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Vehicular Pollution Monitoring Using IOT and Controlling the State of Vehicles Based on Traffic Signals

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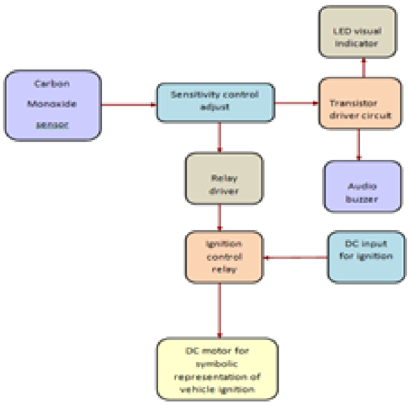
ABSTRACT:
Degradation of air quality in cities is the result of a complex interaction between natural and anthropogenic environmental conditions. With the increase in urbanization and industrialization and due to poor control on emissions and little use of catalytic converters, a great amount of particulate and toxic gases are produced. Most of the pollution caused in the cities is due to increase in buying personal vehicles. With the increase in population and busy world, the graph of usage of the personal vehicles in the cities increases in exponential manner over a decade. Not only the personal vehicles, big trucks, public buses, paid travels vehicles, auto-rickshaws, are increasing tremendously. The unnecessary pollution and fuel consumption is occurred at traffic lights junction, because most of the people won't switch of their engines at the time traffic lights turn red, even though its not required.

INTRODUCTION:
The air pollution may lead to chronic obstructive pulmonary disease (COPD) and increase the risk of cancer. The effect of air pollution in metropolitan cities is very large and leads to effect of chronicle diseases. 70% of the total air pollution is due emission of polluting gases from vehicles. In order to reduce the air pollution, it is very necessary that to measure the amount of air pollution produced from the vehicles and to be identify them. Internet of Things may become very helpful in metropolitan cities for monitoring air pollution from vehicles and also collected data related to the amount of pollution on different roads of a city can be gathered and analyzed.

Image showing pollution on road

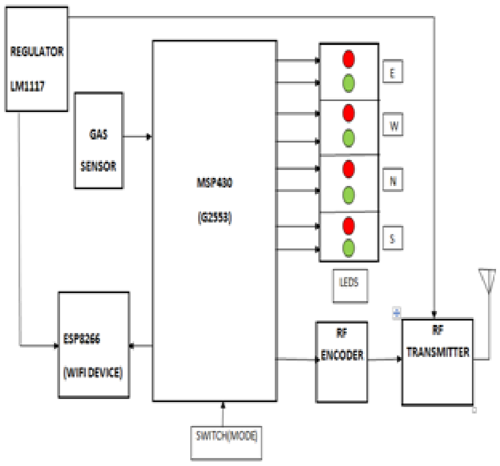
EXISTING SYSTEM:
In this project we are going to design a prototype which detects the amount of CO in the vehicle. When the amount of the CO is reached to a threshold limit (Dangerous/maximum) it automatically turns off the combustion engine of the vehicle with buzzer indication and simultaneously with a LED indication. The components which we are going to use in this project are CO Sensor, relay unit, ignition unit (DC motor). When the CO concentration is high then Relay circuit will be activated which in turn turns ON music generator and at the same time vehicle (DC Motor) turns OFF automatically.



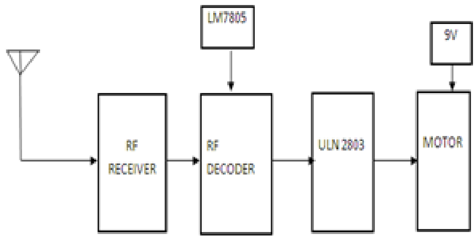
DRAWBACK:
No wireless communication to transmit information.

