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Travolution - An Embedded System in Passenger Car for Road Safety

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Abstract:
Security is the primary concern for every one while traveling. This project describes the design of an effective alarm system that can monitor an automotive vehicle like a car, while it is in mobile or immobile condition. This project is designed to inform about an accident or theft that has occurred to the vehicle, to the family members of the traveling persons and concerned authorities. The vehicle can also be automated based on the zones in which it is travelling.

Key Words: ***ultrasonic sensor, alcohol detection, GPS, GSM, AT89S52, LPC2148***

I INTODUCTION

Existing system[1]

Existing system is an automatic vehicle accident detection system[6] using GPS and GSM modems. The system can be interconnected with the car alarm system and alert the owner on his/her mobile phone. This detection and messaging system is composed of a GPS receiver, Microcontroller and a GSM Modem. GPS Receiver gets the location information from the satellite in the form of latitude and longitude.

The Microcontroller processes this information and this processed information is sent to the user/owner using GSM modem[2]. A GSM modem is interfaced to the MCU. The GSM modem sends an SMS to the predefined mobile number and informs about this accident. This enable it to monitor the accident situations and it can immediately alert the police/ambulance service with the location of accident.

The system was built around the AT89S52 micro controller[3] from Atmel. This micro controller provides all the functionality of the SMS alert system. It also takes care of filtering of the signals at the inputs. The uniqueness of this project is not only alerting the neighbors by its buzzer, but also it sends a caution SMS to stored mobile numbers.

Shortfall in existing system

There are no sensors included for alcohol, and no proper sensors were used for collision detection, theft detection, and zonal identification.

Proposed system

Here we present an automatic vehicle accident detection system using Ultra Sonic Sensors, and the information, along with the longitude and latitude details were sent using the GPS and GSM modems. The system can be interconnected with the Alcohol detection, and alert the owner or concerned authorities. This detection and messaging system is composed of a GPS receiver, Microcontroller and a GSM Modem. GPS Receiver gets the location information from satellites in the form of latitude and longitude.

Alcohol sensor is provided to know whether the driver is alcoholic or not. The red traffic light zone, speed control in specified areas like school zones, and horn prohibited areas like hospitals and police stations will be provided by RF transmitter. The vehicle security is enhanced as all the features are embedded in it. We also have few relays to stop the car, to slow down the car and also to stop the horn. A vibration sensor is included to detect the theft and ultrasonic sensor is

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used to calculate the distance between the car and the obstacle, and when distance is zero centimeters, it is considered as a collision.

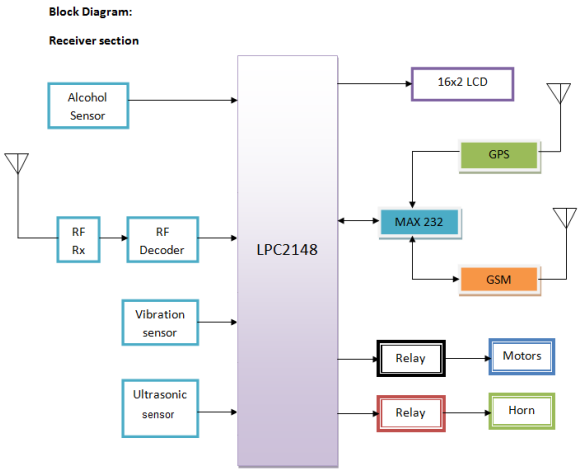
II. DESIGN AND IMPLEMENTATION

The block diagram of transmitter and receiver section is as shown in figure1. The various components are as explained below

LPC2148 controller:

The LPC2148[3] is based on a 16/32 bit ARM7TDMI-S™ CPU with real-time emulation and embedded trace support, together with 128/512 kilobytes of embedded high speed flash memory.

A 128-bit wide memory interface and unique accelerator architecture enable 32-bit code execution at maximum clock rate. For critical code size applications, the alternative 16-bit Thumb Mode reduces code by more than 30% with minimal performance penalty. With their compact 64 pin package, low power consumption, various 32-bit timers, 4- channel 10-bit ADC, USB PORT, PWM channels and 46 GPIO lines with up to 9 external interrupt pins these microcontrollers are particularly suitable for industrial control, medical systems, access control and point-of-sale. With a wide range of serial communications interfaces, they are also very well suited for communication gateways, protocol converters and embedded soft modems as well as many other general-purpose applications.



