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INDOOR AIR QUALITY MONITORING SYSTEM USING IOT

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ABSTRACT

Millions of people worldwide die prematurely as a consequence of air pollution. Many of these deaths occur in large cities, where exhaust from cars, factories, and power plants fills the air with hazardous particles. Indoor air pollution can be higher than outdoor concentrations up to ten times due to incorrect functionality of heating, ventilation, and air conditioning (HVAC) system. Internet of Things can help to perform a real time monitoring of indoor air quality by using embedded electronics, software, sensors, and connectivity. One approach that is gaining momentum is the Web of Things, that uses web architecture and web standards as a framework for creating IoT applications. In this paper, an IoT platform for monitoring indoor air quality is presented.

I.INTRODUCTION:

Air pollution, both indoors and outdoors, is a major environmental health problem affecting people around the world. The level of air pollution is increasing rapidly due to factors such as industries, urbanization, increasing population, vehicle use, etc. As the world's population becomes more urban, cities are under pressure to maintain a liveable life. The harmful effects of contamination include mild allergic reactions such as inflammation of the throat, eyes and nose, as well as serious problems such as bronchitis, heart disease, pneumonia, lung disease and exacerbation of asthma. Indoor air pollution results in substantially harmful effects on human health. When the level of the containments increases beyond the permissible levels in the environment can affect various organs of the human body. People spend most of the day indoor and in an air-conditioned environment which has limited scope of fresh air circulation. Poor air quality in the workplace can affect the productivity of employees. Therefore it is important to know the quality of air-breathing. This can help to avoid polluted air as much as possible and take measures to clean the polluted air [1]. 2. Indoor air quality quantification There are many pollutants in the indoor air. For years, there has been debate over which indoor air quality index is most appropriate. Carbon dioxide (CO2) is probably the most commonly used indicator for measuring carbon dioxide produced by human breathing and carbon dioxide emitted by devices such as gas stoves and boilers [2]. Other indicators are humidity and volatile organic compounds (VOCs), both of which are indicators of indoor air quality. Carbon dioxide is a good indicator of indoor air quality in the workplace, where residents and their activities are the main source of pollution. Outdoor air contains about 400 ppm and breathing produces CO2, so indoor CO2 concentrations are always at least 400 ppm, usually higher. An indoor CO2 concentration of 1150 ppm can provide adequate air quality; 1400 ppm can maintain good indoor air quality in most cases and 1600 ppm indicates poor air quality. CO2 is the most appropriate indicator in a room where ventilation requirements are related to the presence of a person, e.g. work place [2]. Exposure to carbon dioxide can have a variety of health effects. Moderate to high levels of carbon dioxide can

cause headaches and fatigue, and high levels of carbon dioxide can cause nausea, dizziness, and vomiting. Very high concentrations can cause loss of consciousness. These may include headaches, dizziness, restlessness, tingling or tingling, dyspnea, sweating, tiredness, and rapid heart rhythms [2].

II.LITERATURE SURVEY:

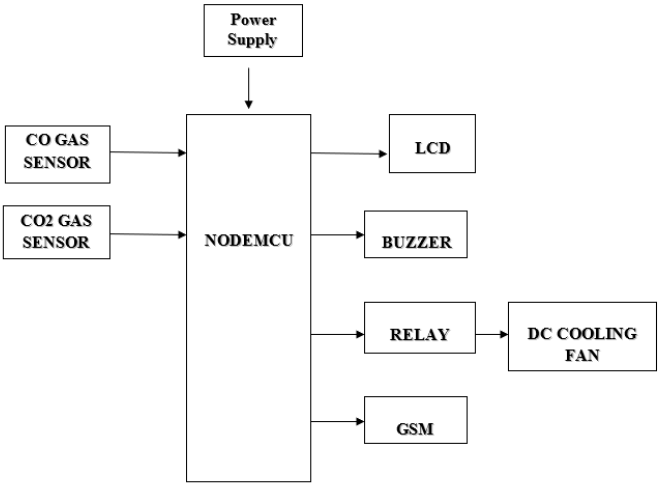
Pallavi Asthana and Sumita Mishra contributed to the design of an IoT-based realtime bolt-based indoor air quality monitoring system. In their job, they design a bolt-based Internet of Things (IoT) system to monitor basic pollutants such as carbon dioxide, carbon monoxide, and particulate matter in the indoor environment of a university campus in real time. IoT systems provide pollution level information directly to smart devices in real time. In this work, the author also proposed measures to improve air quality to improve student health. This can have a positive impact on their academic performance. The project monitors the air quality of Android's basic mobile system and sounds an alarm to alert you when the value is out of tolerance [3]. Srijana Chowdhury, Isha Das, Parisosh Bhuria and Balika J. Chelliah participated in the design of an IoT air pollution meter with a digital dashboard. In this project, we will explain and implement an air pollution meter. The innovations learned here are practical implementations of the IoT concept. This special task is exploring the possibilities of using this kind of innovation in a world where natural well-being is becoming a real risk. This task is implemented using a microcontroller board for Android, iOS, and Arduino. Two sensors, such as a temperature and humidity sensor and two gas sensors, are also used to filter changes [4]. In this project, authors used an IoT-based air pollution monitoring system to monitor air quality through a web server that uses the Internet. An alarm is triggered when the air quality drops to a certain level. This means that there are plenty of harmful gases in the air such as CO2, smoke, alcohol, benzene, NH3 and NOx. PPM displays air quality on LCD and web pages for easy monitoring of air pollution. The system uses MQ135 and MQ6 sensors to monitor air quality. This is because it can detect the most harmful gases and accurately measure their amounts [5]. In this work, authors propose a model where a gadget will be joined to silencer of vehicles. Since vehicles discharge unsafe gases such as Carbon Monoxide (CO), carbon dioxide (CO2) and so on which are the significant purposes behind contamination. In the event that contamination produced by that vehicle is more than edge esteem proprietor will be given an implication through a sensor. On the off chance that vehicle driver doesn't make any move even after two insinuations vehicle will be bolted by the gadget after 10 km and send points of interest of vehicles to RTO office [6]. Yamunathangam, K. Pritheka, P. Varuna contributed to design an IOT Enabled Air Pollution Monitoring and Awareness Creation System. The proposed system includes a design to monitor air pollution and raise public awareness. It aims to combine the use of the Internet of Things with cloud technology to drive services in real time and quickly. The proposed system is installed in certain areas with severe air pollution. Regularly monitor the level of each toxic pollutant. Raise public awareness through an Android application that determines the air quality index (AQI) of observed pollutants and displays the level 118 of each pollutant observed and the air quality index for that particular location. Therefore, the general public can understand the air quality of the area by displaying the gas concentration in digital and graph formats. In addition, the system is extended by allowing the general public to register with the app. This pushes weekly or monthly air quality reports through messages that reach users in a more comfortable way. In this system it has used Arduino Uno board, Ethernet Shield, gas sensors and Thing Speak platform [7].

III.PROPOSED SYSTEM:

Indoor air quality Monitoring System consists of the NODE MCU micro controller which has inbuilt wifi module.In this system ,We are using 2 sensors. CO sensor and CO2 sensor are interfaced with controller. Over an Internet we are utilizing adaptable Wi-Fi sensor ESP8266. The information from these sensors is put away in the cloud. In the wake of handling, through hotspot internet browser will get some information about IP address, by putting IP address site page will make that permits us to screen the system. We can screen the parameters on advanced mobile phones just as Computer.If any sensor value exceeds the threshold value,the buzzer will make sound and

parameters are updated in the webpage.And also a message will be sent to the authorized person.

BLOCK DIAGRAM:



IV.MODULE DESCRIPTION:

NODE MCU:

NodeMCU is an open-source Lua-based firmware and development board designed specifically for IoT applications. It includes firmware based on Espressif Systems' ESP8266 Wi-Fi SoC and hardware based on the ESP-12 module.The NodeMCU Development Board can be easily programmed with Arduino IDE since it is easy to use.Programming NodeMCU with the Arduino IDE will hardly take 5-10 minutes. All you need is the Arduino IDE, a USB cable and the NodeMCU board itself.