PROPOSED SYSTEM:
In this project, an alternative solution is presented to monitor and control the pollution at the traffic signaling lights. A simple low cost wireless embedded chip is inserted in the personal vehicles to control the ignition on and off remotely. The pollution at the traffic signaling lights is monitored by the traffic monitor station remotely by placing a series of CO2 sensors connected to a WIFI based control system at the traffic signaling lights. Depend upon the pollution level measured from sensors at the traffic signaling lights, the operator will send a command to the WIFI traffic pollution control system. This control system will broad cast the message to all vehicles to turn off the ignition automatically at the time of red light ON. With the advent of IOT, this WIFI based traffic pollution control system is implemented as interconnected network and each system can be addressed using unique IP address and communicates based on IEEE 802.11b protocol.

Block Diagrams:



Central Wireless Pollution Control System



Block diagram of VIEC

HARDWARE MODULES USED
MSP430 G2553
The Texas Instruments MSP430 family of ultra-low-power microcontrollers consists of several devices featuring different sets of peripherals targeted for various applications. The architecture, combined with five low-power modes, is optimized to achieve extended battery life in portable measurement applications. The device features a powerful 16-bit RISC CPU, 16-bit registers, and constant generators that contribute to maximum code efficiency. The digitally controlled oscillator (DCO) allows wake-up from low-power modes to active mode in less than 1 µs.

MSP430G2553 Micro Controller

KEY FEATURES:
- Low Supply-Voltage Range: 1.8 V to 3.6 V
- Ultra-Low Power Consumption
- Five Power-Saving Modes

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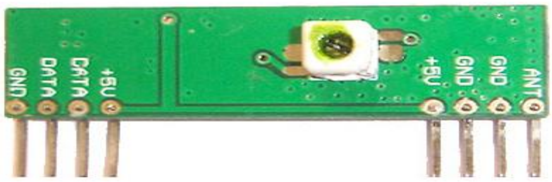
- Ultra-Fast Wake-Up From Standby Mode in Less Than 1 µs
- 16-Bit RISC Architecture, 62.5-ns Instruction Cycle Time
- Basic Clock Module Configurations
- Two 16-Bit Timer A With Three Capture/Compare Registers
- Up to 24 Touch-Sense-Enabled I/O Pins
- Universal Serial Communication Interface (USCI)
- 10-Bit 200-ksps Analog-to-Digital (A/D) Converter With Internal Reference
- On-Chip Emulation Logic With Spy-Bi-Wire interface

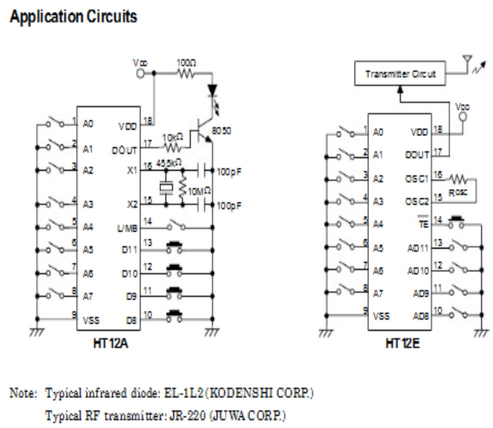
GAS SENSOR:

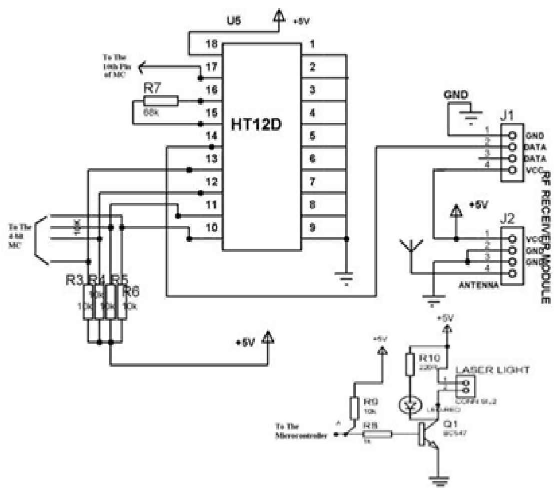
Sensitive material of MQ-6 gas sensor is SnO2, which with lower conductivity in clean air. When the target combustible gas exist, the sensor's conductivity is higher along with the gas concentration rising. Please use simple electro circuit, Convert change of conductivity to correspond output signal of gas concentration.

