ISSN:0975-9646

An Extended Zigbee Wireless Vehicular Identification and Authentication System

Md.Asim Iqbal[1], Dr.Syed Musthaq Ahmed[2]

[1]*BIES,*
Narsampet

[2]*S.R Engineering College.*
Ananathasagar

Abstract: **This paper is based on a prototype development of the proposed system and it presents hardware and firmware aspects of the design. A vehicle identification device profile was defined and developed using the Microchip Zigbee protocol stack. Hardware implementation of Zigbee RF tags, reader and writer was carried out using Microchip micro-controller PIC18F4620, Chipcon CC2420 RF transceiver and an inverted F-type PCB antenna which was used with the transceiver. The designed application functions in the 2.4GHz frequency band. The physical layer of the Zigbee stack is implemented in the CC2420 transceiver and the Microcontroller implements the other layers including the application layers of the Zigbee stack. The system was successfully demonstrated at Ratmalana Air-force base with a maximum omni-directional range of 7meters.**

INTRODUCTION

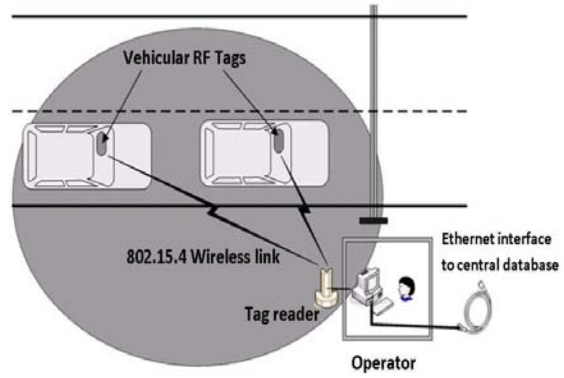
Zigbee is a recently developed wireless technology used in many commercial and research applications. Based on the IEEE 802.15.4 specification [1], it has become a very attractive wireless connectivity solution due to its open standard, lowcost and low power characteristics . Zigbee is suitable for low data-rate and low power consumption applications in comparison with other wireless techologies such as Bluetooth and WiFi.

Applications include home and building automation, industrial control, building management systems, environmental monitoring, vehicle fleet management systems etc. Intelligent vehicle and fleet management systems are required by large companies, establishments and high security zones with restricted access, to identify.

We have proposed a system using Zigbee wireless RF tags to identify and authenticate vehicles entering into such a premises. Design consists of RF vehicle tags containing authentication information for each vehicle authorized, an RF tag reader, an RF tag writer and a central database containing information about all vehicles authorized to enter the facility.

Prototype of the system was demonstrated under real conditions and results conclude that the proposed system is viable. The rest of the paper will be organized as follows, will give details of the system model. An overview of Zigbee protocol and the operation of the proposed system is discussed in..

SYSTEM MODEL



A. Zigbee protocol overview

Zigbee wireless protocol provides means to network a set of autonomous devices each equipped with a IEEE 802.15.4 standard RF transceiver to perform some networked task. The IEEE 802.15.4 wireless standard provides the Physical layer (PHY) and Medium Access Control layer (MAC) for the wireless communication while the Zigbee protocol working on top of it would perform the Network layer (NWK) and Application layer (APL) tasks. The PHY, MAC and NWK layers would handle how the underlying wireless data transmission would be carried out and how the network of RF transceivers would be organized while the APL layer would handle the tasks associated with each autonomous device. After power up, a set of Zigbee devices would involve in network formation.

A device defined as a Zigbee *coordinator* would perform energy scans on the available wireless channels and select an interference free channel for communication. Other devices that wish to join the network would send out *beacon* requests in order to join the network of the *coordinator*. The newly joined child devices to the network can either work as *end devices* or *routers* where the *coordinator* is the parent.

Routers can permit other devices to join it whereas *end devices* can't; i.e. they are leaf nodes of the network. In the proposed system a vehicular RF tag takes the role of a Zigbee *end device* while the tag reader & writer module takes the role of Zigbee *coordinator*. Different Zigbee devices implement different *device profiles* defined under the Zigbee protocol stack to suit the application in which they are being used. The Zigbee alliance has defined several *device profiles* for typical applications intended for Zigbee devices, such as home and building automation, industrial control etc .

