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RESEARCH ARTICLE OPEN ACCESS

Developments of Electronic Circuits in Automotive Systems

Eng. Abdulrahman Al Kandari *, Eng. Ghazi Aldhafiri **
**Public Authority for Applied Education and Training*
*** Public Authority for Applied Education and Training*

ABSTRACT
Electronic systems are becoming quite popular in automobiles. An electric circuit is often found in various parts of the modern car including heated seats along with the computer-controlled engine components. Vehicles in the USA required tire pressure was more than twenty per cent off of the provided pressure. Electrical systems go on increasing the sales of a hybrid along with fully electric cars. In this paper, a detailed view is provided of various electrical networks utilized in automobiles. Additionally, different software is described that is useful in the proper internal functioning of electric components of vehicles (Chan et al., 2020).
Keywords - About five key words in alphabetical order, separated by comma

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I. INTRODUCTION

It has been observed in the past three decades that there has been an exponential increase in the overall electronic systems present in the vehicle. By today, the cost of luxury vehicles is quite high and is twenty-five per cent of the manufacturing cost. According to an analysis, it is estimated that about eighty-five per cent of innovations start from electronics. To gain appreciation in the average amount of money associated with the electronic system and different silicon components including diodes. The average amount noted was $120 whereas it increased up to $2,000. Huge implications have been found due to the growth of the electronic system. For example, high-end vehicles have more than five kilometres of vehicle engineering. According to a study, a company named Apollo employed more than 170kbytes for processing memory. After thirty years, a family car uses 600 Kbytes for keeping the CD player from skipping tracks (Pindoriya et al., 2018).

II. PRIMITIVE CONTROL NETWORKS

These networks are greatly used in the controlling operations of vehicle for different applications including engine management along with the mirror and door controlling. Such systems greatly operate at normal rates of data. The automotive system designs consider the requirements associated with the information flow along with the network bandwidth. The issues associated with this regard. The poor case network associated with the vehicles incorporate the internal network traffic including the internal diagnostic data. The error probability along with its effects on the traffic latency is observed in the network management. The schemes associated with this management include traffic control measures. The automotive industry has adopted the standards for vehicle control networks for lowering production costs along with mass production. The global consensus associated with this model enhances the overall product development cycle along with the effects on the overall cost to the customer. The two best standards for vehicle control networks include CAN and J1850 (Chan et al., 2020).

IN-VEHICLENETWORKS

Such as LANs connect computers, and it is also used in controlling networks for the connection of vehicle electronic equipment. According to some studies, the wiring was termed as standard elements and means for the connection of two or more elements. With the increase in electronic content, the usage of discrete wiring keeps on increasing. By adding a huge number of wires, the weights of the wire increased and lead to the weakened performance of the vehicle. The in-vehicle networks show that 50 kilograms of wiring increased fuel consumption by up to 0.3 litres for every 150 kilometres of travelling. The complex wiring leads to an increased amount of vehicle wiring leading to a lowering down overall efficiency. As a result of

which, the wiring harness became an expensive and complicated in-vehicle electrical system. The replacement of wiring with the LANs reduced the weight of BMW up to 15 kilograms. At the beginning of the 1980s, distributed networks replaced point-to-point wiring. A very low-speed CAN manages the car's comfort electronics. In general, the control applications which are not real-time dependent use the low-speed network segment. The low-speed CANs lead to energy-saving modes that cause the nodes to stop the oscillator. This remains in static mode until a message is provided to get in the run position again. The usage of sleep mode is to stop the battery from running while ignition mode is turned off. It is observed that the high-speed CAN leads to real critical functions including engine management and brake control. The electromagnetic radiations are capable of about a baud rate of 1.2 Mbps. This is resulted in high-speed operations and provides a better shield if the baud rate exceeds 500kbps. CAN is termed a robust control network although it is mostly used in specialized control networks. For instance, X-by-wire systems use electronics instead of hydraulic means for controlling different systems. Such systems are dependent on highly reliable networks (Pindoriya et al., 2018).

