

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

Submission Title: [Introduction of initial evaluation results for UWB data communication in the automotive environment]

Date Submitted: [2 September 2024]

Source: [Tetsuya Nomura¹, Hiroaki Yoshitake², Makoto Okuhara³] [DENSO TEN]

Address [2-28 Goshō-dori, 1-chome, Hyogo-ku, Kobe, Hyogo 652-8510, Japan]

Voice:[+81-78-682-1427],

Email:[1: tetsuya.nomura.j7c@jpgr.denso.com, 2: hiroaki.yoshitake.j7d@jpgr.denso.com, 3: makoto.okuhara.j8s@jpgr.denso.com]

Re: []

Abstract: [This is an introduction of initial evaluation results for UWB data communication in the automotive environment as an automotive use case of wireless BAN standard IEEE802.15.6ma.]

Purpose: [information]

Notice: This document has been prepared to assist the IEEE P802.15. It is offered as a basis for discussion and is not binding on the contributing individual(s) or organization(s). The material in this document is subject to change in form and content after further study. The contributor(s) reserve(s) the right to add, amend or withdraw material contained herein.

Release: The contributor acknowledges and accepts that this contribution becomes the property of IEEE and may be made publicly available by P802.15.

Introduction of initial evaluation results for UWB data communication in the automotive environment

Tetsuya Nomura, Hiroaki Yoshitake, Makoto Okuhara
DENSO TEN Ltd.

1. Motivation
2. System Model
3. Problem of UWB
4. Motivation for participation in Standardization

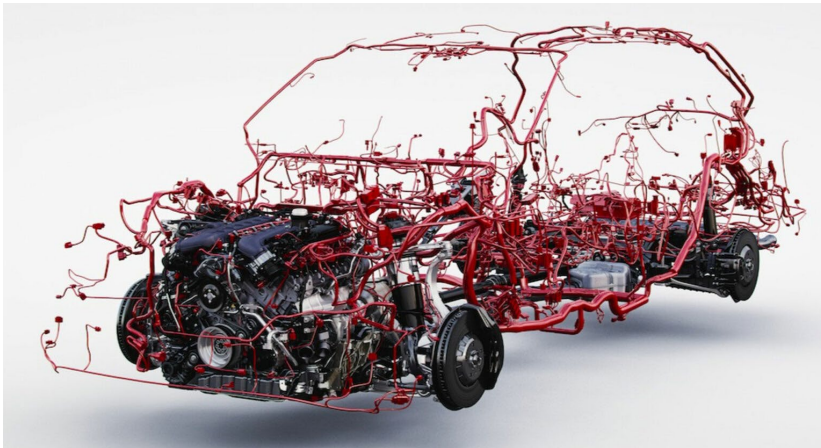
Background:

Carbon-neutral: Reducing the weight of the vehicle

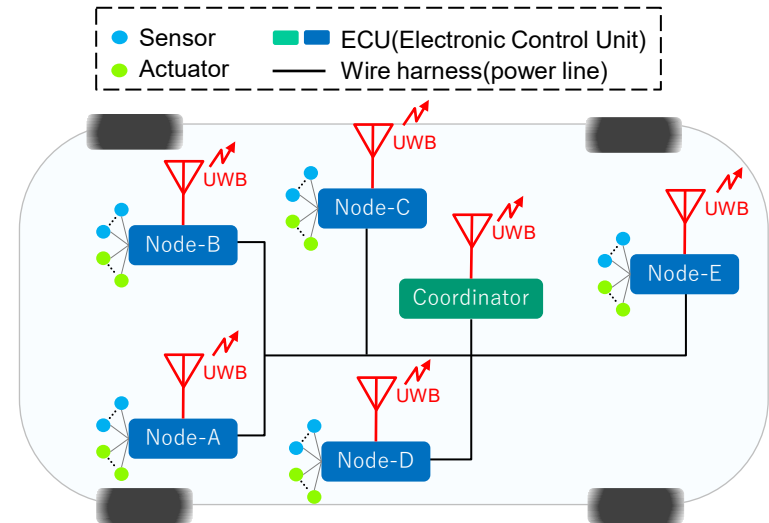
Productivity: Handling easier for people to assemble in the factory

Purpose:

Substitute part of the wire harness using Ultra-wideband (UWB)



Using
UWB



Source: CARSCOOPS "Carmakers Are Rushing To Adopt Simpler Modular Wiring Harnesses"
<https://www.carscoops.com/2022/05/carmakers-are-rushing-to-adopt-simpler-modular-wiring-harnesses/>

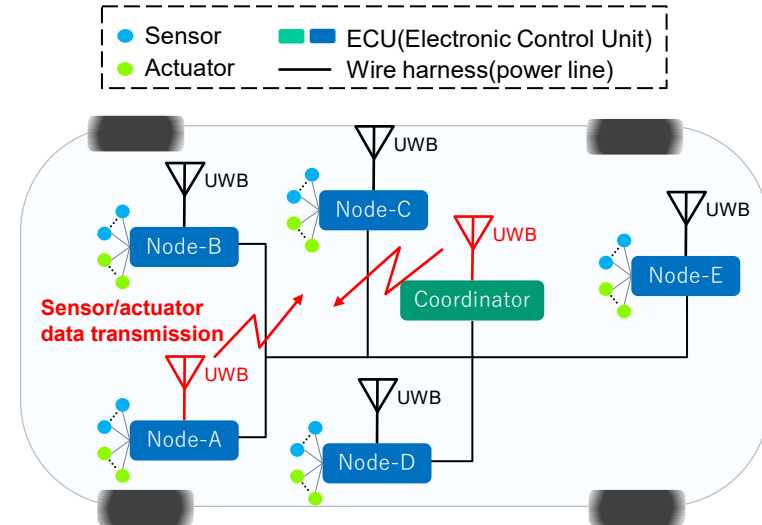
- Wire harness: 20-50 kg (40-100 lbs)
- Reduced fuel consumption of 10 m/L per kg
 → Reduce CO₂ 0.15 g/km

