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IOT Based Air Quality Monitoring System Using Arduino

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ABSTRACT - In the present time, more and more people are becoming concerned about air quality because of its negative impact on health and the environment. It is important that we have to monitor the levels of pollution in the air, temperature, and humidity to understand how clean. The paper discusses how to design and implement an air monitoring system using Arduino technology. Hence, this system enables users to have knowledge on their air condition. The ability for real time surveillance will enable quick response to changes in levels of pollution thereby helping people living around such areas together with authority take appropriate measures that will reduce health hazards as well as impacts caused by environmental problems. Moreover, it can be used as a tool for collecting data hence acting as a resource for data collection analysis, and interpretation which can assist planners or policy makers come up with informed decisions regarding the air quality management strategies. In general terms therefore, it is economical and easily accessible way for assessing pollution in air temperatures as well as moisture content humidity among others hence contributing towards public safety and preservation of nature from pollution.

Key Words: Air Quality, Temperature, Humidity, IOT, Arduino UNO

1. INTRODUCTION

The air pollution, which affects the environment and human health significantly, is a global concern that needs to be addressed urgently. To appreciate the pollution levels and take necessary measures in controlling it, air quality monitoring is crucial. In this context, it is possible to develop a low-cost system for monitoring air quality by using easily available components such as Arduino microcontrollers and sensors like MQ-135, DHT 11, and OLED displays. Air pollution, which has harmful impacts on public health and living organisms can be accessed through the use of Arduino MQ-135 sensor that detects different types of air contaminants including benzene, alcohol, gas and CO2. This is complemented by DHT 11 sensor that helps in determining how comfortable people are within their surroundings as well as their overall well being basing on temperature variations in an environment together with humidity levels. By integrating these sensors into an Arduino based system one can monitor real-time air pollution levels, temperature changes as well as humidity thereby enabling users make informed decisions about their own welfare. Also included is an OLED display which enriches UI since it presents data visually. By simply looking at the information displayed on the OLED screen in a brief manner individuals will easily comprehend those metrics related to air quality to take action to reduce exposure towards pollutants. In the use of Arduino, MQ-135, DHT 11 and OLED display technique to develop air quality monitoring system is a major move towards increasing environmental consciousness and public health. The facility allows people to acquire real-time air quality data thereby resulting in a better dwelling environment for all.

2. METHODOLOGY

The Air Quality Monitoring System operates by using sensors that detect environmental parameters such as gas levels, temperature and humidity. Analog readings from the gas sensor have been converted into air quality data and these are fed to an Arduino through its analog pin. These readings have been correlated with some predefined thresholds that classify air quality as “Good”, “Poor”, “Very Bad” or “Toxic”. On the other hand, DHT11 a sensor reads humidity and temperature concurrently. This collected information is shown on an OLED screen in real-time with help of Adafruit libraries. The system offers a snapshot of the prevailing air conditions thus allowing users to determine how they respond to changes in their environment. Air quality monitoring system using Arduino Uno, MQ-135 sensor, DHT11 sensor and OLED display is a cost-efficient and effective method to evaluate indoor air quality. There are several essential procedures involved. The primary use of Arduino Uno is as the central control unit, which receives data from the MQ-135 gas sensor and the DHT11 humidity/temperature sensors. The MQ-135 detector senses gases like ammonia, benzene or carbon dioxide that are vital in determining air contamination levels. Meanwhile, the DHT11 sensor monitors humidity and temperature levels in order to gain a holistic understanding of indoor environment. At this point, the Arduino will process some of these sensors’ data while computing air quality parameters in relation to these predetermined thresholds or algorithms. Consequently, it exhibits this information on its OLED display screen that is user-friendly based on real-time monitoring. The approach employed herein guarantees constant examination of indoor air quality thereby facilitating early identification of deviations from acceptable rates. This knowledge can be helpful for users who may want to take appropriate measures such as ventilating rooms, purifying air or altering their activities within homes so as to keep them healthy. For this reason, the mixture of Arduino Uno, MQ-135 sensor, DHT11 sensor, and OLED display has provided an approachable and efficient way of monitoring air quality to enhance health and improve indoor and outdoor conditions.

Air pollution levels can be monitored in real time by means of the proposed system for air quality monitoring. It gives an opportunity to make measurements of gas concentrations, humidity and temperatures accurately through the use of Arduino Uno, MQ-135 sensor, DHT11 sensor and OLED display. This allows inhabitants to counteract pollution by taking proactive actions. The system's capabilities can be broadened up by integrating other improvements such as wireless connectivity and remote data logging which will allow for control on a central basis.

