PROVISIONAL PATENT APPLICATION SPECIFICATION

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ASSIGNEE:

TITLE: Sustainable Dynamic Display Substrate and Programmable Smart-Glass System Utilizing Pixel-Scrambling and Re-Assignment Command Architecture

CROSS-REFERENCE TO RELATED APPLICATIONS:

This application claims priority to, and serves as a physical hardware embodiment extension of, the "Sublimaview" pixel-scrambling architecture previously filed by the Inventor. Furthermore, this application cross-references and functions as a physical display medium for the interactive frameworks established under the "SIDOG" and "VR Flyer" patent applications, creating a fully integrated ecosystem for dynamic visual delivery.

1. FIELD OF THE INVENTION

The present invention relates to advanced materials and dynamic display substrates, specifically the integration of programmable, photo-luminescent structures within transparent mediums (glass and polymers) to replace toxic, cellulose-based commercial printing, packaging, and static advertising.

2. BACKGROUND OF THE INVENTION

The global commercial printing and consumer packaging industries rely heavily on cellulose-based substrates (paper/cardboard) and toxic chemical inks and paints. These materials are inherently static; when a marketing message or consumer label changes, the existing material must be discarded, resulting in millions of tons of landfill waste and massive carbon emissions from constant reprinting.

While "Smart Glass" (PDLC, Transparent OLED) and E-Ink exist, they are primarily restricted to high-power architectural applications or flat, opaque e-readers. There is currently no scalable, mouldable, transparent display medium capable of serving as ubiquitous consumer packaging or dynamic residential/commercial glass that integrates a proprietary pixel-scrambling algorithmic engine to manage complex visual data sustainably.

3. SUMMARY OF THE INVENTION

The present invention provides a "Programmable Smart-Glass" and mouldable polymer substrate that acts as a dynamic message delivery medium. By acting as the physical "Chassis" for the previously established Sublimaview pixel-scrambling "Engine," the system allows consumer packaging, storefront windows, automotive glass, and residential windows to display static or highly dynamic imagery on demand.
The invention solves the global packaging waste crisis by eliminating the need for printed labels. A single programmable bottle or container can dynamically update its branding, nutritional info, or promotional messaging via localized programming, creating a zero-waste, reusable packaging ecosystem. The invention also takes advantage of the previously filed SIDOG provisional application in that it can be integrated into commercial and private airlines to simulate positive environment for passengers seeking to peer out the window. e.g.: during a bumpy flight in bad weather or at night, the display would show the passenger a soothing environment instead of what is actually happening just inches from their physical self. These are but a few examples of the endless applications this eco-friendly technology can be made to achieve.

4. DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

The system comprises a central command architecture (the Sublimaview engine) driving two primary hardware embodiments:

Embodiment A: Viscous Magnetic Suspension (Consumer Packaging & Mouldable Forms)
This embodiment is designed for scalable consumer goods (e.g., beverage bottles, cleaning supplies). Photo-luminescent, synthesized magnetic nanoparticles are suspended in a highly viscous, transparent fluid matrix sandwiched between layers of mouldable plexiglass or polymers (e.g., PET).

- *Magnetophoresis & Bistability:* The Sublimaview engine dictates specific magnetic field generations to arrange the nanoparticles into high-resolution images, text, or barcodes.
  Due to the viscosity of the matrix, the system achieves a "bistable state"—meaning once the image is formed, it requires absolutely zero electrical power to maintain it indefinitely. Power is only required to scramble or change the image.

Embodiment B: Fixed-Pixel Matrix (Architectural & Automotive Glass)

This embodiment is designed for structural applications (storefronts, billboards, automotive windows, air craft windows, etc.,,). It utilizes a fixed, transparent micro-LED, Electrochromic, or PhOLED (Phosphorescent Organic Light-Emitting Device) mesh embedded directly within standard silica glass panes.

- *Algorithmic Overrides:* The Sublimaview engine handles ongoing pixel re-assignment and color overrides, allowing the fixed pixels to emulate complex, multi-layered designs or render the glass entirely transparent on command.

