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Research on Smart Devices for Open Platform Ontology for Autonomous Vehicle

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Abstract
Background/Objectives: This paper is the SoC-based application design and experimental study of autonomous vehicle middleware software design technology.
Methods/Statistical analysis: In this study, the speed measurement of digital driving recorder of intelligent vehicle generates pulse value of output impedance of 50Ω under the speed equivalent to about 40km / h, and the corresponding condition value impact noise is generated. The reference point was set to measure the technical safety measures of the digital actuator recorder's normal operation when contacted between.
Findings: The Android-based intelligent SoC middleware design technology experimented in this study is beyond the general automotive communication protocols and the functional services of individual ECU controllers. The application method was applied to the autonomous driving intelligent vehicle platform through the operation technique linked with the device, and the digital signal processing value was verified through the autonomous driving experiment to verify the various media image values and the experimental data value of the autonomous driving information
Improvements/Applications: SoC experiments and research results confirmed through this paper will be very helpful for the development of intelligent vehicle application using digital media if it is used in domestic AI vehicle research and open platform R & D. Along with the communication and telecommunications infrastructure service technology, it is expected to be of great help in speeding up the commercialization of domestic autonomous AI vehicles

Keywords: *SoC, Smart CAR, Android Middleware, MPEG-21(H.264), Smart Device, 5G Network,*

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1. Introduction

The 4th Industrial Revolution, intelligent automobile application technology is evolving beyond the limit of the mobile device to a variety of application software and multi-media collective technology with big data-based AI(artificial intelligence) technology. with the recent commercialization of 5G mobile communication service, artificial intelligent automobile technology, which is a fusion of automobile and IT technology, is evolving into more intelligent automobile service technology, and each multimedia platform service and application developed in such distributed environment is being developed Accordingly, application software technology developed with a single system SoC of a portable terminal device through various service technologies is absolutely required. In this paper, smart device design for ontology design of intelligent automobile open platform enables to design intelligent automobile middleware software design technology such as Android based SVC Codec and real time video and graphics processing that is not expressed in single ASIC application software technology as SoC based application designWe have experimented in smart device environment through researches, and newly designed service functions of various terminal devices provided as open platforms and application solutions in SoC

environment and applied standardized interface analysis technique and proved this experiment.

2. Protocol Open Frame

This study is designed to design in-vehicle networking as an intelligent vehicle open platform based on android-based Operating System(O/S) by applying the efficiency and functionality of artificial intelligence. The module was designed to transfer data between modules[1][2]. The network method between intelligent vehicle modules reduces the number of communication lines required in the vehicle by combining signals through time division multiplexing into a single line by applying a dedicated point-to-point communication serial bus method can be. The information is then sent to each control module for control of each function, such as ABS, seat control, temperature control, and dashboard display[3].

2.1. Smart Device Video compression

The early video compression technology of video technology used MPEG-1 as a standard to compress the entire video and apply it as a single frame. However, according to the evolution of video technology and the variety of high-definition applications and platforms, it is progressive. By adopting the standard method, the interface method did not show only the basic effect such that it was simple enough to store TV images [4].

However, with the advent of various services and platforms, HCI(Human Computer Interaction) protocols and algorithms have been studied and applied to the industry, and standard MPEG-2 has been proposed to effectively process video based on the interface application process in the field of video. In addition to the existing NTSC TV broadcasting data, it has become widely used as a standard for compressing satellite TV, CATV and DVD images. In image compression standards, the compression rate determines the economics of the application using the standard. As hundreds of channels of video are transmitted and processed along the network in real time, and delivered to the final assumption, an improvement in compression rate can reduce the cost of video transmission and storage.

In order to improve the compression rate, the image compression technology was tested by applying the environmental test using VC-1(official name SMPTE 421M) developed by Microsoft as a video compression standard, and the compression efficiency was H.264/MPEG 4 AVC. It is similar to, and supports various profiles and levels from mobile devices to high definition television (HDTV), and has been proposed as a standard for use in high definition DVD(HD/DVD), Blu-ray, and Xbox 360. The compression standard MPEG-4 Part-10(H.264) has been proposed. These new standards provide more than twice the compression rate compared to MPEG-2.

