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Low-Cost Fabrication of a Rear-Projection Display Assembly Using Consumer-Grade Components for Pseudo-Holographic Applications

Kasmir Syariati[1*], Citra Suardi[1], Reinaldo L. Lordianto[1], Andrey Hartawan Suwardi[1], Muhammad Aditya Ridwan[1], Enrico Kevin Ariantho[1], Javin Erasmus Clementino[1], Kusrini[1]

[1] Informatic Departement, Universitas Ciputra, 90224, **Indonesia**

*kasmir.syariati@ciputra.ac.id

Abstract

Rear-projection surfaces are essential components in pseudo-holographic and immersive display systems. However, commercial rear-projection screens are often prohibitively expensive due to high-quality materials and precision manufacturing. This study presents a novel, cost-effective approach for fabricating a rear-projection display using readily available consumer-grade materials. A transparent rear-projection film of unspecified properties was mounted onto a 3D-printed frame and fixed to an acrylic substrate to form the projection screen. The assembly process utilized common hobbyist fabrication techniques, significantly reducing the overall cost. Preliminary tests with a standard classroom projector demonstrated that the DIY screen produced clear, sharp images with wide viewing angles under dark conditions, ideal for pseudo-holographic displays. Under moderate ambient light, the image remained discernible, albeit with slight contrast reduction and minimal hotspotting. The total cost of the assembly was less than $100, a substantial saving compared to commercial alternatives, which can cost several thousand dollars. The results highlight the feasibility of using this method for educational, prototyping, and artistic applications. This work provides a replicable workflow for creating functional, low-cost rear-projection displays, contributing to the democratization of immersive display technologies.

Keywords: rear projection; display devices; optical projection; pseudo-holographic display; immersive media

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1. Introduction

Pseudo-holographic and immersive display systems create the illusion of floating or 3D imagery by leveraging specialized projection media. For example, Pepper's ghost-style setups use transparent screens to overlay virtual images onto real scenes [1]. High-end virtual reality CAVE environments likewise employ multiple rear-projection surfaces (including walls, floors, and ceilings) made of acrylic or glass with diffusive coatings to surround the viewer with imagery [2]. In all such systems, the optical properties of the projection screen such as its transparency, diffusion, and gain, are critical to achieving bright, uniform images and realistic "holographic" effects [3], [4]. Commercial rear-projection films are engineered for high image quality but can be prohibitively expensive and typically require known specifications for optimal use [5]. Recent work notes that the high price of commercial switchable films limits adoption, and optimal performance depends on matching measured optical parameters (gain/angle, transmission, etc.) to the setup [6]. This poses a challenge for researchers or hobbyists attempting pseudo-holographic displays with limited resources.

While prior works have demonstrated creative pseudo-holographic displays, they often utilize proprietary materials or well-characterized screens and do not detail low-cost fabrication workflows. Few studies document how to build effective rear-projection assemblies from generic, off-the-shelf components when material specifications (e.g. exact gain or diffusion profile) are unknown [7], [8], [9]. As a result, replicating such display systems on a budget or adapting consumer-grade projectors for holographic-like projections remains non-trivial. There is a need for an open, step-by-step methodology that addresses mounting and tensioning of inexpensive projection film, alignment of consumer projectors, and the resulting image performance.

From the surveyed literature and practical reports, two key knowledge gaps emerge for rear-projection assemblies. First, there is scant documentation on how to compensate when using a projection film with unknown specifications. Commercial screens come with data on gain, viewing angle, and recommended projector lumens for a given image size. In a do-it-yourself (DIY) scenario, builders may salvage or purchase low-cost projection films that lack any datasheet. The question then becomes how to empirically tune the setup for such a material. Standard practices would be to project test patterns and observe qualities like brightness uniformity and color accuracy. If, for example, the film has a higher gain (more directional), one might observe brightness fall-off at wider viewing angles or a hotspot when viewing off-axis. Without prior knowledge, the builder must iterate: adjusting diffuser additions, trying different projector positions, or even measuring the film's light transmission with basic instruments. This process is not well-covered in academic literature, which often assumes known screen properties. This paper aims to fill that gap by detailing a do-it-yourself approach and examining its feasibility.

