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IOT BASED AIR QUALITY MONITORING SYSTEM

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ABSTRACT:

This project's overarching objective is to develop a microcontroller- and wireless-based air quality monitoring system that is both simple to use and economical. Gas and parameter detection results might be shown on an LCD and sent to a remote user. A 16x2 LCD display, gas sensors, a Node MCU, and an Arduino Nano were used to create this. The expansion of the world's data networks is one positive outcome of IoT-based technology. The capability of the technology to deliver strong signal and channels for digital communication may also be useful to users of the Internet of Things. Smart gadgets can measure air quality for you if you can't go outdoors yourself. The study's main advantages are that the system may be used to monitor pollution levels around the clock, and that the acquired data might be used as a resource for researchers.

INTRODUCTION

The problem of air pollution is widespread over the world. The fast rise in health problems, especially in urban areas of countries, has been linked to the high levels of gaseous pollutants created as a result of industrialisation and the rising number of vehicles. Seasonal allergies, bronchitis, heart disease, pneumonia, and even exacerbation of asthma have all been connected to pollution, which has been associated to mild to severe health implications. The chemical interactions between molecules in the air are what create secondary pollutants, which are created by primary pollutants. At least 90% of the time, everyone is indoors. Over the last several decades, there has been a dramatic improvement in the outdoor air quality of major cities around the nation. Reduced ventilation, energy savings, and the introduction of innovative sources and new materials that cause indoor pollution have all contributed to a fall in air quality despite broad improvements in outside air quality. As a result of decreased ventilation caused by more energy-efficient building design, indoor air quality has worsened even more. This highlights the need of measuring IAQ (indoor air quality).

Literature Criticism

The expense, size, and immobility of conventional monitoring gear are major drawbacks. They cause randomization in the placement of checkpoints. It is crucial to strategically place monitoring stations due to the high spatial variability of air pollution in urban areas (traffic bottlenecks, for example, have much poorer air quality than average) and the strong correlation between air pollution and human activities (such as construction activities). Carbon monoxide, cigarette smoke, ethanol, benzene, nitrogen oxides (NOx), and LPG may all be detected and alerts sent by an IoT-based air pollution monitoring system connected to a web server online. Both the device's LCD and its web interface display the current air quality index (AQI) in PPM. The gadget is able to track not only temperature but also relative humidity. The MQ9 is a good air quality monitor since it can recognize LPG gas, while the MQ135 is perfect because it can detect even tiny concentrations of the most harmful gases. This Internet of Things technology enables remote monitoring of air quality using a computer or mobile phone. The system may provide a warning to the user when pollution levels hit a certain threshold.

PROPOSED METHOD

The framework of the Air Quality Monitoring System is comprised of these parts.

1. Arduino
2. MQ sensors
3. Node MCU
4. LCD
5. LCD Display

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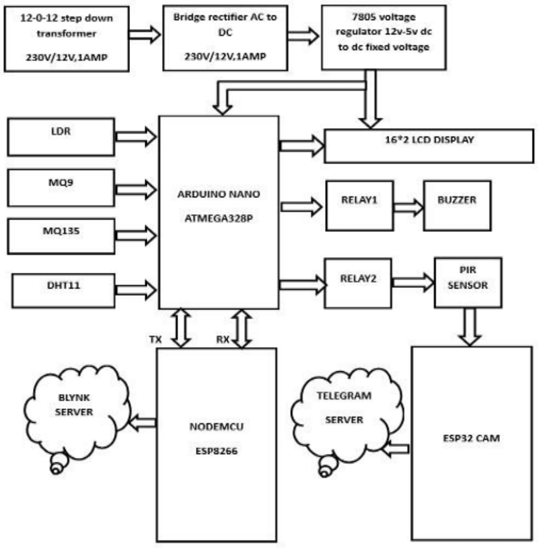

