

# Automobile Vehicle Testing and Control System using AUTOSAR based Module

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## ABSTRACT

The automotive embedded software is changing frequently whenever the specification for hardware is modified. These cause to spend time and cost. By considering these factors of complexity we are going to developed one model on which one control unit can handles the multiple functions of the automotive system consider the car as the automotive system. To resolve these problems, we are developing this model which can be based on the idea of the (Automotive Open System Architecture) i.e. AUTOSAR which is open and standardized automotive software architecture, jointly developed by automobile manufacturers, suppliers and tool developers. Using this standard will serve as a platform upon future vehicle applications will be implemented and will also serve to minimize the current barriers between functional domains. In this paper we are going to compare testing level of the different functions i.e. fuel, temperature, pressure, controlling the antilock brake system using the single control unit.

## Keywords

Automotive System, Test, Validation, Verification, Anti Lock Brake System.

## 1. INTRODUCTION

Nowadays for automotive convenience system has been increasing and drivers want to drive in the comfortable environment especially in the winter and summer season, because the temperature is extremely low and high in each season. The manufacturers have been trying to meet with consumer's needs by increasing convenient system in the vehicle. Increasing convenience system means that vehicle includes more electronic systems. The automotive industry is facing the challenge of the rapidly growing significance of software and software-based functionalities; software complexity is a major reason for project delay and cost overrun.

In order to overcome this problem of complexity in vehicle, decrease the number of electronic system in vehicle this module is used, which can handle different functions of the vehicle on one control unit. The control unit in vehicle where perform functions mechanically and independently. And this cause to spend lots of time and cost in order to verify the logic of embedded software systemically. But the control model shows that it is makes possible by providing standardized software architecture and communication method.

## 2. AUTOSAR OVERVIEW

AUTOSAR have defined a large number of concepts to cover both the technology used today and concepts foreseen to be used in the future. The concepts can represent concrete items existing in a vehicle like hardware elements and software components, but AUTOSAR use the same type of concepts to represent abstract information like mapping of a software

component on an ECU. AUTOSAR is based module is basically very useful handle such complexity of the vehicle. The concept of AUTOSAR handle the multiple functions of system by single ECU are as shown in Figure 1. By introducing AUTOSAR, a type of standardized software architecture, the reusability may be improved as well as time and cost can be saved, and AUTOSAR may be a solution to handle such complexity.

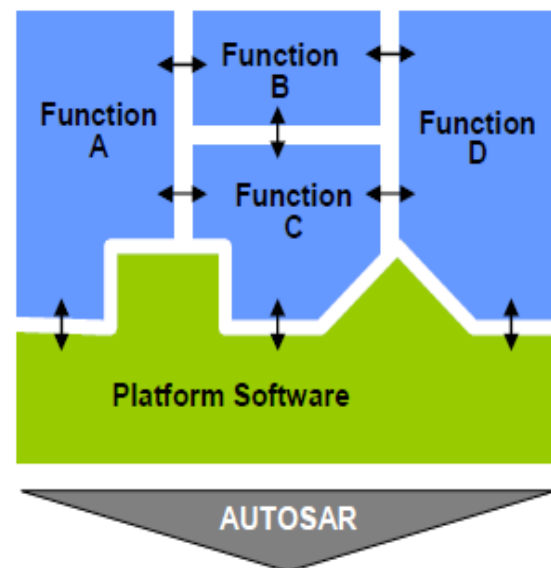


Fig 1: Concept of AUTOSAR

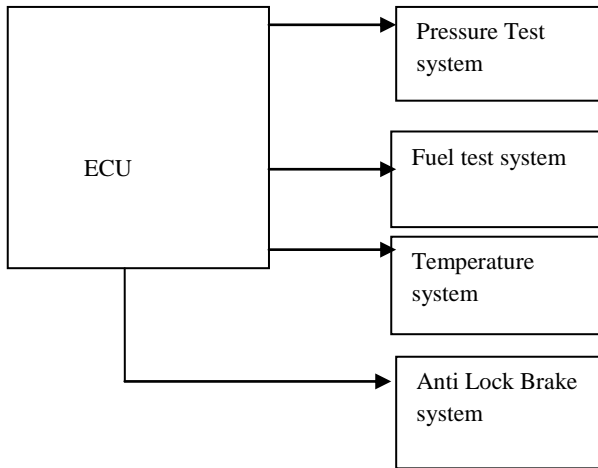
## 3. SYSTEM DESIGN

In this paper we are cover both the technology used today and concepts foreseen to be used in the future. The concepts can represent concrete items existing in a vehicle like hardware elements and software components, but AUTOSAR use the same type of concepts to represent abstract information like mapping of a software component on an ECU, so on the basis of this module we are developing one electronic control unit which can test and control temperature, pressure, fuel level and anti lock breaking system of the vehicle. Development phase of this model can divided into two categories 1) ECU Design 2) Logic Design & Mapping.

