Reducing Accidents of Vehicles by using CAN(Control area network) System

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Abstract

In this era of civilization the requirement of a vehicle in human's daily life is not compormisable. Everytime we want to save our precious time while covering a distance or travelling , in which a vehicle can help us very conveniently and easily. But the vehicle has no brain or power of thinking. The vehicle or the automobile we are driving doesn't know what wrong and what right is. We have to drive it safely so that nothing hazard would happen. But human brain can't be conscious every instance of time, as we human also need rest at some time after doing some job/work and sometimes it goes wrong and mishappens and we face collision and accidents which may cost precious lives. In this scenario we are using CAN (Control Area Network) [7] to avoid collision between vehicles and to minimize the rate of accidents. So in this session we will briefly discuss about high level CAN protocol system and it's use in vehicles to avoid Accidents.

Keywords: *CAN System, collision avoiding, Driver Assistance, Safe driving*

Introduction

The advancements in Vehicle and automobile sectors in modern era has a great impact on human society and people's daily life as well. From the very first day when a Vehicle was discovered, human life has become more easy and convenient to move from one place to another in a time saving and easy way which saves too much efforts and man power. As we can see in 21st century, the automobiles ad vehicles are increasing day by day to help people in covering more distance in less amount of time without any effort, also the risk of accidents and collisions are increasing drastically every day. Researchers and engineers are trying their best to bring out some revolutionary advancement in Automobile industries as well as in the control system of human driven vehicles to avoid maximum numbers of accidents and collisions between vehicles and automobiles. So the advancements in this type of case has been enhanced by implementing "Advanced Driver Assistance System(ADAS)"[1] in which image processing and real time data analysis are done in order to make a vehicle stable on road and maintaining a safe control over the wheels and vehicle control system(steering, breaks, clutch, gears and traction control). So the main aim of engineers and researchers is to make strong communication between vehicles by which they can communicate with each other in order to avoid collision. It is somehow possible by CAN (Control Area Network)[8] which can be also called as the new era communication system of vehicles where vehicles can also talk to each other. Basically it was first introduced by BOSCH company to replace old and traditional complex and expensive in car wiring system. It may be a wireless network of a certain short range or a long range depending upon the CAN Architecture of any vehicle[3].So in this review study we are

going to discuss on a brief demonstration of CAN system, its architecture, basic types of CAN[8] system and how it helps in decreasing collisions and accidents between vehicles and automobiles.

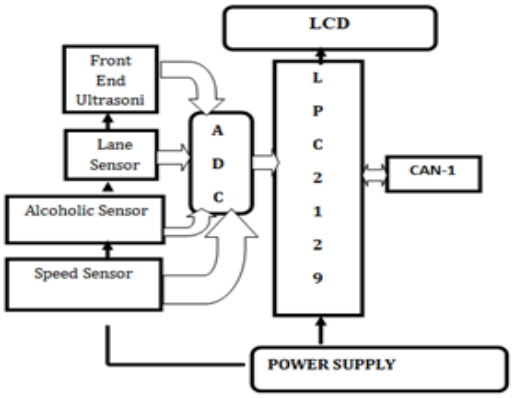
Literature Survey

Basic Types of CAN System [8]

1)Standard CAN
2)Extended CAN

How CAN system is used in Vehicles and Automobiles

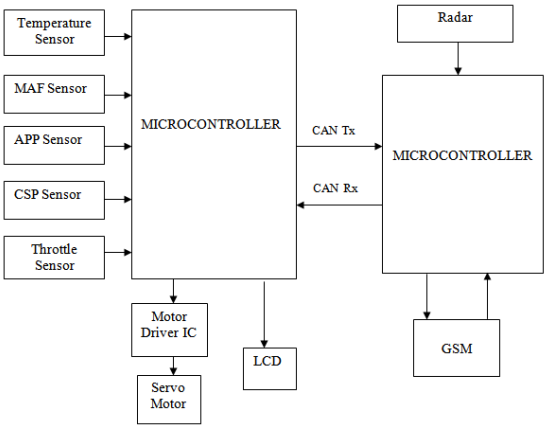
There are several kinds of techniques to implement CAN system in vehicles. We will discuss some of those in this study.
1) Firstly we will discuss about the CAN based collision avoiding systems whose idea was given by M. Suresh and T.VenkathaRamana[1], made up of and controlled using Phllips LPC2129 32 bit microcontroller[1]. It has a ARM7TDMI processor having a lot of onboard interfaces. It includes I/O, LCDs and CAN controller. It has the CAN bus for transmission of analog and digital data which are collected from various sensors and transducers.[1]



