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Air Quality Monitoring System

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Abstract: *In both developed and developing countries, air pollution is increasing daily, compromising the air quality index and causing harm to everyone. Some of the reasons for this rapid increase in air pollution include the growing population, rising number of industries, rapid urbanization, and excessive use of fuel-consuming transportation. Hence, there is an ever-increasing need to monitor air quality using an energy-efficient, ubiquitous and connected manner. The system presented in this project is an advanced real time air quality reporting system supported with Internet Of things (IOT) architecture. The term Internet of Things (IoT) describes the network of physical objects—"things"—that are embedded with sensors, software, and other technologies for the purpose of connecting and exchanging data with other devices and systems over the internet. Degrading air qualit has been a matter of concern nowadays and real time monitoring of air quality helps us to keep a check on it.Air Quality is the scale to measure how polluted the air is. Greater air pollution indicates more dangerous air is for human health. The model presented here uses a combination of the Arduino IDE software and hardware along with a Gas sensors - MQ135, temperature and humidity sensor which help in detecting gases like NO2, CO, Ammonia, and Sulphide. Live location tracking and Data updating will also be done with the help of GPS and IOT. Further, this research work monitor the Air Quality over an IOT analytics application BLYNK using internet connected with the hardware. It can also integrate the real time data into our mobile phone app. The circuit finally displays the PPM values as well as Air Quality level of gases on an Android application which fetches data from sensor through IoT. The current model is implemented successfully and can be deployed for real system implementations.*

Key Word: *Air quality, Temperature, Humidity , Fire*

I.INTRODUCTION

The paper presents a network of indoor air quality monitoring systems, fire alarms, and the prevention of *a*ccidents due to gas leakage. This portable device has embedded sensors that can be mounted at houses, malls, hospitals, garages, and industries. This is an IoT-based project. In recent days, air pollution has reached alarming levels in Pakistan especially in metropolitan cities According to the Ministry of Natural Resources and Environment, there are a lot of factors that add to pollution. For instance, emissions from vehicles, development projects, industries, forest fires, power generation increase the concentration of CO2.Air pollution greatly affects human health and leaves a significant influence on industry workers and the people around them.

Numerous harmful gases affect the air quality and make it unsafe to breathe in. Also, there are some gases like methane gas that can cause major accidents if not eliminated or at least detected at the correct time. In Pakistan, industries are more focused on equipping the fire extinguisher detectors rather than the air monitoring detector. Focusing on an individual's health is also very vital because this type of minor negligence leads to severe health concerns and sometimes even death. Numerous gases are harmful to one's health and unable to detect by human senses. Hence, it is immensely important to keep the air pollution levels checked, specifically in the urban areas.

To execute this plan, we will need to develop an air pollution detector. We sought a model that could detect the degree of pollution. We designed the prototype of an IoT-based air pollution detector to supervise or observe the increased air pollution levels. IoT has a vast application in today's smart world. It helps in connecting everyday elements to the internet where computers allow us to use and exchange data with very little interference from humans. One of the important applications of IoT is natural environment detection. A record of the surroundings and environment is the most important aspect of human life. IoT has caused numerous evolutions in technology like cloud and machine learning. Not just this, IoT is helping us with making improvements in processes for environment monitoring, health improvement LCD, and other fields related to human well-being. Back in time, detection of pollution was a difficult task but nowadays with the help of IoT-based technologies, it is easy to detect and find solutions to rising pollution enabling people to take safety measures at least in confined spaces. Multiple IoT-based devices in the market are purely dedicated to environment monitoring like air quality and concentration measurement of gases. These sensors along with IoT applications create a marvelous environment for better surroundings. The IoT-based Air Pollution Monitoring System analyses the air quality through the internet and will trigger an alarm if the air quality drops below a particular threshold, indicating the presence of dangerous gases such as CO2, smoke, alcohol, benzene, NH3, CH4, and LPG. The system will display the air quality in parts per million on the LCD and webpage enabling easy monitoring. Moreover, the fan will also switch on to clear the pollution in the room.

II.LITERATURE SURVEY

Literature Review 1

Title

Ambient Air Monitoring System With Adaptive Performance Stability

Author

Rady purbakawaca1, (graduate student member, ieee), arief sabdo yuwono2 , i. Dewa made subrata1 , supandi3, and husin alatas 4,5

Year

2022

Description

This study aimed to design an inexpensive air quality monitoring system using metal oxide sensors to measure the concentrations of carbon monoxide (CO), nitrogen dioxide (NO2), sulfur dioxide (SO2), and particulate matter (PM) using laser diffraction, a microcontroller, and a general packet radio service module. Our air quality index monitoring system is a sensor node powered by a rechargeable battery supplied by either a solar panel or an alternating current power supply. Our developed system is equipped with an information system, namely a server and graphical user interface, to receive data, calculate the air pollutant standard index, and access data. In this paper, we discussed a novel adaptive algorithm for reducing packet loss in cellular-network-based transmissions. This algorithm allows nodes to perform repeated data transmissions and extends the response waiting times according to the received signal strength indicator.