Second, adaptation strategies for consumer hardware in advanced displays are not extensively discussed. Many research prototypes either use high-end projectors or focus on the content/display algorithm side rather than the hardware assembly itself [10], [11], [12]. This leaves a gap in guidance for practitioners who want to use, say, a $500 projector and a piece of film to simulate a "holographic" display. Questions such as how large one can scale the screen before the brightness becomes insufficient, or how to minimize edge distortions without specialty lenses, are typically answered through individual experimentation. Our work addresses these gaps by providing a concrete case study. We document the build process and performance of a rear-projection screen using an unknown-spec film, offering insights into what worked and what pitfalls were encountered. By doing so, we hope to codify some of this practical knowledge and inform others attempting similar projects.

Thus, the objective of this study is to develop and document a replicable, low-cost fabrication process for a rear-projection screen assembly using readily available materials. We specifically target a use-case of static pseudo-holographic or "hologram" displays where viewers see projected content on a transparent surface. The assembly's performance will be evaluated in terms of basic image quality (sharpness, brightness uniformity, viewing angle) using consumer-grade projection hardware. By doing so, we aim to determine whether such an assembly can serve educational and prototyping purposes as a budget-friendly alternative to commercial screens. By sharing these results, we hope to lower the entry barrier for creating pseudo-holographic display prototypes and inspire further innovation in accessible immersive display technology.

2. Methods

2.1 Materials

The rear-projection display assembly was fabricated using the following key materials, chosen on the basis of their availability, cost, and relevance to the optical performance requirements of the system:

A. Rear-projection film

A translucent projection film acquired from a commercial supplier without detailed specifications. The film is grayish and slightly frosted in appearance, indicating a diffusive property, and is marketed for adhesive application to glass for see-through displays. We assumed it to have a moderate gain (~1.0-1.5) suitable for wide viewing angles, but no official data on gain or transmission was provided. The film came in a roll and was cut to the desired screen size.

B. Consumer-grade classroom projector

Epson XGA LCD projector, model with 3300 ANSI lumens, 1024×768 resolution was used for testing. This projector represents the type widely available in schools or offices, providing a realistic evaluation of the assembly under non-specialized hardware. It has manual focus, keystone correction, and a throw ratio of ~1.5:1. We also had access to a higher-resolution HD projector (1920×1080, DLP, ~3000 lumens) for comparative observations on image detail and to ensure that any resolution limitations observed were not solely due to the screen.

C. 3D-Printed frame components

A custom frame was designed to hold the acrylic and film assembly. The frame consists of four border pieces and four corner brackets. All parts were fabricated in brown PLA plastic using a consumer FDM 3D printer. PLA was selected for ease of printing and dimensional stability at room temperature

D. Acrylic sheet

A clear cast acrylic sheet of 5 mm thickness, used as the rigid substrate onto which the film is mounted. Acrylic was chosen for its optical clarity and stiffness; 5 mm thickness prevents flexing while remaining manageable in weight. Notably, cast acrylic has better optical quality (less internal stress and birefringence) than extruded acrylic, which helps maintain image clarity.

2.2 Design & Fabrication

The rear projection frame was conceptualized, designed, and developed with the objective of providing a compact, lightweight, and structurally stable support for projection-based display applications. The frame structure was modeled in CAD with emphasis on minimizing material usage while maintaining adequate rigidity. A lattice truss design was selected to optimize the balance between strength and weight reduction, ensuring stability without excessive use of filament. The modular truss configuration also allows for scalability and reconfiguration, making the frame adaptable for different projection screen sizes. The frame geometry was designed to securely hold the sheet in place while ensuring minimal visual obstruction. The overall dimensions were determined based on ergonomic considerations and compatibility with standard projection setups.

