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Design of a Dynamic LED System Controlling Multi-LEDs Based on AURIX Multi-Core Processor

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Abstract

Recently, dynamic LED lighting systems become more important in automobile industry. Also, one of most important things in the automobile embedded system is to reduce the number of electronic control unit in vehicles. In this paper, we propose a novel design of a dynamic LED lighting system using Infineon AURIX processor which has a multi-core architecture to overcome above issue. For the implementation of a dynamic LED system, in this design, three LEDs are controlled using three cores independently. Detailed implementation of the demonstration system using color sequences for LED and a LED device is presented herein and the experimental result shows that the proposed method works well.

Keywords: Dynamic LED system; Multi-LEDs; AURIX MCU; Multi-Core; LED device; Color sequence

1 Introduction

Recently, LED lighting systems have been applied to automobiles due to their functionality and reliability for in-vehicle environment. Also, automotive lighting systems have been changed from static lighting systems to dynamic lighting systems. Since dynamic LED systems can provide variety of visual information and emotion, they are being utilized in various headlights, taillights, interior lights and other applications [1~2].

In today's cars, the number of electronic control unit is increasing continuously. As a result, lots of ECUs have being mounted in vehicle. This can lead to a

troublesome in increasing body weight, thus, reducing the number of ECUs in vehicle is turning into an essential requirement. Recently, multi-core processors have become a one of the effective alternative to fulfill this requirement. Also, many car manufacturers are already trying to apply multi-core for developing automobiles [3].

In this paper, we propose a dynamic LED lighting system based on multi-core architecture. The proposed system is implemented to control the multi-LEDs independently using Infineon's AURIX MCU.

The last of this paper is organized as follows. First, we present proposed multi-core based dynamic LED system in section 2. Then, experiment and result are presented in section 3. Finally, in section 4, we conclude the paper and present future research directions.

2 DYNAMIC LED SYSTEM BASED ON MULTI-CORE

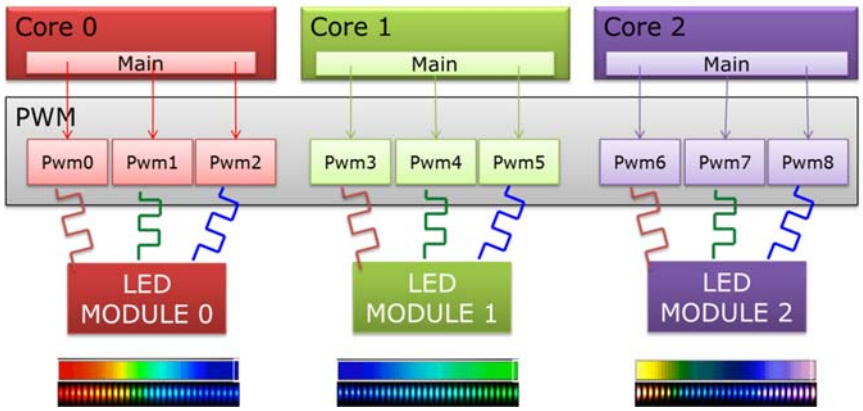

Fig. 1. Overview of dynamic LED system based on multi-core architecture

Figure 1 shows an overview of dynamic LED system based on multi-core architecture. We use the three cores in AURIX MCU. Each core generates three pulse width modulation (PWM) signals to control the red, green and blue value in one LED module. More detail, Core0 generates three signals, including Pwm0, Pwm1 and Pwm2, then are mapped to LED module0. Core1 and core2 also generate signals to map to LED module1, LED module2, respectively.

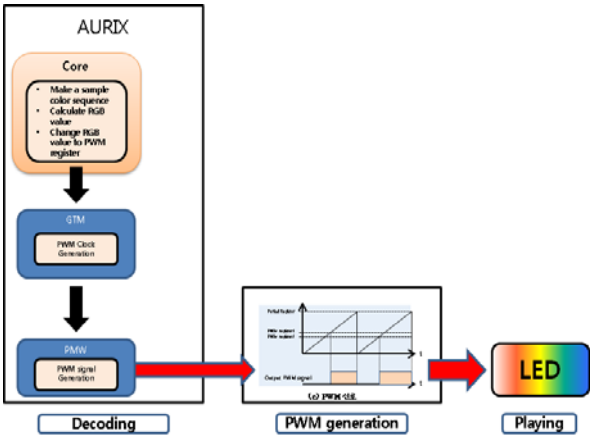

Fig. 2. Operation block diagram of dynamic LED system

In figure 2 shows the operation block diagram of the proposed a dynamic LED system. In this scheme, each core downloads the available color sequences, decode and display equivalent color sequences on the dynamic LED systems. By doing so, it is possible to express color change in the dynamic LED systems [4].

3 EXPERIMENT AND RESULT

In this paper, we use Trace 32 debugger, AURIX TC275 and three dynamic LED modules for the experiment.

Fig. 2. Operation block diagram of dynamic LED system

Figure 3 shows separated components of dynamic LED control system. Among them, Trace 32 debugger downloads the multi-core source codes to individually control the operation of each core. Besides that, a AURIX TC275

supporting multi-core functions will execute the source code and generate PWM signals. Finally, the output PWM signals from AURIX board will be used to display the corresponding colors on the dynamic LED modules. The experiment results show the validity of our proposed system.

4 CONCLUSION

In this paper, we proposed and implemented a dynamic LED control system using AURIX MCU and multi-core architecture. The experiment shows that the proposed dynamic LED system works properly. Furthermore, it also shows the effective utilization of multi-core architecture in a lighting control system.

For the future work, we plan to implement our dynamic LED systems using HILS(Hardware In the Loop Simulation). Also, from obtained results, we will improve the performance and develop various dynamic LED systems to follow the demand of automobile industry.

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