(Figure 1)

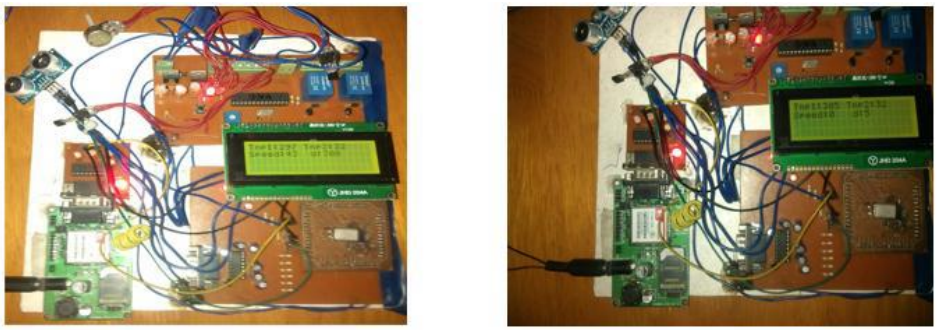
In this process the sensors and transducers in the CAN system sends and receive signals from other cars on the road as well as some other major obstacles . The central database of the CAN system in the vehicle analyze the sensors data and make some brief data analysis to provide some quick assumptions and probabilities of other vehicles and obstacles on the road. The high gain ultrasonic sensor measures other vehicle's distance from the vehicle in which the CAN system is fixed. All the data are further calibrated and analyzed by the data base to make some future assumption to avoid maximum chances of collision between 2 vehicles.

2) Another convenient idea which is given by Ms. Divya K.S , Ms. K.A Drishya, Mrs. Neenu P.A, Mr. Shaktiprasad K.M, [7] is to implement the CAN system using 2 micro controllers on the CAN protocol. This idea is based upon the communication establishment between 2 vehicles to share sensor data with each other. This idea deals with avoiding crash between vehicles by controlling the speed of vehicle when the driver is asleep or not in conscious state to drive. It mainly sense the acceleration and retardation to control the vehicle at any stage and doesn't allow the vehicle to cross It's speed limit and breaking limits. This system has also an obstacle sensing ability by means of which it sense the obstacle near to the vehicle and warns the driver to take necessary action. It also calculates the overall distance of that obstacle from the vehicle. The system can also warns the driver for the obstacle on the basis of level of damage that the obstacle can give to the vehicle.



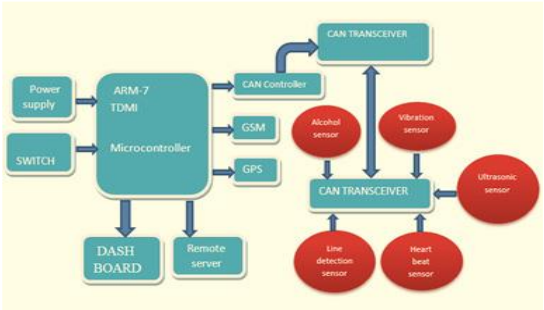
(Figure 2)[7]

The radio waves of radar system in this kind of CAN system frequently emits radio signals and the signals are reflected by the obstacles, in this way the system majors the distance , altitude, height , length of the obstacle and also identify the level of damage that can be occur due to collision. The whole system is based upon RADAR signal and the ARM-7 controller is synchronized and connected with the RADAR system to give real time data to the driver and the control system of the vehicle. Here for achieving high speed real time information processing 2 micro controllers are used at a same time .



(Figure 3) [7]

3) It is an other relevant purpose of CAN based collision avoiding system which was given by Ratnaprabha Kasde and G.Gugapriya[2]. In their study of research they have given some basic principle ideas on ARM-7 TDMI general purpose micro controller to use it in CAN system to control various sensors to get output of some general operations such as intensity of heart beat, vibration, IR sensor, proximity, alcohol detection, ultrasonic readings, GPS real time data. These all things are included in this system's hardware architecture. The CAN system is a peer to peer single wire communication system and the nodes this system is having have equal priorities over the network of CAN.