The frame components were fabricated using fused deposition modeling (FDM) 3D printing technology. Polylactic Acid (PLA) filament was selected as the printing material due to its ease of processing, dimensional stability, and cost-effectiveness. The truss members were printed with a layer height of 0.2 mm and an infill density of 20% to achieve a balance between structural integrity and print time efficiency. After printing, the individual truss modules were assembled using an interlocking mechanism designed within the CAD model, eliminating the need for adhesives or external fasteners between truss members. Once the frame was assembled, the acrylic sheet was aligned with the designated slots and secured to the structure using bolts. This fastening method ensured both stability and durability while allowing modular replacement of the sheet in future iterations.

For projection setup, the projector was placed behind the screen at the appropriate throw distance. We configured it for rear-projection mode (which horizontally mirrors the image to appear correct when projected from behind). The projector was mounted on a tripod to allow easy adjustment of height and angle. We aligned the projector such that its lens was perpendicular to the screen's center to minimize keystone distortion. In cases where space constraints forced an off-axis projection, the projector's keystone correction was used, but for our primary tests we achieved near head-on alignment. The relative angle between projector and screen was also kept small in the vertical direction to avoid any trapezoidal distortion. We attached black felt curtains around the projector where possible to prevent its light from spilling directly into the viewer's eyes an important consideration noted in classroom projector use.

Because the screen is partly transparent, any objects or light behind the screen could be distracting. In our indoor lab setup, we placed a black fabric backdrop about 1 m behind the projector to serve as a dark background. This enhances the perceived contrast of the "holographic" image, since areas meant to be black are actually letting the projector's light through, and having a dark background makes those areas appear darker. In a more permanent installation, one might mount the screen in a frame with a black back cover or use directional ambient light control to achieve a similar effect.

2.3 Evaluation Method

We conducted a series of tests to evaluate the assembled display's performance qualitatively and quantitatively to a limited extent. The evaluation addressed the following aspects: image clarity/sharpness, brightness uniformity (hot spots or dim corners), viewing angle, color/contrast, and overall usability in different ambient lighting conditions.

To do the test, we projected a standard suite of test images onto the screen:

A. A monochrome ANSI checkerboard pattern to check for uniform brightness and obvious hot-spotting. When viewed on a rear-projection screen, a properly diffusing surface should show the white squares with even intensity across the screen if uniform, whereas a hotspot would manifest as the center squares looking brighter than edge squares when viewed off-axis

B. A grayscale step ramp to assess contrast and any color tint. This allowed us to see if the film imparts a tint or if dark levels are contaminated by ambient light. We performed this test in a dark room and with room lights on to see the difference in black level.

C. High-resolution text and grid patterns to gauge sharpness. We projected 12 pt and 8 pt text (in positive and negative contrast) to determine the smallest readable font. We also used a pixel grid and crosshatch pattern to detect any blurring or double-imaging caused by the film.

D. A full-color photograph and video clip to subjectively evaluate color saturation, motion rendering, and overall impression. The photograph included vivid colors and both bright and shadow regions.

The tests were observed under two lighting scenarios: (1) Dark room with minimal ambient light (lights off, projector being the primary light source), and (2) Moderate ambient light with typical indoor lighting (~300 lux on the screen from overhead lights). These conditions simulate use in a controlled exhibit vs. a classroom or trade show environment. For each scenario, we recorded observations from multiple viewing positions: directly in front (on-axis), and at approximately 45° to the left and right of center. We also examined the image from different heights (seated eye level vs. standing) to see if vertical viewing angle had any effect.

Although we lacked a complete photometric measurement setup, we took some basic readings with a light meter. Luminance (in candela/m^2) of a fully white image was measured at the center and corners of the screen from the viewer's side, in a dark room, to estimate uniformity. We also measured the approximate contrast ratio by comparing luminance of a full-white vs. full-black test image in dark conditions. These measurements are not highly precise but provide ballpark figures to compare with typical projection screen performance.

