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An Extensive Review on Fully Reused VLSI Architecture of FM0/Manchester Encoding Using SOLS Technique for DSRC Applications

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Abstract: A fully reused VLSI architecture of FM0/Manchester encoding technique for memory application has been proposed. In this paper we are encoding the 1 bit data into 16 bit data and storing it into a memory of certain address location given by the linear feedback shift register (LFSR),whose input is taken from the pseudo random sequence generator (PRSG). The encoded 16 bit data is stored into memory controller; the encoded data is decoded back into 1 bit data under the condition: when MSB bit is at logic state 1. By using FM0/Manchester encoding and decoding technique, the data will be secure; this process is easy and faster to carry out. This paper develops a fully reused VLSI architecture, and also exhibits an efficient performance.

Keywords - SOLS, DSRC, Reused VLSI, Encoding.

I. INTRODUCTION

Vehicles utilize a variety of wireless technologies to communicate with other devices. This paper focuses on one specific technology, dedicated short-range communication (DSRC), which is designed to support a variety of applications based on vehicular communication. DSRC is under active development in the United States and in other countries. The goal of the paper is to explain the content and status of the major standards that support interoperable DSRC in the United States.

The primary motivation for deploying DSRC is to enable collision prevention applications. These applications depend on frequent data exchanges among vehicles, and between vehicles and roadside infrastructure. The U.S. Department of Transportation (DOT) has estimated that vehicle-to-vehicle (V2V) communication based on DSRC can address up to 82% of all crashes in the United States involving unimpaired drivers, potentially saving thousands of lives and billions of dollars. The National Highway Traffic Safety Administration (NHTSA) within the U.S. DOT plans to decide in 2013 whether to use regulations to require or encourage deployment of DSRC equipment in new vehicles in the U.S.

The basic paradigm of DSRC-based collision avoidance is illustrated in Figure. 1. Each DSRC-equipped vehicle broadcasts its basic state information, including location, speed, and acceleration, several times per second over a range of a few hundred meters. Each vehicle also receives these "safety messages" from DSRC-equipped neighbours. A receiving vehicle uses these messages to compute the trajectory of each neighbor, compares these with its own predicted path, and determines if any of the neighbours poses a collision threat. In addition to V2V communication, vehicles may also communicate to and from DSRC roadside units (RSUs) using safety messages and other types of message. Examples of information a vehicle may learn from an RSU include: the geometry of an approaching intersection, the state of the signals at an intersection, and the existence of a hazard (e.g., disabled vehicle, emergency vehicle, ice, fog).

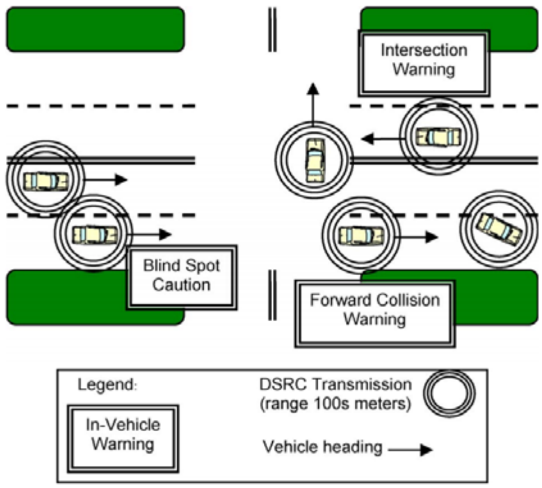

Figure 1. Vehicles sending safety messages, displaying in vehicle warnings.

If a vehicle determines that a potential collision or other hazard (e.g., violating a red light) exists, the onboard system can take action to warn the driver, or even to assist in controlling the vehicle. Feedback to a driver can be conveyed audibly, visually (e.g., heads-up-display, dashboard screen, mirror signal), and haptically (e.g., shaking seat or steering wheel), and can range in intensity from inform to caution to warning. While the communication between DSRC devices must follow carefully designed interoperability standards, the internal threat computation and warning system employed by a vehicle is determined by the automobile manufacturer.

DSRC can be used for many other applications beyond collision avoidance. Most of these involve communication to and from RSUs. For example, DSRC can be used to assist navigation, make electronic payments (e.g., tolls, parking, and fuel), improve fuel efficiency, gather traffic probes, and disseminate traffic updates. It can also be used for more general entertainment and commercial purposes.

