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Study on the Logging Board for Advanced Safety Vehicle ECU Algorithm Verification

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Abstract. As smart cars have recently become more necessary and commercializing them is more demanded in automobile market, active safety measures such as integration control of chassis and non-chassis, active accident prevention and avoidance, lane departure and obstacle warning, autonomous driving, and safety support for passengers and pedestrians are equally asked to be more robust than ever. Therefore, it is imperative to run objective and precise tests and verification on the various parameters of electronic device control algorithm that works with camera image-based information, and carry out modification and correction.

Keywords: Advanced safety vehicle, Data logging, LKAS

1 Introduction

Recently, car makers and the governmental agencies make a greater investment in and efforts to develope the application technologies for "Advanced Safety Vehicle" than ever, it is very necessary to verify each of algorithms applied to the core ECUs as existing cars have rapidly evolved into sophisticated assembles of computer devices equiped with tens of ECUs while geared with high-tech IT technologies. Although the car makers and the governmental agencies make a greater investment in and efforts to develope the application technologies for "Advanced Safety Vehicle" than ever, it is very necessary to verify each of algorithms applied to the core ECUs as existing cars have rapidly evolved into sophisticated assembles of computer devices equiped with tens of ECUs while geared with high-tech IT technologies.

Particularly, logging system is necessary to record and retain working conditions and to record various kinds of information to analyze drivers' driving habits and system functions. In addition, it can understand the error status and console operation status by examining working logs such as error logs (error information) of hardware as well as general logs such as manipulation text, command text, and report text notified to center operator to record and retain driving conditions.

Therefore, this study developed a verification logging system for the electronic control algorithm of a lane keeping assistance system camera. The developed system can not only acquire the lane information of a road through the camera, but also analyze such information and adjust a vehicle automatically through controlling the control board.

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2 Logging board for ECU algorithm verification

MCU, which is the essential part of a control panel that governs an intelligent vehicle, is designed to control electronic devices through image information obtained from a camera as well as errors in its algorithm itself. Therefore, there exists a possibility that distorted image due to a problem in a camera and optical lens themselves lead to false recognition of road information, which can cause a serious situation. In this case, the system can end up in a drastic result, rather than securing safety. When an algorithm works with incorrect information, it can cause error. Therefore, the algorithm applied inside of MCU should be designed to detect the defects of a camera and optical lens by itself and runs the electronic devices of a car correctly.

Therefore, it is imperative to run objective and precise tests and verification on the various parameters of electronic device control algorithm that works with camera image-based information, and carry out modification and correction. Control board algorithm verification system for LKAS (lane keeping assistance system) camera of a smart car that was developed in this study consists of synchronization controller unit, MCU and communication unit as seen in Fig. 1.

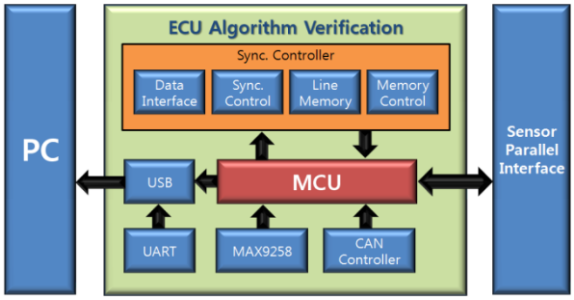

Fig. 1. Logging system for algorithm verification in the LKAS camera

In Fig. 1, synchronization controller consists of data interface, synchronization control, lne memory and memory control unt while communication unit consists of MAX9258, CAN (Controller Area Network), and UART (Universal Asyncronous Receiver/Transmitter). This study defined the specifications of signal activity pixel coming in the system, the form of CMOS image sensor output data, UART transmission data and others and then saving format of image (video) output from the system and image display method as requested by a user.

The verification logging system for the electronic control algorithm of a lane keeping assistance system camera, which was developed by this study, is used for actual vehicle test or a racing car. It saves the data obtained from various sensors while driving in direct circuit of a computer memory chip and outputs when a car is in halt or reads then in connection with a telemeter system while driving. The hardware of the developed system continues transmitting to PC or a notebook in real time the image data of an automotive mega image sensor through USB 3.0 interface while reading CAN data simultaneously coming to two CAN ports, and adds them to the image data. Table 1 shows the specifications of the hardware.

Table 1. Hardware specifications

Item	Description
Input Image Sensor Interface	FPD_LinkⅢ, format : YUV422, size : 1280x800, FrameRate = 30fps, 8/10bit
Input CAN Interface	CAN V2.0B, 2Port Support
PC Upload Interface	USB3.0 Interface
Onboard Buffer Memory	512Mbit x 2 Buffer
Parallel Debugging Interface	13 x 2 Connector
Configuration Sensor Registers	Programmable USB Packet Support
Power Supply	Multi Power Supply (DC5V/3A, USB power)
Dimensions	105 X 105 X 33(mm)

Fig. 2 shows the verification logging system for the electronic control algorithm of a lane keeping assistance system camera, which was developed by this study, and the functions of each block are as follows.

①Main Controller, ②FPD_LinkⅢ/CAN Interface, ③CAN Interface,
④FPD_LinkⅢ De-serializer, ⑤CAN Controller, ⑥USB 3.0 Controller
⑦Multi Power Switch, ⑧Parallel Interface

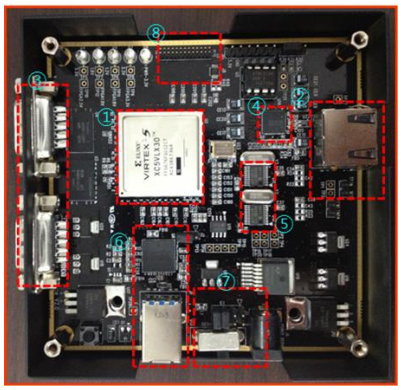

Fig. 2. Developed logging system

3 Conclusion

The verification logging system for the electronic control algorithm of a lane keeping assistance system camera, which was developed by this study, can be applied to ASV. As a result, it can be possible to record various kinds of information while a car is in motion to record and retain working conditions and analyze drivers' driving habits and system functions. In addition, it can understand error status and console operation status by examining working logs such as error logs (error information) of hardware as well as general logs such as manipulation text, command text, and report text notified to center operator to record and retain driving conditions.

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