Fig 4.1 Block Diagram

Working Principle

The MQ135 was just what we were looking for in a high-quality gas sensor for our Air Quality Monitoring Project. In addition to detecting NH3, NOx, alcohol, Benzene, cigarette smoke, and carbon monoxide, this apparatus has the potential to detect a wide variety of other compounds and doors. One may measure the ppm concentration of air contaminants by connecting it to an Arduino (A0). The MQ135 gas sensor transmits voltage values, which must be transformed into ppm concentration information. Instructions for adapting the PPM sensor's output to the MQ135's are provided in the "Code Explanation" section. The sensor read 90 when no gas was there, 350 when gas was present, and 1000 when no gas was present. Symptoms such as fatigue, stuffiness, and headaches often appear about 1000 ppm, while the risk of heart disease and other disorders dramatically increases at roughly 2000 ppm. If the reading is less than 1000 PPM, the words "Good Air" will appear. An alert will ring and the warning "Bad Air, Open Windows" will show on the screen if the number of particles in the air increases beyond 1,000. When the number reaches 2000, an alarm will sound repeatedly, and a "Danger! Move to Fresh Air" notice will be shown on the screen and the website. If employed in instances when a gas leak is suspected, the MQ9 gas sensor might save lives. Here, we'll show you how to wire up a gas detector using an Arduino board. This sensor sends its readings to an Arduino board. A variety of peripherals, including an LCD screen, a buzzer, and an ESP8266 Internet of Things module, may be linked to the microcontroller. The ESP8266 chip is responsible for the computing power of the IoT sensor. This Wi-Fi module for microcontrollers allows for connectivity to the internet and the exchange of data with other devices using TCP/IP. The data collected by these sensors is then sent to the Internet of Things. The data is then sent to a central server via the IoT component. If there is a gas leak, an alarm will sound. An alert light with the message "Leakage detected" has been installed recently. The Wi-Fi module can detect and alert you to LPG gas leaks when linked to your network. Nothing in your setup requires an internet connection to function.

Circuit Diagram

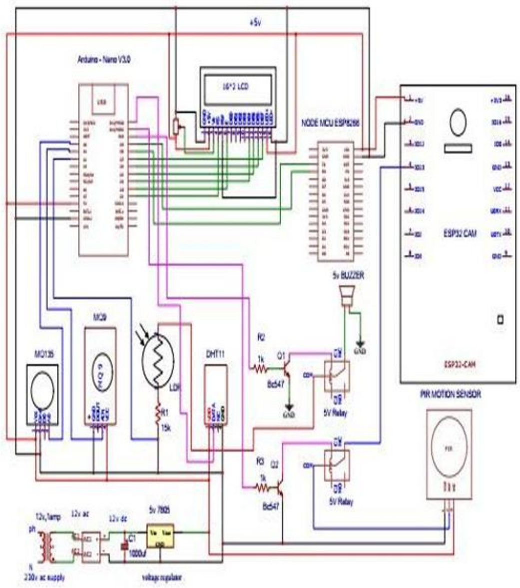

Fig 4.2 Circuit Diagram

RESULTS

Results for Good Air Quality

Fig 5.1 LCD Display showing Good Air Quality

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Here, the LCD shows not just the data for light intensity, temperature, and humidity, but also the Good Air Quality.

Fig 5.2 Blynk App Monitor for Good Air

As can be seen in the aforementioned diagram, the following levels of air quality, as measured by the Blynk IOT App, are well within the norm. Conditions include 72% humidity, 29°C temperatures, 180 ppm gas levels, and 24% luminosity.

Results for Bad Air Quality

LCD display results

Fig 5.3 LCD Display showing PPM values.

Take notice that the LCD panel is showing very high CO2, gas level, light intensity, temperature, and humidity.

Fig 5.4 LCD Display showing Bad Air quality.

The LCD displays the air quality index, temperature, and relative humidity.

Air quality warnings have been added to the Blynk app.