### 3.1 ECU Design:

As the ECU designing takes place which will be based on the AUTOSAR module then single ECU can handle the multiple functions of the vehicle. For decreasing this complexity in vehicle I am going to develop testing system for vehicle based on AUTOSAR module. As the AUTOSAR is the automotive open and standardized system architecture i.e. ECU will handle any function of the vehicle openly or freely without

make any changes in configuration of ECU. As every vehicle contains around 80 to 70 ECUs, using this module the number of ECUs will decrease, i.e. the only one ECU can handle any function of the system. Consider if we design an ECU for temperature testing of a system, if we disconnect that ECU from the temperature system and attach it to the pressure system of the vehicle, then it will show the test value for the pressure, not showing any error, i.e. still the ECU works for pressure, thus only one ECU will handle up to 5 to 6 functions of the vehicle without showing any error in it. Thus using this module, it is possible to decrease the number of ECUs in the system, i.e. the ECU will handle the multiple functions of the vehicle or automotive system.



**Fig 2: Block Diagram System**

In this paper we are going to develop the SW-C for three or four functions of the vehicle which can be operated on AUTOSAR module based on single ECU.

### 3.1.1 Fuel System:

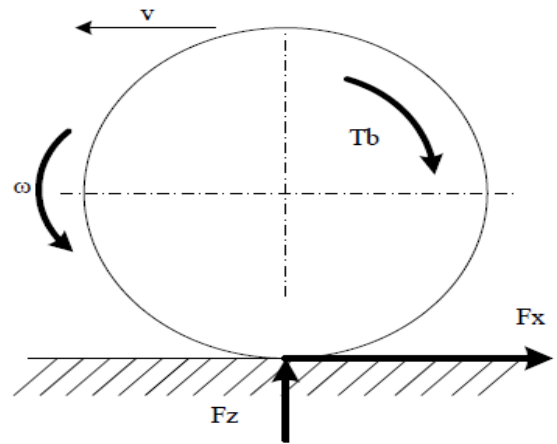
Considering the fuel tank in the car, using this method the SW-C is built for these functions, which can be tested for fuel level in the car. Fuel level is inbuilt in the software component, which can be tested for the level in the system. The value can be tested on the basis of fuel level sensor and component which is inbuilt within the electronic control unit.

### 3.1.2 Pressure and Temperature testing:

As mentioned, for other functions also SW-C is built and all components are embedded on the highly integrated ECU. Testing of these functions is done on the basis of sensors and the inbuilt software component. Each software component will provide the limited range.

### 3.1.3 Antilock braking system (ABS):

It works by sensing the speed of each of the tyres using the speed sensor. As one tyre stops during braking, the speed sensor sends a signal to the ECU (Electronic Control Unit) which will then calculate and control the ABS modulator by releasing the pressure within the brake system.



**Fig 3: Forces on Wheel**

As pressure is being released during braking, the wheel will have a stop and go effect which will result in a pulsation feel during braking. This in turn prevents wheel lockup.

### 3.1.4 Solenoid Valve:

A solenoid valve is an electromechanical valve for use with liquid or gas. The valve is controlled by an electric current through a solenoid: in the case of a two-port valve the flow is switched on or off; in the case of a three-port valve, the outflow is switched between the two outlet ports. We provide Solenoid Valves which are also known as electromechanical valves that are used for controlling, either by stopping or allowing the flow of liquid and gas by electric current through a solenoid.

Pressure:

0-1.0MPa (water valve)

0.05-1.5MPa (steam valve)

Sizes: G1/8-G3/8, ZG3/8-ZG2

The codes are embedded within the chip of the microcontroller for the four functions of the vehicle. Sensors, software component of function attach to different ports of the microcontroller. Sensors are used for the testing value of the given components but the value for temperature, pressure, fuel level having fixed range. When the system is on, if we test for temperature the sensor is activated and checking that this value is within range or not, display the message on the LCD screen. Pressure is generated within the system through the solenoid valve. As the pressure is generated in the form of liquid or gas hydraulic air braking system activated which can control the speed of the wheel automatically using rolling the wheel. Lockup the brake helpful during the wet condition of the road on which chances of slipping are more.

## 3.2 Logic Design Testing and Mapping:

There are some steps for building and integrating a SW-C into the embedded systems of a vehicle.

1. By using the embedded C language the architectural model is created for functional modules of the given system.
2. All SW-C are built within the electronic unit.
3. Creating the interactions between interfaces of SW-C and implementing SW-C through the system.
4. Integrating the SW-C with the ECU.
5. Verify and testing system based on SW-C.
6. Testing the ECU in both the emulation environment and real vehicle.

#### 4. CONCLUSION

This paper shows that Automotive System improved its reliability. Decrease in current barriers. It will be easier for suppliers to achieve multiple use of functions for different vehicle manufacturers. Open standardized electric/electronic architecture concept for the automotive industry, with some solution principles, such as the scalability and transferability of functions.

AUTOSAR divides electronic structure into several layers and modules. At the same time of defining the interface between communications these layers and modules, System also defines software components and standardized hardware platform. The ECU internal codes are abstracted into several layers. This paper showed the basic concepts of AUTOSAR through two directions, such as system processing. Thus, this system is useful for handling various functions of the vehicle and testing them on single ECU.

#### 5. ACKNOWLEDGMENT

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