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IOT Based Pollution and Temperature Monitoring System

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ABSTRACT

In this article we have discussed and analyze Internet of Things (IOT) based pollution and temperature monitoring system. This system monitoring start from traditional way to the most sophisticated computer has been used to monitor the pollution as well as temperature quality, however the fresh air, preferable sound and temperature is necessary for all human body, for that various technology has been used and some of this technology is really useful in order to provide a real time air, sound quality and temperature data. The aim of this paper is to highlight some technology which is used for air and sound pollution monitoring and identify the important research in this important area.

Keywords: *IOT, Arduino uno, LM135, Sound Sensor, Wi-Fi Module*

I. INTRODUCTION

The main objective of IOT based pollution and temperature Monitoring System is that the Air and sound pollution is a growing issue these days. Environmental monitoring is a systematic approach for observing and studying the condition of environment. For the healthy human being require to breath in a clean air but to increasing the transportation system fresh air get polluted. Many health related issues are arising from air pollution and temperature. Major source of air pollution is road traffic emission which emits the 97% of CO and 75% of NO. Therefore, air quality monitoring is needed in order to provide useful information about the pollution. Here we propose an air pollution as well as sound pollution monitoring system that allows us to monitor and check live air pollution as well as sound pollution in an area through IOT. The main mission of pollution and temperature quality monitoring network is to record the concentration of pollution and deliver these information or data to the population to warn against the any danger.

IOT

The IOT allows objects to be sensed or controlled remotely across existing network infrastructure, creating opportunities for more direct integration of the physical world into computer-based systems, and resulting in improved efficiency, accuracy and economic benefit in addition to reduced human intervention.

Fig1.IoT concept

When IoT is augmented with sensors and actuators, the technology becomes an instance of the more general class of cyber-physical systems, which also encompasses technologies such as smart grids, virtual

power plants, smart homes, intelligent transportation and smart cities. Each thing is uniquely identifiable through its embedded computing system but is able to interoperate within the existing Internet infrastructure. Experts estimate that the IoT will consist of about 30 billion objects by 2020.

Typically, IoT is expected to offer advanced connectivity of devices, systems, and services that goes beyond machine-to-machine (M2M) communications and covers a variety of protocols, domains, and applications. The interconnection of these embedded devices (including smart objects).

"Things", in the IoT sense, can refer to a wide variety of devices such as heart monitoring implants, biochip transponders on farm animals, cameras streaming live feeds of wild animals in coastal waters, automobiles with built-in sensors, DNA analysis devices for environmental/food/pathogen monitoring. These devices collect useful data with the help of various existing technologies and then autonomously flow the data between other devices. Current market examples include home automation (also known as smart home devices) such as the control and automation of lighting, heating (like smart thermostat), ventilation, air conditioning systems, and appliances such as washer/dryers, robotic vacuums, air purifiers, ovens, or refrigerators/freezers that use Wi-Fi for remote monitoring. Examples also include Smart cities, fitness and health monitoring, Industrial automation for gathering of data.

IOT Applications:

Smart city is another powerful application of IOT generating curiosity among world's population.

Smart surveillance, automated transportation, smarter energy management systems, water distribution, urban security and environmental monitoring all are examples of internet of things applications for smart cities.

Internet of Things refers to the rapidly growing network of connected objects that are able to collect and exchange data using embedded sensors. Thermostats, cars, lights, refrigerators and more appliances can all be connected to the IOT.

II. LITERATURE REVIEW AND MOTIVATIONS

In this paper, a general architecture for the IoT was built and hence a very complex task, mainly because of the extremely large variety of devices, link layer technologies, and services that may be involved in such a system. This paper hence provides a ex-pansive survey of the enabling technologies, protocols, and architecture for an urban IoT. The function of this paper is to discuss in general reference structure for the design of an urban IoT. They described the specific characteristics of an urban IoT. Then the overview of the web based approach for the design of IoT services, and the related protocols and technologies, discussing their suitability for the Smart City environment [1].

