ISSN: 2994-6433

Research Article

Journal of Sensor Networks and Data Communications

Mixed Modes Pixels Display Technology: Is there a Room for Physical Plasma Inside Modern Day Display Screens?

Ahmed M. Hala*

Gaseous Electronics LLC, Riyadh, Saudi Arabia

***Corresponding Author**
Ahmed M. Hala, Gaseous Electronics LLC, Riyadh, Saudi Arabia.

Submitted: 2024, Nov 25; **Accepted:** 2024, Dec 23; **Published:** 2024, Dec 27

Citation: Hala, A. M. (2024). Mixed Modes Pixels Display Technology: Is there a Room for Physical Plasma Inside Modern Day Display Screens? *J Sen Net Data Comm, 4*(3), 01-04.

Abstract

The classical definition of a charge is limited to assigning opposite polarities to it, which is used to design electric current circuits whose charges are sustained by an energy from a potential (voltage) difference for example. However, recent research and reviews of physical plasma chaotic behaviour revealed that the energy acquired by the charges can be studied closely in space and time domains using novel attributions such as charge (dimness) or (brightness). This is both qualitatively and computationally significant especially when building display screens. After the decline of physical plasma screens technology more than10 years ago, it has been recognized again as it provides unique displays for a variety of media channels. The research presented here concerns working on the so - called mixed modes pixels screens technology, where each screen pixel is allowed to house light emitting diodes elements in addition to making room for a physical plasma compartment to house an electric discharge. Switching between, or mixing, the output from these elements is what defines the overall viewer experience. Moreover, it will be shown that recent research on tracking charge transport across a display screen, allows for a selective capture of images from the sender and receiver at the screen surface, thereby enabling a possible two way televised transmission.

Keywords: Physical Plasma, Charge, Pixels, Broadcast Technology, Metamaterials, Signal Processing and Analysis, Photonics, Electrooptics, Plasma Display

1. Introduction

Physical Plasma Panel (PPP) displays dominated the market due especially to image quality - resolution and luminous efficiency [2]. The market dropped this technology due to specifications related to their extra energy consumption, more heat emission and heavier weight, among other factors. High speed imaging through in-pixel storage inside displays can be used and enhanced by placing light emitting components to adjust brightness. In PPP display technology, this provides an innovative addition to the traditional PPP display cells by allowing for True Random Numbers Generation (TRNG) elements from the ambient environment through fast event capture and in-pixel storage. Data collected by each PPP display set, including those of power consumption, heat and light emission values can be analyzed and adjusted by AI algorithms [3]. This will help in launching a new generation of PPP displays in the marketplace. Moreover, advances in metamaterials technologies allow for the control of PPP displays at the picture screen level.

2. Development of PPP Display

Before 1925, image transmission relied on electromechanical systems, using a modulated light source or a cathode tube to display images. Hungarian inventor Kálmán Tihanyi revolutionized this approach by introducing plasma technology to capture and reproduce images on a flat-screen television. His invention focused solely on visual transmission, excluding sound, as existing solutions already addressed audio. Tihanyi's design featured a photosensitive element coated with materials like sulfur telluride or thallium sulfide, functioning similarly to the condenser matrix of an iconoscope. Both image capture and reproduction systems employed a high-pressure gas-filled discharge tube to scan the image surface.

Tihanyi's plasma-based approach recognized the challenges of electromagnetic disturbances caused by electric discharges in plasma. These disturbances could interfere with nearby electronic systems and disrupt viewing experiences. To address this, he proposed enclosing the discharge tube in a metallic case, ensuring electromagnetic compatibility. This innovation highlighted his foresight in meeting emerging technical standards. The scanning process relied on an electric charge accumulation mechanism, with an electric discharge traveling along imaginary scanning lines, thus enabling precise image capture and signal conversion.

For image capture and signal conversion, Tihanyi proposed a high-speed electric field traveling along a series of miniature electrodes placed on a glass plate. These electrodes acted as transmission lines, facilitating electric discharges to address individual image elements. Each discharge transmitted a corresponding signal, which was then modulated to reproduce the image on a flat screen. The display could generate images either through luminous spots from discharges or by exciting a phosphorescent screen filled with high-pressure inert gas, ensuring a detailed and innovative image reproduction system [2].