III. MEDIA-DEPENDENT TRANSPORT SYSTEMS

The applications of MOST along with the fibre network protocol include high-volume streaming along with automotive multimedia and computer networking. A huge number of firms including Audi, and BMW are dependent on the MOST cooperative.

3.1 Time-Triggering Protocol

The real-time distributed systems include fault-tolerant along with the time-triggered protocol which properly ensures that there is no point of failure. The protocol also proposes various systems which replace the hydraulic braking and the sub-systems. TTP is termed as an offshoot of an X-by-wire project.

3.2 Local interconnected network

In locally connected networks, the time-dependent protocol is used in on-off devices including car seats along with sunroofs and door mirrors. According to the low-speed and single-wire system being enhanced by the standard networks. LINT has been termed a relatively high-speed network such as CAN. The LIN lowers the fears associated with the security networks inside the cars. The LIN is a master-slave protocol which does not provide stress to the vulnerable points in the network including the door mirrors. The door mirrors contain the points where the deactivation of the car alarm can occur easily. This inexpensive open standard was created by several brands including BMW, Audi and Volvo (Khalfi et al., 2021).

3.3 Byteflight

Byteflight is a safety-related, adaptable time-division multiple-access (TDMA) protocol that can be used with seat-belt tensioners and airbags. It is flexible. Infineon, Motorola, Tyco EC, BMW, and ELMOS collaborated on its development. Byteflight is a very high-performance network with many of the features required for X-by-wire, even though it was not designed specifically for X-by-wire applications (Ahmad, 2020).

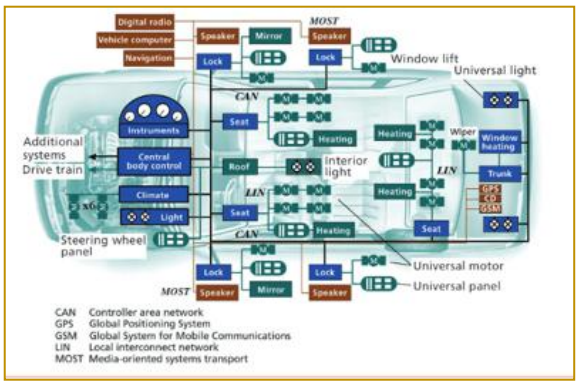

Fig1: Byteflight

3.4 Wire controlled networks

A variety of systems such as E-steer have high volume European vehicles this year. The X-by-Y wire is one of the best research projects which has led to designing of the novel computer frameworks. The major terms in this strategy involve the time-triggered protocol along with the TDMA schemes which are used for fault-tolerant common time base. TTP is highly reliable and is somehow less flexible compared to that other automobile networks.

IV. DISTRIBUTED SOFTWARE DEVELOPMENT FOR AUTOMOTIVE SYSTEMS

Any sort of engineering design faces several challenges while developing distributed real-time control. A proper approach which helps design

along with prototyping of the system is both cost-sufficient along with improved efficient. The development cycle of vehicle electronics is using several prototyping techniques. The formation of system requirement analysis is dependent on rapid prototyping techniques. The analysis is mostly aided by the VASE tool that results in the computer-based designing of systems. The visual modelling tools used for the formation of such networks are useful in addressing the challenges associated with the creation of the object-oriented model. These tool outputs can be easily linked with a design approach that is helpful in object-oriented programming. The outputs of such tools are mostly associated with the engineering documentation activity along with a combination of system diagrams along with code implementation. The interactive approach also used as path A is taking the place of traditional path B. Automatic code generation from different representations is quite possible now. A hardware environment is used for testing the resulting code. The most important advancements made include target hardware along with pc platforms that can easily run the software of the prototype. The operating systems can be easily configured by making the systems accurately accessible along with the hardware requirements in the design cycle. The implementations associated with hardware in the loop are quite possible while consideration of real-time simulations. The components of real-time simulations are processed using different Matlab and Simulink (Bakr et al., 2019).