- Realization of million-ton class CO₂ reduction and energy savings

1. Motivation
- 2. System Model**
3. Problem of UWB
4. Motivation for participation in Standardization

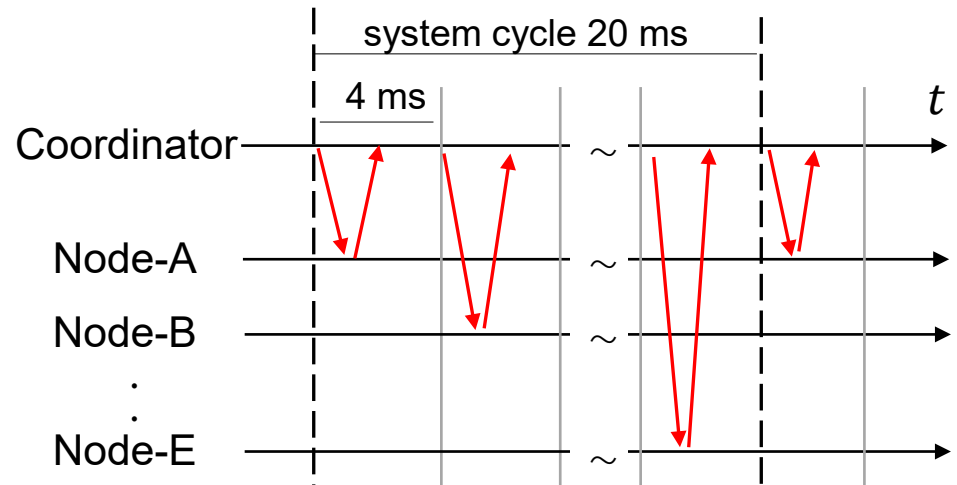
System architecture:

- Coordinator as a brain, each node as a limb
- Each node is connected to sensors and actuators via a wire harness as before.
- First target the signals of the so-called body system (e.g., headlights, windshield wipers)



Communication method:

- System response time: < 25ms
- MAC: Polling method
- PHY: UWB
- Time slot: 4ms



1. Motivation
2. System Model
- 3. Problem of UWB**
4. Motivation for participation in Standardization

UWB applicability in a car:

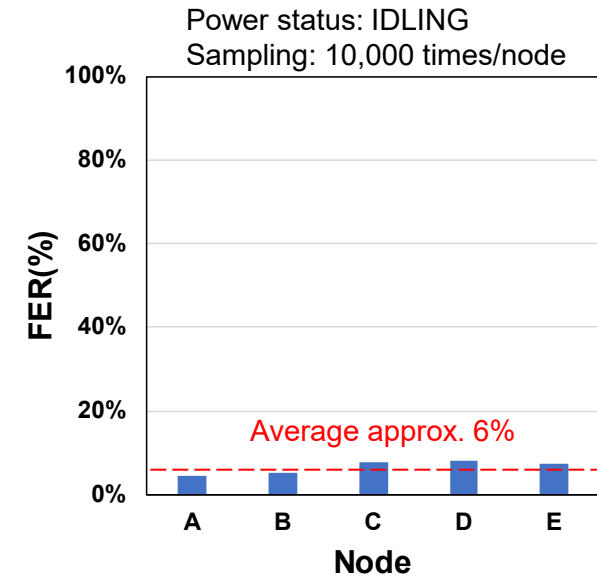
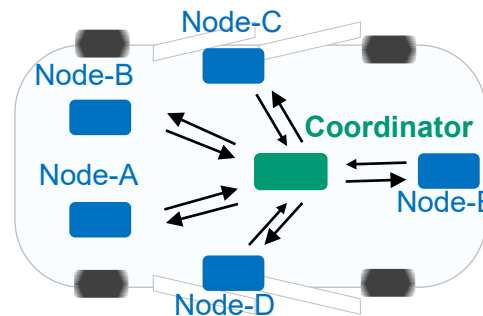
Communication is successful at any location, regardless of vehicle status

	Passenger compartment	Engine compartment	Trunk
ACC-ON	✓	✓	✓
IG-ON	✓	✓	✓
IDLING	✓	✓	✓

✓ :100% success

Problem of UWB:

UWBs at close range interfere with each other, resulting in an FER of approximately 6%



Measures against interference between UWB networks are required

1. Motivation
2. System Model
3. Problem of UWB
- 4. Motivation for participation in Standardization**

Motivation for participation in TG6ma

- Bringing UWB data communications to the mobility sector (e.g. cars, buses, trains/etc)
- In control environments where high reliability is required, real-time performance and low latency can be achieved by using the 6ma.

**Thank you for your time and
look forward to working with you closely.**