Concept of Energy efficient Visible Light Communication system for Indoor massive connected sensing network

In the extreme frequency band, after THz communications, Fig. 1 also shows the spectrum of light, including infrared as well as visible light. Visible light communications (VLC) have been proposed soon after white light emitting diodes (LEDs) where developed, about two decades ago. Since then, VLC have received extensive attention, mostly by the research community. Today, VLC is a rather mature wireless communications technology, and a highly qualified technology to be used in 5G and 6G.

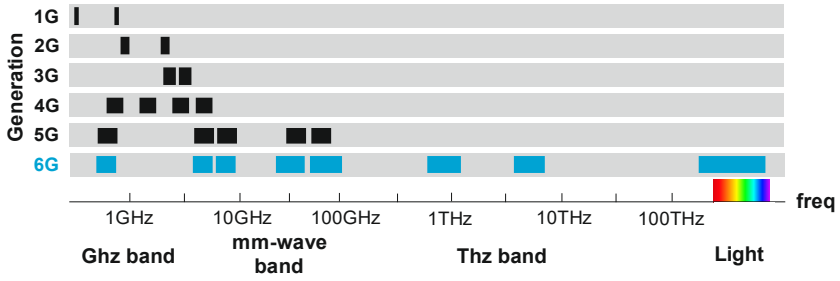
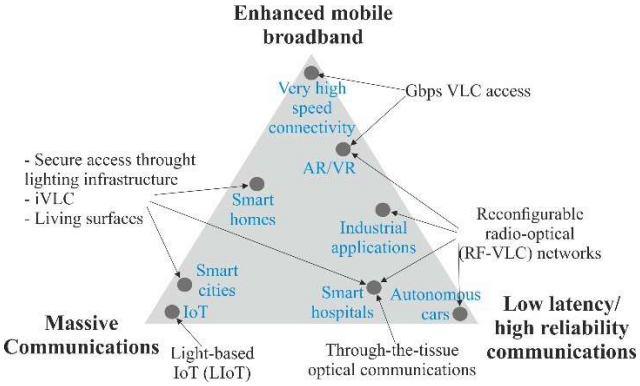


Figure 1Spectrum usage throughout past, present and future mobile generations.

Optical components have been widely available for decades, and they are typically low-cost. In general terms, propagation in optical wireless communications is quite like that in THz bands, with very short reach and signals being easily blocked by objects. Based on H2020 European project IoRL(IoRL.5G-ppp.eu)[lina2020], ISEP proposes a PhD project on "Design of Energy efficient Visible Light Communication system for Indoor massive connected sensing network in future IoT network".

The future Internet of Things (IoT) system, which is slowly but surely connecting the world way beyond people, vehicles and machines, aims at connecting virtually anything. Meanwhile, In the future, trillions of objects could be, among others, identified, controlled and localized remotely. Connection density has been identified by 3GPP as a key performance indicator (KPI) for mMTC use cases with an expected increase in connection density to 1,000,000 connected devices per km2 [3GPP2018]. To reponse Masstive connection requirement, one of the challenges of IoT is that nodes need energy to operate, and while this is not a big issue in many cases (vehicles, home/office appliances, etc.), it is a key restriction in many objects, as internal batteries need to used. The scientific problematic of this PhD project is centered on the energy efficient design in Visible light communication for future Massive communication IoT network.

Power efficiency in VLC system will targeted in this project. to design and develop a novel LED driver and amplifier architecture that significantly reduces power loss to no detriment of the spectrum efficiency of the existing solutions. A novel VLC system model should be studied firstly which is not only considers the VLC channel link information but also VLC transmitter (LED driver, pre-equalization and amplifier architecture) and VLC receiver (Photodiode, post-equalization and) device nois. The design will also include a reconfiguration strategy which could be implmented on FPGA. A number of prototypes and development cycles will be required to achieve the ideal combination of modulation bandwidth, current capacity, and power efficiency. Objective is to improve of at least one order of magnitude in power efficiency in VLC transmitter.



The candidate will be PhD student in Sorbonne University and be a member of LISITE laboratory in ISEP engineering school, he/she will do research on the study of energy efficient modeling and implementation of VLC system in future IoT network. In this context, this subject address three main objectives:

• The definition of an power consumption model of VLC electronic system based on VLC link budget

• A number of prototypes and development cycles will be required to achieve the ideal combination of modulation bandwidth, current capacity, and power efficiency. Objective is to improve of at least one order of magnitude in power efficiency in VLC system.

REFERENCES:

[Lina2020] Lina SHI,Dayu Shi, xun zhang, Andrei Vladimirescu, 5G Internet of Radio Light positioning system for indoor broadcasting service, in IEEE Transaction on Broadcasting, IEEE, 2020.

[3GPP2018] 3GPP and ETSI, “TS 122 261 - V15.5.0 - 5G; Service requirements for next generation new services and markets (Release 15),” Tech. Rep., 2018. [Online]. Available: https://www.etsi.org/deliver/etsi ts/122200 122299/122261/15.05.00 60/ts 122261v150500p.pdf