Because of the ever increasing demand wireless data in the modern era, the Radio Frequency (RF) spectrum is becoming more congested. The remaining RF spectrum is being shrunk at a very heavy rate, and spectral management is becoming more difficult. Mobile data is estimated to grow more than 10 times between 2013 and 2019, and due to this explosion in data usage, mobile operators are having serious concerns focusing on public Wireless Fidelity (WiFi) and other alternative technologies. Visible Light Communication (VLC) is a recent promising technology complementary to RF spectrum which operates at the visible light spectrum band (roughly 400 THz to 780 THz) and it has 10,000 times bigger size than radio waves (roughly 3 kHz to 300 GHz). Due to this tremendous potential, VLC has captured a lot of interest recently as there is already an extensive deployment of energy efficient Light Emitting Diodes (LEDs). The advancements in LED technology with fast nanosecond switching times is also very encouraging. In this work, we present hybrid RF/VLC architecture which is capable of providing simultaneous lighting and communication coverage in an indoor setting. The architecture consists of a multi-element hemispherical bulb design, where it is possible to transmit multiple data streams from the multi-element hemispherical bulb using LED modules. We present the detailed components of the architecture and make simulations considering various VLC transmitter configurations. Also, we devise an approach for an efficient bulb design mechanism to maintain both illumination and communication at a satisfactory rate, and analyze it in the case of two users in a room. The approach involves formulating an optimization problem and tackling the problem using a simple partitioning algorithm. The results indicate that good link quality and high spatial reuse can be maintained in a typical indoor communication setting.

Major: Computer Engineering

Educational Career:
Bachelor's of Electrical and Electronic Engineering, BS, 2011, Bangladesh University of Engineering and Technology

Committee in Charge:
Murat Yuksel, Chair, Electrical and Computer Engineering
Yaser Fallah, Electrical and Computer Engineering
Damla Turgut, Electrical and Computer Engineering

Approved for distribution by Murat Yuksel, Committee Chair, on March 20, 2018.

The public is welcome to attend.