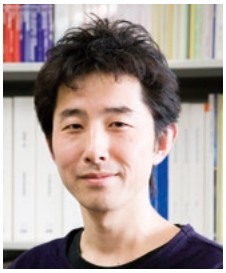
Research on electronic information display devices and systems

Tomokazu SHIGA Laboratory



Tomokazu SHIGA

Summary of Research

Development and Introduction of Better Displays with Higher Efficiency and Power-saving Performance

Plasma display panels (PDP) and liquid crystal displays (LCD) have replaced the conventional cathode-ray tube in recent years, and TV screens are growing increasingly larger. Our laboratory pursues research related to displays–devices essential to the home appliance industry. Due to growing display panel sizes, display systems consume more electric power than ever before, raising environmental concerns. In the case of PDP, the luminous efficiency of display panels needs to be improved to reduce power consumption. To that end, we are optimizing the panel structure and drive waveforms.

Drive System and High Image Quality

Better image quality is one of our research targets. We are developing various drive systems and performing experiments to achieve reduced drive voltages, faster addressing speed, and higher contrast. For instance, when a display device shows bright images, these images are perceived to have high image quality. To increase the luminous intensity of a display panel and to allow it to display black image areas accurately, we test different drive systems in combination with a small test PDP. We produce actual drive circuits, then vary the signal waveform to evaluate image quality. In the case of the LCD, larger panel sizes also result in increased power consumption, and this is also generating major concerns. To find a solution to this problem, we developed a totally new system that varies the luminous intensity of the backlight according to the type of image displayed. We are attempting to apply this system to reduce power consumption. The LCD backlight constantly and uniformly illuminates the rear surface of the LCD panel, meaning that both light and dark image areas receive the same amount of light. The portion of light that illuminates dark image areas is wasted. The system developed at our laboratory adjusts the intensity of the backlight based on the image displayed to minimize power consumption and achieve high power-saving performance.

Countermeasures Against Flickers

We also pursue research on image quality based on human engineering. Due to the characteristics of the human eye, a problematic phenomenon called flickering is more readily visible to the periphery of the retina than the center. Hence, screen flicker is more noticeable to human vision on large displays, due to the increased field of view. Our research also explores methods for preventing screen flicker by exploring the visual characteristics of the human.

Keywords

Display, television, plasma display panel (PDP), liquid crystal display (LCD), discharge, low power, power conservation, high image quality, luminous efficiency, drive systems, human engineering, visual characteristics

Affiliations	Society for Information Displays, Institute of Image Information and Television Engineers, Illuminating Engineering Institute of Japan, Institute of Electronics, Information and Communication Engineers
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Advantages

R&D from the Viewpoint of Television Engineers

One of the distinctive features of our laboratory is that our research constantly takes the viewpoint of television engineers into account. In companies or other organizations engaged in the development of display devices, dedicated sections or teams perform R&D activities in their own specialized fields. For example, a group of panel specialists works on improving panels, while a team of circuit designers tweaks or develops electrical circuits. These organizations are often vertically divided. In some cases, TV products are developed and completed with little apparent regard among the development staff of the fact that the images displayed will be viewed by people.

Beautiful, Comfortable-to-watch TV Screens

Our laboratory takes human factors into account. Our research prioritizes making displayed images as beautiful and comfortable as possible for people to watch, since

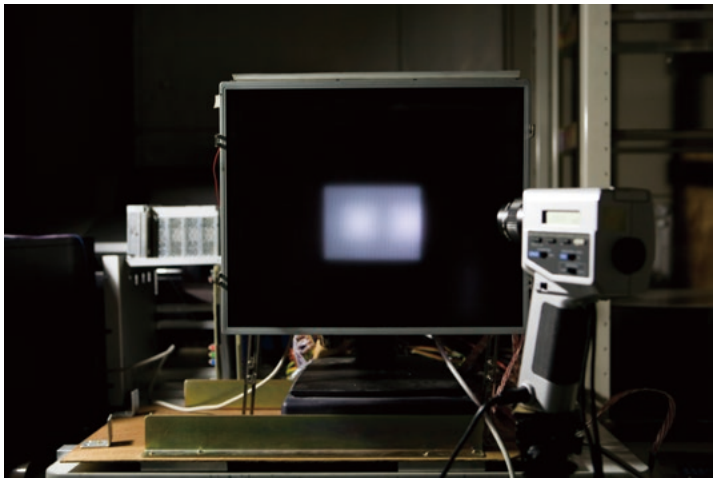
this is an essential objective of television engineers. No other university laboratory that we know of engages in full-fledged research on PDPs or explores power-saving technologies for LCDs based on new and innovative ideas.

In other words, it is no exaggeration to say that our laboratory is the only university laboratory in Japan capable of effective research on displays from the perspective of television engineers. As a university laboratory, in contrast to corporate research laboratories, we bring diverse perspectives to our research to produce innovative research results.

Future Prospects

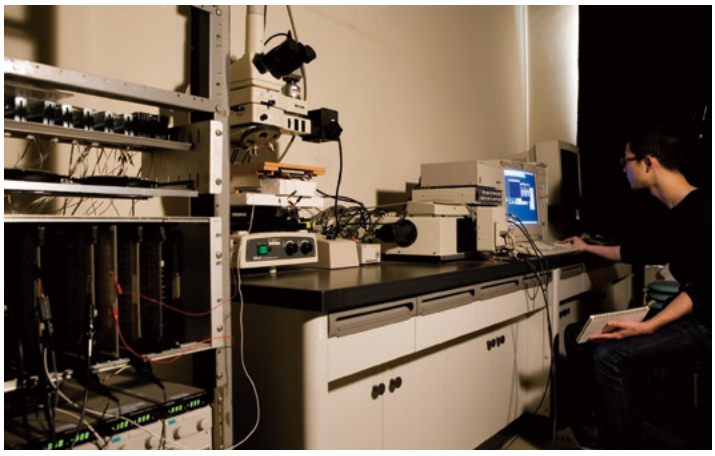
Developing Displays that are Gentle to Human Eyes

Our studies indicate PDP power consumption can theoretically be reduced to about half of current levels through improvements in luminous efficiency. For LCDs, we have confirmed that the method mentioned earlier would allow panels to operate at half the current levels of power consumption. The goal of our continuing research in this area is to ensure power-saving performance equal to our research results when these technologies are incorporated into commercial products. We also intend to pursue higher image display quality with respect to the human eye. This research challenge requires more than high-resolution display panels. It requires a thorough understanding of the characteristics of the human eye. One example is the organic EL display panel, a technology expected to become the next-generation display panel, one capable of achieving high moving picture response speed not possible with LCDs. However, a TV product produced with a sole focus on this aspect of performance will result in a flickering display. By integrating human engineering principles, our laboratory seeks to contribute to the development of people-friendly display devices.



Local brightness control for the backlight

Measurement of the brightness of a small test PDP



Observation of discharge development using a high-speed ICCD camera