An Anti-Collision Warning System for Cooperative Driving

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Abstract- **Active safety is an important feature of a modern vehicle to provide precaution warning or compensatory control before the pre-crash stage of vehicle safety. All vehicle signals and information are acquired by several in-vehicle sensors on ECUs or surrounding vehicles, and integrated in vehicle gateway through in-vehicle or vehicle-to-vehicle communications. The information exchanged among the host and surrounding vehicles provides comprehensive vehicle and driving status of each vehicle, so the driver can drive more safely with the cooperative driving mechanism. The demonstration system consists of a vehicle gateway, which is based on a heterogeneous multi-core processor, consisting of one PIC core for I/O control and system management for intensive computation of information fusion. After reaching within the communication limit, the vehicles set up time synchronization and then exchange vehicle information.**

Keywords-Multi-sensor, Information fusion, Cooperative driving, Vehicle gateway, In-vehicle network.

I. INTRODUCTION

To well protect drivers and passengers from car collision, the driving status and vehicle data are acquired and processed by a variety of car electronics before the pre-crash stage of vehicle safety to determine any potential risk condition. Some accidents happen because the driver cannot predict or observe the operation of other drivers. Increasing the response time will largely decrease the probability of car accident. The traffic crashes caused by the human factor in United States are reported about 80–90% of all incidents by National Highway Traffic Safety Administration (NHTSA), so active vehicle safety is one of the major research topics for intelligent transportation system (ITS) The safety concern is the most important issue for vehicle operation, while cooperative driving improves the vehicle safety by exchanging the vehicle information to enhance the driving information and the response time. Cooperative driving improves vehicle safety by exchanging vehicle data, so the driving status of neighboring vehicle can be observed in advance and thus the response time will be shortened. The vehicle gateway implements the information fusion of in-vehicle sensor data and wireless communication packets. The vehicle data is exchanged through vehicle-to-vehicle communications and the GPP of vehicle gateway informs the SPP that the latest vehicle data were received. The information fusion engine in SPP will integrate local vehicle sensor data and the acquired neighboring vehicle information, and implement information fusion to generate several safety indexes and produce warning messages.

II MULTI-SENSOR INFORMATION FUSION

Each sensor type has its advantages and limitation to measure environmental parameters, while the same type of sensors in different cars may have different degrees of precision or fault. In order to provide full coverage to the detection of surrounding objects coming close to a host vehicle to prevent from collision.

A. Signal Processing

The input signals from Accelerometer, LPG, Temperature sensor and Brakes receiver are processed or received by the microcontrollers of ECUs or vehicle gateway, and stored in time sequential linked lists.

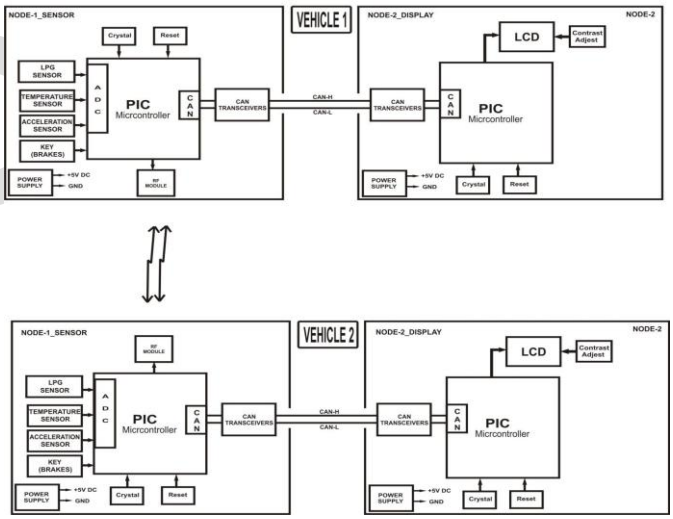

Fig.1-Block diagram of An Anti-Collision Warning System for Cooperative Driving.

III.SYSTEM HARDWARE:

The complete system consists of several modules, each of which is described in the following sub-sections.