Enterprise-Grade Cryptographic Security & Failsafe Protocols:

- To prevent unauthorized visual hijacking or malicious reprogramming of public displays, the command architecture integrates a localized cryptographic handshake. Before the Sublimaview engine executes any pixel-scrambling or magnetic reassignment, it requires an authenticated token (e.g., AES-256 encryption, rolling UWB codes, or a secure cloud-verified API key). If the substrate detects an unauthorized transmission attempt or signal jamming, it engages a hardware-level failsafe, instantly locking the display into its current bistable state or reverting the glass to total transparency to neutralize the malicious attack.

Ubiquitous Civic and Commercial Deployment:

- The dynamic substrate is engineered for massive structural deployment, serving to replace traditional static signage, printed schedules, and powered LCD monitors across public infrastructure. This includes integration into public transit networks (train stations, subway cars, bus shelters), municipal facilities (public washrooms, wayfinding signage), and high-traffic commercial environments (grocery store aisles, bars, restaurants). In these environments, the substrate provides secure, real-time, localized updates without the maintenance and energy costs associated with traditional electronic monitors.

Consumer Interface and AI Generation:

Beyond enterprise commercial deployment, the system features a decentralized, consumer-facing control architecture. Users can interface with the smart-glass (e.g., residential windows, vehicle glass) via a localized mobile application (smartphone) using secure NFC, BLE, or Wi-Fi Direct. The software allows the average consumer to select pre-existing templates (e.g., rotating holiday motifs), upload personal designs, or utilize an integrated Artificial Intelligence (AI) generative engine to create custom, on-the-fly graphics for immediate display without requiring commercial programming expertise.

Illumination and High-Fidelity Rendering:

To ensure visibility in low-light conditions and provide self-illumination ("glow-in-the-dark" capabilities), the substrates integrate active edge-lighting and micro-backlighting. The pixel matrix is scalable to ultra-high-definition densities (e.g., 4K and 8K resolutions), fully capable of rendering full-motion video, cinematic playback, and television-style commercial broadcasting. Furthermore, by utilizing multi-layered transparent substrates, the pixel-scrambling engine can offset images between layers to produce stereoscopic 3D graphics and simulated holographic depth.

Aerospace and Automotive Embodiments:

The programmable glass serves as a direct replacement for traditional automotive paint, vinyl wraps, and magnetic commercial signage, allowing small businesses or private users to dynamically alter vehicle branding via smartphone. In aerospace applications (e.g., commercial airliner windows), the system can display targeted advertising or be programmed to simulate a high-definition "sunny view" during night flights or inclement weather, providing psychological comfort to passengers while integrating seamlessly with interactive systems like the VR Flyer.

Cryptographic Nanoparticle Addressing (The Physical-Digital Bridge): To facilitate the Sublimaview pixel-scrambling architecture within a physical medium, each photo-luminescent magnetic nanoparticle (in Embodiment A) or fixed pixel node (in Embodiment B) is manufactured with a unique micro-identifying signature (e.g., a specific magnetic resonant frequency, a micro-RFID equivalent, or a localized digital address). The command software maintains a secure registry of these discrete keys. This allows the algorithm to cryptographically communicate with, assign color state to, and dictate the precise spatial coordinates of every individual particle or pixel, flawlessly mirroring the digital descrambling of encrypted data in a physical space.

Optical Multiplexing and AR/XR Spatial Integration: The Sublimaview command engine is capable of interleaving multiple discrete visual data streams within the same physical substrate. The programmable glass can display a primary macroscopic image visible to the naked eye, while simultaneously projecting a secondary, frequency-shifted, or polarized scrambled image in the mutual display space. This secondary imagery remains entirely imperceptible or appears as ambient light to the naked eye. It can only be visually descrambled, isolated, and viewed by users equipped with synchronized, mated eyewear (such as AR/XR headsets, smart glasses, or proprietary polarized lenses) that possess the corresponding decryption key, allowing for hidden consumer gamification, secure data transmission, or personalized advertising.