3. Results and Discussion

3.1 Assembly Process

The assembly process resulted in a functional rear-projection screen with an overall material cost significantly lower than commercial equivalents. **Figure 1** shows the finished screen panel mounted on its stand (photograph taken from the audience side).

Figure 1. Finished screen panel

Visually, the screen in idle state (no projection) is light gray and translucent. It is not fully transparent like glass; looking through, one can see shapes and colors on the other side but with a frosted, blurred quality. This is expected, as the diffusion in the film scatters transmitted light. In a pseudo-holographic display context, this means when the projector is off, the screen is somewhat visible (unlike a completely clear glass), but when the projector displays dark/black background, the screen becomes inconspicuous against a dim environment. We noted that under normal room light, the screen acts like a semi-transparent partition: about 40% of background light is blocked by it (qualitatively). This property actually helps the projected image quality by providing some contrast even if lights are on, albeit the screen is not "invisible."

The structural stability of the assembly is good. The acrylic did not flex or bow, and the frame kept it perfectly flat. If slight bending force is applied to the panel, the frame and acrylic together resist well. This is important for maintaining focus across the screen. The stand held the screen upright with no wobble. One downside observed is that the PLA frame could potentially deform in very hot conditions (PLA softens ~60°C), but in our indoor use it remained rigid. For long-term usage or larger screens, using PETG or ABS plastic for the frame (which have higher temperature resistance) might be advisable.

3.2 Projection Test

In a darkened room, the projected image quality on the DIY screen was remarkably clear and bright. The ANSI checkerboard test revealed no significant hot-spot when viewed on-axis - all squares, center to edge, appeared uniformly illuminated to the eye, as seen in Figure 2. Moving to an extreme off-axis angle (~60° from center), a slight luminance drop-off at the far edge was noted, but the center did not bloom excessively. This suggests the film's diffusion is sufficient to spread light broadly (consistent with an approximate unity gain screen). We estimate the brightness uniformity (**Table 1**) (center vs 75% toward edge) to be within 15% when viewed at a 45° angle, which is a good result for rear projection.

