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MONITORING OF ADC FOR SYSTEM WITH REMOTEACCELERATOR PEDAL

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Abstract: Safety-critical automotiveapplications have extreme demands for functional safety and reliability. Conventionally, functional safety requirements have been managed by car manufacturers and system providers. Safety are going to be defined by concerning two existing safety standards: IEC 61508 (International Electro technical Commission (IEC) and ISO 26262. To achieve the safety requirements of automotive industry, the entire process of ISO26262 standard to be followed on every development cycle (Hardware/Software). This project presents Monitoring of ADC for system with remote accelerator pedal. It deals with monitoring the ADC data transfer and ensuring it's within limits required in automotive so as to forestall safety hazards. Additionally to already available accelerator pedal, ADC conversion in remote accelerator pedal also should be monitored parallel. It read analog value converted to digital value and given to controller. If there any failures happening inside ADC it'll effect total system, for that reason ADC monitoring is required. Here acceleration pedal position defines the driver requested engine torque. If the accelerator pedal position gets incorrectly read, there will be unwanted acceleration. For that case safety is required so we select ADC monitoring**.**

***Index Terms* - IEC 61508, ISO 26262, monitoring of ADC.**

I. INTRODUCTION

Automotive safety plays major role in today's world. It defines the study and practice of design, construction, equipment and regulation to reduce the occurrence and consequences of traffic collisions involving motorized vehicles. Automobile manufacturer give first preference to safety. The progression and development of the automobile has led to a rise within the dangers associated with its operation. Nowadays modern vehicles are equipped with many devices that help prevent serious injury within the event of a crash, or help avoid an accident all at once. Modern vehicles aren't just a mix of engine, chassis, body, and wheels. They're equipped with many sensors and electronic devices to help drivers. By 2020, around 35 percent of total manufacturing costs for vehicles are for electronics. However, with the increasing complexity of electronics involved, the demand of addressing functional safety is now propagating through the supply chain to semiconductor companies and design tool providers. The automotive industry is expanding exponentially and more features are being added to vehicles for safe driving.

Most of those features are integrated as an electronic system or subsystem. To correlate these electronic systems, vehicle manufacturers introduced Electronic Control Units (ECU). An ECU takes inputs from sensors and calculate data for its required task. In addition, one ECU can take input from another ECU to carry out its functions. This massive number of ECUs' communications create the in-vehicle network. Inside vehicles, any data transportation is happening through communication buses. Many sorts of communication buses are employed in current vehicles from that CAN bus is most ordinarily used.

To achieve the safety requirement of automotive industry, the entire process of ISO26262 standard to be followed on every development cycle. This voluntary industry standard is that the first comprehensive and voluntary automotive safety standard that addresses the functional safety of electrical and/or electronic (E/E) and software-intensive features in today's road vehicles. ISO 26262 is an adaptation of the International Electro technical Commission 61508 standard to road vehicles. ISO 26262 stipulates a safety engineering process for systems. It recognizes that safety may be a system attribute and might be addressed using a systems engineering approach. It also stresses the importance of cultivating a safety culture and applying the management of safety engineering. It uses hazard analysis methods to come up with system-level safety requirements, and safety analysis methods to come up with lower-level safety requirements among other inputs. Safety analyses on the system design to spot the causes of systematic failures and therefore the effects of systematic faults are applied in accordance with ISO 26262-9:2011 Clause 8. As a results of the analysis, Failures in its peripheral elements (Like ADC) to be detected. To avoid failures resulting from high complexity, the architectural design is predicated on the subsequent principles:

- Modularity and hierarchical design
- Testability
- Adequate level of granularity
- Simplicity

In this paper we specialize in Monitoring of ADC for system with remote pedal. Monitoring of automobile parts is extremely important. Here it check the inner ADC working is ok or not. Using ADC it'll read the analog signal and correspondingly produce digital value that's given to the controller. If there's any failures happening inside ADC it'll affect the overall working of system, for that purpose ADC monitoring is required. These are the subsequent monitoring test to be performed i.e. null load test pulse and test voltage check. The ADC must be monitored because the main torque request of the driver - the acceleration pedal and remote acceleration pedal position - is recorded via the ADC converter. Remote app is employed only in large engine vehicles to regulate the torque. If there's any failures happen inside ADC module, it'll do appropriate error reaction. So it'll analyze errors occurring in ADC also check the common cause failures are the failures regarding voltage, temperature and frequency impact the working of ADC. Also the function shall test the working of Interrupt service routine is correctly or not.

2. RELATED WORKS

The combined mismatch effects which bring on overlapping errors, I/Q imbalance, and jitter-induced distortions in FI-ADC systems are explicitly analyzed. A composite system behavioral model within the frequency domain has also been derived, which elucidates how these channel mismatch errors interact with one another. For the primary time, we have exploited the notion of autocorrelation matrix to quantify the combined overlapping effects caused by imperfect channel separation and incomplete anti-aliasing. Additionally, we have derived closed-form expressions for calculating the specific SNR and IRR for given parameters or their distributions [1].

automobiles are assembled with embedded electronic systems which include many Electronic Controller Units (ECUs), electronic sensors, signals, bus systems and coding. Because of the challenging application in electrical, electronics and programmable electronics, it's necessary to research the potential risk of malfunction for automotive systems. IEC 61508 has become a base for international standard of safety related system. The safety system failure plays a major role on the protection of humans and/or the environment. Thus, ISO 26262 has been introduced in November, 2011 for automotive electrical/electronic (E/E) systems which emphasizing the whole safety installation from sensor to actuator with its technical still as management issues [2].

