Extended Abstract

Alternatives for Short Range Low Power Wireless Communications

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Abstract

The three leading contending standards for short-range low-power wireless communications (Bluetooth, Zigbee, Ultra-Wideband) are compared as to viability and practicality for implementation. The three standards all operate completely or partially in the largely unregulated ISM band with transmission ranges varying from a few meters to a maximum of around 15 meters.

An ongoing case-study involves the development of a hybrid wireless automotive harness. The decision process leading to the choice of Bluetooth over the other two contenders is presented. Ongoing work with the wireless automotive harness includes a re-structuring of the software to function as a layer under a Controller Area Network (CAN). Computer models are also being developed to provide extensive studies of the performance, reliability, and security implications.

1. Comparison: Bluetooth, ZigBee, UWB

A comparison table for the three contending standards is shown below:

	Bluetooth	**ZigBee**	**UWB**
1. IEEE Standard	802.15.1	802.15.3	802.15.4
2. Range (Nom)	10 m	10 m	<10 m
3. Chip Price	$5	$2	< $1 (?)
4. Data Rate	Medium	Low	High
6. Interference	Good	Good	Excellent
7. Media	Voice/Data	Data	Video/Radar
8. SIG	Consortium	Alliance	Forum
9. Main Layers	5	5	Evolving
10. Data Payload	2744	104	Evolving
11. Power Req	Low	Very-low	Ultra-low
12. Tx Power	1 mW	< 1 mW	200 uW
13. Security	Good	Good	Excellent
14. Installed Base	Very large	Small	Small
15. Tx Penetrate	Good	Good	Excellent
16. Spec Stability	Excellent	Good	Evolving
17. Mode	FHSS	DSSS	DSMBOA
18. Frequency	2.4 GHz	.8-2.4	3.1-10.6
19. Channels	23,79	1,10,16	Evolving
20. Error Correct	8, 16-bit	16 CRC	Evolving
21. Security	Good	Good	Excellent
22. Topology	Star	Star	Peer-Peer
23. No of nodes	7, or more	65534	Evolving
24. Link BW	1 MHz	20-250K	.1-1GHz

2. Case Study: Hybrid Wireless Harness

The approach taken for the wireless harness is not to interconnect all components/modules by means of wireless signals, rather the approach is to use regular wires to connect components within a cluster of components and then to connect different clusters using wireless signals. This approach is depicted in figure 1. A cluster is a group of components that are physically located close to each other. An example would be an instrument panel. The hybrid wireless approach provides several advantages including:

1. Reduced vehicle weight.
2. Simplified in-vehicle electrical wiring.
3. Easier maintenance of electrical submodules.
4. Cost savings over an all wireless approach.

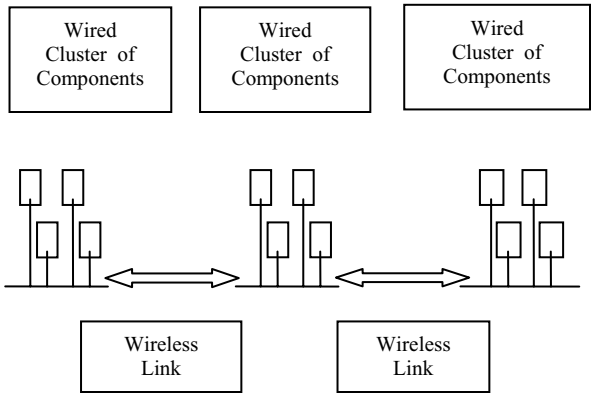

Figure 1. Wired/wireless hybrid.

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3. References

[1] Agrawal, D. P. and Zeng, Q. A., Introduction to Wireless and Mobile Systems, Brooks/Cole, 2003.

[2] Akingbehin, K. and Patel, N., "Development of a Hybrid Automotive Wireless Harness", Fast Abstract, 28th Annual International Computer Software and Applications Conference, CompSAC 2004, Hong Kong, September 2004.

[3] Etschberger, K., "Controller Area Networks: Basics, Protocols, Chips, and Applications", Ixxan, 2001.

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