Smart Pollution Monitoring Using Internet of Things

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Abstract- *Now a day's The Internet of Things (IoT) is an important topic in technology industry, policy, and engineering circles.Sensors are embedded in physical objects are linked through wired and wireless networks, often using the same Internet Protocol (IP) that connects the Internet. The idea is that not only your computer and your smartphone can talk to each other, but also all the things around you.In this project monitoring of air pollution and has been done. Every parameter measure in this project can be monitor through any PC having internet connection by using IOT app made.The MQ_7 Gas sensor will measure amount of CO_2 gas present in air around industry.*

Keywords- CSTR-PID-ZN-Fuzzy-MRAM-MATLAB.

I. INTRODUCTION

1.1 Internet of things

Now a day's The Internet of Things (IoT) is an important topic in technology industry, policy, and engineering circles.

The term "Internet of Things" (IoT) was first used in 1999 by British technology pioneer Kevin Ashton to describe a system in which objects in the physical world could be connected to the Internet by sensors, softwares. Sensors are embedded in physical objects are linked throughwired and wireless networks, often using the same Internet Protocol (IP) that connects the Internet. The idea is that not only your computer and your smartphone can talk to each other, but also all the things around you. From connected homes and cities to connected cars and machines to devices that track an individual's behavior and use the data collected for new kind of services. IoT systems like networked vehicles, intelligent traffic systems, and sensors embedded in roads and bridges move us closer to the idea of "smart cities'', which help minimize congestion and energy consumption.

IoT technology offers the possibility to transform agriculture, industry, and energy production and distribution by increasing the availability of information along the value chain of production using networked sensors.Although not required, most IoT devices usually have some cloud service to manage the device from the web or mobile app. The point of a device being networked is so you can access it effortlessly from anywhere you have an internet connection. A networked device you can't access remotely doesn't have much value.Most people think of automated devices when they think of IoT. That's because of the smart home concept we've been predicting since the 1950s. This category includes things like connected lights, switches, thermostats, and other home appliances (including smart batteries).

1.2 Introduction to air noise water pollution in industrial reservoir

1.2.1 Air pollution

The main sources of air pollution in India and elsewhere are mineral dust and gases, automobiles, thermal power plants and industries .Air pollution can also cause acid rain which damages soil, vegetation and aquatic life of the region.

II. LITERATURE SURVEY

2.1 "Internet of Things for Smart Cities" By Andrea Zanella, NicolaBui, Angelo Castellani, Lorenzo Vangelista, Senior Members ,IEEE, and Michele Zorzi, Fellow, IEEE,published in IEEE Internet Of Things Journal, Vol. 1, No. 1, February 2014 at pg.22-32

The Internet of Things (IoT) shall be able to incorporate transparently and seamlessly a large number of different and heterogeneous end systems, while providing open access to selected subsets of data for the development of a plethora of digital services. Building a general architecture for the IoT is 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. In this paper, we focus specifically to an urban IoT system that, while still being quite a broad category, is characterized by their specific application domain. Urban IoTs, in fact, are designed to support the Smart City vision, which aims at exploiting the most advanced communication technologies to support added-value services for the administration of the city and for the citizens. This paper hence provides a comprehensive survey of

the enabling technologies, protocols, and architecture for an urban IoT. Furthermore, the paper will present and discuss the technical solutions and best-practice guidelines adopted in the Padova Smart City project, a proof-of-concept deployment of an IoT island in the city of Padova, Italy, performed in collaboration with the city municipality.

2.2 "Implementation of an Efficient Noise and Air Pollution Monitoring System Using Internet of Things (IoT)" ByAnjaiahGuthi ,M. Tech Student, ECE, GRIET, Hyderabad,published in International Journal of Advanced Research in Computer and Communication Engineering,Vol. 5, Issue 7, July 2016 at pg.237-242

The rapid growth in infrastructure and industrial plants creating environmental issues like climate change, malfunctioning and pollution has greatly influenced for the need of an efficient, cheap, operationally adaptable and smart monitoring systems. In this context smart sensor networks are an emerging field of research which combines many challenges of computer science, wireless communication and electronics. In this paper a solution for monitoring the noise and air pollution levels in industrial environment or particular area of interest using wireless embedded computing system is proposed.