4.1 Software development cycle

The figure below provides a better description of software development cycle used in automotive systems. During initial stage, design is being specified and it undergoes number of experiments along with better overall analyses. After these steps, theses networks are being implemented in automotive systems.

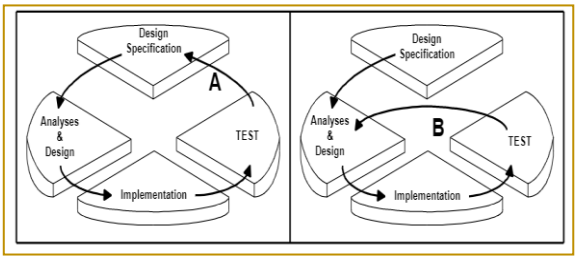

Fig2: Software development cycle

4.2 OSEK/VDX s

It defines a set of interfaces that make it possible to create portable and reusable software components. A structural overview of OSEK/VDXvii. The hardware and network involved are separated from the software application interface specification. The figure depicts this idea. Functionality can be scaled and configured, allowing for optimal application and architecture tuning. The specification makes functional validation and verification easier. The standardization of the API (Application Programming Interface) makes it possible to develop on a variety of platforms without having to learn a new toolset, which cuts down on development time. Now, a single microcontroller can house software from multiple vendors. In the past, products were developed independently, and competition rather than cooperation was the norm. Now, for the first time, the various system suppliers can work together effectively. The purse-string holders are currently modifying the regulations in some way. The ultimate objective of OSEK/VDX is cost reduction by facilitating the development of reusable embedded application software (Solikin, et al., 2020).

4.2 VDX Structural Overview

VDX is termed as a standard body that is formed by German automotive companies. It provides specification of software architecture into to form control system of vehicles. The figure below provides description of OSEK operating systems in which standard APi and protocols are used (Chan et al., 2020). Various layers included data, network and data link layer are used in this operating system for carrying different functions.

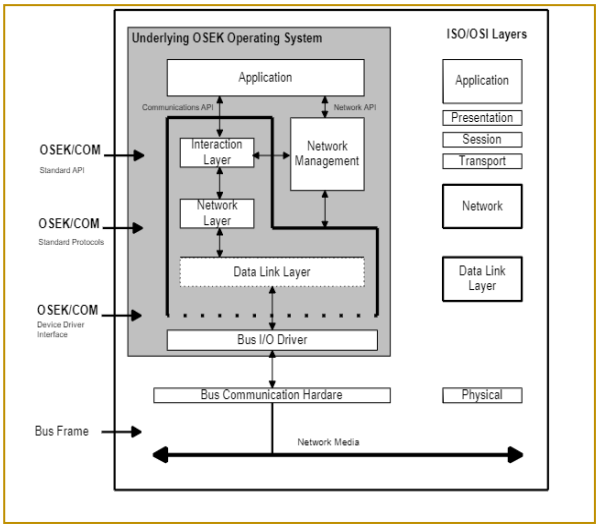

Fig3: VDX Structural Overview

V. CONCLUSION

In short, vehicle networks have been invented to overcome the problems associated with a bulk amount of wiring. The new automotive networks have led to several new opportunities in the industry. The control networks are highly established in high-end vehicles and can be easily applied to all types of vehicles despite differences in features. The control networks operate behind the scenes and have great effects on consumer perceptions. It offers new concepts in the features of vehicles. The control-by-wire solutions have provided new engineering solutions through which car users can easily trust electronics. These systems have lowered the usage of tired mechanical systems which may cause serious faults in the operation of vehicles. Software developments have become an essential part of engine designs in the automotive design process. The automotive-based industries should greatly benefit from the standardization of the vehicle network systems and software environments (Chan et al., 2020).

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