High-speed LED displays and its applications

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Recently, several types of high frame-rate LED displays have been developed[1-6] to improve performance on 3D displays and interactive user interfaces, including volumetric 3D representations, exercises with video movies, and a new digital signage techniques.[3] Conventional information display architecture has a latency problem from video signal input to optical output.

In order to overcome the latency problem, we have proposed new architectures for LED display, such as a high-frame-rate LED display with spatiotemporal mapping,[1] smart LED tile (SLT),[5] and column-parallel LED display (CPLD).[6] This paper shows our developments on high-speed LED displays and their applications.

SLT integrates sensors, a wireless communication module, a processor, an LED driver, and battery within 5 cm by 5 cm square, as shown in Fig. 1. SLT can show acceleration, rotation angle, luminance, or sound instantaneously. SLT position can be detected according to electric field intensity of wireless communication.

Architecture of CPLD is shown in Fig. 2. CPLD is composed of LED lines. Each LED line is operated by a microprocessor. The microprocessors operate parallel SIMD (single instruction multiple data). The SIMD instructions are performed in a master and slaves configuration. After all slave microcontrollers receive the data, the master broadcasts a synchronization signal to the slave microprocessors and all LED lines emit at the same time. As shown in Fig. 3, the developed CPLD also have a feature of flexible shape. The LED screen comprises flexible LED lines. Each LED pixel represents full color (24 bits). Pixel pitch is 7.0 mm. Each full-color LED is integrated with a driver IC (WS2811), which is driven in 3-channels LED drive (power supply, GND, and signal). Our developed prototype contains 60 x 48 pixels.

Applications of high-speed LED displays include hand-waving steganography,[3] visualization of acceleration, and free-space 3D interface of AIRR (aerial imaging by retro-reflection) screen by use of our developed high-frame-rate LED display system.[7]
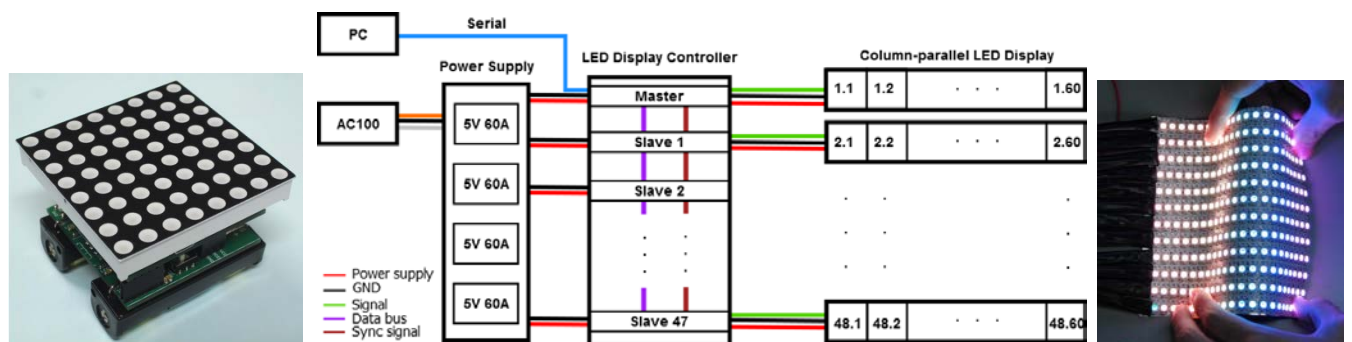

Fig. 1. Smart LED tile.   Fig. 2. Column-parallel LED display (CPLD) architecture.   Fig. 3. CPLD screen.

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