

Chapter 3

An Introduction to LiFi and Review of Prototypes Designed on FPGA and Other Hardware

Faisal Khan Khaskheli

Dawood University of Engineering and Technology, Pakistan

Fahim Aziz Umrani

Mehran University of Engineering and Technology, Pakistan

Attiya Baqai

Mehran University of Engineering and Technology, Pakistan

ABSTRACT

The current wireless networks are highly deficient when it comes to catering to the needs of the modern world with applications such as IoT and online interactive gaming. LiFi (visible light communication) has attracted interest as a solution to this problem due to its high data rate, wider spectrum, low power consumption, higher security, lower cost, and immunity to EMI. The idea behind LiFi is to use LED lights already available for space lighting for the purpose of transmitting. The chapter begins with a brief introduction to LiFi and then takes the reader through the history and market status of the technology all the way through to popular modulation techniques and finally ends with summarizing the transceiver prototypes designed previously with special emphasis on FPGA-based prototypes. The chapter provides a starting point for young budding researchers interested in LiFi and its implementation.

DOI: 10.4018/978-1-5225-9767-4.ch003

INTRODUCTION

It has been three decades since the wireless mobile communication systems became commercially available and the technology has already become an essential part of our everyday life, becoming a fundamental commodity. The past two decades have seen an exponential increase in mobile data traffic and have gone through a massive deployment of wireless communication systems. Technology advancements such as Internet of Things and Virtual reality have put huge pressure on currently available Radio frequency spectrum and the limited availability of RF spectrum is pointing towards a looming 'RF spectrum crisis' (Ofcom, 2013 ; Tsonev, Videv & Haas, 2013). This has prompted researchers to look to move towards higher frequencies and smaller cell sizes, exploring the millimeter wave part of the spectrum. While a smaller cell size is not a problem as far as system performance is concerned as it significantly improves performance. It does create other problems. Providing infrastructure to each cell and increased power consumptions are major issues in such networks. One of the possible solutions suggested to these problems is Visible Light Communication (VLC). It is just the next logical step in the move towards higher frequencies and takes one into the Nanometer range. VLC has attracted particular interest because lighting has virtually become a basic commodity for every home and place of work. Especially since LED has become a common device for illumination, it has made the dream of combining communication and illumination a reality. The existing infrastructure means the VLC Access points area readily available and existing technologies like Power Line Communication (PLC) and Power over Ethernet (PoE) mean the technology required for backhaul connectivity is also ready at hand. Also because light is on most of the times in indoor environment, the technology is power efficient since data is piggy backing illumination in most cases. Other benefits of VLC in addition to these include inherent security and immunity to Electromagnetic Interference (EMI).

Li-Fi is a relatively new subclass under the larger umbrella of VLC. Most of the research available is simulation based. However, some prototypes have been developed on various platforms that shall be discussed later in this chapter. Designers have implemented prototype Li-Fi/VLC transceivers on microcontrollers, FPGAs, Raspberry Pi and Arduino using a range of physical layer devices from expensive LED packages including drive circuits to cheap off the shelf devices. Data rates of around 1 Gbps and 3.4 Gbps have been reported using phosphorous coated white LED (Khalid, Cossu, Corsini,

29 more pages are available in the full version of this document, which may be purchased using the "Add to Cart" button on the publisher's webpage: www.igi-global.com/chapter/an-introduction-to-lifi-and-review-of-prototypes-designed-on-fpga-and-other-hardware/231762

Related Content

An Intelligent Thermal Imaging System Adopting Fuzzy-Logic-Based Viola Jones Method in Flu Detection

Wai Kit Wong, Nur Izzati Nadiyah Binti Ishak, Heng Siong Lim and Jalil bin Md Desa (2017). *Recent Advances in Applied Thermal Imaging for Industrial Applications* (pp. 1-39).

www.irma-international.org/chapter/an-intelligent-thermal-imaging-system-adopting-fuzzy-logic-based-viola-jones-method-in-flu-detection/179762

The Quest for Extraterrestrial Intelligence

Hui Chieh Teoh and Katrina Pui Yee Shak (2020). *Analyzing the Physics of Radio Telescopes and Radio Astronomy* (pp. 290-299).

www.irma-international.org/chapter/the-quest-for-extraterrestrial-intelligence/250956

Thermography in Animal Models of Cancer: A Tool for Studying Oncobiology in Laboratory Animals

Rui M. Gil da Costa, António Ramos Silva, Ana Faustino Rocha, Paula Alexandra Oliveira, Joaquim Gabriel, Ana Margarida Abrantes and Maria Filomena Botelho (2017). *Innovative Research in Thermal Imaging for Biology and Medicine* (pp. 237-263).

www.irma-international.org/chapter/thermography-in-animal-models-of-cancer/175110

Whole-Body Cryotherapy as a Tool to Improving of Infrared Thermography Diagnostics

Armand Cholewka, Agata Stanek, Karolina Siero-Stotny and Joanna Kajewska (2017). *Innovative Research in Thermal Imaging for Biology and Medicine* (pp. 93-118).

www.irma-international.org/chapter/whole-body-cryotherapy-as-a-tool-to-improving-of-infrared-thermography-diagnostics/175104

The Radio Sun and Planets

Hui Chieh Teoh (2020). *Analyzing the Physics of Radio Telescopes and Radio Astronomy* (pp. 230-249).

www.irma-international.org/chapter/the-radio-sun-and-planets/250953