**Tutorial 2**

# Automotive Electronics: System, Software, and Local Area Network

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## Abstract

In this tutorial, an overview of automotive electronic systems and details of the development methodologies are presented. Automobiles were born to enhance human mobile performance. In early development stage, automotive engineers focused to strengthen automobile engine power. Afterwards, automobiles had enough function to drive faster than any animal, but they caused some social problems such as traffic accidents, environmental problems and traffic congestions. Automotive electronic technologies have been developed in order to solve these social problems.

*Roles of electronic technologies on automobile functional developments*
For the solution to safety, environment and traffic problems, various functions are necessary which could not be completed only by mechanical systems. In this section, roles of automobile electronic systems on countermeasures to the social problems are discussed. Vehicle motion control systems, power-train control systems, navigation systems, and advanced drive assist systems are introduced and automotive functions are defined.

*Design requirement for automotive electronic systems architecture*
Electronic systems composed basically of sensors, ECU's (Electronic Control Units), actuators and human interfaces. In early days, each electronic system was designed independently. Today's automobile has various functions which could be completed by multiple electric systems. Therefore, fundamental architecture of integrated electronic systems in an automobile is important to be designed in order to optimize the total function, cost and productivity.

*Design and development procedure of electronic systems and software*
In vehicle systems and software, required functions and complexity of products are increasing. In this situation, ECU suppliers are working with efficient development methodology to achieve the highest quality. Today most common development processes are still classical V shaped process, module design and C language programming. However, several new technologies such as UML design method are tried and some of them are adopted as the standard process. Automatic testing and simulation environment are also important for the development procedure.

*Automotive Local Area Network*
Recently more and more automotive equipment are controlled electronically and the number of ECU's is increasing. The number of wire harnesses is also increasing and many problems such as the increase of weight, lack of installation space and difficulty of handling are experienced. As the solution of these problems, multiplexing with automotive Local Area Network is important to secure high speed communication as well as to decrease the weight and volume of wire harnesses. We will review technologies of automotive Local Area Network from CAN and LIN, which are currently de facto standards, to FlexRay that is about to start being adopted.

**Categories & Subject Descriptors:** J.7 Consumer Electronics, C.3 Real time and embedded system

**General Terms:** Design

**Keywords:** Automotive electronics