A CAN PROTOCOL BASED EMBEDDED SYSTEM TO AVOID FRONT END COLLISION OF VEHICLES

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Abstract - There are lots of securities and other applications embedded in now days in vehicles. The driving habits of various individuals are different and we don't have any system which can monitor these conditions. A CAN protocol based embedded system to avoid front in collision of vehicles that works by collecting and sending actual, real-time data directly from leading vehicles or obstacles. You stay aware and informed, so you can reinforce responsible to alert and alarm, or immediately address areas of concern. In this paper designing to alert, alarm and to avoid front end collision of vehicles, which is based on CAN network. The CAN bus is used as a communication of a distributed control network. This paper mainly introduces the design of the hardware and the software in detail. This device track distance between two vehicles, speed, Engine temperature and vibration of a vehicle. With its unique Dashboard Reporting Tools, Owners not only know answers to where, when, and how fast, but importantly they now have insights as to "how" their driver is driving. Driving behaviours such as excessive braking, quick acceleration, and how those can change between the daytime and nighttimes are just some of the key areas analyzed. Dashboard Report provides a quick and easy to understand summary of behaviour of each section. This project is implemented in two sections. First one known runs with ARM data acquisition node to which sensors are connected and another ARM node connected with LCD display and motor. Communications between two nodes are accomplished through High Speed CAN communication. Sensors connected are temperature, speed, and MEMS sensors. The master node collects all these information through CAN network and stores in three sessions. To acquire the results, respective session switches are provided at the master node.

Keywords: CAN, ARM, TEMPERATURE SENSOR, ULTRASONIC SENSOR, MEMS ACCELEROMETER.

I. INTRODUCTION

As this project is implemented in two sections, first one known runs with ARM data acquisition node to which sensors and CAN are connected and another ARM with LCD and motor. Communications between two nodes are accomplished through High Speed CAN communication. Sensors connected are temperature, IR, MEMS and ultrasonic sensors. The master node collects all these information through CAN network and stores in three sessions. To acquire the results, respective session switches are provided at the master node. These results can be monitored on display. Automotive safety has gained an increasing amount of interest from the general public, governments, and the automobile industry. This is more than justified by traffic accident statistics, as each year around 1.2 million people die due to road traffic accidents. For these reasons safety remains a core value of Volvo Cars or vehicles. This paper presents some of the latest active safety developments within vehicles. Front-end collisions are common accident scenarios and a common cause of these accidents is driver distraction and thus not reacting in time. No vehicle system is a substitute for the most important safety feature in any vehicle: the driver. However, Volvo is harnessing innovative technologies to help alert drivers to avoid potential collisions and reduce the potential impact speed when a collision cannot be avoided. One of those systems is Collision Warning with Auto Brake where the area in front of the vehicle is continuously monitored with the help of ultrasonic sensor fitted in front of the vehicles. A warning/alarming and brake support will be provided for collisions with other front vehicles, both moving and stationary. Additionally, if the driver does not intervene in spite of the warning and the possible collision is judged to be unavoidable; intervention braking is automatically applied to slow down the car. This aims at reducing impact speeds and thus the risk for consequences. This system has been verified using innovative CAS methods and practical tests. Finally, it is discussed how the benefit of such systems can be judged from real-life safety perspective using traffic.

II. LITERATURE SURVEY

In February 28, 2015 study by Smart Computing Review presented the Driver Authentication and Accident Avoidance System for Vehicles. The method it was build the system to avoid the accidence and save the human life and the system was provided by substantial numbers of sensors all these sensors work as a subsystem such as Alcohol Detection System. This system mainly is designed to know the driver conditions if he is drunk or not. And if the driver is drunk the system will automatically define that and turn off the engine and the car can't work until the driver is outreaches from the drunk and alerts the driver by tune. The methodology of his work is to measure the breath