In this paper, a real time monitoring of three gases such as Carbon monoxide, carbon dioxide & Sulphur dioxide are simulated in real environment .In this simulation, these three gases are successfully tested in the area. Then extended the simulated results to update in web. As the technology increase, the degree of automation in the almost all sectors is also increases. A Radio component that can communicate the sink node or ZigBee router which combine the sensed pollution gas level from sensor node and forwards to the pollution server which is in our campus. Powering these components is typically one or two small batteries.. The sensors self-organize themselves in a radio network using a routing algorithm, monitor the area for measure the gas levels in air, and transmit the data to a central node, sometimes called a pollution server or base station, or sink node that collects the data from all of the sensors[2].

This paper presents the design of a system to give a result for detecting Industrial causing environmental pollution. It may enable to reduce the pollution level over a certain period of time. This system may be integrated as an enabling equipment to design intelligent transportation system for Smart City. The performance and robustness of the pollution monitor and control system can be in additional to improved by implementing Various type of sensors for controlling environmental pollution causing

parameters, thereby enhance the industrial and natural environment. This system can be also used in the MSEB board. As by using different sensors instead of CO and temperature for saving the electricity[3].

The propose of building a smart city is to improve the quality of human life by using technology to improve the efficiency of services. An area that is being surveyed for estimating how much the area is affected by pollution. The structure of the monitoring system was based on a combination of expansive distributed sensing units, information system for data aggregation, and reasoning and context awareness. The results are encouraging as the reliability of sensing information transmission through the proposed integrated network architecture is 97%[4].

In this paper the air & sound monitoring system overcomes the problem of the highly-polluted areas which is a major issue. This system is supports the new technology and effectively supports the healthy life concept. This system has features for the people to monitor the amount of pollution on their mobile phones using the application. So, it becomes very reliable and efficient for the Municipal officials along with the Civilians to monitor environment. This concept of IOT is beneficial for the welfare of the society. And it is implemented using the latest technology[5].

III. SYSTEM MODEL AND ASSUMPTIONS

Block Diagram:

Proposed system can detect the harmful gases and Excessive noise. This system is new concept which can detect both Air and Sound pollution. The sensor we are using here is MQ135 as air and Microphone as sound sensor. Sensor MQ135 is air quality sensor which is used to detect the harmful gases like NH3, CO, CO2 and SO2. The MQ135 sensor is sense the condition and gives the signal to the system. The air and sound pollution monitoring system consist of Gas sensor (MQ135), Sound sensor, Arduino microcontroller, ESP8266 Wi-Fi module and cloud etc.

The block diagram for the working of the Sound and air pollution monitoring system is as following:

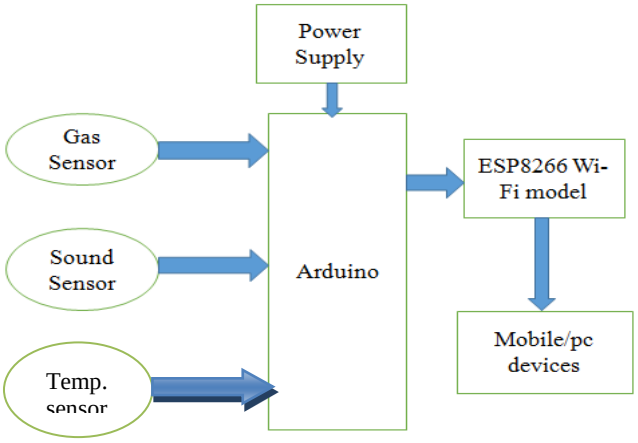


Fig 2: Block Diagram

The sensor we are using here is MQ135 and Microphone sound sensor. Sensor MQ135 is air quality sensor which is used to detect the harmful gases like NH3, CO, CO2 and SO2. The MQ135 is used to measure the air quality of the atmosphere. Microphone sensor shows the noise value in dB. Here we are proposed system in which the arduino is the heart of the system. The atmospheric condition is checking by the sensors all the time. When the sensed value reaches to the threshold point then sensor gives that information to the arduino.

