

Analysis of Can, Lin Protocol and Wireless Body Control Module

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Abstract- Body control module is important part of modern automotive industry, considering the functionalities of overall automotive vehicle it plays very important role. In a typical Body Control Module all the functionalities are controlled by a micro controller based system called Body control Module Electronic Control Unit (ECU). This work emphasis on analysis of CAN, LIN communication and wireless BCM and about achieving wireless body control module using different wireless protocols and analyse which wireless approach best suits a wireless BCM with respect to the parameters such as interference ,signal loss and path loss .

Keywords: Automotive, BCM, ECU.

1 .INTRODUCTION

ECU in general works as a gateway for all the component and also called as BCM Gateway. Communication between BCM ECU and components for the BCM Components like door control, climate control, windows, windshield etc. executed using standard automotive protocol CAN (Controller Area Network), LIN (Local Interconnect Network). CAN and LIN protocols work intern in pattern of Master and Slave, using different combination and input communication. All the components in automotive vehicle are connected through wire with single wire or multiple wire depending upon the need of the usage CAN and LIN communication. Considering advancements in technology and need of research it is always good to replace wire from some wireless media.

The BCM regularly communicates with a large number of sensors, actuators and ECUs. General-purpose input/output (GPIO) pins are used for communicating with sensors and actuators. Communication with other embedded devices is done via communication layers such as:

- *LIN (Local Interconnect Network)* a cheap serial communication interface based on a master slave architecture that reaches speed up to 20 kbps. Intended to assure connectivity between various peripheral sensors and actuators for doors, windows, etc.,
- *CAN (Controller Area Network)* a two wire broadcast bus that has a fault tolerant low speed version which operates at 125kbps and a high speed version that operates at up to 1Mbps. *CAN-FD (CAN with Flexible Data-Rate)* was designed as replacement for CAN and allows a bandwidth of 2.5 Mbps.

Wireless body control module, main advantage would be diagnostics of automotive products before having any kind of malfunction and moreover data for the vehicles can be used in service industry effectively. In general it is difficult for a transport company to know about its vehicle diagnostics like mileage, fuel meter etc., but if real-time information can be collected a transmitted on to cloud, it can make life of transporter very easy.

This work is about creating wireless Body control Module using any wireless media like Wi-Fi, Bluetooth or Low RF. Wi-Fi for ZigBee provides as communication without wires for connectivity and the device is there on 802.11, modules under this are interoperable. That means it can work with similar devices of other networks. So running these devices with other network devices is just matter of time. ZigBee Protocol is compatible with all the devices that are compatible with standard 802.11 BGN.

2. RELATED WORK

There can be number of approaches for wireless Body Control module. Primarily Body Control can very well use ZigBee, Bluetooth and Wi-Fi. All of them have its own advantages and disadvantages. Wi-Fi is having very high data rate of 1- 100MBPs and connectivity distance till 300 meters. Bluetooth has medium data rate that start from 1 MBPs and goes up to 3 MBPs and it can cover distance up to 100 meters. ZigBee has data rate up to 1 MBPs and it can cover distance up to 100 meters. Considering all the fact of interference Wi-Fi is not useful for wireless body control. Since availability of Wi-Fi is everywhere so, it may cause big impact in the terms of noise and interference moreover considering the cost factor it cannot be an efficient prototype for wireless Body control. On the another hand Bluetooth can be considered as a very important protocol for wireless Body control considering the parameters like data rate and cover distance but it has its own limitation in the terms of signal handling, as it cannot handle multiple signals at one point of time. Hence Bluetooth is also not feasible as such for wireless BCM. For ZigBee, features like supported data rate and distance covered it looks like most useful protocol for Wireless Body Control Module, moreover as per the cost also it falls within the range.

3. PROPOSED WORK

Emerging trend of automotive industry always push for hassle-free and safe drive, major part of market is cost centric where customers want more and more features

with effective cost. Security and safety is always a concern for automotive industry, so the place where wire is used is always a sensitive place irrespective of type of wire, a little spark can damage big project or any plant.

Proposal is about effective wireless communication and reduces the dependency as much as can possible without affecting the much basic automotive functionality. In order achieve this kind of technology; there is a need of analysis of various kind of wireless technology that can be used specific to automotive industry. ZigBee wireless sensors are considered as good for short range, and high performance communication with low power need, so this is basic advantage for Automotive domain.

IEEE 802.15.4 standard are the standards for ZigBee and they are based on the WPAN(Wireless Personal Area Networks) . One of the main questions to answer before adoption of wireless technologies in a car is whether the performance delivered by these technologies is high enough, particularly for critical monitoring and control applications. In general car body metallic so it produce reflection of signals and moreover it is difficult to have non line of sight communication considering the structure of car body.

