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Vehicle To Vehicle Communication

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Abstract: Intelligent vehicle cooperation based on reliable communication systems contributes not only to reducing traffic accidents but also to improving traffic flow. Adaptive Cruise Control systems can gain enhanced performance by adding vehicle–vehicle communication to provide additional information to augment range sensor data, leading to Co-operative ACC. This project presents the design, development, implementation, and testing of a CACC system. In the prototype, we are going to design the ACC using an ARM micro-controller as the Main controller and another ARM as the Low level controller. Using Controller area network protocol the slave module will transmit the data i.e. GPS location, Speed using speed sensor and distance based on ultrasonic sensor interface. The data will be transmitted to the Master Controller for analysing, then will control the motor.

Keywords: Control Area Network; Global System for Mobile Communication; LCD; ARM Controller.

I. INTRODUCTION

Significant developments in Advanced Driver Assistance Systems (ADAS) have been achieved during the last decade. Intelligent systems based on on-board perception/detection devices have contributed to improving road safety. The next step in the development of ADAS points toward vehicle-to-vehicle (V2V) communications to obtain more extensive and reliable information about vehicles in the surrounding area, representing cooperative Intelligent Transportation Systems (ITS). Using wireless communication, potential risk situations can be detected earlier to help avoid crashes, and more extensive information about other vehicle's motions can help improve vehicle control performance.

Research projects have been conducted throughout the world to define the requirements for an appropriate vehicular communication system and its possible applications. Although most of the V2V cooperative ITS applications have been focused on improving collision avoidance and safety, the extension of the commercially available Adaptive Cruise Control (ACC) system toward the Co-operative ACC (CACC) system has a high potential to improve traffic flow capacity and smoothness, reducing congestion on highways. By introducing V2Vcommunications, the vehicle gets information not only from its preceding vehicle as occurs in ACC but also from the vehicles in front of the preceding one. Due to this preview information, oscillations due to speed changes by preceding vehicles can be drastically reduced.

II. PROPOSED WORK

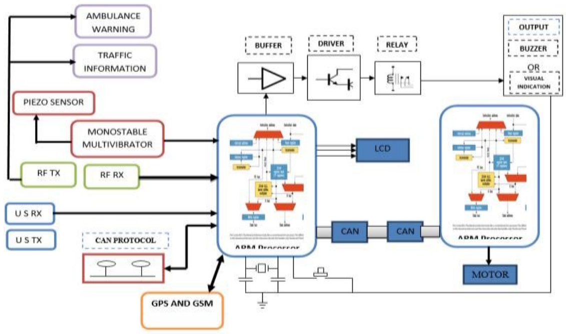


Fig 1. Block Diagram of CACC system based on CAN protocol

a) *Power supply unit*: This section needs two voltages viz., +12 V & +5 V, as working voltages. Hence specially designed power supply is constructed to get regulated power supplies.

b) *ARM processor*: ARM is computer processor based RISC architecture. A RISC-based computer design approach means ARM processors require significantly fewer transistors than typical processors in average computers. This approach reduces costs, heat and power use. The low power consumption of ARM processors has made them very popular.

c) *CAN bus*: CAN bus (for controller area network) is a vehicle bus standard designed to allow microcontrollers and devices to communicate with each other within a vehicle without a host computer. CAN bus is a message-based protocol, designed specifically for automotive applications but now also used in other areas such as aerospace, maritime, industrial automation and medical equipment.

d) *Buffers*: They do not affect the logical state of a digital signal (i.e. a logic 1 input results in a logic 1 output whereas logic 0 input results in a logic 0 output). Buffers are normally used to provide extra current drive at the output but can also be used to regularize the logic present at an interface.

e) *Drivers*: This section is used to drive the relay where the output is complement of input which is applied to the drive but current will be amplified.

f) *Relays*: It is an electromagnetic device which is used to drive the load connected across the relay and the o/p of relay can be connected to controller or load for further processing.

g) *RF Transmitter*: The RF transmitter is built around the ASIC and common passive and active components, which are very easy to obtain from the material shelf. The circuit works on Very High Frequency band with wide covering range. The Carrier frequency is 147 MHz and Data frequencies are 17 MHz, 19 MHz, 22 MHz & 25 MHz. It should be noted that ASIC or Application Specific Integrated Circuit is proprietary product and data sheet or pin details or working principles are not readily available to the user.

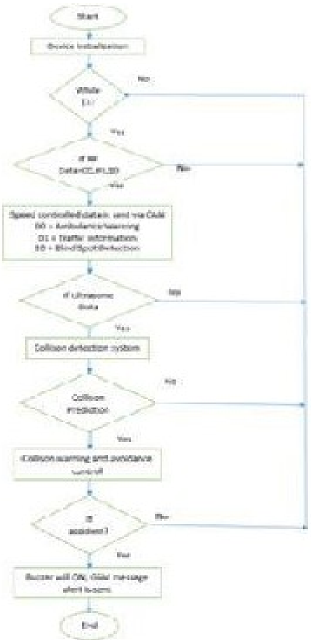
h) *RF receiver*: This circuit is built around the ASIC i.e., Application Specific Integrated Circuit, hence less circuitry is observed. The Radio Frequency tuned circuit has 147 MHz carrier frequency with four options viz., 17 KHz, 19KHz, 22 KHz and 25 KHz. The transmitted signals are received on coil L1 which acts as receiver antenna. The oscillator transistor removes the received signals from 147MHz carrier frequency and fed to ASIC. The tank circuit formed by C1 and L1 gives the carrier frequency range. The current limiting resistor R1 and bypass capacitor C5 stabilizes the oscillator. The resistor R2, R3 and R4 provide the biasing voltage to the oscillator transistor T1. Capacitors C2 and C3 are there to bypass the noise and harmonics present in the received signals. Through coupling capacitor C7 output of the RF Receiver is fed to ASIC. The ASIC manipulates the received signal and gives out four channels as output viz., 17 KHz, 19 KHz, 22 KHz and 25 KHz. Each channel is amplified by pre-amplifier transistor T2 along with bias resistor R9. The output of the pre-amplifier transistor is fed to relay driver stage to activate the respective relay ON. The Darlington pair T3 and T4 are arranged in driver stage to drive the low impedance relay.