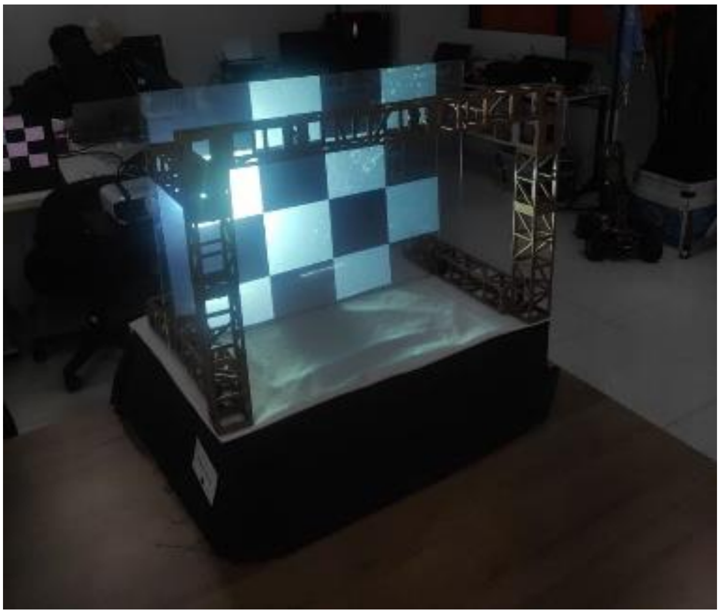

Figure 2. ANSI sheckerboard test

The grayscale ramp test yielded a full gradient from black to white with discernable steps, indicating the screen preserves contrast reasonably well in the dark, as seen in **Figure 3**. The measured on/off contrast on-screen was about 150:1 (center of screen, dark room), as shown in **Table 2**. This is lower than the projector's native contrast, due partly to the film's base transparency and perhaps internal reflections in the acrylic. However, the blacks appeared sufficiently dark when a black backdrop was behind the screen. With room lights on, the black level rose substantially (the darkest black on screen appeared as a gray, with contrast dropping to ~10:1 under ambient ~300 lux). This was expected. Like most screens, ambient light hitting the screen washes out the image. In practical terms, content was still visible under moderate lighting, but not "punchy." For pseudo-holographic effect, one would ideally dim the lights. otherwise, the illusion of floating imagery is compromised by the grayish haze over the screen.

Table 1. Brightness Uniformity

Location	Luminance (cd/m²)	Relative Brightness (%)
Center	80	100%
75% Toward Edge	68	85%

Figure 3. Grayscale ramp test

Testing fine text and graphics confirmed that the assembly can display details up to the projector's resolution limit, as seen in **Figure 4**. On our XGA projector, 8 pt text (about 2.8 mm high) was just at the edge of legibility from 2 m away. 12 pt text was clear and sharp. There was no noticeable double image or ghosting, indicating the film-to-acrylic bond is firm and the film itself has a thin diffusive layer (thick scattering layers can cause multiple image overlaps). The edges of white text on black were a tiny bit fuzzy under close inspection, which is normal for a diffusive screen - high frequencies are slightly blurred by the scatter. With the 1080p projector, we could see a finer rendition of a diagonal line test pattern, confirming that the screen is not the limiting factor for resolution; rather, the projector's resolution and focus are. No moiré or speckle was observed (speckle is usually an issue with laser projectors on diffusion screens, but our projector is LED/LCD based, and the film's matte texture likely suppresses coherent artifacts.

Table 2. Contrast Ratio (Dark Room vs. Moderate Light)

Lighting Condition	Contrast Ratio
Dark Room (minimal light)	150:01:00
Moderate Ambient Light (~300 lux)	10:01

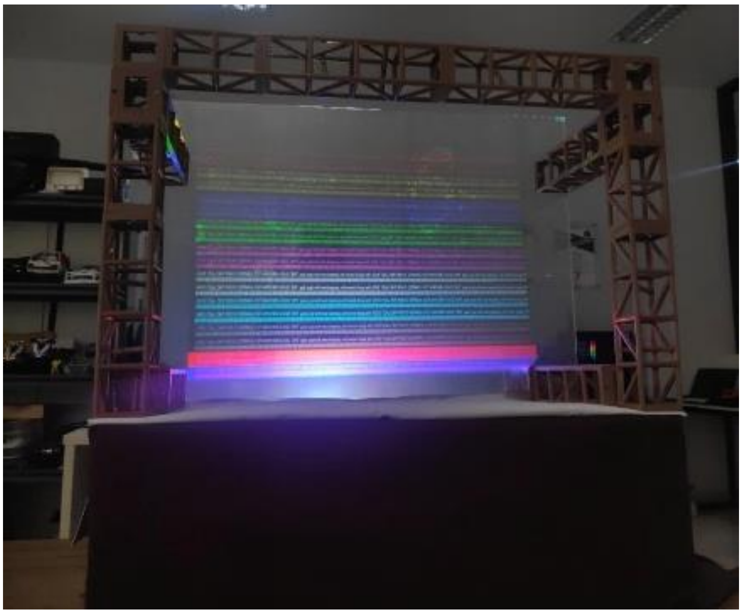

Figure 4. Text test

Video and animation tests were also carried out as shown in **Figure 5**. The viewing angle of the screen was very wide horizontally. Even at >70° off-center, one could still make out the image, though brightness and color begin to drop. Vertically, because the projector was roughly at center height, the viewing symmetry was. We estimate the half-gain angle (angle where brightness falls to half of on-axis) to be beyond 60° horizontally, meaning the film offers nearly 180° visibility (useful for multiple viewers spread out), as shown in **Tabel 3**. This matches expectations for a diffusion-based rear screen. However, one artifact at extreme angles was a slight specular reflection visible from the acrylic: at very glancing angles, the acrylic's surface reflected the projector's light, creating a faint ghost of the image. This only occurred if one's line of sight was almost parallel to the screen not a typical viewing position, so we consider it a minor.

