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Application of RFID Technology for Solving Vehicle Emission in Cities

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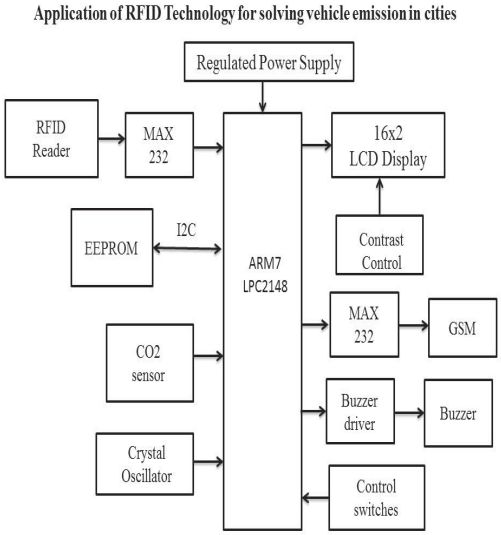
Abstract:

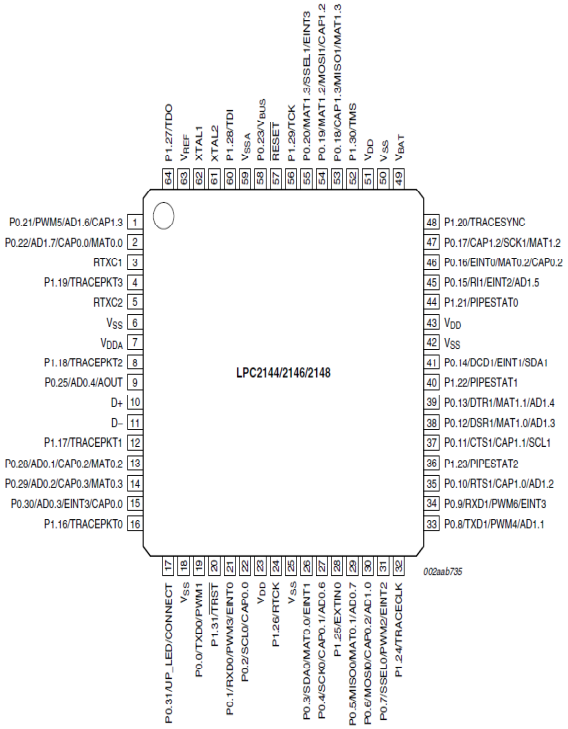
With the increasing of automobile quantity, especially in some metropolis, such as Beijing or Hong Kong, it is very impending to resolve the problem of air pollution resulting from automobile exhaust gas. To fight this problem, the motor emissions standards have been established and promoted in many developed countries for many years. Furthermore, some improved measures in vehicle engines or the quality of gasoline have also been developed by researchers. However, these methods seem not to solve radically the emissions pollution problems. Many countries and regions have already presented a series of emissions standards, meanwhile some methods has been developed, include update motor engine or improve the quality of the gasoline. However, these actions have not brought about a striking effect as we expect.

There are also some situations to fail implement these emissions standards. In this paper, a wireless inspection and notification system through the concept GSM is proposed. By applying the system, it is possible to smoothly realize a green traffic network. In this system, Radio frequency identification (RFID) technology as a low-cost and mature wireless communication method is adopted to collect and transmit emissions information of vehicles. In this project the peripherals are connected to the ARM7 processor. When ever the CO2 sensor detects the gas from the vehicle that information will be transmitted to the concerned authority in the form of SMS by using GSM and status is displayed on LCD display, alert will be given by buzzer.

In this system, Radio frequency identification (RFID) technology as a low-cost and mature wireless communication method is adopted to collect and transmit emissions information of vehicle. The respective authority number is stored in EEPROM by interfacing this with the ARM7 through I2c protocol.



Pin diagram of LPC2148



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Key features:

» 16-bit/32-bit ARM7TDMI-S microcontroller in a tiny LQFP64 package.

• 8 kB to 40 kB of on-chip static RAM and 32 kB to 512 kB of on-chip flash memory.

» 128-bit wide interface/accelerator enables high-speed 60 MHz operation.

» In-System Programming/In-Application Programming (ISP/IAP) via on-chip boot loader

» Software. Single flash sector or full chip erase in 400 ms and programming of

» 256 bytes in 1 ms.

» EmbeddedICE RT and Embedded Trace interfaces offer real-time debugging with the

» On-chip RealMonitor software and high-speed tracing of instruction execution.

» USB 2.0 Full-speed compliant device controller with 2 kB of endpoint RAM.