i) *Monostable Multivibrators*: It have only ONE stable state (hence their name: "Mono"), and produce a single output pulse when it is triggered externally. Monostable Multivibrators only return back to their first original and stable state after a period of time determined by the time constant of the RC coupled circuit. The standard 555 timer is housed in an 8-pin DIL package and operates from supply rail voltages of between 5V and 18V. This encompasses the normal range for TTL devices and thus the device is ideally suited for use in conjunction with TTL circuitry.

j) *Piezo sensor*: A piezoelectric sensor is a device that uses the piezoelectric effect, to measure changes in pressure, acceleration, strain or force by converting them to an electrical charge. The prefix Piezo- is Greek for 'press' or 'squeeze'.

k) *Ultrasonic Sensor*: Ultrasonic sensors (also known as transceivers when they both send and receive, but more generally called transducers) work on a principle similar to radar or sonar, which evaluate attributes of a target by interpreting the echoes from radio or sound waves respectively. Active ultrasonic sensors generate high frequency sound waves and evaluate the echo which is received back by the sensor, measuring the time interval between sending the signal and receiving the echo to determine the distance to an object. Passive ultrasonic sensors are basically microphones that detect ultrasonic noise that is present under certain conditions.

III. Design Flow



IV. Advantages

a) To reduce disturbances propagated from the leading vehicle to the rest of the vehicles in the platoon.

b) Sensors to detect vehicles or objects close to the vehicle.

c) Provides 360 degree of detection in any dangerous situation.

d) Vehicle safety, smoothen traffic flow and reduce a driver's workload.

V. Applications

a) Vehicle collision avoidance to prevent threat to life.

b) Blind Spot Information System.

c) Overtake vehicle warning.

d) E-call.

e) Stolen Vehicle Tracking.

f) Traffic Light Optimum Speed Advisory.

g) Emergency vehicle warning.

VI. Future Scope

a) Weather Information.

b) Dynamic Ride Sharing

c) Pedestrian crossing

VII. Excepted Result

Fig 2. Output of the ultrasonic sensor used in the project

The output of the ultrasonic sensor is shown in fig 2. If the distance is less than threshold value the automatic brake is applied by the microcontroller. The first image of the fig6.1 shows the distance between the obstacle and vehicle is 200 cm.

The second image shows that the slave microcontroller is giving the information to the master microcontroller that obstacle is detected and to slow down the speed of the following vehicle.

Third image shows that the vehicle is facing an obstacle in a certain distance. Hence the master detects the obstacle and fourth image shows that master microcontroller is passing the information to stop the vehicle by using the automatic braking system.

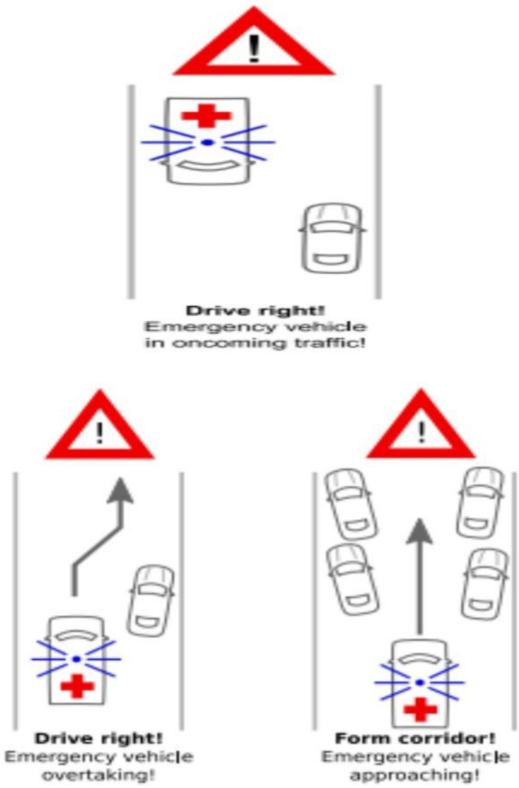


Fig 3. Emergency vehicle warning output

Fig 4. Tracking vehicle using GPS system

VIII. Conclusion

This project demonstrates for safety purposes. Protocol forms a communication bridge between the controllers. Real-time, reliability and flexibility, all these characteristics make CAN an indispensable network communication technology applied in automobile network communication field. The CAN based communication system for vehicle automation is designed. Software system and hardware system are easily to be expanded and upgraded.

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