RF communication

Radio frequency (RF) is a frequency or rate of oscillation within the range of about 3 Hz to 300 GHz. This range corresponds to frequency of alternating current electrical signals used to produce and detect radio waves. Since most of this range is beyond the vibration rate that most mechanical systems can respond to, RF usually refers to oscillations in electrical circuits or electromagnetic radiation







Circuit diagram of RF receiver

ESP8266EX

- The Internet of Things (IoT) is the network of physical objects or "things" embedded with electronics, software, sensors, and network

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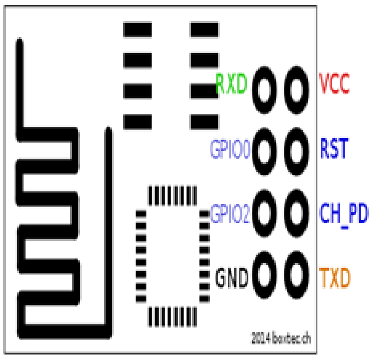
connectivity, which enables these objects to collect and exchange data.

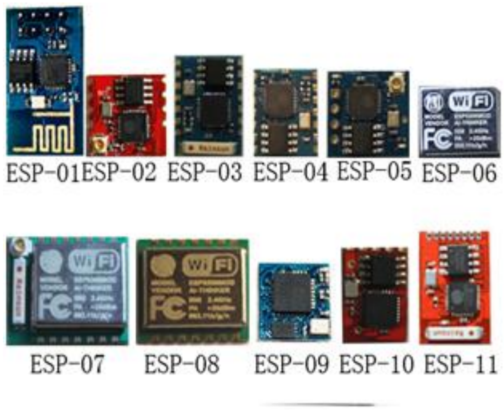
Different Modules

- ESP8266(ESPRESSIF)
- ESP8089
- ESP6203



ESP8266EX offers a complete and self-contained Wi-Fi networking solution; it can be used to host the application or to offload Wi-Fi networking functions from another application processor. When ESP8266EX hosts the application, it boots up directly from an external flash. In has integrated cache to improve the performance of the system in such applications.

Alternately, serving as a Wi-Fi adapter, wireless internet access can be added to any micro controller-based design with simple connectivity (SPI/SDIO or I2C/UART interface). ESP8266EX is among the most integrated Wi-Fi chip in the industry; it integrates the antenna switches, RF balun, power amplifier, low noise receive amplifier, filters, power management modules, it requires minimal external circuitry, and the entire solution, including front-end module, is designed to occupy minimal PCB area. ESP8266EX also integrates an enhanced version of Tensilica's L106 Diamond series 32-bit processor, with on-chip SRAM, besides the WiFi functionalities. ESP8266EX is often integrated with external sensors and other application specific devices through its GPIOs; sample codes for such applications are provided in the software development kit (SDK).



SOFTWARE TOOLS:

It is an integrated development environment for Texas instruments embedded processors. It includes debugger, compiler, editor, operating system, etc. The IDE is built on the Eclipse open source software framework and extended by TI to support device capabilities. CCSv5 is based on "off the shelf" Eclipse. CCS will use unmodified versions of Eclipse. TI contributes changes directly to the open source community. Drop in Eclipse plug-ins from other vendors or take TI tools and drop them into an existing Eclipse environment. It integrates additional tools like OS application development tools (Linux, Android…), Code analysis, source control and other tools.

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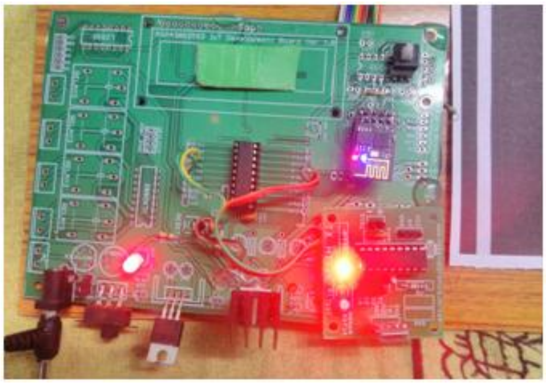
ADVANTAGES:

- Unnecessary pollution and fuel consumption at traffic lights junction will be avoided.
- Vehicle engines can be controlled during traffic lights turn red through remote control system.
- Very few vehicles are using catalytic converters to control the emission of toxic gases not much cost effective than these RF implanted vehicle identification engine control devices.
- Due to IOT, this pollution information can be monitored and controlled from anywhere and anytime.

