# Designing the Monitoring System of Harmful Gas in Special Vehicle

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## Abstract

*The paper presents the designing of ARM processor based gas detector and warning of high temperature in the vehicles. If any gas leakage has detected in the vehicle by gas sensor it detects it and automatically alerts by transmitting the warning message to the authorized user through SMS using GSM modem and also your vehicle doors will automatically gets opened. If high temperature is sensed by the temperature sensor in the vehicle by buzzer sound it will alert the user and the SMS will be sent to the authorized user that there is temperature exceed in the vehicle, Based on that if user wants can control some appliances in host section. By this monitoring system in the vehicle the information can be sent through wireless technology without manual effect the system can be handled.*

***Key words:*** *temperature sensor, gas sensor, ARM, GSM modem.*

## 1. Introduction

Now a day, vehicle usage is very much higher. Most of the people are using gas fuel instead of petrol or diesel. This method is quite easy but on the other hand it is harmful also. So, these types of vehicles required proper monitoring. For this we need to modify an existing safety model employed in domestic field by designing a gas detector and warning of temperature exceeding, This safety system that can be used in any automation field, houses etc. The monitoring of air quality inside vehicle is completely combined with original equipment. The monitoring system of harmful gas and fire inside special vehicle has many advantages such as advance performance, high reliability, etc. The advantage of this automated detection/alarm system is that it offers faster response time and accurate detection of an emergency in turn leading to faster diffusion of the situation, compared to manual methods. This is a very compelling reason that justifies designing such a safety system.

The reaming paper deals with section II describes the methods in section III discussed the ARM 7 family, section VI discussed the hardware components used in the system, the results are being presented in section V and last section describes the concluding.

## 2. Methods

### 2.1. Overview of the System

The monitoring system design of harmful gas inside special vehicle block diagram is shown in fig 1 and fig 2. It consist of two sensors one is gas sensor which detects the harmful gas leakage in the vehicle, and the other is temperature sensor which detects the variation in temperature. And also there is ARM processor which monitors the whole system according to application. After detecting gas the processor sends the information to the driver unit and actuator unit to open the door of the vehicle meanwhile, a message is sent by converting the signal from microprocessor to GSM modem through level converter RS-232.And if high temperature is sensed in the vehicle the ARM processor will sends the information to the buzzer. Meanwhile message is sent to the user.

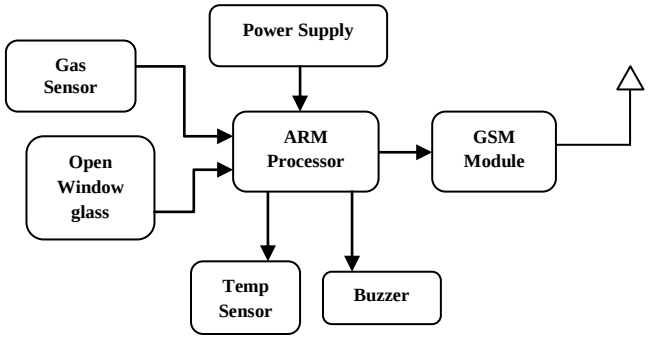


**Figure 1. Block diagram of system modules**

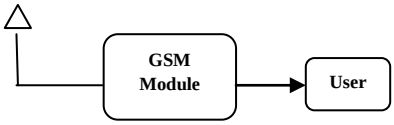


**Figure 2. Block diagram of User Module**

### 2.2. Working of the System

Gas leakage and maximum temperature level in the vehicle is detected by the sensors when it reaches the maximum level the information is sent to the microprocessor and it alerts the user by transmitting the SMS meanwhile, the vehicle doors gets opened when there is gas leakage. And the buzzer sounds if temperature exceeds in the vehicle.