1. Accelerometer Module:

Small board size - Just 28mm X 23mm
Simple 5 pin interface (VCC, GND, Xout, Yout, Zout) Selectable Sensitivity (1.5g/2g/4g/6g) and Sleep Mode Selectable through jumpers or microcontroller Needs no external components Easy to mount on General purpose

PCB, Breadboards and special PCBs Low Current Consumption: 500 µA. Low Voltage Operation: 3.6V to 5V High Sensitivity (800 mV/g @ 1.5g) for small movements Fast Turn On Time Integral Signal Conditioning with Low Pass Filter Robust Design, High Shocks Survivability.

ACCELEROMETER:

Fig.2-Accelometer

The ADXL335 is a small, thin, low power, complete 3-axis accelerometer with signal conditioned voltage outputs .The product measures acceleration with a minimum full-scale range of ±3 g. It can measure the static acceleration of gravity in tilt-sensing applications, as well as dynamic acceleration resulting from motion, shock, or vibration. Small, low profile package 4 mm × 4 mm × 1.45 mm LFCSP Low power: 350 µA (typical) Single-supply operation: 1.8 V to 3.6 V 10,000 g shock survival Excellent temperature stability.

2. MQ6: LPG Sensor:

High sensitivity to LPG. They are used in gas detecting equipment for LPG in family and industry or car.

3. RF Module:

RF Transceiver 2.4 GHz, SPI Interface, 30 meters range This is an FSK Transceiver module, which is designed using the Chipcon IC(CC2500). It is a high performance and low cost module. It gives 30 meters range with onboard antenna. High sensitivity (type -104dBm) this trans-receiver will be used together with a microcontroller. It provides extensive hardware support for packet handling, data buffering, burst transmissions, clear channel assessment, link quality indication and wake on radio.

4. CAN Bus:

It is used for vehicle monitoring system and fault diagnosis. It is a combination of hardware and software which can receive data, analyze data and display vehicle status and fault information.

Fig. 3- V2V service terminal.

5. Microchip PIC18 Fxx8:

PIC18Fxx8 is an enhanced flash microcontroller with CAN. The PIC18, which includes a RISC CPU running up to 10 MIPS, with 16-bit wide instructions and 8-bit wide data path, is dedicated to the ECUs functioning as low-end I/O control or data acquisition. There are 4 timers, one capture/compare/PWM module and up to 8 channels 10-bit ADC modules and a Master Synchronous Serial Port operating with SPI or I2C mode. Dedicated Short Range Communications (DSRC) The Federal Communication Commission (FCC) of US has allocated 75MHz of spectrum in 5.9 GHz band (5.850 GHz - 5.925 GHz) as Dedicated Short Range Communications (DSRC) in 1999 to support low-latency vehicle-to-vehicle (V2V) and vehicle-to-infrastructure (V2I) communications for improving traffic safety and highway efficiency.

6. Sensors:

Different types of sensors are used for acquiring vehicle diagnosis or driving status. The raw data are pre-processed by the ECUs and then merged in the vehicle gateway. Some off-the-shelf sensors, like GPS receivers, are manufactured as full function modules, so the processor in the module processes the signals and output the measuring results with defined format through a standard interface.

7. Vehicle gateway:

Because of the advance of integrated circuit technology, an ECU not only shrinks the size and reduces the power consumption, but provides more complicated functionality and data processing capability. Moreover, a multi-core processor is feasible for decreasing the amount of chip components, eliminating the cable connection, and lowering down the cost.

8. Electronic control unit:

The ECUs are used for acquiring vehicle sensor data, diagnostic information and human physiological signals, and transmit them to the vehicle gateway after some pre-processing computation.

