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AIR POLLUTION MONITORING USING ARDUINO MICROCONTROLLER

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Abstract: The Emissions of many air pollutants have been shown to have variety of negative effects on public health and the natural environment. Emissions that are principal pollutants of concern include: Hydrocarbons- A class of burned or partially burned fuel, hydrocarbons are toxins. Hydrocarbons are a major contributor to smog, which can be a major problem in urban areas. Prolonged exposure to hydrocarbons contributes to asthma, liver disease, lung disease, and cancer. Regulations governing hydrocarbons vary according to type of engine and jurisdiction.

Methane is not directly toxic, but is more difficult to break down in a catalytic converter, so in effect a "non-methane hydrocarbon" regulation can be considered easier to meet. Since methane is a greenhouse gas, interest is rising in how to eliminate emissions of it. This project attempts to develop an effective solution for pollution is monitoring & Controlling by using gas sensor on a real time basis namely real time wireless air pollution controlling system. Commercially available gas sensors for sensing concentration of gases like CO_2,CO are calibrated using appropriate calibration technologies.

I. INTRODUCTION

An embedded system is a computer system with a dedicated function within a larger mechanical or electrical system, often with real-time computing constraints. It is embedded as part of a complete device often including hardware and mechanical parts. Embedded systems control many devices in common use today.

Examples of properties typical of embedded computers when compared with general-purpose ones are low power consumption, small size, rugged operating ranges, and low per-unit cost. This comes at the price of limited processing resources, which make them significantly more difficult to program and to interface with. However, by building intelligence mechanisms on the top of the hardware, taking advantage of possible existing sensors and the existence of a network of embedded units, one can both optimally manage available resources at the unit and network levels as well as provide augmented functionalities, well beyond those available. For example, intelligent techniques can

Modern embedded systems are often based on microcontrollers (i.e. CPUs with integrated memory or peripheral interfaces) but ordinary microprocessors (using external chips for memory and peripheral interface circuits) are also still common, especially in more complex systems. In either case, the processor(s) used may be types ranging from general purpose to those specialized in certain class of computations, or even custom designed for the application at hand. A common standard class of dedicated processors is the digital signal processor (DSP).

II. PROPOSED SYSTEM

The Project aims at designing an air pollution monitoring system which can be installed in a specific locality and to enhance the system from the previously developed systems. The environment status can be used by anyone to get in live updates about the pollution in their region. It uses microcontroller integrated with individual gas sensors along with temperature & humidity, and smoke which measures the concentration of each gas separately. The collected data is uploaded to the cloud using cloud data platform at regular time intervals.

III. SYSTEM DESCRIPTION

Arduino Uno:

The Arduino Uno is a microcontroller board based on the ATmega328. It has 14 digital input/output pins (of which 6 can be used as PWM outputs), 6 analog inputs, a 16 MHz ceramic resonator, a USB connection, a power jack, an ICSP header, and a reset button. It contains everything needed to support the microcontroller; simply connect it to a computer with a USB cable or power it with a AC-to-DC adapter or battery to get started

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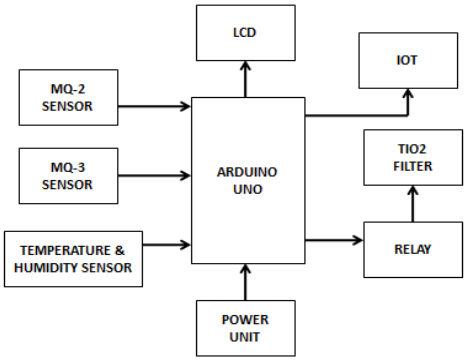
BLOCK DIAGRAM



The Uno differs from all preceding boards in that it does not use the FTDI USB-to-serial driver chip. Instead, it features the Atmega16U2 (Atmega8U2 up to version R2) programmed as a USB-to-serial converter pinout: added SDA and SCL pins that are near to the AREF pin and two other new pins placed near to the RESET pin, the IOREF that allow the shields to adapt to the voltage provided from the board. In future, shields will be compatible both with the board that use the AVR, which operate with 5V and with the Arduino Due that operate with 3.3V. The second one is a not connected pin, that is reserved for future purposes.

• Stronger RESET circuit.
• Atmega 16U2 replace the 8U2.

Gas Sensor:

Gas sensor measures the concentration of gas in its vicinity. Gas sensor interacts with a gas to measure its concentration. Each gas has a unique breakdown voltage i.e. the electric field at which it is ionized. Sensor identifies gases by measuring these voltages. The concentration of the gas can be determined by measuring the current discharge in the device.

Carbon monoxide gas sensor:

It can either be battery-operated or AC powered. Mostly the sensor will not sound an alarm at lower concentrations (e.g. 100 ppm). The alarm will sound within a few minutes at 400 ppm. So the function is specific to concentration-time. Figure shows simple carbon monoxide sensor.