5. PROVISIONAL CLAIMS

1. A programmable display system comprising a transparent or semi-transparent physical substrate, wherein the visual output of said substrate is exclusively dictated by a dynamic pixel-scrambling algorithm (the Sublimaview architecture) to render, alter, or erase multi-colored imagery on demand.

2. The system of Claim 1, formulated as a sustainable consumer packaging medium, wherein photo-luminescent magnetic nanoparticles are suspended within a viscous fluid matrix between mouldable polymer layers.

3. The method of Claim 2, utilizing magnetophoresis to arrange said nanoparticles into specific visual configurations, wherein the viscosity of the matrix provides a bistable state, maintaining the image indefinitely without continuous electrical current.

4. The system of Claim 1, formulated as structural glass, wherein a fixed matrix of transparent light-emitting pixels (e.g., PhOLED or micro-LED) is embedded within a silica or polycarbonate pane, and wherein the pixel-scrambling algorithm dynamically reassigns pixel color and opacity to transition the glass between transparent and graphic-display states.

5. A method for eliminating toxic cellulose-based printing and packaging waste, comprising the deployment of the mouldable substrate of Claim 2 as consumer product containers, allowing branding, barcode, and regulatory information to be dynamically updated via localized magnetic or electronic reprogramming rather than physical disposal and reprinting.

6. An interactive commercial interface wherein the dynamic display substrate is configured to update consumer data, retail pricing, or point-of-sale (POS) promotions in real-time via localized secure transmissions (NFC, BLE, or UWB), eliminating the need for physical relabeling in retail environments.

7. A consumer control interface for the system of Claim 1, wherein localized displays are programmed, altered, or dynamically generated via a mobile device utilizing an integrated Artificial Intelligence (AI) graphic generation engine and user-selectable templates.

8. The system of Claim 4, further comprising active edge-lighting and micro-backlighting infrastructure, rendering the dynamic display highly visible in low-light or zero-light environments.

9. A multi-layered embodiment of the fixed-pixel matrix capable of rendering full-motion, ultra-high-definition video, stereoscopic 3D imagery, and holographic effects via algorithmic layer-offsetting governed by the pixel-scrambling architecture.

10. An aerospace and automotive structural integration, wherein vehicle or aircraft windows are replaced or a sub structure is added/overlaid by the dynamic substrate, configured to eliminate physical paint and signage, display dynamic commercial advertising, or simulate external environmental conditions (e.g., daylight simulation during night-time transit or real-time inclement weather situations).

11. An enterprise security and anti-hijacking protocol for the system of Claim 1, wherein the pixel-scrambling architecture requires a verified cryptographic handshake prior to executing any visual alteration, thereby preventing unauthorized malicious reprogramming, and comprising a hardware failsafe configured to lock the substrate into a predefined visual state or render it transparent upon detecting an intrusion attempt.

12. The deployment of the dynamic substrate across ubiquitous civic and commercial infrastructure, functioning as secure, real-time programmable signage for public transit networks, municipal facilities, and high-traffic retail environments, eliminating the requirement for static cellulose signage or continuous-draw electronic monitors.

13. The system of Claim 1, further comprising an integrated transparent photovoltaic layer configured to harvest ambient artificial or solar irradiance, rendering the substrate energy-autonomous by internally generating the electrical current required to power localized wireless communications and execute visual alterations via the pixel-scrambling architecture.

14. The system of Claim 1, wherein each physical nanoparticle or individual pixel node comprises a unique resonant, physical, or digital identifying key, allowing the central pixel-scrambling algorithm to cryptographically address, spatially position, and color-assign individual physical units, ensuring that macroscopic imagery can only be assembled or altered by a software engine possessing the corresponding registry of nanoparticle keys.

15. An optical multiplexing and spatial-sharing method for the dynamic display substrate, wherein the pixel-scrambling architecture interleaves a secondary, optically encrypted, frequency-shifted, or polarized image within the primary macroscopic visual output; said secondary image remaining imperceptible to the naked eye and uniquely capable of being visually descrambled and viewed only by users equipped with synchronized augmented reality (AR), mixed reality (XR), or proprietary mated eyewear.

"Figure 1: Architectural and Automotive Implementations of the Dynamic Display Substrate.