

Internship

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TASK-1

IoT based air pollution monitoring system

- 1) **Problem Statement understanding** : Nowadays, we see a drastic environment changes due to air pollution. Acid Rain, Haze, Global Climate Change(Greenhouse Effect), Ozone Depletion, Crop and Forrest Damage, etc are some of the effects of air pollution. Not only air pollution affects our environment, it also has harmful effects on us. Long-term exposure to air pollution can cause cancer and damage to the immune, neurological, reproductive, and respiratory systems. In extreme cases, it can even cause death[1]. In India, as many as 131 cities are exceeding the permissible limit for PM 10 and 18 cities are exceeding the permissible limit for NO2 [2]. So air pollution monitoring system is very important. This project proposes an air pollution monitoring system. The system was developed using the Arduino microcontroller. The air pollution monitoring system was designed to monitor and analyze air quality in real-time and log data to a remote server, keeping the data updated over the internet [3]. This can be a website or an android application. From this simple technology, we can give access of data around their area to the

people so that they can know the air quality around their neighbourhood.

2) Software Requirements :

- a) Proteus Software**
- b) Arduino IDE**
- c) Any Python IDE for web development**

3) Hardware Requirement:

a) MQ135 Gas sensor

Detection Range: 10~1000ppm(ammonia gas, toluene, Hydrogen, smoke)

b) Arduino Uno

c) Wi-Fi module ESP8266

Temperature range:- -40C - 125C

d) Breadboard(PCB would be preferred if we are considering a commercial product)

e) 16x2 LCD Module

f) 10K potentiometer

g) 1K ohm resistors

h) 220 ohm resistor

i) Buzzer

4) Additions and Updates:

a) Here, we can add a KY-038 Sound sensor which converts our system to air and sound pollution monitoring system which will be beneficial as sound pollution should also be monitored regularly. Similarly, adding BME280 Barometric Pressure sensor can be used with MQ135 which would then detect Pressure, Temperature and Humidity also. Similarly we can use PM10 and PM2.5 sensors also for making the system more effective.

b) Also we can use ESP32 instead of ESP8266 as ESP32 adds an extra CPU core, faster Wi-Fi, more GPIOs, and supports Bluetooth 4.2 and Bluetooth low energy. Additionally, the ESP32 comes

with [touch-sensitive pins](#) that can be used to [wake up the ESP32 from deep sleep](#), a [built-in hall effect sensor](#). But it is more complex and costly.[4]

5) Applications:

- a) The data collected from air quality monitoring helps us assess impacts caused by poor air quality on public health.
- b) Air quality data helps us determine if an area is meeting the air quality standards devised by CPCB, WHO or OSHA.
- c) The data collected from air quality monitoring would primarily help us identify polluted areas, the level of pollution and air quality level.
- d) Air quality monitoring would assist in determining if air pollution control programmes devised in a locality are working efficiently or not.
- e) Air quality data helps us understand the mortality rate of any location due to air pollution. We can also assess and compare the short term and long term diseases/disorders which are a result of air pollution.
- f) Based upon the data collected control measures can be devised for protection of environment and health of all living organisms.[5]

6) Advantages:

- a) It is simple and easy to access.
- b) The data is directly updated to the website and for mobile application updates are given to the user on a regular basis.
- c) Accurate Pollution monitoring.
- d) Remote location monitoring.[6]

7) Challenges:

- a) Precise coding in the Arduino IDE is required with proper Libraries.
- b) Hardware failure detection is difficult.
- c) For different gases, different sensors are required. So multiple sensors have to be used. If not used, then precision will be weak.

8) Conclusion: This research proposed a smart air pollution monitoring system that constantly keeps track of air quality in an area and displays the air quality measured on an LCD screen. It also sends data measured to the website or android app which will be built by us. The system helps to create awareness of the quality of air that one breathes daily. This monitoring device can deliver real-time measurements of air quality.

9) References:

[1]- Massachusetts Department of Environment Protection

<https://www.mass.gov/files/documents/2016/08/vl/health-and-env-effects-air-pollutions.pdf>

[2]-All about effective air quality monitoring by Vivek Chattopadhyaya

<https://www.downtoearth.org.in/news/all-about-effective-air-quality-monitoring-46494#:~:text=Monitoring%20helps%20in%20assessing%20the,alerting%20people%20and%20initiate%20action.>

[3]-A Smart Air Pollution Monitoring System article in International Journal of Civil Engineering and Technology

https://www.researchgate.net/publication/328015436_A_Smart_Air_Pollution_Monitoring_System

[4]- ESP32 vs ESP8266

<https://makeradvisor.com/esp32-vs-esp8266/>

[5]- Perfect Pollucon Services

<https://www.ppsthane.com/blog/benefits-of-air-quality-monitoring>

[6]- IOT Based Air Pollution Monitoring System by International Journal of Scientific & Engineering Research Volume 9, Issue 2

<https://www.ijser.org/researchpaper/IOT-Based-Air-Pollution-Monitoring-System.pdf>