Here it'll focusing in the development and implementation of digital driving system for a semi-autonomous vehicle to boost the driver vehicle interface. It uses an ARM based data acquisition system that Uses ADC to carry all control data from analog to digital format and visualize through LCD. CAN is employed for efficient data transfer. It also takes feedback of vehicle conditions and controlled by main controller. Furthermore this unit equipped with GSM which communicates to the owner during emergency situations[3]. The monitoring and control system of car engine temperature and battery voltage, light and carbon monoxide gas is done with the help of temperature sensor, 12V battery, light sensor and gas sensor. The LDR is used for detecting light due to spark or fire occurred in the car engine. A warning message about the presence or absence of CO gas in the car engine is displayed in LCD. A 12V DC fan is used to reduce the engine heat when the engine temperature has excess heat than normal engine temperature value. LED display is found if the car battery is full or low voltage condition. By the time spark or light is in the engine, the alarm system automatically activates with a limited time[4].

A new method for ADC nonlinearity correction has been described based on a Bayesian-filtering approach. The method can work on whatever stimulus signal is used without a priori knowledge about it. The proposed improvement has been checked by a numerical simulation using behavioral models provided by an ADC manufacturer and by an experiment in real ADCs. The most relevant drawback of this method is the need for a priori knowledge of the probability density function of the input signal. This is a limitation for the application of this method in fields where no information about the signal is available, such as in general-purpose instrumentation for signal analysis [5].

3. PROPOSED SYSTEM

3.1. Block Diagram

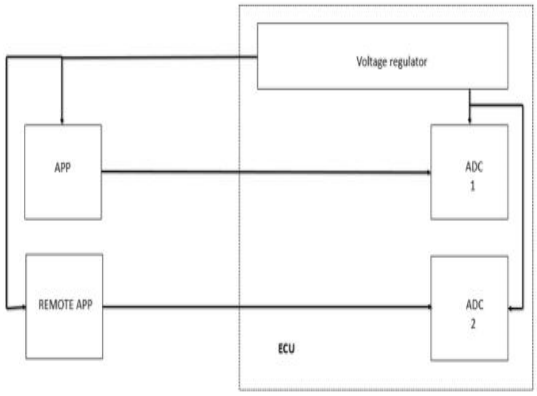

Fig 1: Block diagram of ADC monitoring system.

In present work, aims monitoring of internal ADC for the safety of automobiles. Analog-to-digital converters - These devices read the outputs of some of the sensors within the car, like the APP ad Remote APP. Secondary accelerator pedal (Remote APP) utilized in large engine vehicles to regulate the torque. If the accelerator pedal signal and remote accelerator pedal signal are read through an AD converter. The output of sensor is an analog voltage, the processor only understands digital value, therefore the analog-digital converter changes this voltage into a digital value. If there any problem inside ADC it'll effect total system, for that reason ADC monitoring is required. So it'll check the errors occurring in ADC like offset error, gain error, ADC isn't alive, mux stuck fault. Also it'll check the common cause failures are the failures regarding voltage, temperature and frequency that impact the working of ADC moreover because the function shall test the working of Interrupt service routine is correctly or not. Here acceleration pedal position (for APP & Remote APP) defines the driver requested engine torque. If the accelerator pedal position gets incorrectly read, there will be unwanted acceleration. For safety ADC monitoring is preferred. The subsequent monitoring tests are performed.

- Null load test pulse
- Test voltage check

A. Null Load Test Pulse

The ADC channel for the second accelerator pedal voltage (APP2) is pulled to ground every 320ms. Within the subsequent calculation interval, a check is carried out to see whether the last converted value lies below the applicable threshold. After this, the ADC channel of APP2 is released again. The ADC is taken into account as operational if the result's below the threshold. If the result's above the threshold, there's an error and therefore the idling test impulse is instantly repeated within the next calculation interval. Furthermore, an error reaction is requested after the debouncing counter has reached the ultimate value.

B. Test Voltage Check

A specified voltage is periodically converted via an extra ADC channel and it's checked, whether the converted value lays within the applicable limits. If the converted value isn't within these limits, an error reaction (injection quantity limitation) is requested after the debouncing counter has reached the ultimate value.