Table 3. Viewing Angle Performance

Direction	Angle (°)	Observations
Horizontal	70°	Minimal brightness and color degradation
Vertical	60°	No significant degradation at eye-level

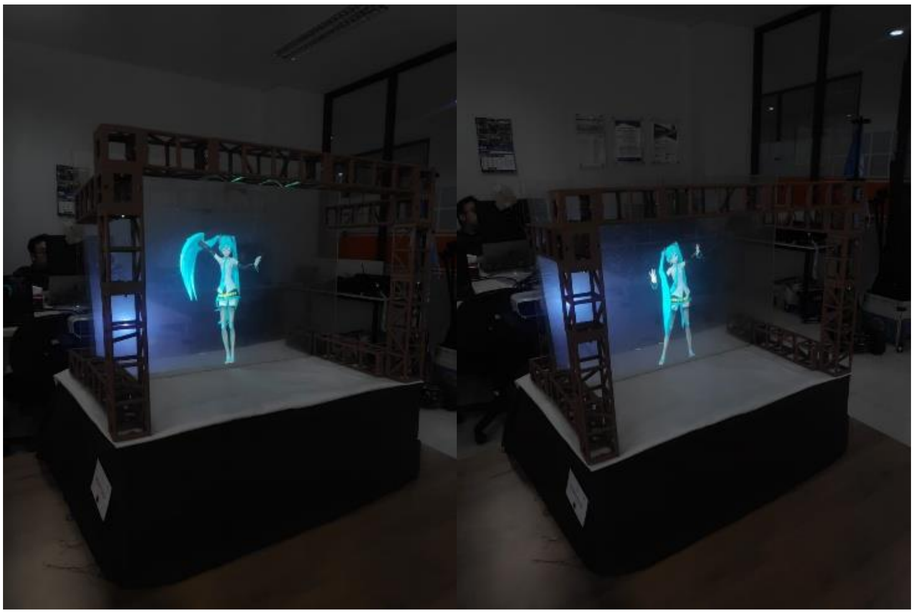

Figure 5. Video and animation test

The experiment demonstrated several strengths of the low-cost assembly. First, the affordability and accessibility are significant: all components can be sourced easily, and fabrication does not require industrial tools. The resultant screen delivered a qualitatively high-quality image in favorable conditions. The image uniformity was a strong point; despite using an unknown film, the distribution of light was even enough to avoid hotspots, likely because the film's diffusing properties are well-matched to a wide viewing application. The viewing angle was very broad, making the assembly suitable for group viewing and walk-around exhibits. Another strength is the modularity of the design - the 3D-printed frame concept can be adapted to different sizes or even shapes. Assembly and disassembly are straightforward, which is beneficial for transport or iterative improvements. The frame and stand proved portable and lightweight, so the entire setup can be moved or stored easily, which is ideal for temporary installations or classroom use where you might set it up for a lesson and then take it down.

A notable weakness lies in the unknown spec of the film which means we could not optimize the setup for, say, maximum brightness. If the film's gain is low, a lot of projector lumens are wasted (transmitted out the back or diffused). Indeed, our measured peak brightness (~80 cd/m^2 in dark room center) was on the low side, implying that in anything but darkness the image could struggle. A higher-gain film would improve this, but we worked blind regarding the film's properties. Furthermore, we noticed the film + acrylic combination has internal reflections when a very bright object was on screen (white area) next to a dark area, a faint ghost reflection of the bright area could be seen offset. Likely the light reflecting between the acrylic surfaces. This is a common issue in glass/acrylic rear screens. And our

DIY approach has not mitigated it but professionally, one might use optical coatings to reduce inter-reflections.

