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Smart Canteen Air Guard: IoT-Based Pollution Monitoring System

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PROJECT OVERVIEW :

This air pollution monitoring system's primary goal is to use IOT in canteens to track the concentration of dangerous gases in the air. These days, air pollution is becoming a bigger problem. One For everyone to live healthier and have a brighter future, air quality must be monitored and controlled. In addition to modest allergy reactions like irritation of the throat, eyes, and nose, air pollution can cause more significant issues like bronchitis, heart disease, pneumonia, lung infections, and worsened asthma. The atmosphere in canteens has changed significantly as a result of urbanization and the rise in the population.

Anything in the air that can harm both people and the environment is considered an air pollution. The material may consist of gasses, liquid droplets, or solid particles. A pollution may be man-made or naturally occurring. There are two types of pollutants: primary and secondary. Ash from volcanic eruptions is one example of a mechanism that often produces primary pollutants. Additional instances are sulfur dioxide emitted from factories or carbon monoxide gas from automobile exhaust. Direct emissions of secondary pollutants do not occur. Instead, they develop in the air as a result of interactions or reactions between main contaminants. One well-known example of a secondary pollutant is ground level ozone. Certain pollutants can be classified as both primary and secondary since they can be produced from other primary pollutants or discharged directly..

INTRODUCTION :

Air pollution is a critical environmental issue that significantly impacts human health and the ecosystem. In confined spaces like canteens, where large groups of people gather, the air quality can deteriorate rapidly due to factors such as cooking emissions, overcrowding, and inadequate ventilation. Monitoring air quality in such environments is essential to ensure a healthy and comfortable atmosphere for users.

The way environmental data is gathered, examined, and used has been completely transformed by the incorporation of the Internet of Things (IoT) into air pollution monitoring systems. IoT-enabled solutions offer quick reactions to worsening air conditions by providing real-time data on air quality indicators like temperature, humidity, particle matter (PM), and carbon dioxide (CO_2)..

This project focuses on the development of an **Air Pollution Monitoring System Using IoT for Canteens**. The system employs IoT sensors to measure air quality parameters and transmit the data to a centralized platform for analysis. The goal is to create an efficient and cost-effective solution to monitor and maintain air quality in canteens, ensuring a healthier environment for all users. By leveraging IoT technology, the system aims to provide actionable insights, automate responses, and promote sustainable practices in managing indoor air quality.

SYSTEM ARCHITECTURE :

HARDWARE REQUIREMENTS :

- MQ135 Gas sensor
- Arduino Uno
- Wi-Fi module ESP8266
- 16X2 LCD
- Breadboard

SOFTWARE REQUIREMENTS:

- Arduino UNO Version 4.2.0(IN PC)
- Thingspeak

DESKTOP CONFIGURATION :

- MAC/WINDOWS/UBUNTU OS
- 15.6 INCH SCREEN
- BROWSER ENABLED
- CLOCK SPEED >2.4 GHZ

BACKGROUND STUDY :

EXISTING SYSTEM :

- The commercial meters available in the market are Fluke CO220 carbon monoxide meter for CO,
- Amprobe CO2 meter for CO2, ForbixSemicon LPG gas leakage sensor alarm for LPG leakage detection.
- The drawbacks of the conventional monitoring instruments are their large size, heavy weight and extraordinary expensiveness.
- These lead to sparse deployment of the monitoring stations.
- Since the state of air pollution in urban areas is heavily influenced by human activity (such as construction activities) and location (such as traffic chokepoints, which have significantly worse air quality than average), the monitoring stations must be placed carefully for maximum effectiveness.

PROPOSED SYSTEM

- Utilizing air sensors, the system continuously transmits data about the presence of dangerous gases or chemicals in the atmosphere.
- The Arduino Uno processes the data from the sensors and sends it to the program.
- This makes it possible for authorities to keep an eye on air pollution in various locations and take appropriate action.

SYSTEM DESIGN AND ANALYSIS :

MQ135 Gas Sensor Module :

SnO2 is the sensitive substance utilized in the MQ135 gas sensor. In clean air, this material's conductivity is reduced. As the concentration of the target polluting gas rises, so does the sensor's conductivity. The MQ135 is capable of monitoring a variety of harmful gases, including CO2, benzene series steam, ammonia gas, and sulfur dioxide. The voltage rate is approximately 5.0V±0.1V AC or DC, and the detection range is 10–10,000 ppm. NH3, NOx, alcohol, benzene, smoke, CO2, and a few more gases can all be detected by the MQ135 sensor. The output is provided as voltage levels.