4. SYSTEM DESIGN

The monitoring of ADC system with remote accelerator pedal is done by checking the customer requirement. The customer requirements is noted in one tool that is RQONE (Rational Clear Quest), so the project tracking based on this RQONE number, the number will be unique for each customer requirement. RQONE tool show that the requirement that needed to be done and a short description, in our case the requirement will be ―Add Remote APP along with APP also the Remote APP can be monitored parallel‖. The next phase is the implementation of the requirement. In order to satisfy the requirement, find a slot for Remote APP. For that purpose ADC driver team has to be contacted, the discussion is end with an understanding that one time slot is not possible for APP & Remote APP to be force low. Also it doesn't allow to force low two signal at a time. So that reason find another interval for Remote APP. After that the developer do further analysis. Then find the failures needed to be detected. Suppose ADC fail, check what the error reaction to be triggered. So for finalizing the error reaction, recheck the customer requirement. Because it will mention there is same or different error reaction for APP and Remote APP. Also check there is separate status variable is needed to be set for APP and Remote APP.

After this next step is documentation that will be done in DOORS. Then the next phase will be the design phase. For design purpose there is one tool (Bosch tool) to be used, actually that tool is auto code generation tool. In our case this tool used for drawing design patterns instead of code generation. Here the coding will be done manually. Then the next phase is the documentation of specifications using LEA editor. Then the coding will be done in Notepad++. Next step is build using compilers, compilers will be different for each project and if the build was successful it will generate a hex file. Further step is to generate warnings using software analyzer. Also check it will satisfy the MISRA guidelines. Then ensure that there is no high prior warning. Then review will be done. For reviewingpurpose use one tool that is review tool, in that tool all review points are to be documented. Finally testing, for that purpose TPT (Time partition tool) is used for unit regression testing. The testing will be done for the whole component.

5. EXPERIMENTAL RESULT

As a result, we obtained ADC monitoring system with remote accelerator pedal. Here we use Accelerator pedal and Remote Accelerator pedal are used for ADC monitoring, both are used in different slots according to customer requirement. Also this system detects failures happening inside ADC and common failures. According to the failures happens, it will done the appropriate error reaction (injection cut off).

6. CONCLUSION

Globally, car companies spend about $36 billion annually for influencing new technologies in their vehicles. Some of the massive advancement in automotive industry in last 10 years have come in area of safety. This project discusses about safety measures that are needed within the automotive vehicle. ISO 26262 provides guidance to the automotive industry to take care of a safety level that has been achieved to a better level and also for new generation safety systems. System faults and random hardware faults are a number of the challenges within the increasing complexity and interaction of the E/E systems of rapid growing automobile's features in safety - critical markets. This project concentrate on internal ADC working fine or not. The ADC must be monitored because the main torque request of the driver - the acceleration pedal and remote acceleration pedal position - is recorded via the ADC converter. If there's any corruption happen in ADC module, it'll do appropriate error reaction.

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REFERENCE

[1] Jinpeng Song, "Analysis and Correction of Combined Channel Mismatch Effects in Frequency-Interleaved ADC", IEEE Transactions On Circuits And Systems–i: Regular Papers, Vol. 66, NO.2, February 2019.

[2] Azianti Ismail, "Research Trends in Automotive Functional Safety", International Conference on Quality, Reliability, Risk, Maintenance, and Safety Engineering (QR2MSE), 2013

[3] S. Vijayalakshmi, "Vehicle Control System Implementation Using CAN Protocol", International Journal of Advanced Research in Electrical, Electronics and Instrumentation Engineering, Vol. 2, Issue 6, June 2013.

[4] Moe MoeKhaing, "Microcontroller Based Automatically Car Engine Status Monitoring and Control System", International Journal of Scientific Engineering And Technology, Vol.03,Issue.08, May-2014.

[5] Luca De Vito, "An Improved ADCError-Correction Scheme Based on a Bayesian Approach", IEEE Transactions On Instrumentation And Measurement Vol.57, No.1, January

[6] Pavankumar Naik1, "An Automotive Diagnostics, Fuel Efficiency and Emission Monitoring System Using CAN", International Conference on Big Data, IoT and Data Science (BID) Vishwakarma Institute of Technology, Pune, Dec 20-22, 2017.

[7] Mohammed Ismail, "Design and Development of a Vehicle Monitoring System Using CAN Protocol", International Journal of Advanced Research in Computer and Communication Engineering, Vol. 4, Issue 11, November 2015.

[8] Presi.T.P, "Design And Development Of PIC Microcontroller Based Vehicle Monitoring System Using Controller Area Network (CAN) Protocol", Department of Applied electronics and instrumentation MES college of engineering Applications‖, IEEE Journal Of Oceanic Engineering, 2017.

[9] Bosch. CAN Specification 2.0. http://www.dcd.pl/dcdpdf/can2spec.pdf, 1991. Visited August, 2007.

[10] Beckers, Kristian, et al, "Systematic derivation of functional safety requirements for automotive systems", International Conference on Computer Safety, Reliability, and Security Springer, Cham, 2014.

[11] IEC."Functional Safety - Standards, ed. 1.0." 2007

[12] "ISO 26262: Road vehicles Functional safety", International Standard. 2011.

[13] Renjun Li, Chu Liu and FengLuo, "A Design for Automotive CAN Bus Monitoring System", IEEE Vehicle Power and Propulsion Conference (VPPC), September 3-5, 2008, Harbin, China

[14] CAN specification version 2.0. Robert Bosch GmbH, Stuttgart, Germany, 1991

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