Development of a Compact IoT Enabled Device to Monitor Air Pollution for Environmental Sustainability

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Abstract

Degrading air quality has been a matter of concern nowadays, and monitoring the air quality helps us keep a check on it. Air pollution is a pressing global issue with far-reaching impacts on public health and the environment. The need for effective and real-time monitoring systems has become increasingly apparent to combat this growing concern. Here, an innovative air pollution surveillance system (APSS) that leverages internet of things (IoT) technology to enable comprehensive and dynamic air quality assessment is introduced. The proposed APMS employs a network of IoT-enabled sensors strategically deployed across urban and industrial areas. These sensors are equipped to measure various pollutants, including particulate matter (PM2.5 and PM10), nitrogen dioxide (NO2), sulfur dioxide (SO2), ozone (O3), carbon monoxide (CO), and volatile organic compounds (VOCs). Here, a regression model is created to forecast air quality using sensor data while taking into account variables including weather information, traffic patterns, and pollutants. Additionally, air quality categories (such as good, moderate, and harmful) are classified using classification algorithms based on preset thresholds.

1.Design of Proposed Air Pollution Surveillance System

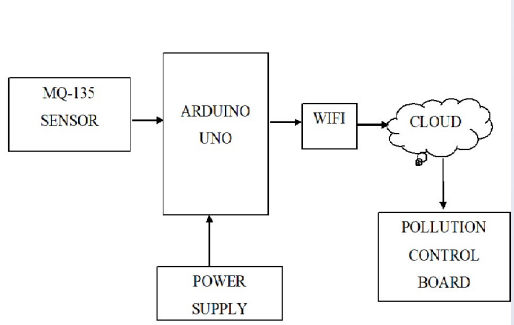

Figure 1. Flow Diagram

2. Simulation and Experimentation of APSS

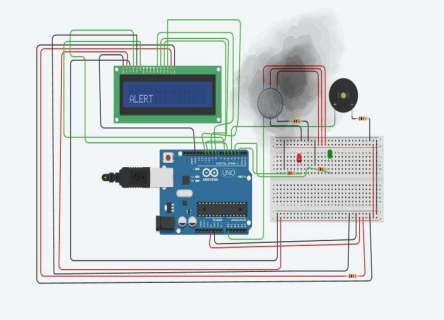

Figure 2. Simulation of APSS.

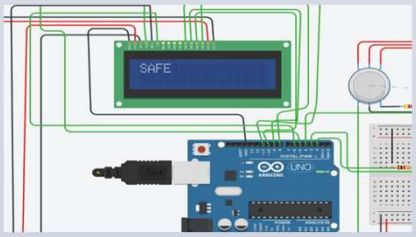

Figure 3. Output of APSS for LCD

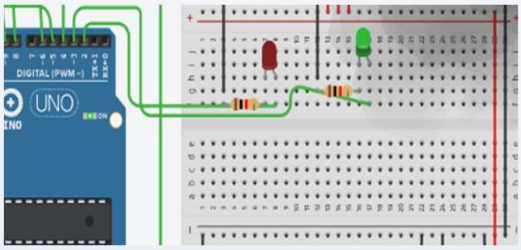

Figure 4. Output of APSS for LED.

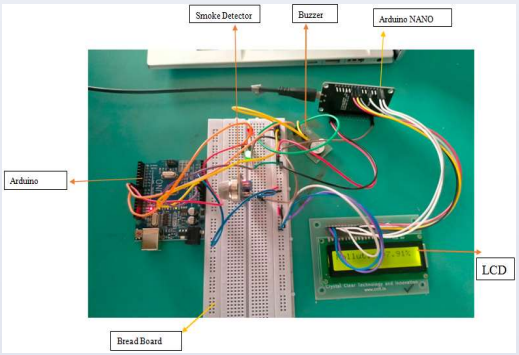

Figure 5. Hardware Model Of APSS

TABLE 1. PERFORMANCE OF COMPONENTS

COMPONENTS	USES
MQ-135 GAS SENSOR	It is used to detect gases like CO_2, smoke, alcohol, benzene and NH_3 present in the air.
LCD	It is used to display the message of the PPM value
BREAD BOARD	It is used to fix the gas sensor, LED, and to connect the wi-fi module, buzzer, LCD and Arduino.
ALERT SYSTEM	To give the alert sound when the PPM value goes beyond safe value.
ARDUINO UNO	To receive the data from the gas sensor and to send the details to the wi-fi module.
MCU NODE (WIFI MODULE)	Wi-fi module is used to send the data to pollution control board received from gas sensor.
LED	To indicate whether the air quality is safe or alert.

Conclusion

The proposed APSS is cost-effective and handy. The fascinating feature of the proposed model is that it reports pollution to the pollution control board, which helps to avoid polluted areas as soon as they get polluted.

- A key aspect was to monitor pollution levels to create a profile of a city or region and predict risks at individual levels. This awareness can also lead people to make direct contributions to reduce pollution levels.
- This system can be upgraded by adding more sensors, so it is portable.
- There is no need for any application to be installed; the system sends directly to the pollution control board.

The proposed system was tested successfully, and it is able to sense and send air quality data. This system can be used as a warning system when the air quality gets severe, and measures could be taken to prevent it.