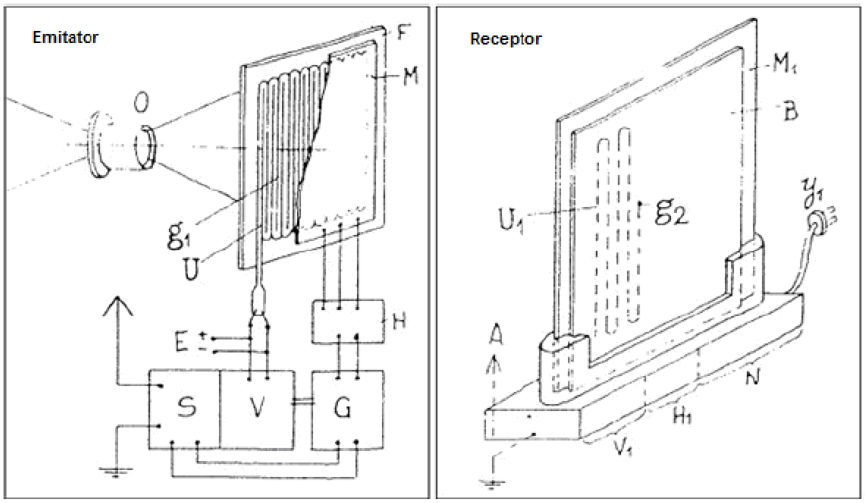

Figure 1: Kálmán Tihanyi's Idea of Plasma Television [2].

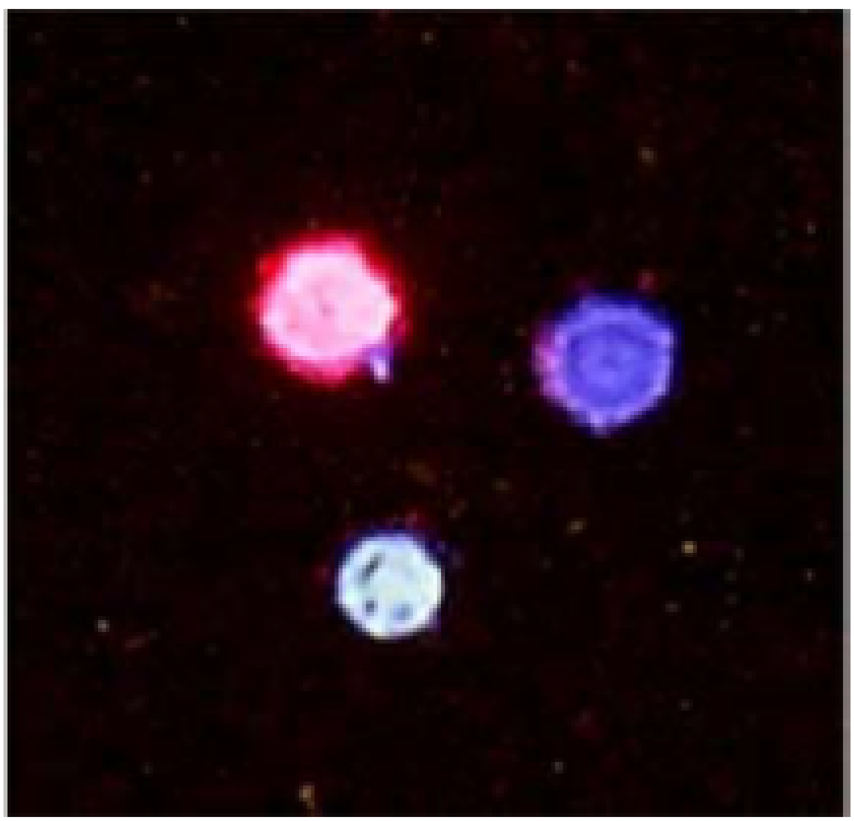

Figure 2: 1st color plasma panel was these 3 cells prototype with red and green color phosphors excited by a xenon gas discharge. It was developed at the University of Illinois in 1967. All of today’s color plasma TVs generate light this way. The deep blue cell on the right had no phosphor [4].