Literature Review 2

Title

A Wireless Sensor Network for Monitoring Environmental Quality in the Manufacturing Industry.

Author

Qilong Han 1, Peng Liu 1, Haitao Zhang 1, And Zhipeng Cai 2 , (Member, Ieee)

Year

2019

Description

The main contributions of this paper are: first, we improve the network layout by employing the Zigbee network, which is combined with factory characteristics, and collected data on carbonic oxide, nitrogen dioxide, sulfur dioxide, ozone, particulate matter, temperature, and humidity. And then, to establish the dilution coefficient and diffusion coefficient of pollution diffusion, we adopt air movement as the energy model and, by utilizing the method of pollution traceability, achieve the complete coverage pollution monitoring of the whole city by local monitoring sites. Finally, we propose an improved long short-term memory (LSTM) method to predict the pollution period of urban air quality. The experimental results show that the improved LSTM prediction model has strong applicability and high accuracy in the period prediction of pollution weather.

Literature Review 3

Title

Design and Implementation of LPWA-Based Air Quality Monitoring System.

Author

Kan Zheng1, (Senior Member, Ieee), Shaohang Zhao1, Zhe Yang1, Xiong Xiong1, And Wei Xiang2, (Senior Member, Ieee).

Year

2019

Description

In this paper, we propose a new method to implement the air quality monitoring system based on state-of-the-art Internet-of-Things (IoT) techniques. In this system, portable sensors collect the air quality information timely, which is transmitted through a low power wide area network. All air quality data are processed and analyzed in the IoT cloud. The completed air quality monitoring system, including both hardware and software, is developed and deployed successfully in urban environments. Experimental results show that the proposed system is reliable in sensing the air quality, which helps reveal the change patterns of air quality to some extent.

Literature Review 4

Title

Dense Air Quality Sensor Networks: Validation, Analysis, and Benefits.

Author

Martha Arbayani Zaidan , Member, IEEE, Yuning Xie, Naser Hossein Motlagh , Bo Wang, Wei Nie, Petteri Nurmi , Sasu Tarkoma , Senior Member, IEEE, Tuukka Petäjä, Aijun Ding, and Markku Kulmala.

Year

2022

Description

This article demonstrates how a dense sensor network deployment offers significant advantages in providing better and more detailed air quality information. We use data from a dense sensor network consisting of 126 low-cost sensors

(LCSs) deployed in a highly populated district in Nanjing, China. Using data obtained from 13 existing reference stations installed in the same district, we propose three LCS validation methods to evaluate the performance of LCSs in the network. The methods assess the reliability, accuracy of tests, and failure and anomaly detection performance. We also demonstrate how the reliable data generated from the sensor network provides deep insights into air pollution information at a higher spatiotemporal resolution. We further discuss potential improvements and applications derived from the dense deployment of LCSs in cities. Statistical analysis.

Literature Review 5

Title

Real Time Localized Air Quality Monitoring and Prediction Through Mobile and Fixed IoT Sensing Network.

Author

Dan zhang 1,2 and simon s. Woo3,4

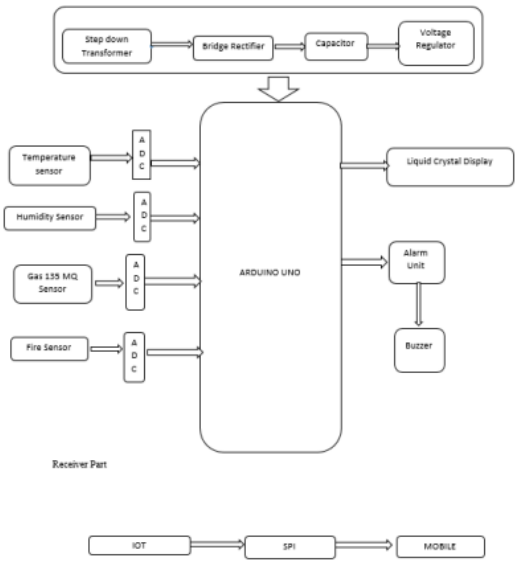
Year

2020

Description

In this paper, we explored a new way to predict immediate air quality around people, by combining fixed and mobile sensors. Our experimental results show that our proposed hybrid distributed fixed and IoT sensor system is effective in predicting air quality around the people. In addition, our proposed system can be practically realizable by leveraging public transportation system such as buses as well as taxis to be equipped with IoT sensor devices to measure different VOLUME 8, 2020 89593 D. Zhang, S. S. Woo: Real Time Localized Air Quality Monitoring and Prediction Through Mobile and Fixed IoT Sensing Network areas.