The specification has also provided flexibility to include custom *device profiles* to suit customized applications [1]. We have defined the *vehicle identification device profile* to suit our application as shown in

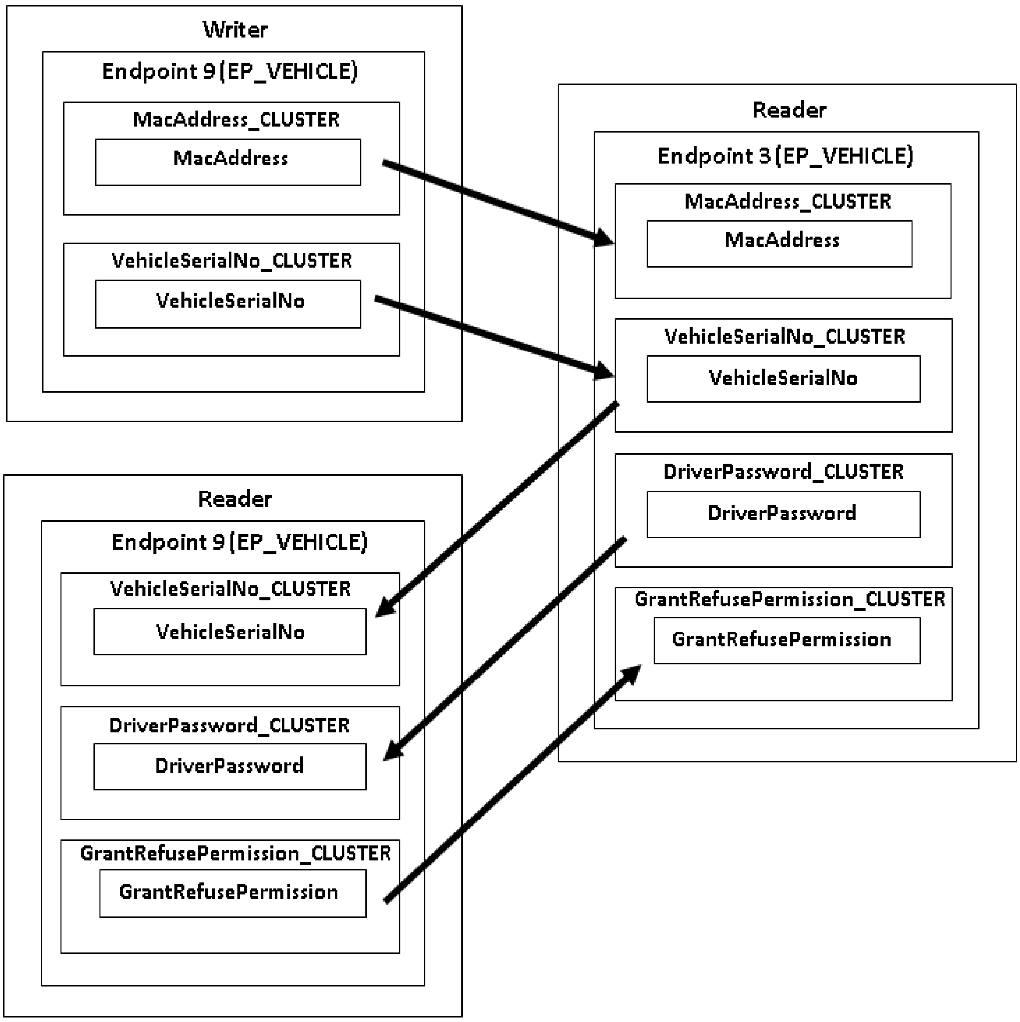
B. Tag-Reader communication

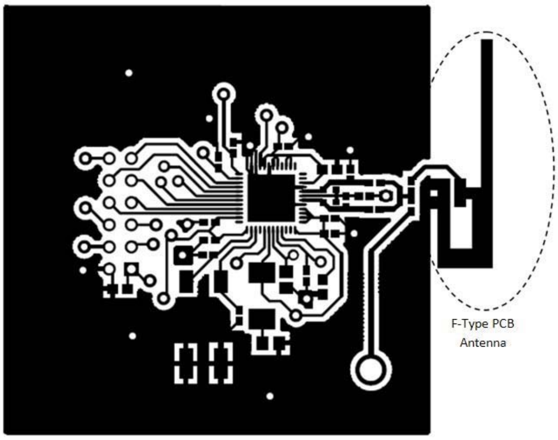
Vehicular Tag and Tag reader. Once a tagged vehicle arrives into the vicinity of the RF tag reader the vehicular RF tag would issue beacon requests to the Tag reader. Tag reader would respond with beacon response and join the RF tag into its network as a child node.

Once connected to the personal area network (PAN) of the Tag reader, it would request the vehicle serial number from the tag. After reception of the serial number from the tag the password for driver authentication is requested by the reader which is validated with the central database once received from the tag.

After both serial number and password are successfully exchanged the vehicle would leave the Tag readers PAN. A maximum of 10 RF tags can be accommodated in the PAN of the reader. Since tags joining the PAN would leave once they are validated or denied access, this PAN size of 10 is sufficient for the efficient operation of the system.It is very much used for the manr recent and well specialized applications in the field of electronics ,consumer oriented services in order to track the service good whteher it is dispatche dtto the correct pace or not and more over every service is a very accurate and reliable service is being given by the rf tag reader of the kit Different Zigbee devices implement different *device profiles* defined under the Zigbee protocol stack to suit the application in which they are being used.

The Zigbee alliance has defined several *device profiles* for typical applications intended for Zigbee devices, such as home and building automation, industrial control etc .





RESULTS

