Wireless LED

Billions of visible LEDs are produced each year, and the emergence of high brightness AlGaAs and AlInGaP devices has given rise to many new markets. The surprising growth of activity in, relatively old, LED technology has been spurred by the introduction of AlInGaP devices. Recently developed AlGaInN materials have led to the improvements in the performance of bluish-green LEDs, which have luminous efficacy peaks much higher than those for incandescent lamps. This advancement has led to the production of large-area full-color outdoors LED displays with diverse industrial applications.

The novel idea of this article is to modulate light waves from visible LEDs for communication purposes. This concurrent use of visible LEDs for simultaneous signaling and communication, called iLight, leads to many new and interesting applications and is based on the idea of fast switching of LEDs and the modulation visible-light waves for free-space communications. The feasibility of such approach has been examined and hardware has been implemented with experimental results. The implementation of an optical link has been carried out using an LED traffic-signal head as a transmitter.

Audio messages can be sent using the LED transmitter, and the receiver located at a distance around 20 m away can play back the messages with the speaker. Another prototype that resembles a circular speed-limit sign with a 2-ft diameter was built. The audio signal can be received in open air over a distance of 59.3 m or 194.5 ft. For data transmission, digital data can be sent using the same LED transmitter, and the experiments were setup to send a speed limit or location ID information.

The work reported in this article differs from the use of infrared (IR) radiation as a medium for short-range wireless communications. Currently, IR links and local-area networks available. IR transceivers for use as IR data links are widely available in the markets. Some systems are comprised of IR transmitters that convey speech messages to small receivers carried by persons with severe visual impairments. The Talking Signs system is one such IR remote signage system developed at the Smith-Kettlewell Rehabilitation Engineering Research center. It can provide a repeating, directionally selective voice message that originates at a sign. However, there has been very little work on the use of visible light as a communication medium.

The availability of high brightness LEDs make the visible-light medium even more feasible for communications. All products with visible-LED components (like an LED traffic signal head) can be turned into an information beacon. This iLight technology has many characteristics that are different from IR. The iLight transceivers make use of the direct line-of-sight (LOS) property of visible light, which is ideal in applications for providing directional guidance to persons with visual impairments. On the other hand, IR has the property of bouncing back and forth in a confined environment. Another advantage of iLight is that the transmitter provides easy targets for LOS reception by the receiver. This is because the LEDs, being on at all times, are also indicators of the location of the transmitter. A user searching for information has only to look for lights from an iLight transmitter. Very often, the device is concurrently used for illumination, display, or visual signage. Hence, there is no need to implement an additional transmitter for information broadcasting. Compared with an IR transmitter, an iLight transmitter has to be concerned with even brightness. There should be no apparent difference to a user on the visible light that emits from an iLight device.