NodeMCU ESP8266 Specifications & Features

- Microcontroller: Tensilica 32-bit RISC CPU Xtensa LX106
- Operating Voltage: 3.3V
- Input Voltage: 7-12V
- Digital I/O Pins (DIO): 16
- Analog Input Pins (ADC): 1
- UARTs: 1
- SPIs: 1
- I2Cs: 1
- Flash Memory: 4 MB
-

This Carbon Monoxide (CO) gas sensor detects the concentrations of CO in the air and ouputs its reading as an analog voltage. The sensor can measure concentrations of 10 to 10,000 ppm.The sensor can operate at temperatures from -10 to 50°C and consumes less than 150 mA at 5V.

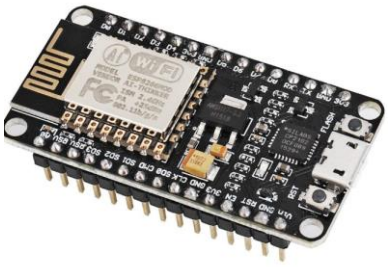


Fig 1:Node MCU

MQ2 GAS SENSOR:

This Carbon Monoxide (CO) gas sensor detects the concentrations of CO in the air and ouputs its reading as an analog voltage. The sensor can measure concentrations of 10 to 10,000 ppm.The sensor can operate at temperatures from -10 to 50°C and consumes less than 150 mA at 5V.

Fig 2:CO sensor

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. When the level of these gases go beyond a threshold limit in the air the digital pin goes high. This threshold value can be set by using the on-board potentiometer. The analog output pin, outputs an analog voltage which can be used to approximate the level of these gases in the atmosphere.

The MQ135 air quality sensor module operates at 5V and consumes around 150mA. It requires some pre-heating before it could actually give accurate results.

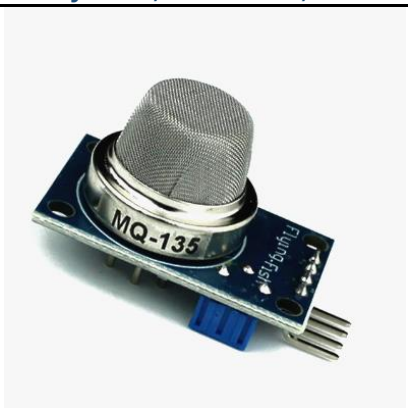


Fig 3:CO2 Sensor

V.RESULTS:

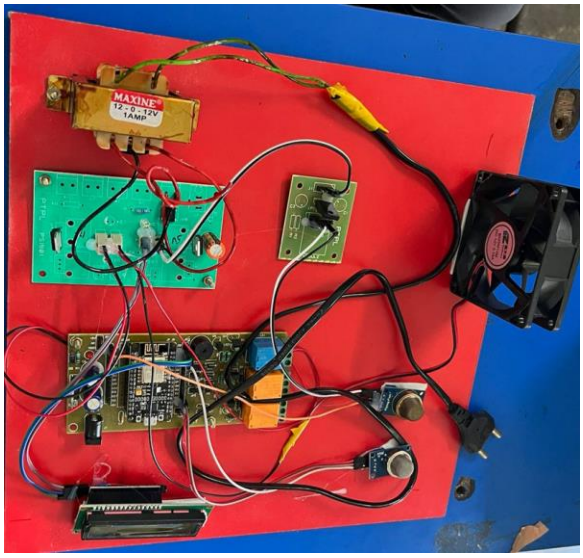


Fig 4 :Hardware implementation

Fig 5:sensor data on web page

VI.CONCLUSION:

The purpose of this project is to design and develop an air quality monitoring system based on the Internet of Things. Air quality is a major issue facing people today. Factors such as industry, urbanization, population growth, and vehicle use pollute the indoor and outdoor air to a considerable extent. Inhaling polluted air affects people's health and causes many illnesses. In this project, we sensed the amount of carbon dioxide. The ppm levels of carbon dioxide were collected for 5 consecutive days and the results were presented. Daily carbon dioxide levels can change for the following reasons: the number of people in the area, the time the area is occupied by other items such as furniture, and the fresh outdoor air (ventilation) that enters the area.

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