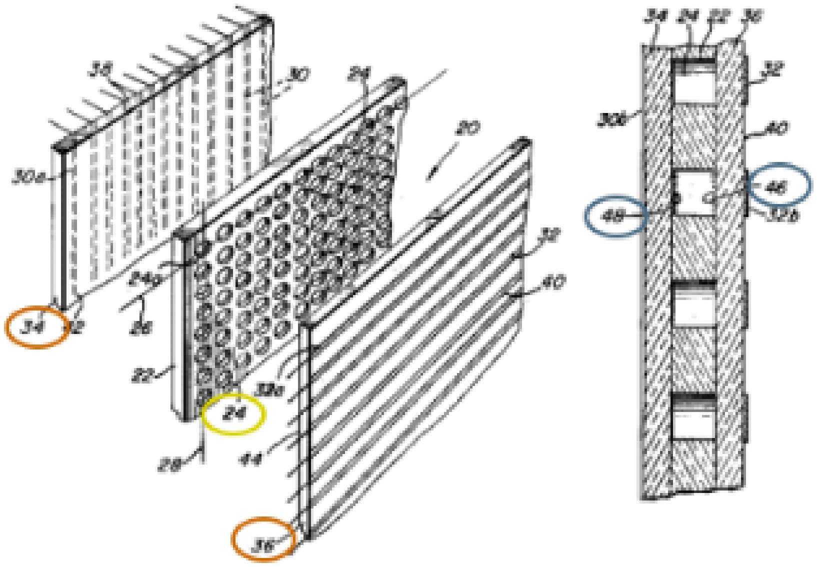

Figure 3: The driving electrodes are insulated with dielectric layers are contained in cells (24) The dielectric layer could be used to store charge on the walls (46) and (48) [4].

3. Enhancement of PPP Display Performance

The event capture rate of an event capture device can be limited due to factors such as the use of slower semiconductor technologies (greater than 130 nm) or operational bottlenecks in the event capture process. These bottlenecks typically occur during the three phases of event capture: detecting the event, converting it into a readable format (e.g., digital), and reading out the converted data from the device. These constraints can affect the overall performance and speed of the event capture device.

To address these limitations, high-speed imaging techniques using in-pixel storage can be incorporated into PPP display cells. By integrating an event sensor with in-pixel storage, the device can separate the event capture process from other operations, enhancing the event capture rate. Additionally, in-pixel light-emitting components can further improve the circuit's capacity to efficiently capture and process events, enabling more effective and high-speed imaging [3].

4. Discussion and Outlook

Enhancing the viewing experience of TVs and monitors involves leveraging surface phenomena on screens through advanced technologies like dielectric metasurfaces and metamaterials. Metasurfaces are planar versions of metamaterials, designed with subwavelength thickness to manipulate electromagnetic waves effectively. These surfaces can block, absorb, or guide waves across a wide frequency spectrum, from microwave to visible light. By carefully designing impedance cells, it is possible to control wave behaviors such as phase and velocity, enabling functions like guiding waves in specific directions or controlling scattering. Metasurfaces have versatile applications, including creating 2D lenses for antennas and planar microwave sources, offering significant improvements in electromagnetic manipulation [5].

Another key innovation in enhancing transmission and reception technologies is the plasma antenna. Unlike traditional metal antennas, plasma antennas use ionized gas as a conductive medium, providing the advantage of being reconfigurable and operable in an on-and-off manner. Research efforts have successfully reduced the power required for gas ionization through techniques like pulsing, making plasma antennas more efficient. Despite using the same geometric resonances as metal antennas, plasma antennas excel due to their adaptability. They can transmit and receive signals across frequencies with minimal co-site interference by nesting higher-frequency plasma antennas within lower-frequency ones, allowing seamless operation and reducing signal disruptions [6].

5. Conclusion

Physical plasma panel (PPP) displays were removed from mass market production ten years ago in favor of slimmer TV sets and computer monitors. If they were to come back, many innovations have to be introduced to make them compete on the size, weight, heat emission and energy consumption categories. Indeed, many plasma TV sets for example can be manufactured nowadays with dimensions and weights comparable to their LED's counterpart for example. The higher heat emission and more energy consumption factors can be adjusted for each set at a time, using clever and integrated feedback loops that use true random numbers generated at the screen picture level. Further, and considering physical plasma as an ambient medium that allows waves propagation, the two – way experience can be established, and controlled, at both transmission / receiving ends using elements of metasurfaces technology. In addition, the overall physical plasma monitoring set can be considered as a large tunable antenna for a clearer audio and video broadcast.

Acknowledgment
This research is supported by Gaseous Electronics, LLC (www.gaselco.com) Riyadh, Saudi Arabia.

References

1. M. Hala, "Mixed modes pixels display technology: is there a room for physical plasma inside modern day display screens?," 2024 IEEE International Conference on Plasma Science (ICOPS), Beijing, China, 2024, pp. 1-1.
2. Baltag, O. (2021). History of Plasma Display Reflected by Patents. *Current Journal of Applied Science and Technology, 40*(16), 68-81.
3. Eldesouki, M., Deen, M. J., & Fang, Q. (2011). *U.S. Patent Application No. 12/814,443.*
4. Weber, L. F. (2006). History of the plasma display panel. *IEEE transactions on plasma science, 34*(2), 268-278.
5. Ali, A., Mitra, A., &Aïssa, B. (2022). Metamaterials and metasurfaces: A review from the perspectives of materials, mechanisms and advanced metadevices. *Nanomaterials, 12*(6), 1027.
6. Anderson, T. (2020). *Plasma antennas*. Artech House.