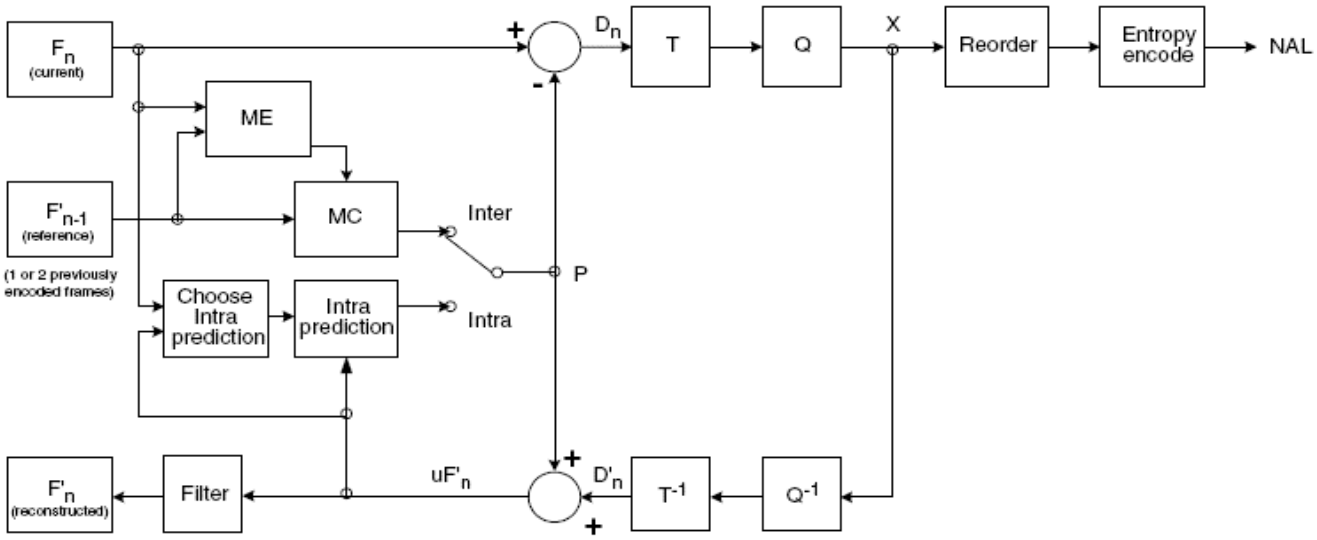

Figure 1. MPEG-21/H.264(PART-10)Encorder Configuration

2003.

VC-1 was approved in 2006 as one of the standard video compression methods by the US City of Motion Pictures and Television Engineers (SMPTE), and H.264 was approved as a joint standard method of ISO / MPEG in

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Table 1: Intelligent Vehicle Ontology Symantic

Smart-CAR Ontology	Symantic Agenda	Ontological Engineering Item
Vehicle Simplified Model	Acceleration Engine	For a typical gasoline engine, the following simplified model can be used to verify the similarity between the calculated torque and the actual torque:
	Transmission, Gear, Wheel	The transmission and final gear are modeled as lumped components with gear ratio i and efficiency η.
	Vehicle dynamics direction	The right part shows the force acting on the wheel, air resistance, rolling resistance, and slope resistance respectively.
Energy Efficiency Based Fuel Economy Calculation	Equivalent fuel based section fuel economy	▪Calculate SOC change of battery as equivalent fuel and apply to total fuel consumption. ▪Lookup table composition of fuel SOC change and fuel change compared to motor
	Energy efficiency-based instantaneous fuel economy	▪The vehicle energy is calculated by combining the fuel consumption of the engine, the SOC variation of the battery, and the kinetic energy variation of the vehicle. ▪Application of vehicle energy using fuel calorific value (kWh / kg) and fuel density (kg/l)
	CASE	▪Velocity trajectory that can show moving distance, initial velocity and final velocity for a certain time
E-CHO Driving	Optimum speed	▪Calculate the backward velocity trajectory for the run and back run
	Driving Pattern	▪Ecodriving Index for Energy Consumption at Optimal Velocity and Real Velocity Trajectories

2.2. Intelligent Vehicle Signal Configuration

In this paper, the intelligent platform smart device open platform ontology is composed of Smart-CAR auto driving technology applying Automotive-IT technology of automobile by applying technology in open platform environment without any inconvenience in each signal terminal technology. It was applied to platform devices, and used in platform design by applying these protocols and APIs to intelligent vehicle test bed system[5].

<Table 1> is a table showing the configuration of intelligent vehicle Ontology Symantic Web. The message agenda of the device data provided by each terminal device is divided into subdivisions, and the data type classification required for engineering is shown.