to determine alcohol consumption. In connection to the second method that he was used is heat rate sensor and this method basically measure the heart beat signal in beats per mints. If the driver heart rate is normal that is ok otherwise send the alarm message to hospital that's means the driver in the critical position or has heart attacks. With regard to that there are another method named human identification method. The principle of this method is to tell the driver by the number of human inside the car because if any one existed inside the car by default the car's window is closed and this issue make asphyxia by time. And this system automatically open the windows if there is someone inside the car without the driver knowing and send a warning to the driver. [1] In MAY 8, 2015 project by ARPN Journal of Engineering and Applied Sciences Presented predictive vehicle collision avoidance system using raspberry-bi it seemed like to avoid accidence in the blind spot area using ultrasonic sensor using raspberry-bi module. The ultrasonic sensor work like radar system to detect the obstacles in the blind spot that can Couse the accidence but it is cheaper than it. In addition to that the ultrasonic sensor is used to measure the distance between the vehicle and the obstacles and saved the distance safe before fatalities happened and alerting the driver before the accidence using two ways visualization using light emitting diode (LED) and make a sound using buzzer and the driver alone apply the brake or steering to controlling on the speed. The main advantage of ultrasonic sensor is that it provides highest reliability in getting proximity and has lesser absorption than RF and IR frequencies. [2] In DEC 2, 2013 study by International Journal of Computer Trends and Technology Presented Advanced Accident Avoidance System for Automobiles. This paper discussed the most important factors of accident due to the intersection accidence and the bad weather and this whether to some extent either the heavy rain, huge ice or high darkness. Indeed this bad weather conditions the driver feel very harsh to drive the vehicle and can't controlling the car. In this paper there are for types of sensors such as lm35 temperature sensor and humidity sensor and those sensors are used to check the weather states and alert the driver if any thinks happen in the weather. And there are a substation number of ultrasonic sensors to detect the near car and infrared sensors used to detect the forward cars by using burst of light to measure the cars speed, distance and position those sensors were fixed in the both car sides and in the forward of the vehicle to avoid all the cars and any barrier and alert the driver. This system were provided by Global System for Mobile communications (GSM) and Global Positioning System (GPS) module. If the accidence were happened then the system automatically take apposition of the car and send it to the police office and the driver family to save the driver and passengers health. In November 5, 2012 study by International Journal of Soft Computing and Engineering Presented Vehicle Collision Avoidance System Using Wireless Sensor Networks. This paper presented the make use of the wireless sensor network (WSN) to transmit the measured data in avoidance system and the using the controller area network protocol (CAN) bus to revive the data and connect the data with the controller to controlling on the actuators. Actually this system mainly consist of laser transmitter and receiver. And the laser transmit a burst of electromagnetic radiation and when this radiation reflect by the barrier then this reflect light transmitting via Zig Bee module to the controller using 2.4 GHz in this step the data that received by Zig Bee receiver then the controller decide about the barrier and send the order using CAN bus to the liquid crystal display (LCD) to alert the driver about the in front vehicle. In this case the driver is decided to avoid the accidence as much as possible. [4] In Jan 1, 2015 project by American Society for Engineering Education presented Vehicle Collision Avoidance System. This paper presented and discussed the vehicle collision avoidance system and alert the driver by every things surrounding the vehicle audible and visualize this is to decrease the number of accident and reduce the human and economic losses. Although they are used the ultrasonic sensor to cover all the blind spot area and then they used radar system and video. It is one of the most popular method in long rang detection for frontal collision avoidance system but it is an active type of detection, as for the Video on the other hand is passive, meaning that it simply receives light from its surroundings. Active detection systems are often more expensive because they require more equipment On the other hand, they are typically more reliable than passive systems.