» In addition, the LPC2146/48 provides 8 kB of on-chip RAM accessible to USB by DMA.

» One or two (LPC2141/42 vs. LPC2144/46/48) 10-bit ADCs provide a total of 6/14

» analog inputs, with conversion times as low as 2.44 µs per channel.

» Single 10-bit DAC provides variable analog output (LPC2142/44/46/48 only).

» Two 32-bit timers/external event counters (with four capture and four compare

» Channels each), PWM unit (six outputs) and watchdog.

» Low power Real-Time Clock (RTC) with independent power and 32 kHz clock input

» Multiple serial interfaces including two UARTs (16C550), two Fast I2C-bus (400 kbit/s),

» SPI and SSP with buffering and variable data length capabilities.

» Vectored Interrupt Controller (VIC) with configurable priorities and vector addresses.

» Up to 45 of 5 V tolerant fast general purpose I/O pins in a tiny LQFP64 package.

» Up to 21 external interrupt pins available.

» 60 MHz maximum CPU clock available from programmable on-chip PLL with settling

» Time of 100 µs.

» On-chip integrated oscillator operates with an external crystal from 1 MHz to 25 MHz.

» Power saving modes include Idle and Power-down.

» Individual enable/disable of peripheral functions as well as peripheral clock scaling for

» Additional power optimization.

» Processor wake-up from Power-down mode via external interrupt or BOD.

» Single power supply chip with POR and BOD circuits:

» CPU operating voltage range of 3.0 V to 3.6 V (3.3 V ± 100 %) with 5 V tolerant I/

This project uses regulated 5V, 500mA power supply. Unregulated 12V DC is used for relay. 7805 three terminal voltage regulator is used for voltage regulation. Bridge type full wave rectifier is used to rectify the ac out put of secondary of 230/12V step down transformer.

LCD:

LCD stands for Liquid Crystal Display. LCD is finding wide spread use replacing LEDs (seven segment LEDs or other multi segment LEDs) because of the following reasons:

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1.The declining prices of LCDs.

2.The ability to display numbers, characters and graphics. This is in contrast to LEDs, which are limited to numbers and a few characters.

3.Incorporation of a refreshing controller into the LCD, thereby relieving the CPU of the task of refreshing the LCD. In contrast, the LED must be refreshed by the CPU to keep displaying the data.

4.Ease of programming for characters and graphics.

These components are "specialized" for being used with the microcontrollers, which means that they cannot be activated by standard IC circuits. They are used for writing different messages on a miniature LCD.

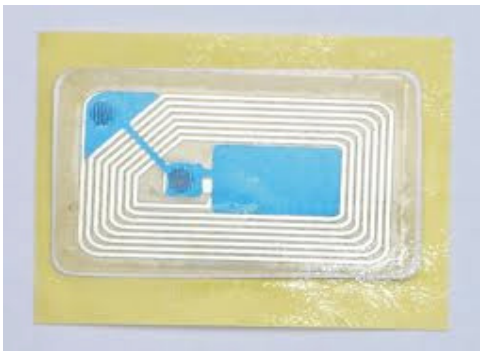
RFID:

Radio-frequency identification (RFID) is the use of a wireless non-contact system that uses radio-frequency electromagnetic fields to transfer data from a tag attached to an object, for the purposes of automatic identification and tracking. Some tags require no battery and are powered by the electromagnetic fields used to read them.

Others use a local power source and emit radio waves (electromagnetic radiation at radio frequencies). The tag contains electronically stored information which can be read from up to several metres (yards) away. Unlike a bar code, the tag does not need to be within line of sight of the reader and may be embedded in the tracked object.

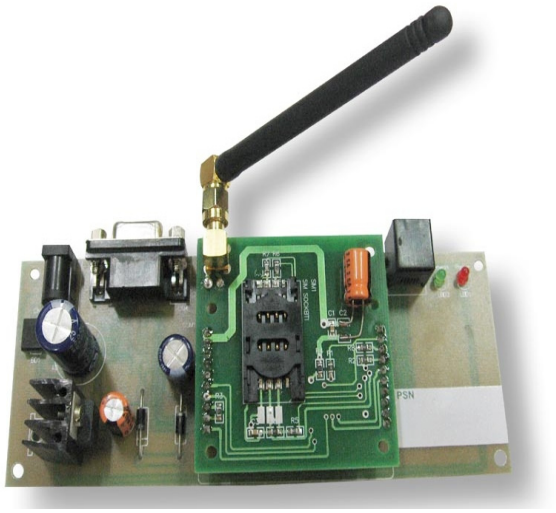
RFID tags are used in many industries. An RFID tag attached to an automobile during production can be used to track its progress through the assembly line. Pharmaceuticals can be tracked through warehouses. Livestock and pets may have tags injected, allowing positive identification of the animal.