2.3. Middleware Platform View

Android-based AI car open platform designed ontology view with smart device and middleware through Symantic Web. Appropriate middleware

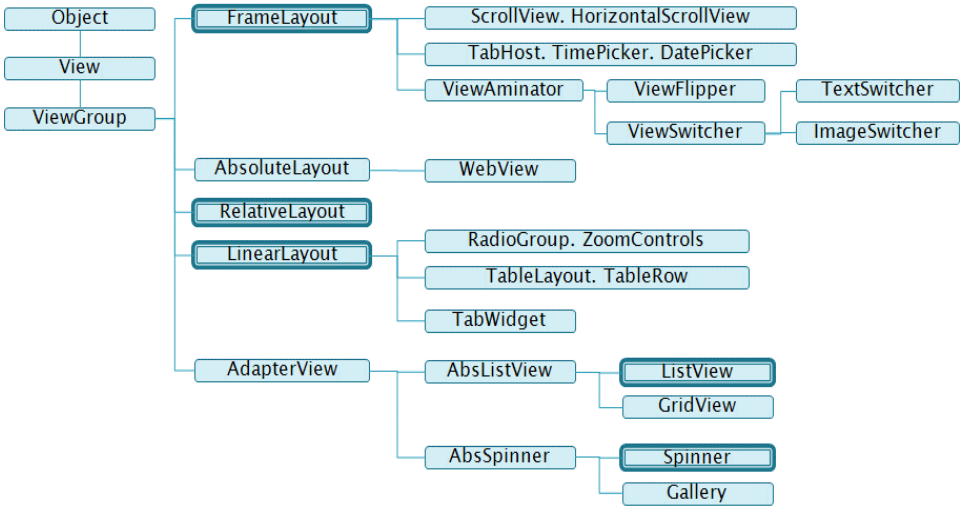

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Figure 2. Android Middleware Platform View

of intelligent vehicle was designed and applied based on embedded application program and researched to provide multimedia platform and information in intelligent vehicle at the same time. It provides experiment and test environment by linking traffic information network (ITS) system service such as road traffic information. <Figure 2> shows the overall view group of ontology platform[6].

As various smartphone applications are recently released, a standardized API can be integrated with various embedded S/W designs and demands on mobile terminal devices such as intelligent car car-intainment system and middleware platform to utilize them. By applying to the testbed environment, Android-based middleware is implemented on Smart-CAR ontology and experimented and applied through various studies[7].

2.3. AI Automotive Driving Open Platform

The CAR-Infortainment system, which is an embedded part of the artificial intelligence vehicle, is the basis for the autonomous driving of artificial intelligence through the ELM327 chip connected to the terminal of the OBD digital driving recorder. It is designed to be integrated with the viewer application module through the Android-based vehicle information system linked with other vehicle information collection modules such as vehicle departure prevention device, drowsiness prevention device, autonomous driving device, HUD/HMD, pattern recognition, and morphological analysis.

3. Intelligent vehicle Open Platform Test Environment

In this study, to design the open platform of artificial intelligence intelligent car and to implement ontology, the smart device middleware system is applied by applying the intelligent open platform based on android to study and design the functions that should be applied in the intelligent vehicle. Was constructed and applied.

The experimental method was designed based on the following two patterns. First, new modules that need to be extended for driving information of intelligent cars are newly designed. Second, web-based platform that includes ontology implementation by interworking with Android-based open platform

is to interface with intelligent vehicle modules.

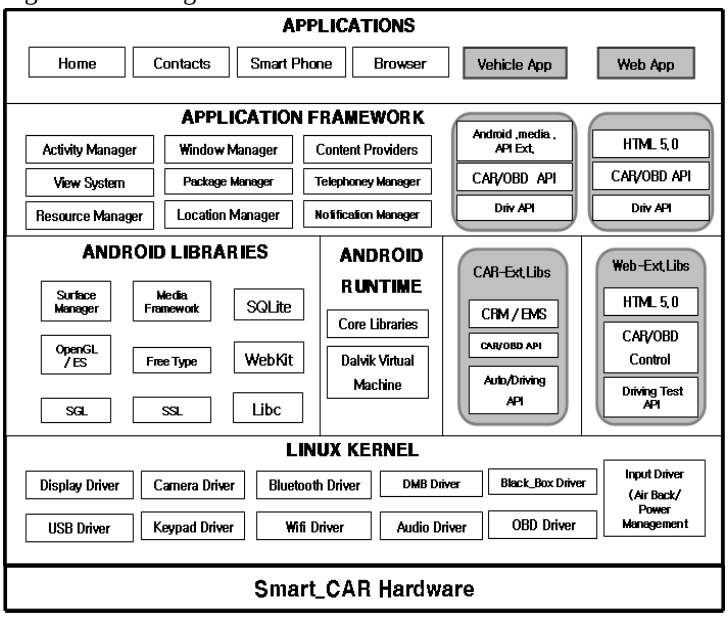

Figure 3. Android middleware in experiment

New API was designed. In this study, we designed and developed an intelligent car middleware based on Android and experimented with SoC based on autonomous driving information linked with smartphone application[8].

Smart device Android consists of a software layer (library, Android runtime, application framework) for running Android applications on top of the Linux kernel. In general, the Android-based Linux Kernel, Application Framework, and Libraries are collectively referred to as “Android” .