Table 4. Ambient Light Performance

Lighting Condition	Image Visibility
Dark Room (minimal light)	High Visibility
Moderate Ambient Light (~300 lux)	Low Visibility

Another weakness is that the assembly, as built, is not very. Scaling up to, for example, a life-size portrait or full kiosk display would introduce challenges: larger acrylic could flex, and joining multiple film pieces could create seams. While our frame can be expanded, a truly large seamless screen might require a different approach (or multiple projectors tiled). Lastly, the ambient light performance is limited, as shown in **Table 4**. In a bright room or daylight, the screen washes out severely. This is partly inherent to rear projection where most rear screens struggle in high ambient light unless they are tinted or have optical gain and partly due to our film's presumably moderate contrast capability. Thus, the intended use of our assembly is in controlled lighting or dim environments; trying to use it as a storefront window in daylight, for instance, would likely disappoint without a much more powerful projector.

3.3 Discussion

Our results confirm that constructing a functional rear-projection display with consumer-grade components is not only feasible but also yields satisfactory visual performance for certain applications. This opens up possibilities for education, exhibitions, and prototyping in ways that were previously limited by cost. For instance, a science museum or a university lab with limited budget could recreate pseudo-holographic demos like floating 3D objects via Pepper's ghost technique using our approach. The image quality in a darkened environment was sharp and immersive enough that most casual viewers would be impressed, fulfilling the goal of engaging visuals. Compared to a professional holographic display foil which can cost thousands of dollars for a large piece, our entire build cost was under $100, making it an attractive alternative for temporary setups or experimentation.

Comparing with commercial rear-projection screens, the DIY version holds up in some aspects and falls short in others. In terms of resolution and basic image formation, we did not notice a significant difference - meaning the film is likely decent at preserving detail and not introducing aberrations. High-end screens might boast specialized coatings that improve contrast or reject ambient light (for example, some have a black layer to absorb off-axis ambient light), which ours does not have. Thus, a commercial screen would outperform in a bright setting. Additionally, our assembly lacks the polish (e.g., anti-reflective surfaces to curb internal reflections, exact gain tuning) that a product would have. But notably, for static holographic installations (like those Pepper's ghost illusions used in museums or concerts), often the solutions are custom-built anyway (using clear foils, glass, etc.). Our approach essentially mirrors those at a smaller scale and with more readily available parts.

From a research perspective, this work demonstrates that even without full material knowledge, a combination of empirical testing and informed guesses (drawing on general properties of projection screens can lead to a viable outcome. This is encouraging for rapid prototyping. Our findings on uniformity and angle suggest that the unknown film we used behaves like a typical diffusive rear screen, which might be true for many such films on the market that are not labeled with specs. Therefore, researchers can be somewhat confident that even an unknown projection film will at least produce an image, and with the methodologies described (tension, black backing, etc.), the image can be optimized.

While feasible, the current implementation has several limitations that should be acknowledged and can guide future improvements. First, the optical performance ceiling is limited by the material. Without knowing or being able to significantly alter the film's fundamental properties (gain, haze, etc.), we are constrained in brightness and contrast. If a project demands higher image luminance or usage in brighter ambient conditions, one might consider using a tinted rear-projection film (gray or black tint to improve contrast) at the cost of needing a more powerful projector. Alternatively, incorporating a fresnel lens sheet behind the film could focus the projected light toward the viewer (increasing gain) but that adds complexity and cost. Our design did not address polarization retention either; if one wanted to use polarization-based 3D with two projectors, the chosen film might scramble polarization. Thus, the assembly in its basic form is unsuitable for stereo 3D projection without changing the screen material to a polarization-preserving type.