III. BLOCK DIAGRAM

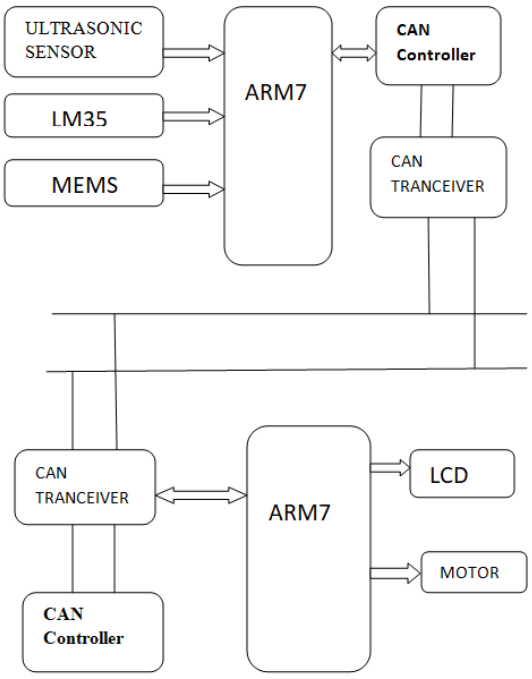

Fig4.1 Block diagram of a CAN protocol based embedded system to avoid front end collision of vehicles

IV. HARDWARE REQUIREMENTS

A. *ARM7*

The ARM7TDMI-S core is the synthesizable version of the ARM7TDMI core, available in both VERILOG and VHDL, ready for compilation into processes supported by in-house or commercially available synthesis libraries. Optimized for flexibility and featuring an identical feature set to the hard macro cell, it improves time-to-market by reducing development time while allowing for increased design flexibility, and enabling >>98% fault coverage. The ARM720T hard macro cell contains the ARM7TDMI core, 8kb unified cache, and a Memory Management Unit (MMU) that allows the use of protected execution spaces and virtual memory. This macro cell is compatible with leading operating systems including Windows CE, Linux, palm OS, and SYMBIAN OS.

The ARM7EJ-S processor is a synthesizable core that provides all the benefits of the ARM7TDMI – low power consumption, small size, and the thumb instruction set – while also incorporating ARM's latest DSP extensions and Gazelle technology, enabling acceleration of java-based applications. Compatible with the ARM9™, ARM9E™, and ARM10™ families, and Strong-Arm® architecture software written for the ARM7TDMI processor is 100% binary-compatible with other members of the ARM7 family and forwards-compatible with the ARM9, ARM9E, and ARM10 families, as well as products in Intel's Strong ARM and xscale architectures. This gives designers a choice of software-compatible processors with strong price-performance points. Support for the ARM architecture today includes:

- Operating systems such as Windows CE, Linux, palm OS and SYMBIAN OS
- More than 40 real-time operating systems, including qnx, wind river's vx works

B. *MEMS ACCELEROMETER*

MEMS accelerometers are one of the simplest but also most applicable micro-electromechanical systems. They became indispensable in automobile industry, computer and audio-video technology. This seminar presents MEMS technology as a highly developing industry. Special attention is given to the capacitor accelerometers, how do they work and their applications. The seminar closes with quite extensively described MEMS fabrication.

C. *ULTRASONIC SENSORS*

Ultrasonic sensors service the market by providing a cost effective sensing method with unique properties not possessed by other sensing technologies. By using a wide variety of ultrasonic transducers and several different frequency ranges, an ultrasonic sensor can be designed to solve many applicationproblems that are cost prohibitive or simply cannot be solved by other sensors.

Long range detection: In industrial sensing, more and more applications require detection over distance. Ultrasonic sensors detect over long ranges up to forty feet, while limit switches and inductive sensors do not