In order to port Android to platform-specific Smart-CAR hardware, Linux kernel and Android must be prepared for S / W environment. The Android-based

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platform consists of applications at the top, and it represents services such as various terminal devices and applications for smartphones of intelligent cars, and below is composed of Application Framework, Android Runtime, and Linux Kernel. The bottom part is composed of Smart CAR Hardware, which is a vehicle body platform of automobile. In order to implement open platform middleware of autonomous vehicle, this paper designed additional API to link each layer of Android and module for intelligent vehicle[9].

Using the Android open platform designed in this study, we designed and defined the middleware modules and APIs for each Android layer to be used in intelligent vehicles in each layer of software and hardware platform of intelligent autonomous vehicles. Intelligent vehicle open platform technology, combined with IT technology, is becoming significantly faster than other manufacturing technologies in terms of function. In particular, electronic technology has been developed as a CAR-Infortainment artificial intelligence technology in connection with various applications used in smart phones due to the development of device service of communication.

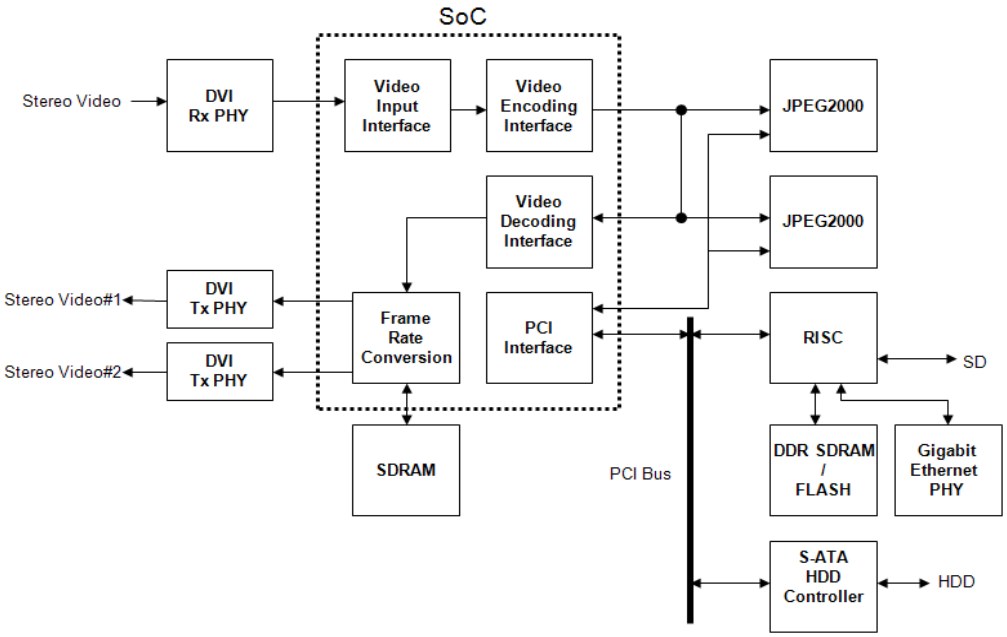

Figure 4. JPEG-2000 Codec SoC Diagram

4. Conclusion

This paper presents driving record information of intelligent vehicle using smart platform ontology using open platform, and driving test of driving recorder by linking various device information appearing in terminal device with SoC Chip Set through Android middleware in smart mobile environment. The value was shown and confirmed. The research of intelligent platform SoC based open platform in general Android smart phone has not been developed so far, and especially in R & D, it is possible to apply the international standard SoC integrated design method beyond ASIC design technique which is a traditional research method. Experimented using 5G network, which is 20 times faster than 4G network, as a test bed, and designed and coded smart device Android middleware and linked it with platform's open source. It is judged that it can be utilized and is satisfied with the experimental results[10].

The Android-based intelligent SoC middleware design technology experimented in this study is beyond the general automotive communication protocols and functional services of individual ECU controllers. Through the operation technique linked with the device, it was applied to the autonomous driving intelligent vehicle platform, and through this autonomous driving experiment, digital signal processing values were verified to verify various media image values and experimental data values of autonomous driving information. Future research aims to utilize SoC-based integrated terminal system under commercialization at a more commercialized level, and actively utilize it for the development of autonomous driving intelligent automobile industry and technology standardization, the core industry of the 4th Industrial Revolution, and the world's first 5G[11[12]].

We will endeavor to commercialize the product to develop into the best technology of AI autonomous driving technology with international competitiveness by using

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domestic communication technology that has commercialized mobile network service technology. Lastly, the results confirmed through SoC experiments and studies through this paper will be conducive to the development of intelligent vehicle applications using digital media if it is used for domestic AI vehicle research and open platform R&D. Along with the 5G mobile communication infrastructure service technology, it is expected to be of great help in speeding up the commercialization of autonomous AI vehicles in Korea.

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