A Cloud Based Information Integration Platform for Smart Cars

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Abstract. Current in-car computers have limited processing capabilities, and the content in smart car applications is poor extension. Even more, tradition software install approach which was used in smart cars lacks neither economy nor convenience. To solve these issues, we introduced a Cloud based Information Integration Platform for Smart Cars that has the ability to encourage flexibility in smart cars and enhance the value of them. To achieve the smart control and information sharing in smart cars, the platform collects data on the CAN bus automatically, with the ability to process CAN bus messages in Clouds. The Smart Car Information Service as the user interface was used to implement smart cars applications through customized business process. This fill up the information processing gap between the smart cars and cloud computing. Furthermore, we can use this platform for different purposes in smart cars.

Keywords: Web Services; CAN bus; Cloud Computing; Smart Cars.

1 Introduction

The smart car is the future trend in automotive improvement. With the development of automotive electronic technology, the smart car technology is evolving rapidly. Currently, the traditional in-car computers in smarts cars have limited processing capabilities to run many functions, such as navigation and display real time information. It is not smart enough without the information sharing among the real world and the computer. Thus, the smart car technology has the potentials to make the car easier to control, more dynamic and economical, and safer to drive. To achieve these benefits, in-car information systems need to be seamlessly integrated with the external information services, supporting the transfer, exchange, and sharing of information among them. Our motivation is to design a new information integration platform for smart cars to enhance the ability of processing the real time information from the smart cars and reduce the delay of smart car applications development. The mission is comprehensive applications of smart cars electronic control technology, car network technologies and intelligent control technologies.

Currently, a smart car mainly uses Controller Area Network (CAN) bus as the network connection. In this paper, we focus on the novel use of CAN bus applications and cloud computing technologies. Our primary contribution is the synthesis of ideas,
some of them are novel in their respective areas. The proposed platform seamlessly integrates the in-car information system with the external cloud information services, allowing smart car applications to be developed. A data conversion approach is developed which is able to convert the data from binary code in CAN bus to the XML format so that they can be processed by CAN message service in Clouds. As the participant to the smart cars information integration platform, the designed smart car information service can be easily extended by integrating various services to support new use case scenarios.

The rest of the paper is organized as follows. The second section reviews major technologies that are related to this research. In Section 3, we describe the architecture of the proposed platform in details. Then we present a use case scenario as a sample application to active our designed platform in Section 4. Finally, Section 5 concludes this paper and outlines our future work.

2 Related Technologies

The proposed Cloud based information integration platform for smart cars provides a novel approach to connecting the in-car system with external systems. This can lead to the development of new smart car applications. The platform is developed based on the technologies and components as follows.

- The in-car computer is a core of our platform. Traditionally, it is a mini PC or a SCM (Single-Chip Microcomputer). For example, the CarTel [1] node was described as a kind of in-car computer which runs on the Linux 2.4.31 kernel. An in-car computer can connect to the Internet via 3G or 3.5G networks, such as CDMA 1x EVolution Data-Only (EVDO), High-Speed Downlink Packet Access (HSDPA), and mobile WiMax [2].
- The Global Positioning System (GPS) navigation system in a car provides route planning, and even voice guidance [3-5].
- Controller Area Network (CAN) is a serial communication bus designed to provide simple, efficient and robust communications for in-car networks[6]. The car’s electronic equipments were connected by this control network. One subset of a modern vehicle’s network architecture [7], shows the trend towards incorporating ever more extensive electronics
- With Software as a service (SaaS), Cloud computing can provides the applications to users for use as a service on demand, either through a time subscription or a “pay-as-you-go” model. Cloud Computing refers to both the applications delivered as services over the Internet and the hardware and systems software in the datacenters that provide those services [8].

3 Architecture

3.1 Components and Design

The Cloud based Information Integration Platform for Smart Cars has two different layers, namely the hardware layer and the services & software layer.