Scaling up the design presents challenges: a larger acrylic sheet is heavier and may not be as uniformly flat. One solution is to use a thin acrylic with a supporting frame behind it. Or use a tensioned film without acrylic for a big screen. However, stretching an unknown film uniformly without wrinkles would require a different approach. Our approach used the acrylic mainly for its flat, self-supporting surface to stick film onto). Removing it would reduce weight but necessitate a robust frame to stretch the film. Future iterations could experiment with a fabric rear-projection material in a 3D-printed frame, which might allow much larger sizes with minimal cost.

Another limitation is that our evaluation was mostly qualitative. For a formal comparison to commercial solutions, more photometric data would be needed (gain curve, MTF, etc.). Doing so would strengthen the case for the DIY screen's performance. For example, if we measured and found our screen has gain ~0.8 and 160° viewing angle, and a reference commercial screen has gain 0.8 and 180° angle, then we can quantitatively say we approach the commercial performance. Due to resource constraints, we did not fully characterize these. However, anecdotally the performance seemed in line with general rear-projection screen behavior documented historically

Projector limitations also influenced the results. Our use of a 3300-lumen, lower-resolution projector meant that the full potential of the screen wasn't tested in terms of 4K imagery or HDR (high dynamic range) content. If a 4K, 5000-lumen projector were used, the screen most likely show visibly sharper and brighter results, especially sharper since our screen material did not appear to be the bottleneck for resolution. The contrast might still be limited by the film, but brightness could increase. One interesting compromise could be using multiple cheap projectors in a tiled or overlapped manner to increase brightness on the same screeen.

The modular nature of our design makes it adaptable to various scenarios. Larger screens can be made by scaling the frame and using a bigger. If an ultra-large display is needed, tiling multiple panels with minimal seams is a potential approach. Our 3D-printed connectors could be extended to join screens at edges. For instance, four of our panels could form a 2×2 video wall for a more expansive display, using four projectors. There would be visible seams at the frame borders, but perhaps in a dark environment they wouldn't detract much, or one could design a custom joining frame to minimize the gap.

Another direction is shaping the screen differently. We built a flat screen, but pseudo-holographic displays sometimes use angled screens or pyramidal arrangements. Our method could fabricate those. The ease of 3D printing custom shapes makes this quite.

One intriguing extension is to combine the rear-projection screen with interactive technology. For example, adding touch interactivity through IR touch frame or camera-based touch detection could turn it into an interactive kiosk display. The acrylic provides a solid touch surface, and the overall setup could support moderate touch inputs. Alternatively, the transparent screen could be used in augmented reality setups where we position real objects behind it and project contextual information on the screen in front of them. We didn't explore interactivity, but it's a natural next step given that similar systems have been turned into interactive displays with motion or touch

Finally, continued research could focus on material science aspects. Measuring the optical characteristics of various low-cost films or even developing custom coatings that can be applied to acrylic to make it a rear-projection screen. If successful, that would eliminate the need to source special film at all. Our approach demonstrates viability, and further work can refine the balance between transparency and diffusion. There is an opportunity to systematically compare DIY screen materials such as tracing paper, diffusive vinyl, commercial film, etc. under the same conditions to inform which is best for different pseudo-holographic effects.

4. Conclusion

This study presents a low-cost method for creating a rear-projection display using consumer-grade components, suitable for pseudo-holographic applications. The approach combines a diffusive projection film, acrylic substrate, and 3D-printed frame, providing a functional and affordable alternative to commercial systems. The assembled screen delivered clear images with wide viewing angles and minimal artifacts, making it ideal for educational demos, art installations, and creative projects. While the system performed well under dark conditions, ambient light posed challenges to contrast. Future improvements could focus on optimizing the choice of projection film, experimenting with higher-performance materials, and addressing ambient light interference. Scaling the design for larger displays and refining fabrication techniques will also be key areas for development. This work demonstrates the potential of DIY, low-cost rear-projection systems to democratize access to immersive display technologies, particularly in education, art, and research. By lowering the cost barrier, it opens up opportunities for innovation and broadens the accessibility of advanced visual experiences.

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Authors' Declaration

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