After that arduino check all sensor value. Arduino then process the values and gives the signal to the webpage. This system is based on the arduino and all the processing is takes place in arduino only. Wi-Fi module is providing the network connection to the computer for sending the information to the public.

This allows authorities to monitor air pollution in different areas and act against it. Also, authorities can keep a watch on the noise pollution near schools, hospitals and no honking areas.

IV. HARDWARE REQUIREMENT

Arduino controller:

Arduino Uno R3 microcontroller. It is the most flexible hardware platform used based on ATmega328P which can be programmed according to the function where it is to be used. It has 6 analog inputs, 14 digital input/output pins(6 pins of these can

be used as PWM outputs) , a USB connection, a 16 MHz quartz crystal, SPI, serial interface, a reset button, a power jack and an ICSP header.

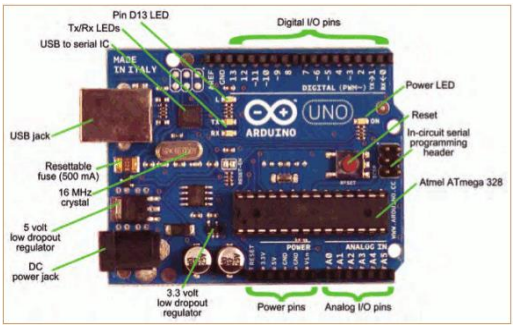


Fig 4: ArduinoUno board

It is the primary component of the framework. In addition, it is an open source microcontroller device with easily accessible software/hardware platform and is compatible with many sensors available. Everything needed for its working is present on the board; we only require a USB cable to directly connect it to the computer or give power using battery source or AC to DC adapter to get started.

Also, it is not expensive and can be assessed with free authoring software i.e. IDE. With the availability of a large no. of source codes over the internet, the programming of Arduino becomes easy. The online growing community backing Arduino consists of programmers like us that share their examples for others to make it a more reliable platform

Parameter	Value
CPU type	8-bit AVR
Performance	20MIPS at 20MHz
Flash Memory	32 kB
SRAM	2 kB
EEPROM	1 kB
PIN Count	28-pin PDIP,32-pin TQFP
Max. operating Frequency	20MHz
Number Of touch Channel	16
Max. Input output pin	26
External interrupts	2

Table 1: Arduino features

Gas Sensor(MQ135):

Sensitive material of MQ135 gas sensor is SnO2, which has lower conductivity in clean air. When the target combustible gas exist, the sensor's conductivity is more higher along with the gas concentration rising.

MQ135 gas sensor has high sensitivity to A Sulphide and Benze steam, also sensitive to smoke and other harmful gases. It is with low cost.

Fig 5: Gas sensor(MQ135)

Specification of MQ135 :

1. Operating Voltage: 5V DC.
2. Type: Analog & Digital.
3. Pin:1-O/P,2-GND,3-Vcc
4. Detecting Type: Air Quality.
5. Sensitivity to Ammonia, Sulphide and Benzene steam.
6. Detecting Range: 100-1000ppm

Feature:

- Good sensitivity to Harmful gases in wide range
- High sensitivity to Ammonia, Sulfide and Benze
- Long life and low cost
- Simple drive circuit

Application:

- Domestic air pollution detector
- Industrial air pollution detector
- Portable air pollution detector

Sound Sensor:

The sound sensor module provides an easy way to detect sound and is generally used for detecting sound intensity. This module can be used for security, switch, and monitoring applications. Its

accuracy can be easily adjusted for the convenience of usage.

It uses a microphone which supplies the input to an amplifier, peak detector and buffer. When the sensor detects a sound, it processes an output signal voltage which is sent to a microcontroller then performs necessary processing.