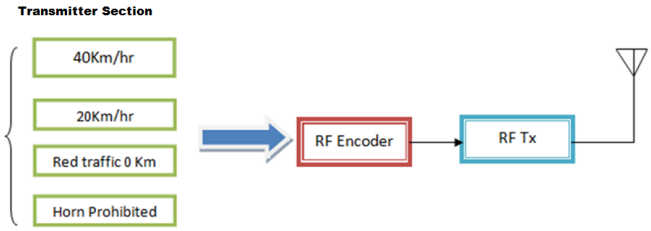


Fig 1: Block Diagram

The LPC2148 is based on a 16/32 bit ARM7TDMI-S™ CPU[5] with real-time emulation and embedded trace support, together with 128/512 kilobytes of embedded high speed flash memory.

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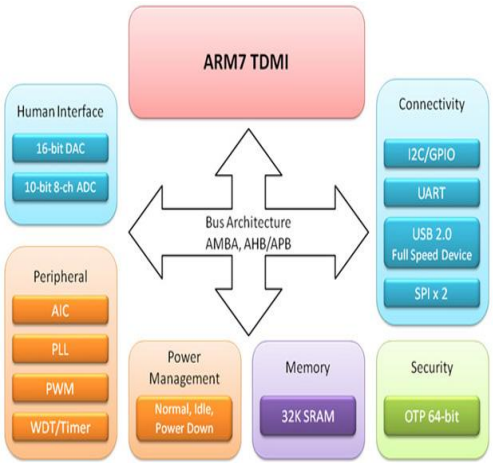

Fig 2: ARM Processor Architecture

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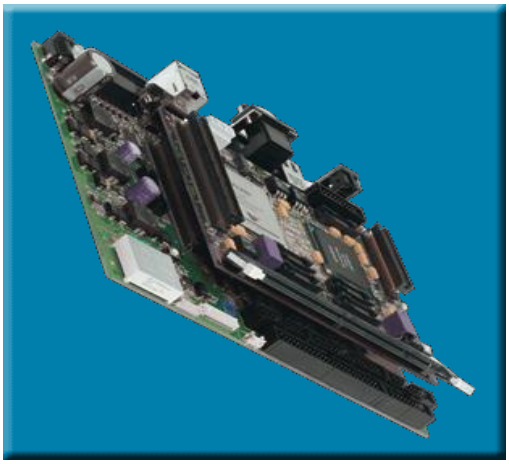

Fig 3: ARM7 board

Global System for Mobile Communication:

GSM, reigns as the world's most widely used cell phone technology. Cell phones use a cell phone service carrier's GSM network by searching for cell phone towers in the nearby area. Global system for mobile communication (GSM) is a globally accepted standard for digital cellular communication.

GSM is the name of a standardization group established in 1982 to create a common European mobile telephone standard that would formulate specifications for a pan-European mobile cellular radio system operating at 900 MHz. It is estimated that many countries outside of Europe will join the GSM partnership.

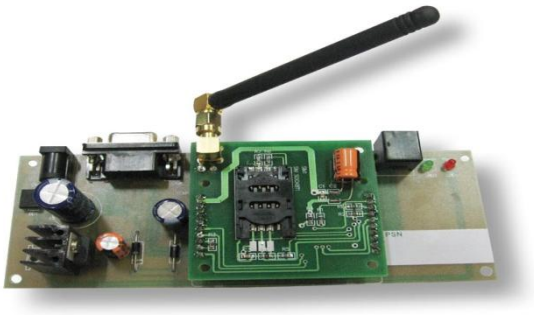

Fig 4: GSM Unit

General Features:

- Tri-band GSM/GPRS900/1800/1900Mhz
- GPRS multi-slot class 10
- GPRS mobile station class –B
- Complaint to GSM phase 2/2+
- -class 4(2W @900MHz)
- -class 1(1W @/18001900MHz)
- Dimensions: 40x33x2.85 mm
- Weight: 8gm
- 7. Control via AT commands
- (GSM 07.07, 07.05 and SIMCOM enhanced AT commands)
- SIM application tool kit
- supply voltage range from 3.5 to 4.5 v
- Low power consumption
- Normal operation temperature: -20 'C to +55 'C
- Restricted operation temperature : -20 'C to -25 'C and +55 'C to +70 'C
- storage temperature: -40 'C to +80 'C

