

Abstract

Visible light communication (VLC) systems offer an efficient, versatile approach to wireless signal communications. With a large bandwidth and data rates approaching 100Mbps, these systems may supplement RF technology, allowing wireless communication to meet the rising global data demand. VLC grants opportunity for versatile applications that include both infrastructure-to-device and device-to-device communications. Such applications include wireless audio transmission, smart home devices, emergency signal systems, and autonomous vehicle development. With pre-established infrastructure in the form of traffic beacons, stoplights, streetlights, office or home lighting, and more, VLC can be implemented at relatively low costs and holds the added benefit of providing illumination while communicating data.

A basic VLC project was built to test these advantages and determine the plausibility of continuing VLC research by investing in more complex and costly designs. This simple system features an LED that transmits an amplitude modulated signal. The transmitted light signal is received by a phototransistor and passed through filtering and amplifying circuits to the actuator. Objectives of this project include advancing understanding of wireless communications through hands-on experience and addressing key research challenges like flicker mitigation and the phenomenon of dimness perception. Flickering is defined as any undulating perceived by the human eye, and poses the risk of user irritation. This effect can be reduced by maintaining signal frequencies over 60Hz. Likewise, the issue of dimming is based on a trick of perception: a light source that is physically dimmed is perceived to be brighter than its actual intensity and vice versa, due to the contraction and relaxation of the human iris. VLC designers must ensure that the light output from applications falls within levels comfortable for the average user. Ultimately, this wireless audio communication system provides a tangible, experimental basis for future efforts to research and implement more extensive concepts associated with VLC systems.