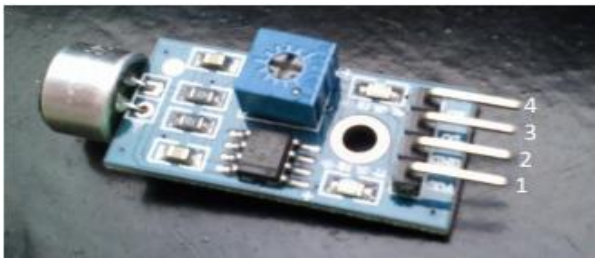


Fig 5: sound sensor

1. VCC: 3.3V-5V DC
2. GND: ground
3. DO: digital output
4. AO: analog output

Specification of Sound Sensor :

- Operating voltage 3.3V-5V
- Output model: digital switch outputs (0 and 1, high or low level)
- Voltage Gain 26dB
- Microphone Impedance 2.2kΩ
- Microphone Frequency 16.20 kHz

ESP8266 Wi-Fi model:

ESP8266 is an impressive, low cost Wi-Fi module suitable for adding Wi-Fi functionality to an existing microcontroller project via a UART serial connection. The module can even be reprogrammed to act as a standalone Wi-Fi connected device

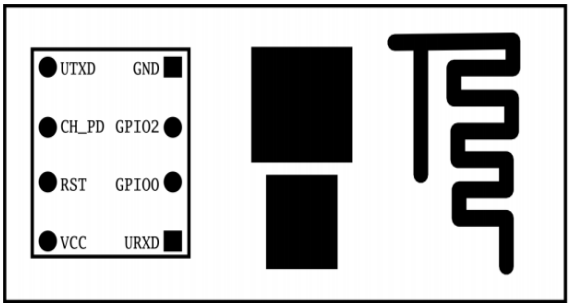


Fig 6: Wi-Fi module pin out(ESP8266)

Specification of Wi-Fi module:

- 802.11 b/g/n protocol
- Wi-Fi Direct (P2P)
- Integrated TCP/IP protocol stack
- Integrated PLL, regulators, and power management units
- +19.5dBm output power in 802.11b mode
- Integrated temperature sensor
- Supports antenna diversity
- Power down leakage current of < 10uA
- Integrated low power 32-bit CPU could be used as application processor

ESP8266 Applications

- Smart power plug
- Home automation
- Mesh network

Temperature Sensor(LM35):

The LM35 series are precision integrated-circuit temperature sensors, whose output voltage is linearly proportional to the Celsius (Centigrade) temperature. The LM35 thus has an advantage over linear temperature sensors calibrated in ˚ Kelvin, as the user is not required to subtract a large constant voltage from its output to obtain convenient Centigrade scaling.

It can be used with single power supplies, or with plus and minus supplies. As it draws only 60 μA from its supply, it has very low self-heating, less than 0.1˚C in still air. The LM35 is rated to operate over a –55˚ to +150˚C temperature range, while the LM35C is rated for a –40˚ to +110˚C range.

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 from 4 to 30 volts
- Less than 60 μA current drain
- Low self-heating, 0.08˚C in still air
- Nonlinearity only ±1⁄4˚C typical
- Low impedance output, 0.1 Ω for 1 mA load

V.ADVANTAGES

i. Remotely we can Monitor Pollution.
ii. Cheap In Cost.
iii. Data can be used to control pollution.
iv. Small in size.
v. Data is useful for government Health departments.

V. APPLICATION

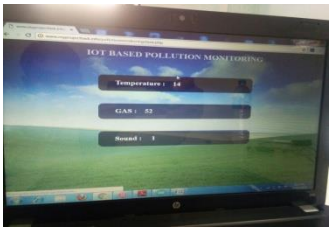
Smart cities:

- Industrial pollution monitoring
- Public place
- School area.
- Environmental Section.

This system can install in Vehicles.

VI. RESULT

The pollution and Temperature Monitoring system monitor pollution in air and measure the temperature in atmospheric using mobile application. It shows the value of air and sound pollution and temperature.



VIII.CONCLUSION

Thus the articles explain the basic structure and system design for IOT based pollution and temperature monitoring system. The articles also explain the basic blocks and components used in this system.

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