III.PROPOSED BLOCK DIAGRAM



IV.PROJECT DESCRIPTION

1. Hardware Description:

Arduino Uno

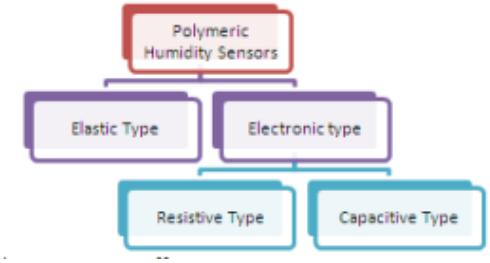
The Arduino Uno is a microcontroller board based on the ATmega328. It has 14 digital Input/output pins (of which 6 can be used as PWM outputs), 6 analog inputs, a 16 MHz crystal oscillator, a USB connection, a power jack, an ICSP header, and a reset button. It contains everything needed to support the 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.

Temperature Sensor

The first slave connected to a temperature sensor LM35. This senses the temperature of an engine and provides the level of temperature.

Humidity Sensor

The HH10D relative humidity sensor module is comprised of a capacitive type humidity sensor, a CMOS capacitor to frequency converter and an EEPROM used to hold the calibration factors. Due to the characteristics of capacitor type humidity sensor, the system can respond to humidity change very quickly. Each sensor is calibrated twice at two different accurate humidity chambers and two unique sensor related coefficients are stored onto the EEPROM on the module.



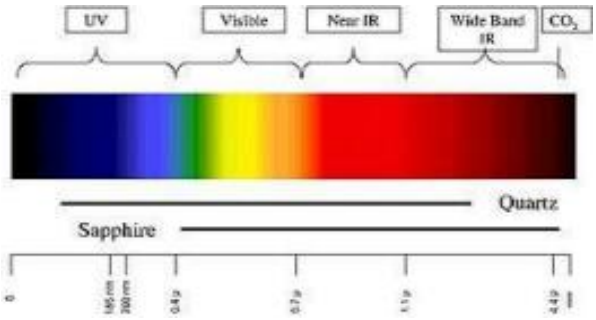
Mq 135 Gas Sensor

The MQ-135 Gas sensor can detect gases like Ammonia (NH3), sulfur (S), Benzene (C6H6), CO2, and other harmful gases and smoke. Similar to other MQ series gas sensor, this sensor also has a digital and analog output pin.

Fire Sensor

A flame detector is a sensor designed to detect and respond to the presence of a flame or fire. Responses to a detected flame depend on the installation, but can include sounding an alarm, deactivating a fuel line (such as a propane or a natural gas line), and activating a fire suppression system.

Flame Detector Type Regions



Lcd Display

Liquid crystal cell displays (LCDs) are used in similar applications where LEDs are used. These applications are display of display of numeric and alphanumeric characters in dot matrix and segmental displays.

Buzzer

A buzzer or beeper is a signalling device, The word "buzzer" comes from the rasping noise that buzzers made when they were electromechanical devices, operated from stepped-down AC line voltage at 50 or 60 cycles. Other sounds commonly used to indicate that a button has been pressed are a ring or a beep.

2. Software Descriptions:

Embedded C

Embedded C is a set of language extensions for the C Programming language by the C Standards committee to address commonality issues that exist between C extensions for different embedded systems Embedded systems are programmed using different type of languages:

· Machine Code
· Low level language, i.e., assembly
· High level language like C, C++, Java, Ada, etc.
· Application level language like Visual Basic, scripts, Access, etc.

Arduino Ide

The Arduino Integrated Development Environment - or Arduino Software (IDE) - contains a text editor for writing code, a message area, a text console, a toolbar with buttons for common functions and a series of menus. It connects to the Arduino and Genuino hardware to upload programs and communicate with them.

Proteus

Proteus (PROcessor for TExt Easy to USe) is a fully functional, procedural programming language created in 1998

by Simone Zanella. Proteus incorporates many functions derived from several other languages: C, BASIC, Assembly, Clipper/dBase; it is especially versatile in dealing with strings, having hundreds of dedicated functions; this makes it one of the richest languages for text manipulation.

3. Technology Descriptions

Iot

The Internet of Things (IoT) describes the network of physical objects—"things"—that are embedded with sensors, software, and other technologies for the purpose of connecting and exchanging data with other devices and systems over the internet. These devices range from ordinary household objects to sophisticated industrial tools.

V.CONCLUSION

In this project, we have presented the results of an air quality and hazardous pollutants monitoring system using iot. We have developed the hardware composed of esp32 and have incorporated a range of sensors capable of detecting and gauging various kinds of hazardous gases and pollutants. Such a system can be further improved to make marketable product.

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