Features:

- High Sensitivity
- High sensitivity to Ammonia, Sulfide and Benze
- Stable and Long Life
- Detection Range: 10 - 300 ppm NH3, 10 - 1000 ppm Benzene, 10 - 300 Alcohol
- Heater Voltage: 5.0V
- Dimensions: 18mm Diameter, 17mm High excluding pins, Pins - 6mm High Long life and low cost

WIFI Module (ESP8266):

- The ESP8266 is a low-cost Wi-Fi chip with full TCP/IP stack and MCU (microcontroller unit) capability.
- It runs on 3.3V and gives our system access to Wi-Fi or internet
- Every microcontroller can access your WiFi network thanks to the ESP8266 WiFi Module, a self-contained SOC with an integrated TCP/IP protocol stack. It is possible for the ESP8266 1 to either host an application or to delegate all WiFi networking tasks to another application processor. 6 With the pre-programmed AT command set software that comes with each ESP8266 module, you can connect it to your Arduino device and receive roughly the same amount of WiFi functionality as a WiFi shield—and that's right out of the box! 5 The community for the ESP8266 module is enormous and constantly expanding, making it a very affordable board.
- Through its GPIOs, this module may be integrated with sensors and other application-specific devices with little upfront work and less loading during runtime thanks to its robust on-board processing and storage capabilities. Its high level of on-chip integration makes it possible for the front-end module and other external circuitry to take up very little space on the PCB. The ESP8266 has a self-calibrated radio frequency (RF) that enables it to function in any operational environment and doesn't require any extra RF components. It also supports Bluetooth coexistence interfaces and APSD for VoIP applications.

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.
- In order to upload programs and interact with the Arduino and other hardware, it connects to them.
- Sketches are programs created with the Arduino Software (IDE).
- The text editor is used to write these sketches, which are then saved with the.ino file extension.
- The editor includes tools for text replacement and search as well as cutting and pasting.

The message section shows errors and provides feedback during exporting and saving.

- The Arduino Software (IDE)'s text output, including comprehensive error warnings and other data, is shown on the console.
- The configured board and serial port are shown in the window's lower right corner.
- You may create, open, and save sketches, launch the serial monitor, and check and upload programs using the toolbar buttons..

TESTING METHODS

The different types of testing are :- Usability Testing

- Compatibility Testing
- Reliability and Scalability Testing
- Data Integrity Testing
- Security Testing
- Performance Testing

USABILITY TESTING

The devices that people utilize come in a wide variety of shapes and sizes. Additionally, each user has a different impression. In IoT testing, it is crucial to verify the system's usability.

COMPATIBILITY TESTING

Numerous gadgets can be linked together using an IOT system. The hardware and software configurations of these devices vary. As a result, the number of conceivable combinations is enormous. Therefore, it is crucial to verify the IOT system's interoperability.

RELIABILITY AND SCALABILITY TESTING

When creating an IOT test environment that uses virtualization techniques and technologies to simulate sensors, reliability and scalability are crucial.

DATA INTEGRITY TESTING

It's important to check the Data integrity in IOT testing as it involves large amount of data and its application.

SECURITY TESTING

Many users are accessing vast amounts of data in the IOT environment. As a result, it's critical to verify users through authentication and include data privacy rules in security testing.

PERFORMANCE TESTING

Performance testing is important to create strategic approach for developing and implementing an IOT testing plan

CONCLUSION :

This system uses an Arduino microcontroller to monitor the environment's air quality. It is suggested that IOT technology enhance air quality monitoring. The process of monitoring different environmental characteristics, like the air quality monitoring issue we encountered, is improved by the usage of IOT technology. Here, the MQ135 gas sensor is used to detect various hazardous gases, and the Arduino is the central component of this project. The entire process is connected to the internet via a Wi-Fi module, and the visual output is done via an LCD. If canteens are not properly kept, they could become a breeding ground for numerous illnesses. Thus, we used a sensor to monitor the air pollution level and a wifi module to transfer the data to the cloud. LCD is also used to show it to the user.