(Figure 4) [2]

Whenever the CAN system transmit data , firstly it checks the status of CAN BUS if it is busy or free to receive data from the system. At a single time only one single node can share data with the CAN

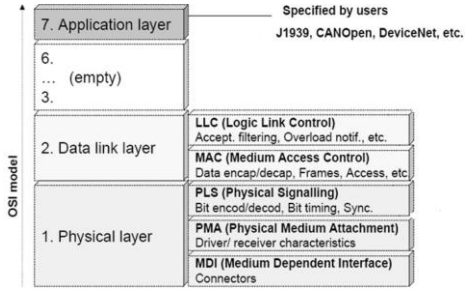
bus and the CAN controller decides which task to perform first for better performance and results. The ARM-7 TDMI controller is used with the help of various softwares such as Keil and Flash magic . For a better and perfect ral time information processing this system should be used with good quality Ethernet cable for better data transmission between the CAN bus and the ARM-7 TDMI controller circuit .

Start of Frame	Arbitration Field	Control Field	Data Field (up to 8 bytes)	CRC Field	ACK Field	End of Frame

(Figure 5) CAN data frame

When the driver is driving the vehicle the CAN system will be continuously measuring the data given by the alcohol sensor and heartbeat sensor. Measuring these two major levels the level of risk while driving can be given as a output by the CAN system. The vibration sensor's data is processed by the ARM-7 TDMI and the signals are transmitted to CAN bus to check the level of damage that can be possible on the body of vehicle and warns the driver to slow down the vehicle in order to reduce the vibration of the vehicle. The ultrasonic sensor detects any obstacles along with dangerous roughness on the road to avoid collision. The IR sensor can measure the heat level of the atmosphere to ensure the low level of risk of burning of engine.

4) This is the 4th purpose which was was given by Kshyap Joshi and Vipul Gohil[3] which represents a brief idea on ARM-7 based controller area network to avoid crash and collisions between vehicles and Automobiles . In their brief study and research they have mentioned especially about ARM-7 micro controller as well as emphasizing on cost effectiveness and budget friendliness for people. The CAN protocol which they have mentioned in their study uses non-destructive bitwise arbitration process by means of which shared resources are accessed to use for real time information and data processing. Use of large amount of overhead along with 15-bit CRC makes CAN system more reliable and secure in terms of safety and precautions.



(Figure 6) Hierarchical structure of CAN BUS

This CAN system is using several kinds of sensors such as Bump sensor, Alcohol detection sensor, speed sensor, Lane sensor, ultrasonic sensor and some other hardwares such as Microcontroller(ATMEGA based controllers), Host Microprocessor, Transceiver.The CAN system calibrates the sensor data up to the microcontroller understood level signal and then Microprocessor
This system using an Algorithm to perform every necessary task. The following algorithms are the process and directions which command the whole system to perform necessary task to takes necessary action to avoid any kind of crash, collisions or accidents.
Make the driving safe and accident less.

a). ***Transmitter***

Algorithm for transmitter side which consists sensors, AVR microcontroller and CAN (MCP2515) is as follows:

1. SPI initialization (Serial Interface).
2. starting the LCD.
3. Initialize CAN (MCP2515).
4. giving impulse to ultrasonic sensor.
5. Measure distance from other vehicles in its region.
6. measuring distance through CAN (MCP2515).
7. If alcohol is sensed by sensor then give signal to system otherwise go to step 8.
8. If lane cutting on road is detected then send signal to system otherwise go to step 9.
9. measure the vehicle speed and if speed is beyond safe limit send signal to system otherwise go to
step 10.
10. sense impact and if impact is being detected, then send signal to system otherwise go to step 4

b) ***Receiver***

Algorithm for transmitter side which consists outputdevices, AVR microcontroller and CAN (MCP2515) is as follows:

1. Start SPI (Serial Peripheral Interface).
2 . Initialize the LCD.
3 . Initialize the CAN (MCP2515).
4 . Send processed information to the transmitter.
5. Receive the distance measured data from transmitter and ensure
If the distance is less than safe value then give a warning signal to the driver.
6. If signal is received then show “it is unsafe to start ” else go
to 7.
7. If lane cutting signal is received then show “the lane is wrong” else go to 8.
8. when warning data are processed and obstacle is found then turn the buzzer on else go to 9th step.