4. ANALYSIS

A car is very complex system, car's material and presence of radio frequency make it more complex but considering ZigBee alone, it is one of the best protocol to communicate within the object like Car, but presence of bluetooth is a major problem for wireless BCM . If we compare ZigBee with existing Bluetooth has BW of 1 MHz and it is following a frequency hopping scheme with a 1600 Hops/sec hoping rate at max, and it is also using TDSS (Time Division Duplex Scheme), using that channels are divided in 625 microseconds and for that master and slaves transmits one by one. Practically all the ZigBee links will be connected as transmitter inside and outside the car depending on the vehicle function that car is supporting and receiver is placed on the Dashboard. So as per the need wireless sensors at different location transmits sensed data to central node. Ideally Bluetooth links in cars used for data transfer application and voice data application. In Bluetooth setup Bluetooth master sends file or data to Bluetooth slave and slave sends respective acknowledgements, this indirectly create a significant interference for the ZigBee. If we compare the parameters of ZigBee and Bluetooth,

	ZigBee	bluetooth
Type of device	CC2520 ZigBee	CN512 Bluetooth
Frequency	2.4GHz	2.4GHz
Occupiedbandwidth	2 MHz	1 MHz
Data rate	250 KBPS	1,2,3 MBPS
Output power	Max 5 Dbm	4 Dbm
Sensitivity of receiver	98 DBM(-)	80 DBM(-)

Hence, considering the above parameters there exist problem of interference. and there may be additional contribution from passengers in car and that may cause additional path loss.

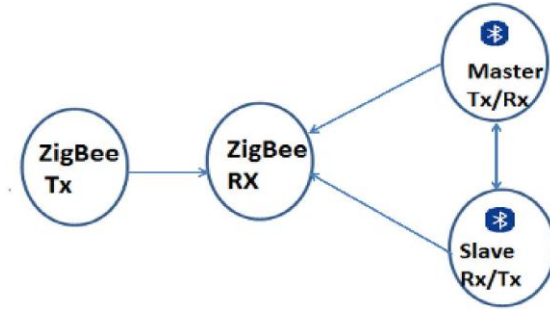


Figure .Interference in ZigBee Model.

Figure shows the interference and communication when both the models ZigBee and Bluetooth exist together. In general Bluetooth is used for media play and file transfer for any automotive system and it used FTP protocol for file transferring. In inter Bluetooth communication Master sends the data in packet and slave receives it and sends acknowledge it, on the other hand ZigBee work on separate model , it does not have trans-receiver kind of mechanism, it is transmitter and receiver mechanism. Now figure shows the interference from Bluetooth for ZigBee, there is communication in Bluetooth device and same cause's interference on Zigbee receiver. There are certain problems as mentioned below.

a).Path loss(Large Scale)

Now if we calculate difference between the power that is transmitted and received, that difference is called as path loss. So this happens because of any kind of signal attenuation. In general this path loss is around 1 % . Since path loss is very less and functionalities wise there is no major impact on wireless body control module, then ZigBee again satisfy this criteria.

In case path loss is more, in that case we need to analyze path loss data and that may be big roadblock for using ZigBee, since it is very much there in control so it satisfy the criteria.

b).Fading

If there is variation in path effect that particular phenomenon is called as fading. It may happen because of multiple signals. In current automotive wired architecture communication takes place using CAN and LIN protocols which handles multiple signals,but in case of wireless it will be difficult to control.

Since it is difficult to control but it is always important to make sure that functionality is not getting affected. In general there is fading time of 50 ns and it is not too high, that means we can easily survive with that without affecting any kind of functionalities, moreover for ZigBee system duration is 500 ns and that is really very high with respect to fading time, that means fading will also not affect much in case we are choosing ZigBee for wireless Body Control Module.So considering all the parameter like fading, signal loss, path loss, ZigBee satisfy all the criterial for wireless body control and it prevents from any kind of data loss or breaking communication.

CONCLUSION

There are plenty of wireless protocols available now a days, so we need consider the basic need of an automotive product like, limited range of communication, effectiveness for the vehicle, cost effective and moreover its action to handle the interference and noise. In current analysis compare and study protocol like Wi-Fi, Bluetooth and ZigBee in order to find the best and ZigBee has advantage over all of them.

REFERENCE

- [1] "Gateway system for CAN and FlexRay in automotive ECU networks" by Zhoa Rui, Qin Gui-he, Liu Jia Gioa.
- [2] " A comparision of LIN and TTP/A" by H kopetz, W. Elmenrich, C. Mack
- [3] "Automated Test System Design of Body Control Module", by Xinhong YANG, Yi LIN and Feng GAO.]
- [4] Article on " body electronics challenges" by freescale semiconductors.
- [5] "Diagnosis Design Based On KWP2000 in Body Control Module", by Sun Bin, Hu Yue-li and Wang Kun.
- [6] "A Framework for Self-Verification of Firmware Updates over the Air in Vehicle ECUs" by Dennis K Nilsson Lei Sun, Tatsuo Nakajima.
- [7] "Solving automotive challenges with Electronics" by Dr. Reinhard Ploss, Anton Mueller, Patrick Leteinturier.
- [8] " Centralized channel assignments for
- [9] IEEE802.11 WLANs" by M. Drienberg and F. Zheng.
- [10] "Zigbee-based intra-car wireless sensor network," by M. Tsai, C. Saraydar, T. Talty, M. Ames, A. Macdonald, and O. Tonguz. "Pulse propagation characteristics at
- [11] 2.4 GHz inside buildings," by S. Kim, H. Bertoni, and M. Stem "vehicle Mobile Gateway for provisioning and support of ITS service on nomadic devices," by H Yun and S. Lee.
- [12] "Wireless communications: principle & practice" by T. S. Rappaport