The performance of the RF transceiver circuit was investigated using different test modes of the CC2420 transceiver. show the outputs of the spectrum analyser for different performance tests conducted with the RF transceiver test setup. The plot in the bottom left of the figure shows the output obtained at the RF output pins of the transceiver when the device was programmed to output an unmodulated carrier, a peak at 2.4 GHz frequency can be clearly observed in the spectrum analyzer output. The plot in the bottom right shows the output of the spectrum analyzer when the device was programmed to modulate its carrier with a pseudo random data sequence. Field tests were carried out at

REFERENCES

[1] A. Wheeler, “Commercial applications of wireless sensor networks using zigbee,” in *Communications Magazine, IEEE*, vol. 45, no. 4, Toronto, Ont., Canada, Apr. 2007, pp. 70–77.

[2] N. Baker, “Zigbee and bluetooth strengths and weaknesses for industrial applications,” *Computing & Control Engineering Journal*, vol. 16, pp. 20–25, Apr./May 2005.

[3] Z. Wu, H. Chu, Y. Pan, and X. Yang, “Bus priority control system based on wireless sensor network (WSN) and zigbee,” in *Vehicular Electronics and Safety, 2006. ICVES 2006. IEEE International Conference on*, Dec. 2006, pp. 148–151.

[4] H.-M. Tsai, C. Saraydar, T. Talty, M. Ames, A. Macdonald, and O. K. Tonguz, “Zigbee-based intra-car wireless sensor network,” in *Communications, 2007. ICC ’07. IEEE International Conference on*, June 2007, pp. 3965–3971.

[5] K. Selvarajah, A. Tully, and P. T. Blythe, “Zigbee for intelligent transport system applications,” in *Road Transport Information and Control – RTIC 2008 and ITS United Kingdom Members’ Conference, IET*, May 2008, pp. 1–7.

[6] (2008, 01) PIC18F2525/2620/4525/4620 Datasheet 28/40/44-Pin Enhanced Flash Microcontrollers with 10-Bit A/D and nanowatt Technology. Microchip Technology Inc. [Online]. Available: http://www.microchip.com

[7] Y. Y. David Flowers, Kim Otten and N. Rajbharti. (2006, 12) Microchip stack for the zigbee protocol. Microchip Technology Inc. [Online]. Available: http://www.microchip.com

[8] D. Flowers. (2006, 10) Data Encryption Routines for the PIC18. Microchip Technology Inc. [Online]. Available: http://www.microchip.com