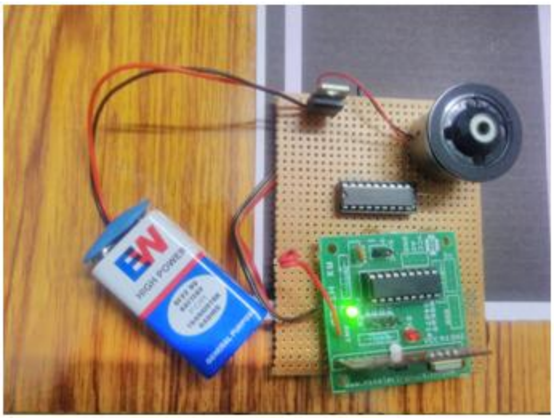
APPLICATIONS:

- Public Transportation
- Traffic junctions

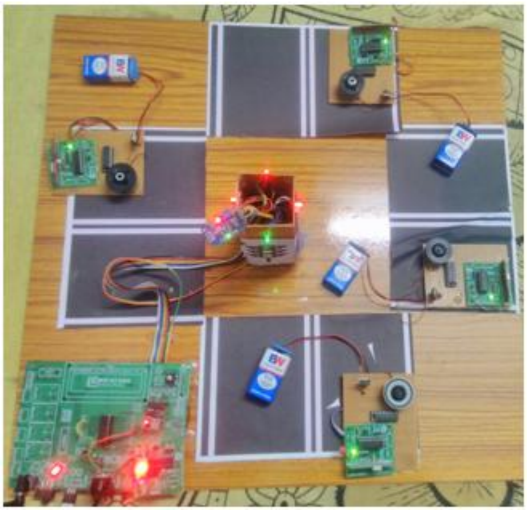
RESULTS OF THE PROJECT



Central System



VIEC



MODE ZERO (0)

No control on vehicle (motor)

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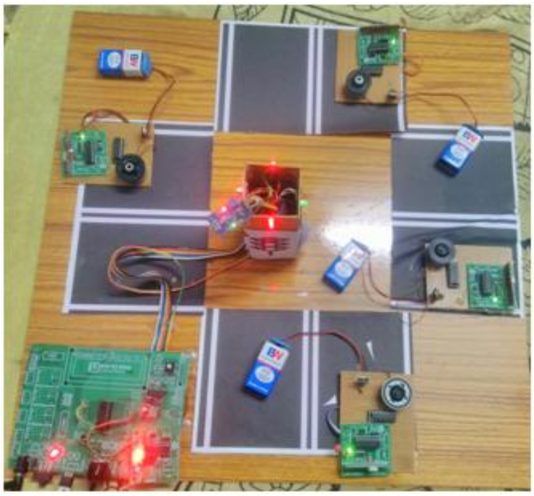

MODE ONE (1)

The vehicle (motor) turns OFF when traffic signal is RED

FUTURE SCOPE:

In future research, integration of this proposed frame work with inter-vehicular Adhoc network (IVAN) technology will make the traffic pollution controlling system with ease to install and maintain. Also by using compass sensors the controlling of vehicles can be done effectively

CONCLUSION:

The proposed system for monitoring and controlling of pollution at traffic lights will reduce the air pollution at metropolitan cities to some extent. A simple radio frequency based embedded chip in the personal vehicles will allow the remote operator to control the ignition on and off at traffic signaling. With advent of advanced chip technology the wireless pollution control system can be a single SOC to get connect with internet, process the sensor information and control the vehicles at traffic junction. This will reduce the overall cost of the proposed system and also provide the ease of maintenance. The cloud technology also makes the system maintenance with lower cost.

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