1.0) to the target value (-1.2) to create a smooth logo dissolve effect. Simultaneously, visual effects are activated during the shader transition to synchronize with the user interaction flow. This mech-

anism integrates time-driven animation, shader parameter control, and object lifecycle management—techniques commonly used in AR scenes for content guidance and pacing control.

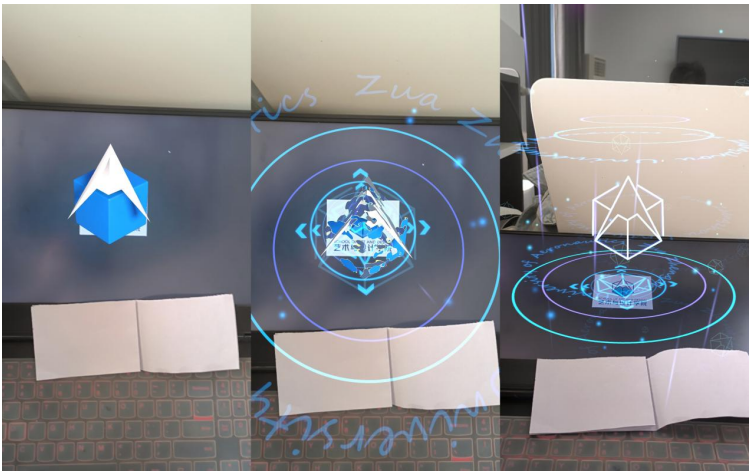

Fig. 7. Implementation of AR Effects

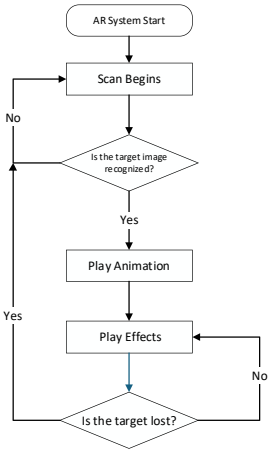

Fig. 8. Interaction Flow Diagram

3 Conclusion

This system integrates AR technology with logo design, taking the logo of the School of Art and Design at Zhengzhou University of Aeronautics as a case study to create AR-based motion effects. It breaks the limitations of traditional logos that are static and convey information in a one-way manner, injecting new vitality and possibilities into the field of logo design.

Not only does it enable real-time interaction between the logo and users—enhancing both the efficiency and engagement of information delivery—but it also broadens the scope of logo applications across diverse contexts such as business, culture, and education. Looking ahead, as technology continues to evolve and design concepts deepen, it is hoped that such innovations will offer users more immersive and creative interactive experiences. Furthermore, continued research and practice are encouraged to further explore its potential and promote the advancement of logo design toward greater intelligence and diversity.

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