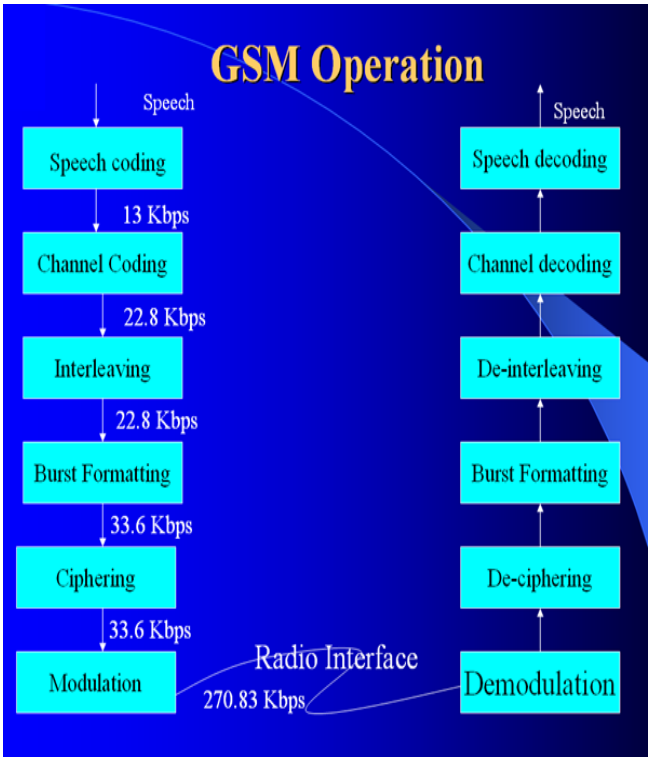

Fig 5: GSM Operation

Global Positioning System

A GPS receiver calculates its position by precisely timing the signals sent by the GPS satellites high above the Earth. Each satellite continually transmits messages which include the time the message was transmitted precise orbital information (the

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ephemeris), the general system health and rough orbits of all GPS satellites (the almanac).

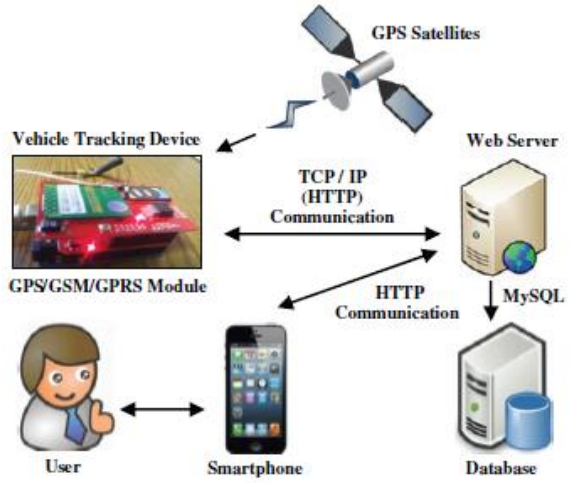

Fig 6: Global Positioning System

The operation of GSM is defined in figure 5.

Alcohol Gas Sensor - MQ-3

This alcohol sensor[4] is used for detecting alcohol concentration in your breath, just like the usual breathalyzer. It has higher sensitivity and faster response time. Sensor provides an analog resistive output based on alcohol concentration. The drive circuit needs just one resistor. A simple interface could be a 0-3.3V ADC.

Dimensions:
16.8mm diameter
9.3 mm height without the pins

Fig 7: Alcohol sensor

III. Advantages and Applications

Advantages

- Sophisticated security
- Monitors all hazards and threats
- Alert message to mobile phone for remote information
- Mobile number can be changed at any time

Applications:

- Can be implemented in any automotive vehicle.
- Security can be enhanced for the vehicles.
- Remote monitoring of vehicle is possible.

IV. Conclusion and Future Scope

Conclusion:

Since *security* plays a crucial role while traveling, using the concept of *TRAVOLUTION*, which include the cutting edge technology by using ARM7 and LPC2148, the passenger's journey will become even more safe and secure.

Future Scope

Using Radar Vision Fusion technology, the collision can be avoided using Breaking functionality by identifying the distance between the car and the obstacle. Using the Longitude and Latitude values, the car's location can be tracked.

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