The solution includes the technology Internet of Things (IoT) which is outcome of merged field of computer science and electronics. Here the sensing devices are connected to the embedded computing system to monitor the fluctuation of parameters like noise and air pollution levels from their normal levels. This model is adaptable and distributive for any infrastructural environment that needs continuous monitoring, controlling and behavior analysis. The working performance of the proposed model is evaluated using prototype implementation, consisting of Arduino UNO board, sensor devices and MATLAB with Arduino hardware support package. The implementation is tested for two or three parameters like noise, CO and radiation levels with respect to the normal behavior levels or given specifications which provide a control over the pollution monitoring to make the environment smart.

2.3 "Design of a WSN Platform for Long-TermEnvironmental Monitoring for IoT Applications" By Mihai T. Lazarescu,published in IEEE Journal On Emerging And Selected Topics In Circuits And Systems, Vol. 3, No. 1, March 2013at pg.45-54

The Internet of Things (IoT) provides a virtual view, via the Internet Protocol, to a huge variety of real life objects,ranging from a car, to a teacup, to a building, to trees in a forest.Its appeal is the ubiquitous generalized access to the status and location of any "thing" we may be interested in.Wireless sensor networks (WSN) are well suited for long-term environmental data acquisition for IoT representation. This paper presents the functional design and implementation of a complete WSN platform that can be used for a range of long-term environmental monitoring IoT applications. The application requirements for low cost, high number of sensors, fast deployment, long lifetime, low maintenance, and high quality of service are considered in the specification and design of the platform and of all its components. Low-effort platform reuse is also considered starting from the specifications and at all design levels for a wide array of related monitoring applications.

III. BLOCK DIAGRAM

3.1 Working

3.1.1 Temperature Sensor

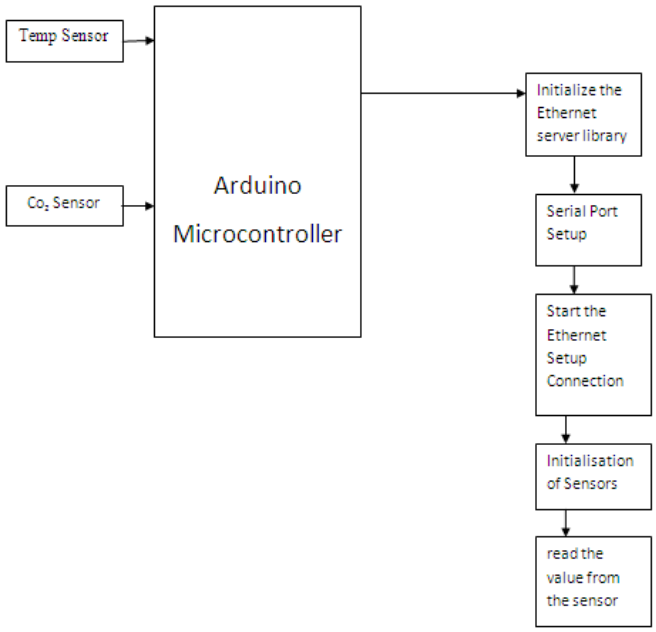

Fig 3.1 Block diagram

3.1.2MQ_7 Gas Sensor

CO_2 sensor is an instrument for the measurement of Carbon dioxide gas used for measuring the air pollution.

3.1.3Arduino Microcontroller

All Sensors are connected to Arduino microcontroller.

By using USB to Serial Converter we can send data to be monitored to server PC.

3.1.13 Web Server

The web server is used for a system monitoring and retrieving of data.

IV. HARDWARE DESCRIPTION

4.1 Temperature Sensor

The LM35 series are precision integrated-circuit temperature devices with an output voltage linearly-proportional to the Centigrade temperature. The LM35 device has an advantage over linear temperature sensors calibrated in Kelvin, as the user is not required to subtract a large constant voltage from the output to obtain convenient Centigrade scaling. The LM35 device does not require any external calibration or trimming to provide typical accuracies of ±¼°C at room temperature and ±¾°C .The LM35's low output impedance, linear output, and precise inherent calibration make interfacing to readout or control circuitry especially easy.