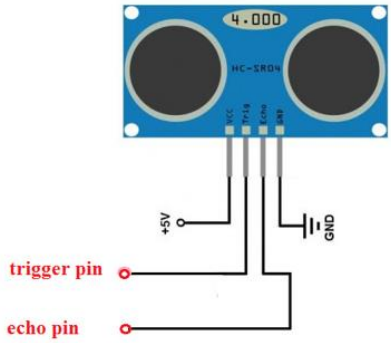

Fig 5.3 ultrasonic sensor

D. *CONTROLLER AREA NETWORK (CAN)*

The development of CAN began when more and more electronic devices were implemented into modern motor vehicles. Examples of such devices include engine management systems, active suspension, ABS, gear control, lighting control, air conditioning, airbags and central locking. All this means more safety and more comfort for the driver and of course a reduction of fuel consumption and exhaust emissions. To improve the behaviour of the vehicle even further, it was necessary for the different control systems (and their sensors) to exchange information. This was usually done by discrete interconnection of the different systems (i.e. point to point wiring). The requirement for information exchange has then grown to such an extent that a cable network with a length of up to several miles and many connectors was required. This produced growing problems concerning material cost, production time and reliability the solution to this problem was the connection of the control systems via a serial bus system. This bus had to full fill some special requirements due to its usage in a vehicle. With the use of CAN, point-to-point wiring is replaced by one serial bus connecting all control systems. This is accomplished by adding some CAN-specific hardware to each control unit that provides the "rules" or the protocol for transmitting and receiving information via the bus.

E. *LM35 TEMPERATURE SENSOR*

The LM35 series are precision integrated-circuit temperature sensors, whose output voltage is linearly proportional to the Celsius (Centigrade) temperature. The LM35 thus has an advantage over linear temperature sensors calibrated in ° Kelvin, as the user is not required to subtract a large constant voltage from its output to obtain convenient Centigrade scaling. The LM35 does not require any external calibration or trimming to provide typical accuracies of ±¼°C at room temperature and ±¾°C over a full -55 to +150°C temperature range. Low cost is assured by trimming

and calibration at the wafer level. The LM35's low output impedance, linear output, and precise inherent calibration make interfacing to readout or control circuitry especially easy. It can be used with single power supplies, or with plus and minus supplies. As it draws only 60 µA from its supply, it has very low self-heating, less than 0.1°C in still air. The LM35 is rated to operate over a -55° to +150°C temperature range, while the LM35C is rated for a -40° to +110°C range (-10° with improved accuracy). The LM35 series is available packaged in hermetic TO-46 transistor packages, while the LM35C, LM35CA, and LM35D are also available in the plastic TO-92 transistor package.

Fig 5.5 LM35

F. LCD MODULE

Dot matrix LCD modules is used for display the parameters and fault condition.16 characters 2 lines display is used. It has controller which interface data's and LCD panel. Liquid crystal displays (LCD's) have materials, which combine the properties of both liquids and crystals. Rather than having a melting point, they have a temperature range within which the molecules are almost as mobile as they would be in a liquid, but are grouped together in an ordered form similar to a crystal. An LCD consists of two glass panels, with the liquid crystal material sandwiched in between them. The inner surface of the glass plates are coated with transparent electrodes which define the character, symbols or patterns to be displayed polymeric layers are present in between the electrodes and the liquid crystal molecules to maintain a defined orientation angle

Fig 5.6 LCD

V. SOFTWARE REQUIRMENT

A. KEIL C

Keil software is the leading vendor for 8/16-bit development tools (ranked at first position in the 2004 embedded market study of the embedded system and EE times magazine). Keil software is represented worldwide in more than 40 countries, since the market introduction in 1988; the keil C51 compiler is the de facto industry standard and supports more than 500 current 8051 device variants. Now, keil software offers development tools for ARM.

B. FLASH MAGIC

Flash magic can control the entry into ISP mode of some microcontroller devices by using the COM port handshaking signals to control the device. Typically the handshaking signals are used to control such pins as Reset, PSEN and VCC. The exact pins used depend on the specific device.

When this feature is supported, Flash Magic will automatically place the device into ISP mode at the beginning of an ISP operation. Flash Magic will then automatically cause the device to execute code at the end of the ISP operation.

C. ORCAD

ORCAD really consists of tools. Capture is used for design entry in schematic form. You will probably be already familiar with looking at circuits in this form from working with other tools in your university courses. Layout is a tool for designing the physical layout of components and circuits on a PCB. During the design process, you will move back and forth between these two tools.

VI. RESULT

The main aim of the project to develop a system automatic to prevent or avoid front end collision of vehicle and accident avoidance using ultrasonic sensor whenever any obstacle is detected in running vehicle depends on distance automatically control the speed of vehicle and vehicle will be stopped automatically, not manually.

