Project: IEEE P802.15 Working Group for Wireless Personal Area Networks (WPANs)

Submission Title: [VLC Use cases and technical requirements]
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Abstract: [This document proposed some use cases of visible light communications (VLC) and discussed the technical requirements of VLC]

Purpose: [This document provides materials to help draft the PAR of VLC group]

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Outline

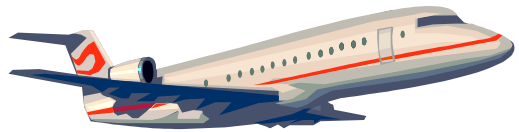
- Introduction
- Usage Scenarios
  - Aircraft: Intra-Cabin Communications
  - Hospital and Home Health Care
  - Underwater Communications
- Technical Requirements
- Discussions

Introduction

- Visible Light Communications (VLC) has a lot of applications as discussed in this group
- In this presentation, we only focus on those scenarios that RF wireless can not be used

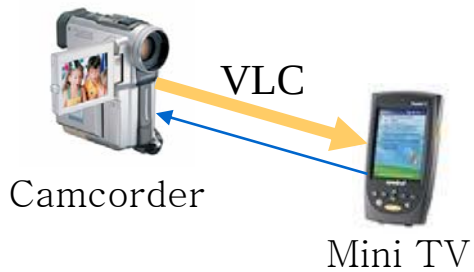
Aircraft: Intra-Cabin Communication

- Current situation
  - RF wireless is prohibited in airplane
- Seat light is used for communication between CE user devices and airplane backbone
- Applications:
  - A/V Entertainment
  - Gaming between passengers
  - Flight information announcement
  - Web browsing
  - E-mail
  - etc.
- Power line communication (PLC), Ethernet, or other wired network can be used as backbone network



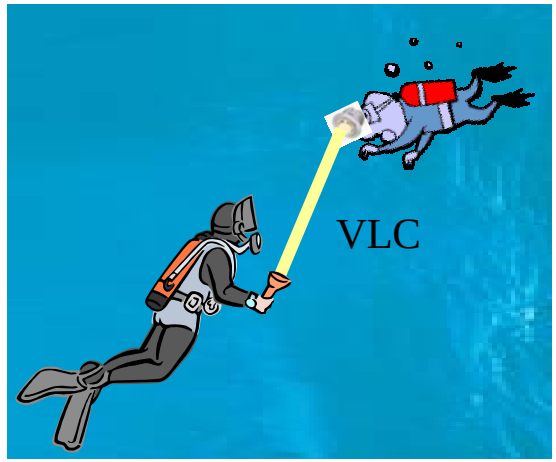
Health Care usage: Hospital or Home

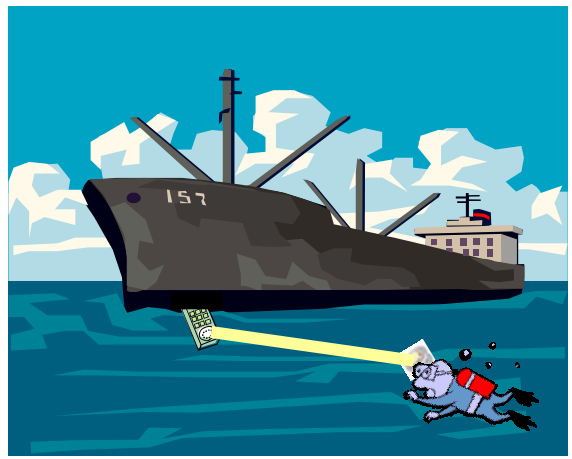
- Current situation:
  - Stringent restriction on deploying RF Wireless
- VLC for connecting two individual devices
- VLC for the device to connect with backbone
- Applications:
  - Information exchange between two devices (health information between medical devices, file between two CE devices)
  - Web browsing
  - E-mail
  - etc.
- Ethernet, PLC or other wired network may be used as backbone network



Underwater Communications (1/2)

- Current situation
  - High attenuation of RF Wireless under water
- During diving,
  - Head light can be used to transmit voice data between two persons
  - Sending/receiving cellular phone signals with VLC





Underwater Communications (2/2)

- Other scenarios:
  - used for sensor data transmission under water
    - Aquarium, etc.
  - in water entertainment
    - Kids play in swimming pool, etc.

Basic Technical Requirements (1/2)

- Topology
  - VLC mainly useful for point to point communications for the last hop
    - Gateway is used to connect backbone network or Internet access
  - Requires bi-directional communications
- Data rate
  - From several Kbps to 100Mbps depending on the contents to be transmitted
- Transmission range
  - Within 10 meters for WPAN applications
- Reliability
  - BER <=10^-6 at PHY SAP

Basic Technical Requirements (2/2)

- Delay
  - Sufficiently low latency in order to satisfy the applications. For video streaming, delay shall be less than 10ms.
- Power consumption
  - Low power consumption required particularly for portable devices
- Device discovery
  - Simple and fast device discovery and light direction alignment between two devices
- Interference handling
  - Requires interference avoidance and recovery mechanisms
- Channelization
  - Multiple channels

Discussions

- Topology
  - Do we want to support connections among multiple devices?
    - If so, how to switch the light direction between devices?
- Blockage recovery
  - If the light is blocked, how to recover the communications between two devices?
- Multiple hops
  - Do we allow the signal go through multiple hops of VLC links?
- Hybrid network
  - Inter-working between PLC/Ethernet and VLC?

Thanks!