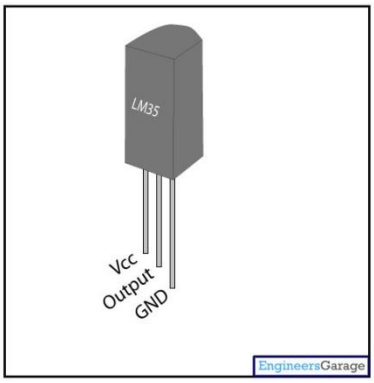

Fig 4.1 Pin Diagram

4.1.1 Pin Description

Pin No	Function	Name
1	Supply voltage; 5V (+35V to -2V)	Vcc
2	Output voltage (+6V to -1V)	Output
3	Ground (0V)	Ground

4.1.2 Features of LM35 Temperature Sensor

1) Calibrated directly in ° Celsius (Centigrade)
2) Linear + 10.0 mV/°C scale factor
3) Rated for full −55° to +150°C range
4) Suitable for remote applications
5) Low cost due to wafer-level trimming
6) Operates from 4 to 30 volts
7) Less than 60 µA current drain
8) Low self-heating, 0.08°C in still air
9) Nonlinearity only ±1⁄4°C typical
10) Low impedance output, 0.1 W for 1 mA load

4.2 MQ-7 Gas Sensors

Structure and configuration, basic measuring circuit.Structure and configuration of MQ-7 gas sensor is composed by micro AL2O3 ceramic tube, Tin Dioxide (SnO2) sensitive layer, measuring electrode and heater are fixed into a crust made by plastic and stainless steel net. The heater provides necessary work conditions for work of sensitive components

4.2.1 Features

1. High sensitivity to carbon monoxide
2. Stable and long life

4.2.2 Application

They are used in gas detecting equipment for carbon dioxide (CO_2).

4.3Arduino Microcontroller

1) Arduino is an open-source platform used for building electronics projects.
2) Arduino consists of both a physical programmable circuit board (often referred to as a microcontroller) and a piece of software, or IDE (Integrated Development Environment) that runs on your computer, used to write and upload computer code to the physical board.
3) The Arduino IDE uses a simplified version of C++,Java.

Fig 4.4 Arduino kit diagram

4.5.1 Pin description

1. **USB connection (1):**EveryArduino board needs a way to be connected to a power source. The Arduino UNO can be powered from a USB cable coming from your computer or a wall power supply .
2. **Barrel Jack(2):**Power supply is terminated.
3. **GND (3):** Short for 'Ground'. There are several GND pins on the Arduino, any of which can be used to ground your circuit.
4. **5V (4) & 3.3V (5):** The 5V pin supplies 5 volts of power, and the 3.3V pin supplies 3.3 volts of power. Most of the simple components used with the Arduino run happily off of 5 or 3.3 volts.
5. **Analog (6):** The area of pins under the 'Analog In' label (A0 through A5 on the UNO) are Analog In pins. These pins can read the signal from an analogsensor and convert it into a digital value that we can read.
6. **Digital (7)**: Across from the analog pins are the digital pins (0 through 13 on the UNO). These pins can be used for both digital input (like telling if a button is pushed) and digital output (like powering an LED).
7. **PWM (8)**: You may have noticed the tilde (~) next to some of the digital pins (3, 5, 6, 9, 10, and 11 on the UNO). These pins act as normal digital pins, but can also be used for something called Pulse-Width Modulation (PWM)
8. **AREF (9)**: Stands for Analog Reference. Most of the time you can leave this pin alone. It is sometimes used to set an external reference voltage (between 0 and 5 Volts) as the upper limit for the analog input pins.
9. **Reset Button(10):**Pushing it will temporarily connect the reset pin to ground and restart any code that is loaded on the Arduino. This can be very useful if your code doesn't repeat, but you want to test it multiple times.
10. **Power LED Indicator(11):**This LED should light up whenever you plug your Arduino into a power source. If this light doesn't turn on, there's a good chance something is wrong.
11. **TX RX LEDs(12):**These LEDs will give us some nice visual indications whenever our Arduino is receiving or transmitting data.
12. **Main IC (13) :** Think of it as the brains of our Arduino. The main IC on the Arduino is slightly different from board type to board type, but is usually from the ATmega line of IC's from the ATMEL Company. This can be important, as you may need to know the IC type (along with your board type) before loading up a new program from the Arduino software.
13. **Voltage Regulator(14):**The voltage regulator does exactly what it says – it controls the amount of voltage that is let into the Arduino board. Think of it as a kind of gatekeeper; it will turn away an extra voltage that might harm the circuit. Of course, it has its limits, so don't hook up your Arduino to anything greater than 20 volts.