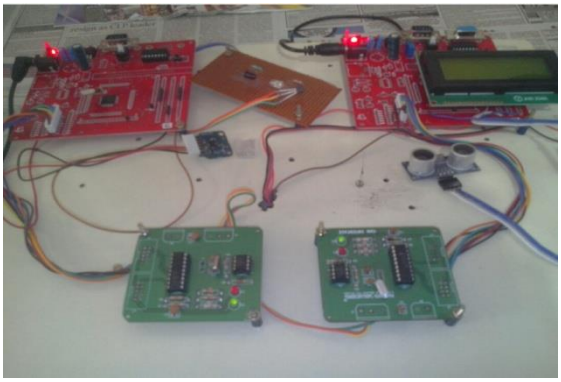

Fig 7.1 Output of proposed system

This CAN based embedded system is smart, economic and efficient for automobile companies.The system ofmodule monitoring and controlling different parameter like distance between vehicles, temperature, vibration of engine. The whole system has low-cost and easy to maintain and given

up gradation facility. Using ARM7LPC2148 can reduce cost as well as the complexity of monitoring and controlling of data.

Real time data monitoring and controlling of vehicles from collision/accident is possible using CAN protocol and different sensors like ultrasonic, temperature and MEMS accelerometer sensors.
The sensor readings will be continuously transmitted to the dash board part ARM core. The system is integrated with CAN controller for the effective control of collision avoidance parameters.
In future we can extend this network to host multiple clients in order to obtain real world evaluation results. Furthermore, we will integrate the GPS, GSM to get the location of accident occurring.

We can integrate high strength of ultrasonic sensor to measure long distance for high speed vehicles. Going further, most of the units can be embedded within the controller such as android application, with change in technology thereby improving the detection system. Combination of this Sensors network and other wireless devices would dominate in the near future. Many "works are inprogress" that will surely develop into more usable devices in the future.

VII. REFERENCES

[1]. Li Ran, Wu Junfeng, Wang Haiying, Li Gechen. "Design Method of CAN BUS Network Communication Structure for Electric Vehicle", IFOST 2010 Proceedings IEEE.

[2]. Yujia Wang, Hao Su, Mingjun Zhang., "CAN-Bus-Based Communication System Research for Modular underwater Vehicle", 2011 IEEE DOI 10.1109/ICICTA.2011.

[3]. Chin E. Lin, S. F. Tai, H. T. Lin, T. P. Chen, P. K. Chang, C. C. Kao "Prototype Of A Small Aircraft Avionics Using Hybrid Data Bus Technology" 2005 IEEE

[4]. Chin E. Lin, Hung-Ming Yen, "A Prototype Dual Can-Bus Avionics System For Small Aircraft Transportation System" 2006 IEEE.

[5]. V. Claesson, C. Ekelin, N. Suri, "The event-triggered and time- triggered medium-access methods", 6th IEEE International Symposium on Object-Oriented Real-Time Distributed computing, May 14-16, 2003, pp. 131-134.

[6]. Chris Quigley, Richard McLaughlin, "Electronic System Inte-GrationFor Hybrid And Electric Vehicles".

[7]. Chin E. Lin, H. M. Yen, "Reliability And Stability Survey On Can-Based Avionics Network For Small Aircraft" -7803-9307- 4/05/2005 IEEE.

[8]. Feng Xia, Xiaohua Dai, Zhi Wang, and Youxian Sun, "Feedback Based Network Scheduling of Networked Control Systems"2005 IEEE.

[9]. Ashwini S.Shinde, Prof.Vidhyadhar B. Dharmadhikari, "Controller Area Network for Vehicle Automation" International Journal of Emerging Technology and Advanced Engineering www.ijetae.com ISSN 2250-2459, Volume 2, Issue 2, February 2012.

[10]. MazranEsro, Amat Amir Basari, Siva Kumar S, A. Sadhiqin M I, ZulkifliSyariff, "Controller Area Network (CAN) Application in Security System" World Academy of Science, Engineering and Technology 35 2009.

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