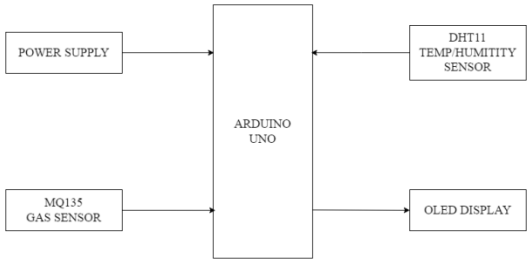

Fig- 1

3. RESULT AND DISCUSSION

By combining Arduino Uno with sensors like MQ-135 for gas detection, DHT11 for temperature and humidity, and an OLED display, one can have an efficient air quality monitoring system. The MQ-135 sensor detects dangerous gases including ammonia, benzene as well as carbon monoxide that are very important in determining the air pollution rates. Additionally the DHT11 sensor provides more information by measuring temperature and humidity levels which affect the air quality negatively or positively. To this end, collected data can be analyzed and visualized on the OLED display in real-time using the processing capability of Arduino Uno. These features enable users to easily interpret air quality measurements thus empowering them to make informed decisions about their environment. Moreover, Arduino's flexibility makes it possible to add other sensors or functionalities into such systems. This is a very useful system for diverse applications including among others indoor air quality monitoring in homes, offices and industries as well as outdoor environmental monitoring. It acts not only as awareness means but also as a basis for putting up preventive measures aimed at reducing impacts of air pollution on health and environment it. Overall, the Arduino Uno-based air quality monitoring system provides a cost-effective and accessible solution for monitoring and improving air quality.

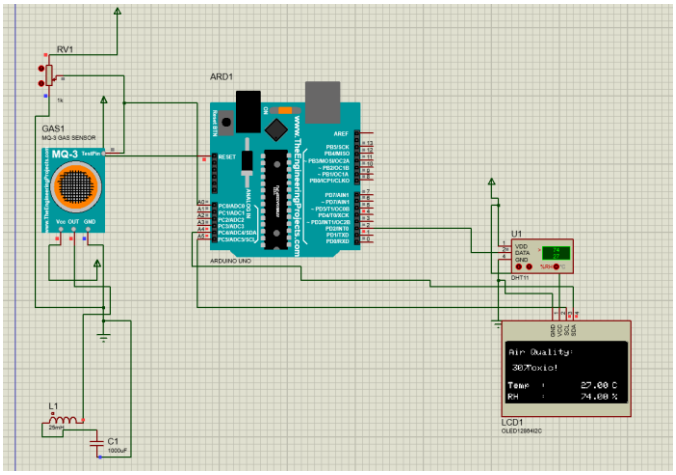

Fig- 2

Arduino-based simulation with Proteus for air quality monitoring system showed the efficacy of the system in detecting different types of contaminations. In addition, during setup, parameters like temperature, humidity levels and air were successfully measured. Employing various sensors and data processing algorithms enabled this system to show real time measurements of air quality. This simulation has made it feasible to consider using Arduino based solutions for environmental monitoring which can be useful both indoors as well as outdoors. The general implication arising from these findings is that we need to have easy access to dependable technologies meant for monitoring our environment's purity in order to address matters pertaining to public health.

The monitoring of air quality is the constant measurement of such atmospheric parameters like air quality, temperature and humidity. Reading a truth table correctly indicates the immediate situations that are meant for environmental appraisal and public wellness. This assists in determining its pollution level, how hot or cold it is and how humid or dry its atmosphere may be therefore allowing one to make an informed decision as far as environmental management is concerned.

Table -1

SN.	Air Quality	Temperature	Humidity
1	50 very good	40%	51%
2	100 good	45%	46%
3	150 poor	36%	57%
4	200 very poor	50%	26%
5	250 bad	28%	33%
6	300 toxic	38%	37%

Air-checking systems with Arduino are a cheap means to track the levels of air contamination. Utilizing sensors like gas, particle matter and humidity sensors- integrated with Arduino microcontrollers, these systems provide real-time data on different pollutants. One great advantage of air quality monitors founded on Arduino is their adaptability and scalability. To suit your specific monitoring needs and budgetary constraints, you can choose various sensors to customize your set up. Also, the open-source property of Arduino helps it in integrating easily with other hardware or software parts hence enabling it to log data, visualize data and have remote control features. The reason why such devices are quite important in public health is because they play huge roles in environmental monitoring as well. These gadgets help to identify pollution sources thus giving insight into air quality trends while also helping implement measures to prevent them. Finally, localized access areas that offer information about air quality enable citizens and communities to be involved actively in responsible environmental management. Furthermore; Arduino's mobility and expandability make it possible to install monitoring systems even in varying environments such as cities and far-flung places. This adaptability is vital for purposeful investigations hence reducing the health effects of pollution on people as well as the surroundings. Arduino air quality monitoring systems mark a noteworthy progression in design of environmental sensing tools. By being cheap, versatile and accessible; it creates an opportunity for community participation in air pollution surveillance leading to healthier and more sustainable settlements for inhabitants.

4. CONCLUSIONS

To conclude, the research has developed an air quality monitoring framework using Arduino Uno, MQ-135 sensor, DHT11 sensor and an OLED display which is a considerable advancement in environmental monitoring technology. These components are put together to measure air pollutants and temperature among other parameters important for decision making on surrounding conditions. The main processing unit here is the Arduino Uno which supports data collection and analysis as well while the MQ-135 sensor can detect harmful gases such as ammonia, benzene and carbon monoxide. Additionally, the DHT11 sensor has been added to provide further information about temperature and humidity levels thus contributing in giving a more accurate picture of air quality trends. For better viewing of data by users, this system employs an OLED display that enhances its user friendliness besides being accessible to whoever may be interested. This solution is cost-saving as it provides affordable approach to monitor air pollution with its wide range of applications both at home level or even professional use situations like office buildings or manufacturing industries. Simple in design but reliable in performance, it is not only a tool for community health promotion but also for environmental education purposes. This could be made possible by future improvements and development that can extend the device functions thus expanding horizons towards environment conservation efforts.

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