4.10 USB to Serial converter

A superior minimal effort USB to UART interface permitting you to speak with TTL serial gadgets, for example, microcontroller UART's utilizing your PC

4.6.1 Features

1. Single-Chip USB to UART Data Transfer
2. Integrated USB transceiver; no external resistors required
3. Integrated clock; no external crystal required
4. USB Function Controller
5. Specification 2.0 compliant;
6. Full-speed (12 Mbps)

V. PROPOSED SYSTEM

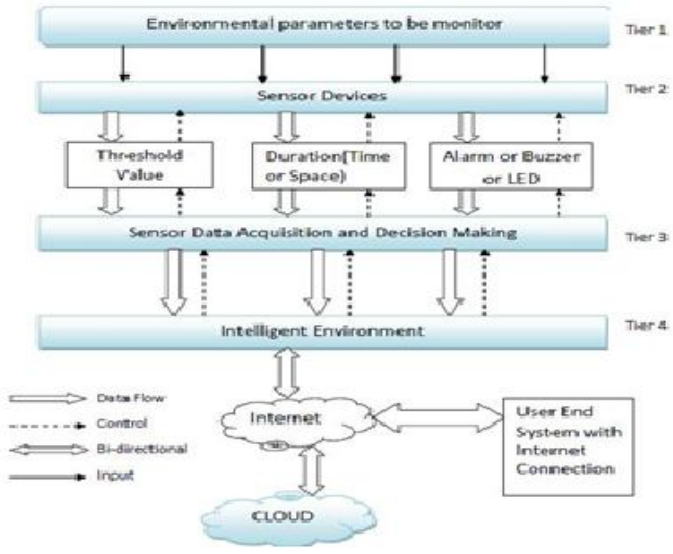

Fig. proposed model

The proposed embedded device is for monitoring CO levels in the atmosphere to make the environment intelligent or interactive with the objects through wireless communication. The proposed model is shown in figure 2 which is more adaptable and distributive in nature to monitor the environmental parameters.

The goal of smart city is to improve quality of life by using technology. Information and Here, the tier 1 provides information about the parameters under the region which is to be monitored for air pollution control.

Tier 2 deals with the sensor devices with suitable characteristics, features and each of these sensor devices are operated and controlled based on their sensitivity as well as the range of sensing.Communication Technology allows city to interact directly with the public to tell what is happening in the city .Consider an area that is being surveyed for estimating how much the area is affected by pollution. The constituents of air along with its proportion are calculated and if it is higher than normal then the officials are intimated about it.

More recently, portable carbon monoxide analyzers with automated data-logging have become available for personal exposure monitoring. These measurements are based on the electrochemical reactions between carbon monoxide and de-ionized water, which are detected by specially designed sensors. Nowadays the resolution, stability and sensitivity of the electrochemical analyzers are within the specifications of the reference method and, together with the data-logging systems, they fit into a small rucksack or even a pocket.

VI. SYSTEMIMPLEMENTATION

Based on the framework shown in figure , we have identified a suitable implementation model that consists of different sensor devices and other modules, their functionalities.

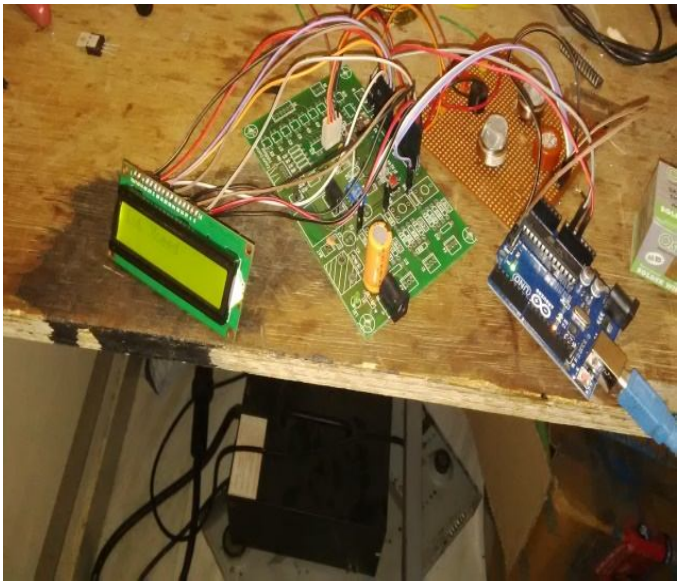

Fig 3System Implementation

In this implementation model we used Arduino UNO board with Wi-Fi module is as embedded device for sensing and storing the data. Arduino UNO board consist of analog input pins (A0-A5), digital output pins (D0-D13), inbuilt ADC and Wi-Fi module connects the embedded device to internet. Sensors are connected to Arduino UNO board for monitoring, ADC will convert the corresponding sensor reading to its digital value and from that value the corresponding environmental parameter will be evaluated. The Wi-Fi connection has to be established to transfer sensors data to end user and also send it to the cloud storage for future usage The sensor detects in that area and Carbon Monoxide (CO) sensor MQ-2 will record the air quality in that region, if the threshold limit is crossed the corresponding controlling action will be taken (like issuing message alarm or buzzer or LED blink).All the sensor devices are connected to internet through Wi-Fi module. The is a model of data storage in which the digital data is stored in logical pools, the physical storage spans multiple servers, and the physical environment is usually owned and managed by hosting company. These storage providers are responsible for keeping the data obtainable and accessible, and the physical environment protected and running.

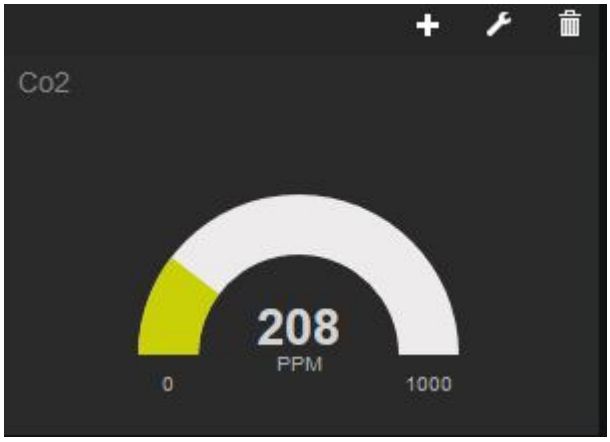

Fig 4 CO2Value

The sensor detects in that area and Carbon dyonoxide (CO) sensor MQ-7 will record the air quality in that region, if the threshold limit is crossed the corresponding controlling action will be taken (like issuing message alarm or buzzer or LED blink).

Fig 5 CO Value

The sensor detects in that area and Carbon monoxide (CO) sensor MQ-2 will record the air quality in that region, if the threshold limit is crossed the corresponding controlling action will be taken (like issuing message alarm or buzzer or LED blink).

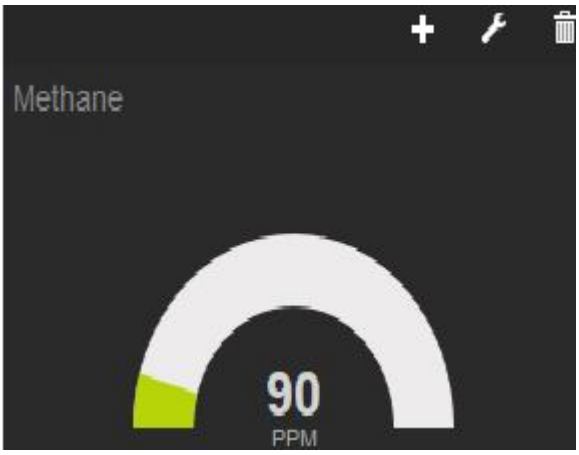

Fig 6 Methane Value

The sensor detects in that area and Carbon dyonoxide (CO) sensor MQ-135 will record the air quality in that region, if the threshold limit is crossed the corresponding controlling action will be taken (like issuing message alarm or buzzer or LED blink).

ADVANTAGES

1. Air quality monitoring system is very effective to control pollution.
2. It achieves high speed and flexibility in the process of monitoring and reporting air parameters data without loss.
3. This protocol gives very high precision and high degree of automation.
4. It is Cost-effective solution.
5. It gives real time and continues observation.

APPLICATIONS

1. For health department.
2. This system can use in commercial and domestic use.

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