Conclusion

Finally from the above study I found a lot of things and facts and experimental proof regarding CAN system using various kind of Microcontrollers and how the CAN system works in avoiding accidents and collisions between Cars and other motor vehicles. There are a lot of researchers till yet who have published their articles and research papers , in which they have put their point of views, proofs and possibilities of improving and

developing the CAN system to its optimum work efficiency. In my Review study I studied some of them and found that CAN system's work efficiency and accuracy depends upon various factors such as the Accuracy of microcontroller, data and signal processing power of system, Wireless system efficiency and strength, type of software which is being used in CAN system, Data analysis and future assumption ability of the system, Algorithm of work flow, efficiency and accuracy of data transmission within the sensors and signal processing, Accuracy and efficiency of all sensors used in a CAN system, Error detection and some other technical facts.

At last I found that the system which is being researched and designed by by Ms. Divya K.S , Ms. K.A Drishya, Mrs. Neenu P.A, Mr. Shaktiprasad K.M [7] is more reliable and convenient in terms of work efficiency and safety. Some other non-technical factors also matters such as cost effectiveness, user friendliness, ease in implementation and power consumption. In this system the implementation of RADAR makes it more reliable and srong in communication within the sensors and micro controllers. The combination of RADAR system with the ARM-7 TDMI makes the whole system more fast and accurate. The use of 2 micro controllers makes it more powerful and accurate in terms of work flow and efficiency. So in my over all point of view the CAN system[7] which is designed and researched by Ms. Divya K.S and her team is more reliable to implement in a vehicle.

Acknowledgments

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References

Journal Article

[1] M. Suresh, T. Venkata Ramana, "CAN based accident avoidance system for automobiles", international journal & magazine of engineering,Technology,Management and Research, ISSN No.:23484845,volume 3(2016), issue No. 12(December), www.ijmetmr.com

[2] Ratnaprabha Kasde, G.Gugapriya, "Accident Avoidance system using CAN" ,Indian journal of science and technology,volume 9(30) August 2016, , IISN No.:09746846, 09745645, www.indjst.org

[3] Kashyap Joshi, Vipul Gohil, "ARM 7 Based controller area network for accident avoidance in automobiles", International Journal of Engineering Trends and Technology, Volume-9,issue 2-March 2014,ISSN No.:22315381, www.ijettjournal.org

[4] S Shanmathi, Prof. C Kamalakanthan, Dr. S.M Ramesh, Dr. S Valarmathy, B Preethi, "Arduino Based CAN Protocol implementation in Vehicle Control System", International Advanced Research Journal in Science, Engineering and Technology, Vol 1, Issue 2, October 2014, www.iarjset.com

[5] Krishnaveni.K and Roopa M , "Implementation of CAN protocol for alerting of vehicle accident using GSM and GPS", International Journal of Engineering Research and General Science Volume 3, Issue 3, Part-2 , May-June, 2015, E-mail: krishnaveni.chethan@gmail.com , surajroopa@gmail.com, www.ijergs.org.

[6] L Navaneeth, Dr. V Rukkumani, "Automatic Vehicle Control Using CAN Protocol" , International Journal of Applied Research , Volume2(3), 2016 issue, ISSN Print :23947500, ISSN Online : 23945869, www.allresearchjournal.com

[7] Ms. Divya KS, Ms. K.A Drishya, Mrs. Neenu P.A, Mr. Shaktiprasad K.M, "Vehicle speed control system using CAN", IJSTE - International Journal of Science Technology & Engineering | Volume 1 | Issue 10 | April 2015 ISSN (online): 2349-784X, *www.ijste.org*

BOOK

[8] Steve Corrigan, Application report on "Introduction to the Control Area Network", Texas Instruments , SLOA101B–August 2002–Revised May 2016, www.ti.com , Texas Instruments, Post Office Box 655303, Dallas, Texas 75265, Copyright © 2018, Texas Instruments Incorporated