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

Submission Title: Opening Long Range Automotive OWC Interest Group

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Abstract: This is a proposal for opening a new interest group for long range OWC for Automotive applications.

Purpose: Introductory opening message to the OWC 802.15 meeting attendees

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Purpose of Long Range Automotive OWC Interest Group

Determine whether there is sufficient interest in creating an long range automotive OWC Interest Group.

Necessity

- Over the next 20 years, as cars capabilities evolve from active safety to autonomous driving are seen as becoming the largest segment of automotive detection and ranging sensors, complementing or replacing radars and cameras.
- Development of high speed and accurate measurement of surrounding area at high speed in the area such as automotive driving, safe driving, collision avoidance, drone to drone communication, and monitoring.
- For instance, it may be desirable for an automotive driver assistance sensor to have a longer detection range or higher resolution for the zone directly in front of the vehicle than for the sides.

Introduction and Background

- The IEEE 802.15.7m OWC TG proposed the International Standard for LiFi, OCC and LED-ID, established the Baseline Document D1. In January 2018, the short-range and low-speed OCC technology and 10Gbps high-speed LiFi technology will be standardized.
- Nagoya University and TOYOTA support OWC technology in V2V situation by using 10Mbps data transmission technology which combines high speed PD communication and image sensor communication. The image transmission speed is 10 fps, which provides a low speed and low resolution.

Introduction and Background (contd.)

- Kanto Gakuin University in Japan is proposing V2V communication and distance measurement technology at 2.34Mbps speed using laser radar and visible light. The maximum distance is 25m ~ 63.5m and the resolution is 50cm.
- Intel, NTU and Panasonic are researching and developing a long distance OWC technology for autonomous vehicles.

Comparison with other Technologies

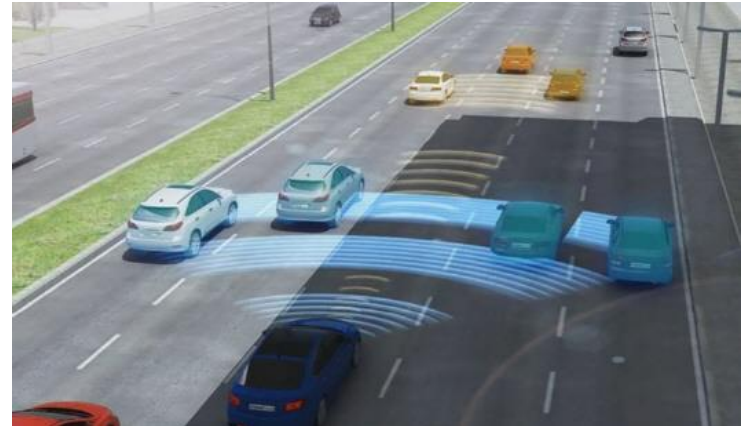
	OWC (IEEE 802.15.7m)	RF
Channel model	Perspective distortion, Lambertian emission	Multipath propagation, Doppler effect
LOS	Yes	No
Band	700-950 (nm in wavelength)	3 Hz-3000 GHz
Electromagnetic Interference	No	Yes
Security	High due to LoS	Low
MIMO	Easy to implement	Hard to implement
Positioning Resolution	Centimeter	Meter
Human safety	Yes	No
License Requirement	No	Yes
Attenuation at bad environment	Less	More

Comparison with 802.15.7m

Properties	Short range OWC (IEEE 802.15.7m)	Long range OWC
Distance	Mainly focus on short range	Focus on long distance
App	General applications	Automotive applications (traffic, drone)
Tx	Ceiling lights Screen/Display Smartphone flashlight LED panels/Signage MIMO LEDs	Traffic light Vehicular light Drone LED
Rx	Smartphone/rolling shutter cameras Global shutter cameras Photodiodes	High-speed cameras Low-speed cameras (for drones)
PHY	Screen modulation Rolling shutter modulation RoI signaling and MIMO High-rate PD Communications	RoI signaling High-speed camera processing High-mobility support

Expectations

- ✓ Long range OWC
- ✓ Precise localization (1cm level)
- ✓ Mobility support: $> 60\text{km/h}$
- ✓ Short processing time
- ✓ Collision avoidance
- ✓ Affordable price
- ✓ 4D Localization
- ✓ Autonomous vehicles (car or drone)
- ✓ Human safety



Use Cases

- ✓ Autonomous driving and safety
- ✓ Distance measurement between multiple objects
- ✓ Avoiding drones collision
- ✓ Autonomous robot navigation
- ✓ Distance measurement and high-speed optical link
- ✓ Multi-vehicle speed measurement
- ✓ Precise localization

Motion to 802.15 Working Group



- Move that 802.15 WG seeks approval to form a Interest Group to develop an extension of 802.15.7m for long range OWC applications.
- Moved:
- Second
- Yes: No: Abstain: