International Research Journal of Engineering and Technology (IRJET) e-ISSN: 2395-0056
Volume: 07 Issue: 01 | Jan 2020 www.irjet.net p-ISSN: 2395-0072

An IoT based low cost air pollution monitoring system

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Abstract - *The extent of air pollution which is brought about by vehicles or ventures or people are expanding. So as to take care of this significant issue, numerous nations and regions have just exhibited a progression of emanations norms, in the mean time a few techniques has been created. Indeed, even there are various techniques to screen the contamination content; those are a lot of exorbitant that not every person can adjust those strategies or gadgets. We are going to make an IoT based Air pollution checking framework, which screens the Air quality over a web server utilizing Internet and will trigger a caution when the air quality goes down past a specific edge level, implies when there are adequate measure of unsafe gases present noticeable all around like CO, CO2, NO2. It will show the air quality on LCD and just as on website page with the goal that we can screen effectively utilizing mobile phone or PC.*

Key Words*: *Air Pollution, IOT(Internet of things), Wifi module, Gas sensors

1. INTRODUCTION

Over the past quarter century, there has been an exponential growth of industries. These industries have caused complex and high problems to the environment. Considering the importance of air quality on human lives, the planet Health Organization (WHO) has developed guidelines for reducing the health effects of pollution on public health by setting the bounds of the concentrations of varied air pollutants, a number of which are ground–level ozone (O3), dioxide (NO2), and sulphur dioxide (SO2).The first and therefore the foremost is that the severe environmental pollution which has caused deterioration of atmosphere, global climate change, stratospheric ozone depletion, loss of biodiversity, changes in hydrological systems and therefore the supplies of water, land degradation and stress on systems of food producing, acid rain, and heating. Stationary and mobile sources release various chemical pollutants, including suspended particulate (SPM), carbon monoxide gas (CO), oxides of nitrogen (NO), oxides of sulfur (SO), lead aerosol, volatile organic compounds (VOC), and other toxics. It's documented that a number of these chemical pollutants have increased the occurrence of diseases like carcinoma, pneumonia, asthma, bronchitis, arteria coronaria disease, and chronic pulmonary diseases. Hence, there's a growing demand for the environmental pollution monitoring systems. In sight of the ever-increasing pollution sources with a range of toxic chemicals, these systems should have the facilities to detect and quantify the sources rapidly. Using laboratory analysis, conventional air automatic monitoring system has relatively complex equipment technology, huge bulkiness, unstable operation and high cost. High cost and enormous volume make it impossible for large-scale istallation. This technique can only be installed in key monitoring locations of some key enterprises, thus system data is unavailable to predict overall pollution situation. To beat defects of traditional monitoring system and detection methods and to scale back test cost, this work proposes a way combining IoT technology with environment monitoring.

2. RELATED WORK

Monitoring environmental conditions in homes are inspected in [4]. A framework is proposed by author to watch temperature, humidity and lightweight intensity, which is predicated on a mixture of pervasive distributed sensing units, data system for data aggregation, and reasoning and context awareness. The reliability of the sensing information is encouraging. Several monitoring system are proposed recently for environmental pollution monitoring. While, number of monitoring systems are specific for monitoring of CO2 (carbon-dioxide). In [5] a monitoring system is developed which provides the concentration of Carbon-di-oxide of remote area. The system also reports various parameters like temperature, humidity and lightweight intensity of the outdoor monitoring area. Similarly, an urban CO2 monitoring system presented by author in [6]. The system operates outdoor at an populated area around 100 square kilometers. To watch volatile organic compounds pollution levels in indoor environments a low-power ZigBee sensor network is proposed in [7]. A WSN based system is presented for indoor and outdoor air quality monitoring in [8]. An array of sensors is present at each one node which is connected to the innermost monitoring unit either hardwired or wirelessly.

3. PROPOSED SYSTEM

A prototype for an Environmental pollution Monitoring System for monitoring the concentrations of major air pollutant gases has been developed. The system uses low cost air-quality monitoring nodes comprises of low cost semiconductor gas sensor with Wi-Fi modules. This technique measures concentrations of gases like CO, CO2

and No2 using semiconductor sensors. The sensors will gather the info of varied environmental parameters and supply it to micro controller which act as a base station. Realization of knowledge gathered by sensors is displayed on based Web server by using IoT. The elemental aspect of proposed work is to supply low cost infrastructure to enable the info collection and monitoring the pollution levels.

BLOCK DIAGRAM

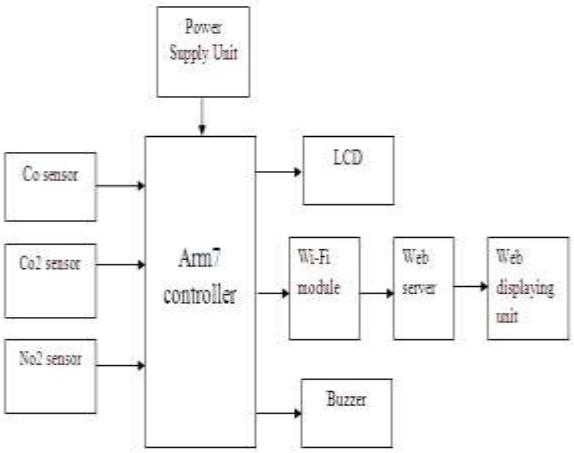

Fig -1: Block diagram of proposed system

HARDWARE REQUIREMENTS

- Wi-Fi Module
- Micro Controller - Arm7
- Sensors – Co,Co2,No2
- LCD
- Buzzer
- Power Supply Unit
- Miscellaneous Components

Arm7 Processor

ARM 7 processor is an electronic model used as a connecting and as well as control link between the devices that are to be controlled. A controller is employed which can be a cellular device or a computer with internet connectivity. A Wi-Fi module is in use which connects the ARM 7 processor to the virtual server.

MQ-135 Gas Sensor

The MQ-135 gas sensor senses the gases like ammonia nitrogen, oxygen, alcohols, aromatic compounds, sulfide and smoke. The boost converter of the chip MQ-3 gas sensor is PT1301. The operating voltage of this gas sensor is from 2.5V to 5.0V. The MQ-3 gas sensor features a lower conductivity to wash the air as a gas sensing material within the atmosphere we will find polluting gases, but the conductivity of gas sensor increases as the concentration of polluting gas increases. MQ-135 gas sensor are often implemented to detect the smoke, benzene, steam and other harmful gases. It's potential to detect different harmful gases. The MQ-135 gas sensor is low cost to get. The essential image of the MQ-135 sensor is shown within the below figure.

Fig -2: MQ135 gas sensor

MQ7 Sensor

MQ-7 carbon monoxide gas fuel Sensor Module detects the concentrations of CO within the air and outputs its reading as an analog voltage. The sensor can measure concentrations of 10 to 10,000 ppm. The sensor can operate at temperatures from 10 to 50℃ and consumes not up to 150 mA at 5 V. This module provides both digital and analog outputs. The intensity for digital output is often easily adjusted using the preset on the board. The MQ-7 sensor module are often easily interfaced with any Micro-controllers like Arduino, arm7 etc.

Fig -3: MQ7 gas sensor

MQ2 gas sensor

MQ2 is one among the commonly used gas sensors in MQ sensor series. It's a Metal Oxide Semiconductor (MOS) type gas Sensor which is also known as Chemi-resistors as the detection is predicated up on change of resistance of the sensing material when the gas comes in touch with the corresponding fabric. Employing a simple potential divider network, concentrations of gas are often detected.

Fig -4: MQ2 gas sensor

WI-FI Module

HLK-RM04 may be a new low-cost embedded UART-ETH-WIFI module (serial port - Ethernet - Wireless network) developed by Shenzhen Hi-Link Electronic co., Ltd. This product is an embedded module supported the universal serial interface network standard, built-in TCP / IP protocol stack, enabling the user interface, Ethernet, wireless network interface between the conversions. Through the HLK-RM04 module, the normal serial devices don't go to change any configuration; data are often transmitted through the web network. It provides a fast solution for the user's serial devices to transmit data via Ethernet.

Fig -5: UART wifi Module

SOFTWARE

Using KEIL µ vision software the specified program is made, executed then flashed into ARM 7 processor using UART Bridge. Embedded C is employed and used as coding language. Here UART Bridge was used to transfer data from PC to processor in sequence. Flash magic software is employed for flashing of program. ARM7 processor starts when the facility power supply is given thereto.

4. RESULTS AND DISCUSSION

The proposed hardware setup was successfully measured the gases and display on LCD screen and webpage. After sensing the information from totally distinct devices, which we are placed specially area unit of interest. The perceived information are going to be mechanically sent to the local server, once an accurate connection is established with device and server, web page provides the knowledge regarding the intensity of CO2, CO, NO2 level variations during this specific region, wherever the embedded monitoring system is placed.

Fig -6: Hardware setup displaying parameters on LCD

We have to attach the Wi-Fi of your ESP8266 device first before uploading the code. After uploading, we'll open the serial monitor and it'll display the IP address. Type the corresponding IP address in your browser, it'll show you the output as shown below. You'll need to refresh the page again if you would like to determine the present Air Quality Value. We've setup an area server to demonstrate its working, but to watch the air quality from anywhere within the world, we'd like to forward the port 80 (used for HTTP or internet) to our local or private IP address (192.168*) of our device. After port forwarding all the incoming connections are going to be forwarded to the present local address and you'll open webpage by just entering the general public IP address of your internet from anywhere. We will forward the port by logging into your router (192.168.1.1) and that we can find the choice to setup the port forwarding.

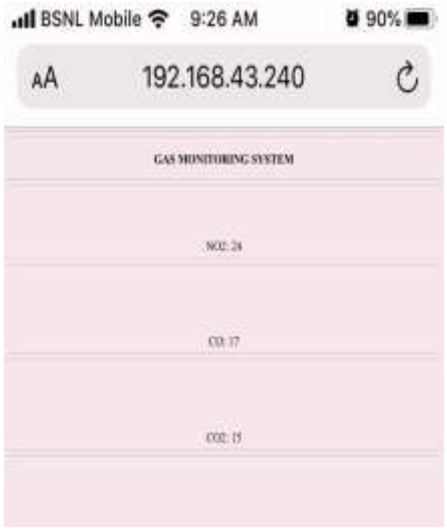

Fig -7: Monitoring gas levels on webpage through mobile

5. CONCLUSION AND FUTURE SCOPE

By keeping the embedded devices within the environment for monitoring enables self protection (i.e., smart environment) to the environment. To implement this got to deploy the sensor devices within the environment for collecting the info and analysis. By deploying sensor devices within the environment, we will bring the environment into real world i.e. it can interact with other objects through the network. Then the collected data and analysis results are going to be available to the top user through the Wi-Fi. Hence we conclude our project proposal is all about for the beneficiary to the peoples in our society to stop themselves

from the hazardous gas. The future scope is that device which we are having are often wiped out an compact way by reducing the proportions of the device for further implementation or the modifications which may be is that detecting the vehicles amount of pollution which may be determined. In future the range are often made increased consistent with the bandwidth for the high range frequencies. Further researches are often made by making the people within the right direction for his or her welfare. Therefore there's another beneficiary by using this device in an app therefore the all are often utilized in an GSM mobile phones for his or her daily updates by increasing their range

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