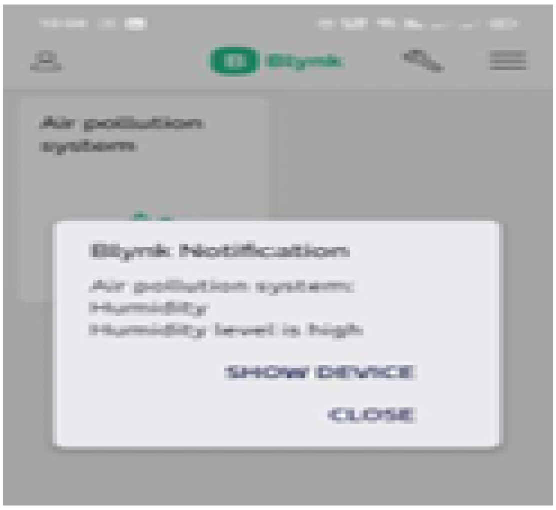

Fig 5.5 High Humidity

Alarms may be set in the Blynk app to go off when the relative humidity exceeds a certain percentage, which can be set by the user (H > 80%).

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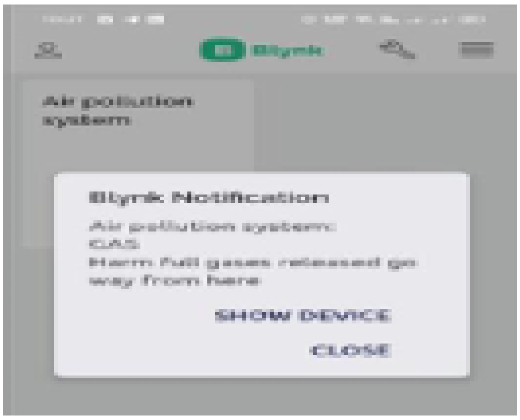

Fig 5.6 Harmful Gases

In the event that the relative humidity (RH) rises to a certain level, say 1400 parts per million of carbon dioxide, the Blynk app will alert the user.

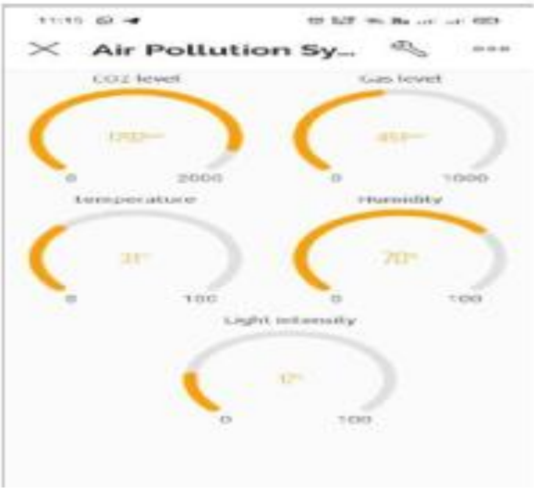

Fig 5.8 Blynk App Monitor for Bad Air

Bad weather is shown on the Blynk IoT App's home screen, with readings for things like CO2 concentration (1792 ppm), gas concentration (451 ppm), temperature (31 °C), humidity (70%), and light intensity (17%).

When the PIR sensor detects movements in an area with Bad air and high ppm values of gases, the ESP32 Camera Module will send these pictures to the Telegram server.

CONCLUSION

The composition of the air is dependent on gases and particles. Exposure to these pollutants has a negative impact on air quality and may increase the likelihood of developing life-threatening illnesses. The presence of toxics may be detected and the appropriate action taken to enhance the air quality for employees by installing air quality monitoring equipment. The results include better production, less machine damage, and higher levels of regulatory compliance. If pollution rates keep up, there will be an even greater need for a system like this one to keep tabs on air quality.We can monitor air quality in real time by connecting to the cloud and storing the data in databases for use in forecasting, analysis, etc. This allows us to design a gadget with a small form factor. Additional MQ series sensors might be installed to improve the accuracy of environmental readings. Current capabilities, such as managing the internal environment by opening and closing windows and doors, may be improved with the use of IoT.

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