Carbon monoxide sensor can be of different types such as:

- Semiconductor sensor
- Electrochemical sensor
- Digital sensor

Carbon dioxide (CO2) gas sensor:

- CO2 absorbs infrared light therefore CO2 sensor consists of a tube containing an infrared source at one end and an infrared detector at the other end.
- The infrared detector detects the infrared light which is not absorbed by CO2 between source and detector.
- Infrared radiation which is not being absorbed by CO2 produces heat so the temperature will increase.
- The infrared detector measures the temperature.
- A voltage is produced due to the temperature increase in the infrared sensor.
- We can read amplified voltage into the data logger.

Hydrogen gas sensor:

Mostly palladium is used to detect hydrogen because palladium selectively absorbs hydrogen gas and forms the chemical palladium hydride.

Humidity Detection

Types of hydrogen gas sensor:

- Optical fiber hydrogen sensors
- Nanoparticle-based hydrogen micro sensors
- Diode based sensor

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Features:

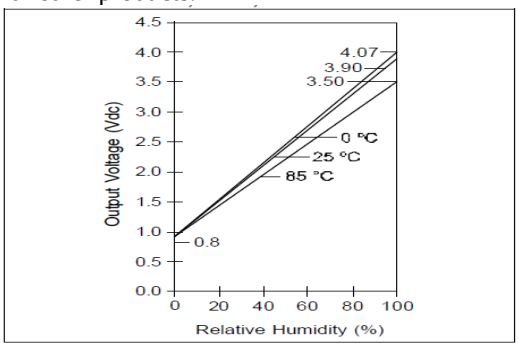
- High sensitivity to LPG, iso-butane, propane
- Small sensitivity to alcohol, smoke.
- Fast response .
- Stable and long life
- Simple drive circuit

Humidity Sensor:

The polymer humidity sensor is made of a thermosetting resin based on AL2O3 ceramics , It's impendence can be changed with the related humidity because the H2O inside the polymer film can infect the inductivity of the sensor.

Feature

The Humidity sensors developed by our technology show excellent electrical properties for water resistance and long-term stability, excellent compared with other products.



Output voltage vs. relative

Titanium Dioxide (TiO2):

TiO2 (titanium dioxide) is an oxide of the metal titanium which occurs naturally as a rutile in some acid igneous rocks and metamorphic rocks, and is also in sedimentary rocks and beach sands. TiO2 (titanium dioxide) is found in heavy mineral sand deposits rutile and is often associated with a common titanium mineral, together with zircon, monazite and magnetite. You will find TiO2in all kinds of paint, printing ink, plastics, paper, synthetic fibers, rubber, condensers, painting colors and crayons, ceramics, electronic components along with food and cosmetics.

Surround Air Multi-Tech Ionizers:

Negative ions clean the air by magnetically attracting to pollutants until these newly-formed larger particles become too heavy to remain in the air you breathe and they fall to the ground. Surround Air Ionizers continually produce negative ions, without creating the "black-wall" effect of older ionization technologies, so even if one of these fallen particles is kicked up into the air, it is quickly removed again. The most important thing, though, is that they are taken out of the air, preventing you from inhaling them into your lungs, which is how they cause problems.

Since certain technologies are much better than others at removing different types of air pollutants, all Surround Ionizers are multi-technology. All models include ionization, a pre filter, a HEPA and Carbon Filter and UV lamp, plus some models include a TiO2 filter or an optional ozone sanitizer. And, the includes electronic sensors. With Surround,

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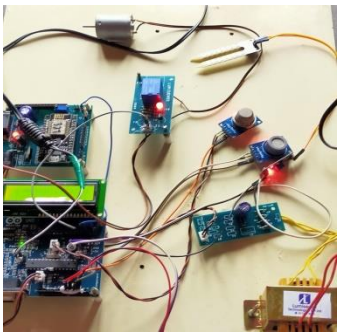
you get the best of the most advanced air purification technologies on the market, all rolled into one air purifier. The best part is that Surround Multi-tech ionizers and replacement filters are affordable for every budget.

RESULT:

This Project at designing an industries air pollution monitoring system which can be installed in a specific locality and to enhance the system from the previously developed system .The environment status can be used by anyone to get in live updates about the pollution in their region.

The output is shown below



III. CONCLUSION:

IV. The proposed ambient air pollution sensing system can provide real-time measurement of five most important for human health air parameters and transfer it to higher level applications for analysis and forecasting. The system integrates CO, PM1.0, PM2.5, PM10, CO2, temperature, and humidity sensors into one compact unit that uses the Arduino platform as a controller component. Measured data is bonded together with timestamp and GPS position. The device saves data into on-board SD card with ability to be transferred to a host computer by direct USB connection or through Wi-Fi transmission or it can be read in-place by TFT display. Mobility is provided by the device compactness and presence of on-board power supply. Such approach gives the ability to implement the low cost flexible mobile air pollution monitoring network in urban areas. Other necessary air pollution parameters could be measured by simple on board adding of new sensors that support corresponding interface. In comparison with the similar systems developed device is designed to be a complete, ready to use portative measuring system, which can be integrated into different higher level ambient air pollution monitoring applications. The article focuses on the implementation features of developed system. Proposed diagrams with their description bring a practical value.

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