RFID identity cards can give employees access to locked areas of a building, and RF transponders mounted in automobiles can be used to bill motorists for access to toll roads or parking.Since RFID tags can be attached to clothing, possessions, or even implanted within people, the possibility of reading personally-linked information without consent has raised privacy concerns.



Global System for Mobile Communication (GSM)
Definition:

GSM, which stands for Global System for Mobile communications, reigns (important) 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.



MODEM SPECIFICATIONS:

The SIM300 is a complete Tri-band GSM solution in a compact plug-in module. Featuring an industry-standard interface, the SIM300 delivers GSM/GPRS900/1800/1900Mhz performance for voice, SMS, data and Fax in a small form factor and with low power consumption.

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The leading features of SIM300 make it deal fir virtually unlimited application, such as WLL applications (Fixed Cellular Terminal), M2M application, handheld devices and much more.

1.Tri-band GSM/GPRS module with a size of 40x33x2.85

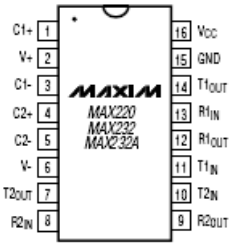
2.Customized MMI and keypad/LCD support

3.An embedded powerful TCP/IP protocol stack

4.Based upon mature and field proven platform, backed up by our support service, from definition to design and production.

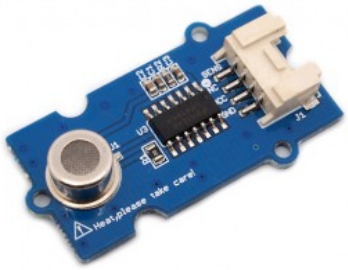
MAX 232:

Max232 IC is a specialized circuit which makes standard voltages as required by RS232 standards. This IC provides best noise rejection and very reliable against discharges and short circuits. MAX232 IC chips are commonly referred to as line drivers.To ensure data transfer between PC and microcontroller, the baud rate and voltage levels of Microcontroller and PC should be the same. The voltage levels of microcontroller are logic1 and logic 0 i.e., logic 1 is +5V and logic 0 is 0V. But for PC, RS232 voltage levels are considered and they are: logic 1 is taken as -3V to -25V and logic 0 as +3V to +25V. So, in order to equal these voltage levels, MAX232 IC is used. Thus this IC converts RS232 voltage levels to microcontroller voltage levels and vice versa.



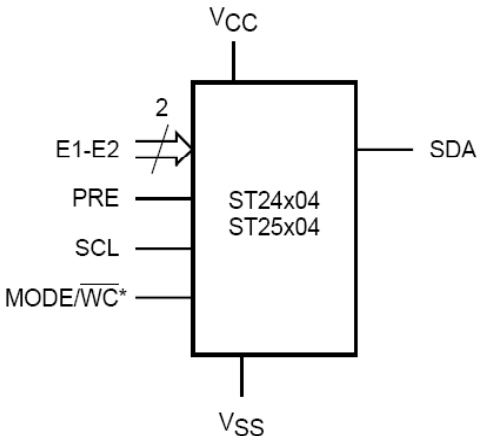
carbon dioxide sensor or CO2 sensor :

CO2 is an instrument for the measurement of carbon dioxide gas. The most common principles for CO2 sensors are infrared gas sensors (NDIR) and chemical gas sensors. Measuring carbon dioxide is important in monitoring indoor air quality, the function of the lungs in the form of a capnograph device, and many industrial processes.



EEPROM (Electrically Erasable Programmable Read only memory)

EEPROM has several advantages over other memory devices, such as the fact that its method of erasure is electrical and therefore instant. In addition, in EEPROM one can select which byte to be erased, in contrast to flash, in which the entire contents of ROM are erased. The main advantage of EEPROM is that one can program and erase its contents while it is in system board. It does not require physical removal of the memory chip from its socket. In general, the cost per bit for EEPROM is much higher when compared to other devices.
Logic diagram.



Working procedure:

- When ever this kit is placed near the vehicle.
- The CO2 sensor interfaced to the controller will take the emission from the vehicle and gives the information to the controller.
- This information will be sent to the officials by GSM modem connected to the controller through MAX232.
- The RFID tag is provided to retrieve the data of the vehicle when ever needed.

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