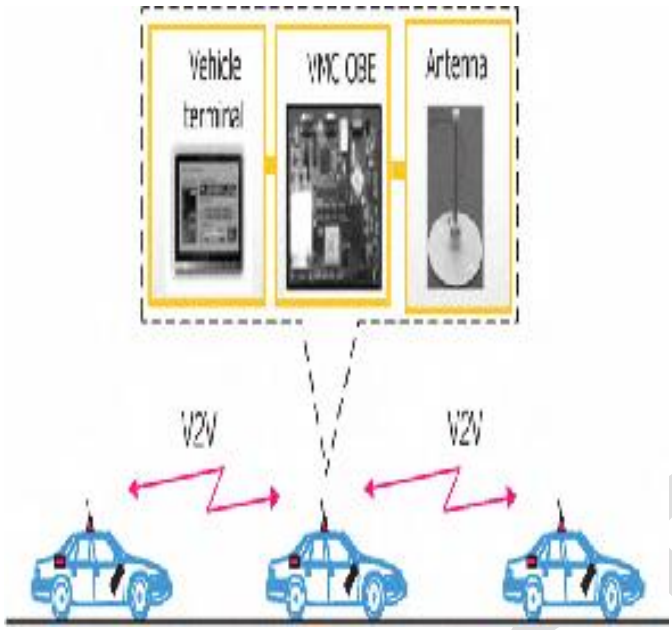

Fig. 4- Anti-collision warning scenario

RESULT

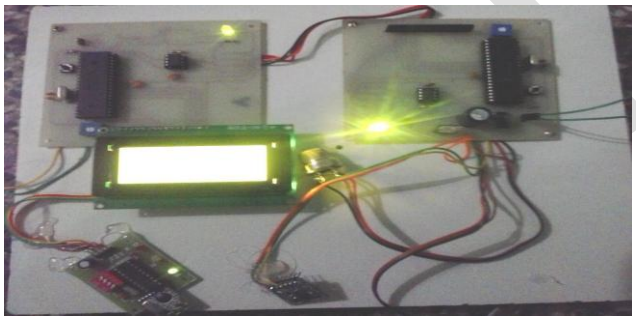

Fig. 5 Vehicle Anti-collision transceiver Model for vehicle 1

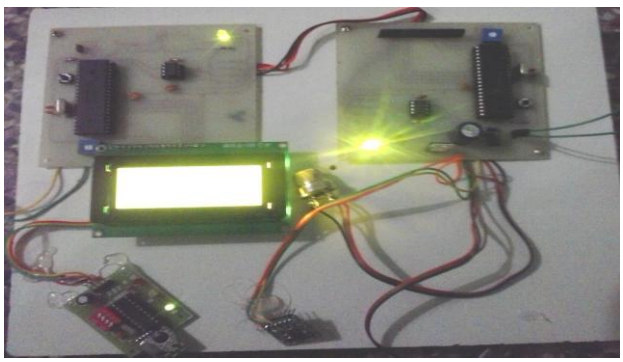

Fig. 6 Vehicle Anti-collision transceiver Model for vehicle 2

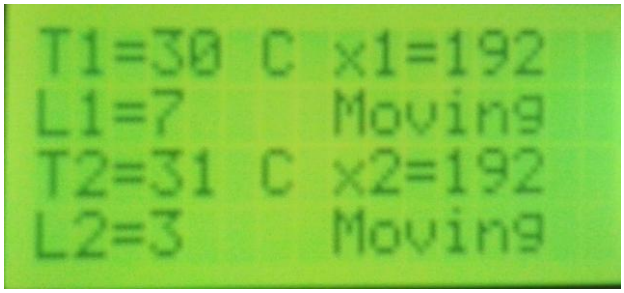

Fig.7 Parameters displayed on LCD

CONCLUSION

The vehicle gateway based on a heterogeneous multi core platform is establishing, and several ECUs are interconnected with the gateway through wired or wireless communications. The multi-sensor information fusion is implemented for computing the relative position, velocity and acceleration to the host vehicle, so the potential collision risk can be assessed and the cooperative driving feature is provided by exchanging information with surrounding vehicles through wireless communications. This design proposes the realization of cooperative driving to enhance the active safety.

FUTURE SCOPE:

Vehicle to Vehicle communication is possible for safe and efficient transportation. By using eye blinking sensor we can measure physiological signals such as open & closed state of eyes & detect micro sleep of driver.

Thus we can avoid the collision of inter vehicle communication by conveying the status of driver & vehicle status by using different sensors.

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