The word "Dedicated" in DSRC refers to the fact that the U.S. Federal Communications Commission has allocated 75 MHz of licensed spectrum in the 5.9 GHz band for DSRC communication. This spectrum is divided into several channels. V2V safety messages are expected to be exchanged on Channel 172, a specific channel designated for safety. The term "Short Range" in DSRC is meant to convey that the communication takes place over hundreds of meters, a shorter distance than cellular and WiMax services typically support.

Dedicated Short Range Communication commonly refers to short to medium range wireless communications that offers data transfer in a vehicular ad-hoc network. A vehicular ad-hoc network with the purpose to do safety communication has two major differences compared to a traditional ad-hoc network: first, the stations are positioned much wider apart resulting in a non-deterministic channel characteristic, and second, the hidden terminal effect cannot be avoided due to the unbounded system and the broadcast nature of safety communication. Consequently a new standard had to be defined to meet the vehicular ad-hoc network's specific requirements. This new standard, referred to as IEEE 802.11p [9], is based on `IEEE 802.11a' [7] and defines the functionality of the physical and the medium access control layer.

DSRC supports seven non-overlapping 10MHz channels with the option to join two channels to double the bandwidth. This is in contrast with the `IEEE 802.11b/g' standards, providing several more but overlapping channels.

It is necessary that all safety messages are transmitted on one designated channel only in order to ensure that all vehicles listen to the proper one for such messages. This channel is referred to as Control Channel and corresponds to the channel number 178 in the United States. The communication on the Control Channel is principally used for safety related communication only and non-safety data exchange is strictly limited in terms of transmission time and interval.

The other six channels eight, if you take the two 20MHz channels into account| are referred to as Service Channels. Two of them, namely 172 and 184, are reserved for safety-related applications. However, these two channels are not meant to be an option for the regular safety communication on the Control Channel. The remaining six channels, namely 174, 175, 176, 180, 181 and 182 can be used for non-safety communication.

Wireless communication is in general much less reliable than a wired one. In a wired communication system packets are usually lost due to congestion and are not likely to be corrupted because of bit errors.
This is different in a wireless communication system. There are two natural effects, namely path loss and fading, resulting in a reception degradation of the signal. These effects are discussed in the remainder of this section to provide a general idea of the reception characteristic of a single DSRC broadcast.

Path loss quantifies the decrease of the signal strength in accordance with the distance to the sender. The signal strength can attenuate faster or slower than it does in free space. So the reception range for a signal can vary greatly in a fast changing environment. In addition to the path loss, the fading effect adds a lot of variation to the signal strength due to minor changes in the environment. This is because of the multi-path propagation of the signal, resulting in constructive or destructive interference.

a. SAFETY MESSAGING FUNDAMENTALS

In simplistic terms, a multivehicle accident is caused either by drastic behaviour changes (e.g., hard braking) of at least one car, or by vehicles unwittingly staying on their collision courses. The former scenario demonstrates the need for what we term event safety messages while the latter case shows the value of routine safety messages. Figure 1a illustrates a scenario in which routine safety messages help enhance safety even when the involved vehicles move in perfectly normal manners on the road.

Accordingly, we define these two types of safety messages below. The definitions are the foundation for all protocol designs in this article.

Routine safety messages: These are status messages regularly sent by vehicles. A routine safety message remains meaningful for a few seconds so that a receiver can predict the movement of the sender during this time unless otherwise notified. This definition is applicable to messages sent by infrastructure as well (e.g., intersection announcement of traffic light status).

Event safety messages: These are triggered by changes in vehicle behaviour (or infrastructure status) that break the continuity implied by routine safety messages defined above (e.g., hard braking).

II. LITERATURE SURVEY

Y. H. Lee and C. W. Pan, [1] the dedicated short-range communication (DSRC) is an emerging technique to push the intelligent transportation system into our daily life. The DSRC standards generally adopt FM0 and Manchester codes to reach dc-balance, enhancing the signal reliability. Nevertheless, the coding-diversity between the FM0 and Manchester codes seriously limits the potential to design a fully reused VLSI architecture for both. In this paper, the similarity-oriented logic simplification (SOLS) technique is proposed to overcome this limitation. The SOLS technique improves the hardware utilization rate from 57.14% to 100% for both FM0 and Manchester encodings. The performance of this paper is evaluated on the post layout simulation in Taiwan Semiconductor Manufacturing Company (TSMC) 0.18-μm 1P6M CMOS technology. The maximum operation frequency is 2 GHz and 900 MHz for Manchester and FM0 encodings, respectively. The power consumption is 1.58 mW at 2 GHz for Manchester encoding and 1.14 mW at 900 MHz for FM0 encoding. The core circuit area is 65.98 × 30.43 μm2. The encoding capability of this paper can fully support the DSRC standards of America, Europe, and Japan. This paper not only develops a fully reused VLSI architecture, but also exhibits an efficient performance compared with the existing works.