## 3. ARM 7 Family

The ARM7 family includes the ARM7TDMI, ARM7TDMI-S, ARM720T, and ARM7EJ-S processors. The ARM7TDMI core is the industry's most widely used 32-bit embedded RISC microprocessor solution. Optimized for cost and power-sensitive applications, the ARM7TDMI solution provides the low power consumption, small size, and high performance needed in portable, embedded applications.

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 Jazelle 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 scale 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 work.

### 3.1. LPC2148 Microcontroller

The ARM7TDMI-S is a general purpose 32-bit microprocessor, which offers high performance and very low power consumption. The ARM architecture is based on Reduced Instruction Set Computer (RISC) principles, and the instruction set and related decode mechanism are much simpler than those of micro programmed Complex Instruction Set Computers (CISC). This simplicity results in a high instruction throughput and impressive real-time interrupt response from a small and cost-effective processor core.

Pipeline techniques are employed so that all parts of the processing and memory systems can operate continuously. Typically while one instruction is being executed, its successor is being decoded and a third instruction is being fetched from memory. Fig 3 shows the on board view of ARM 7.The ARM7TDMI-S processor also employs a unique architectural strategy known as Thumb, which makes it ideally suited to high-volume applications with memory restrictions, or applications where code density is an issue.

The key idea behind Thumb is that of a

super-reduced instruction set. Essentially, the ARM7TDMI-S processor has two instruction sets:

- The standard 32-bit ARM set.
- A 16-bit Thumb set.

The Thumb set's 16-bit instruction length allows it to approach twice the density of standard ARM code while retaining most of the ARM's performance advantage over a traditional 16-bit processor using 16-bit registers. This is possible because Thumb code operates on the same 32-bit register set as ARM code. Thumb code is able to provide up to 65 % of the code size of ARM, and 160 % of the performance of an equivalent ARM processor connected to a 16-bit memory system

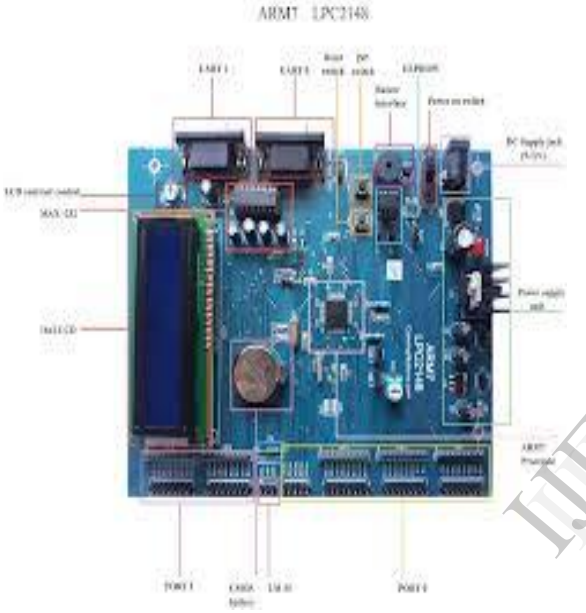

**Figure 3. ARM7 LPC2148**

## 4. Hardware Tools

The hardware tools required for project are

- GSM Module
- Temperature sensor
- Gas Sensor
- MAX 232

### 4.1. GSM MODEM

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.

A GSM modem is a wireless modem that works with a GSM wireless network. A wireless modem behaves like a dial-up modem. The main difference between them is that a dial-up modem sends and receives data through a fixed telephone line while a wireless modem sends and receives data through radio waves.