J. B. Kenney, [2] Wireless vehicular communication has the potential to enable a host of new applications, the most important of which are a class of safety applications that can prevent collisions and save thousands of lives. The automotive industry is working to develop the dedicated short-range communication (DSRC) technology, for use in vehicle-to-vehicle and vehicle-to-roadside communication. The effectiveness of this technology is highly dependent on cooperative standards for interoperability. This paper explains the content and status of the DSRC standards being developed for deployment in the United States. Included in the discussion are the IEEE 802.11p amendment for wireless access in vehicular environments (WAVE), the IEEE 1609.2, 1609.3, and 1609.4 standards for Security, Network Services and Multi-Channel Operation, the SAE J2735 Message Set Dictionary, and the emerging SAE J2945.1 Communication Minimum Performance Requirements standard. The paper shows how these standards fit together to provide a comprehensive solution for DSRC. Most of the key standards are either recently published or expected to be completed in the coming year. A reader will gain a thorough understanding of DSRC technology for vehicular communication, including insights into why specific technical solutions are being adopted, and key challenges remaining for successful DSRC deployment. The U.S. Department of Transportation is planning to decide in 2013 whether to require DSRC equipment in new vehicles.

D. Jiang, V. Taliwal, A. Meier, W. Holfelder and R. Herrtwich, [3] The automotive industry is moving aggressively in the direction of advanced active safety. Dedicated short-range communication (DSRC) is a key enabling technology for the next generation of communication-based safety applications. One aspect of vehicular safety communication is the routine broadcast of messages among all equipped vehicles. Therefore, channel congestion control and broadcast performance improvement are of particular concern and need to be addressed in the overall protocol design. Furthermore, the explicit multichannel nature of DSRC necessitates a concurrent multichannel operational scheme for safety and non-safety applications. This article provides an overview of DSRC based vehicular safety communications and proposes a coherent set of protocols to address these requirements.

P. Benabes, A. Gauthier and J. Oksman, [4] A new Manchester code generator designed at transistor level is presented in this paper. This generator uses 32 transistors and has the same complexity as a standard D flip-flop. It is intended to be used in a complex optical communication system. The main benefit of this design is to use a clock signal running at the same frequency as the data. Output changes on the rising edge and falling edge of the clock. Simulations results show a correct behavior up to 1 Gbit/s data rate with a 0.35 μ CMOS technology within a commercial temperature range.

A. Karagounis, A. Polyzos, B. Kotsos and N. Assimakis, [5] A Manchester code generator designed at transistor level with NMOS switches is presented. This generator uses 26 transistors and has the same complexity as a standard D flip-flop. It is intended to be used in a complex optical communication system. The main benefit of this design is the use of a clock signal running at the same frequency as the data. Output changes on the rising edge and falling edge of the clock. The circuit has been designed in a 90 nm UMC CMOS technology to evaluate the efficiency of the proposed approach and experimental results show a correct behavior up to 5 Gbit/s data rate.

Y. C. Hung, M. M. Kuo, C. K. Tung and S. H. Shieh, [6] In this paper, we propose a modified Manchester and Miller encoder that can operate in high frequency without a sophisticated circuit structure. Based on the previous proposed architecture, the study has adopted the concept of parallel operation to improve data throughput. In addition, the technique of hardware sharing is adopted in this design to reduce the number of transistors. The study uses TSMC CMOS 0.35-mum 2P4M technology. The simulation result of HSPICE indicates that it functions successfully and works at 200-MHz speed. The average power consumption of the circuit under room temperature is 549 muW. The total core area is 70.7 mumtimes72.2 mum. As expected, the circuit can be easily integrated into radio frequency identification (RFID) application.

III. CONCLUSION

With recent advances in the development ofWireless communications protocols and plummeting costs of hardware needed, along with the automobile industrys desire to increase road safety and gain competitive edge in the market , Vehicles are equipped with latest communication hardware’s, GPS etc. hence becoming Computers on Wheels or computers networks on wheels [1]

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