### 4.2 Temperature Sensor - The LM35

The LM35 series are precision integrated-circuit temperature sensors, whose output voltage is linearly proportional to the Celsius (Centigrade) temperature. Temperature sensor is shown in fig 4.
Features:

- Calibrated directly in °Celsius (Centigrade)
- Linear + 10.0 mV/°C scale factor
- 0.5°C accuracy guarantee able (at +25°C)
- Rated for full −55° to +150°C range
- Suitable for remote applications
- Low cost due to wafer-level trimming
- Operates from4 to 30 volts
- Less than 60 µA current drain
- Low self-heating, 0.08°C in still air
- Nonlinearity only ±1⁄4°C typical

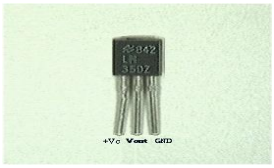

**Figure 4. Temperature sensor**

### 4.3. Gas Sensor

Ideal sensor is used to detect the presence of a dangerous LPG leak in your car or in a service station, storage tank environment. This unit can be easily incorporated into an alarm unit, to sound an alarm or give a visual indication of the LPG concentration. Gas sensor is shown in fig 5.The sensor has excellent sensitivity combined with a quick response time. The sensor can also sense iso-butane, propane, LNG and cigarette smoke.

**Figure 5. Gas sensor**

Features:

- High Sensitivity
- Detection Range: 100 - 10,000 ppm iso-butane propane
- Fast Response Time: <10s
- Heater Voltage: 5.0V
- Dimensions: 18mm Diameter, 17mm High excluding pins, Pins - 6mm High.

### 4.4. Max232

The MAX232 from Maxim was the first IC which one package contains the necessary drivers (two) and receivers (also two), to adapt the RS-232 signal voltage levels to TTL logic. It became popular, because it just needs one voltage (+5V) and generates the necessary RS-232 voltage levels (approx. -10V and +10V) internally. This greatly simplified the design of circuitry. Circuitry designers no longer need to design and build a power supply with three voltages (e.g. -12V, +5V, and +12V), but could just provide one +5V power supply, e.g. with the help of a simple 78x05 voltage converter.

The MAX232 has a successor, the MAX232A. The ICs are almost identical, as shown in fig 6.However, the MAX232A is much more often used (and easier to get) than the original MAX232, and the MAX232A only needs external capacitors 1/10th the capacity of what the original MAX232 needs.


**Figure 6. MAX232**

MAX 232 Specifications:
Transmitted Signal Voltage Levels:

- Binary 0: +5 to +15 Vdc (called a “space” or “on”)
- Binary 1: -5 to -15 Vdc (called a “mark” or “off”)

Received Signal Voltage Levels:

- Binary 0: +3 to +13 Vdc
- Binary 1: -3 to -13 Vdc

Data Format:

- Start bit: Binary 0
- Data: 5, 6, 7 or 8 bits
- Parity: Odd, even, mark or space (not used with 8-bit data)
- Stop bit: Binary 1, one or two bits.
- The USART input/output uses 0V for logic 0 and 5V for logic 1.
- The RS-232 standard (and the COM port) use +12V for logic 0 and –12V for logic 1.
- To convert between these voltages levels we need an additional integrated circuit (such as Maxim’s MAX232).

## 5. Result

In this paper we get the result in the form of SMS through the GSM modem. Whenever there is a leakage of gas in the car the glass of the door gets opened and a message will be sent to prescribed mobile number as “AT+CMGS="<Mobile Number>" GAS LEAKAGE”. And if the temperature in the car exceeds then the buzzer sounds and the message will be sent to the prescribed mobile number as “AT+CMGS="<Mobile Number>" TEMPERATURE EXCEED”.

## 6. Conclusion

The implementation of a vehicle gas leakage and high temperature detector corresponds to increased cases of death caused by gas leakage and fire accidents in cars. These devastating events could be avoided if this system installed. Therefore, the main idea of this research is to create a simple and easy system that has high sensitivity and described here is working as expected with simulated and implemented data on record. The system has then been interfaced to the ARM on-board system. The ARM has been programmed to send signals to sensors buzzer and GSM modem. The development of software was then tested to ensure it worked properly with the hardware. The communication test between hardware and software was successful. The hardware responded correctly to the command sent to it. This result shows that, the system has been implemented and tested successfully. This system has been designed to produce greater flexibility, ease of implementation and lower cost because the system ARM7 LPC2148 is used.

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