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IoT based Fire and Gas monitoring System

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Abstract: In infrastructure and industrial plants the rapid growth is creating environmental issues like pollution, climate change and malfunctioning. It has a great consequence for the requirement of an operationally adaptable, efficient, cheap and smart monitoring systems. For this purpose we come up with idea to use these kind of technology i.e the Internet of Things (IoT) in form of a solution. In this paper, we suggest wireless data gathering frameworks that enable each detector node to track the changes in the behavioural pattern of gases and to identify their role in gas leakage problem, whilst at the same time trying to minimize power consumption. In the proposed device, the temperature detector (DHT 11) the gas detector (MQ2, MQ7 and MQ135) and also humidity sensors are used to determine the environment and the undesirable gas within the manufacturing plant, gauged details can be connected to the web. In addition, our research findings demonstrated substantial energy efficiency and high-precision data analysis relative to conventional protection device strategies. For monitoring the fluctuation of parameters like air pollution levels from their normal levels in this case the sensing devices are connected to the embedded computing system.

Keywords: WHO safe limit, SDS021

I. INTRODUCTION

With the increasing population and increase in vehicles, industries and factories, Air pollution is a matter of concern that we have to deal with every day. Air pollution affects society at large. The population most affected by air pollution is elderly, kids with asthma and people living in poverty. WHO estimates that 7M people die every year from exposure to polluted air. At least 140 million people in India breathe air that is 10 times or more over the WHO safe limit. IOT Based Air Pollution Monitoring System is used to monitor the Air Quality over a web server using the Internet. It will trigger an alarm when the air quality goes down beyond a certain level, meaning when there are sufficient amounts of harmful gases present in the air like CO₂, smoke, alcohol, benzene, NH₃ and NO_x. It will show the air quality in PPM on the LCD and as well as on BLYNK App so that air pollution level can be monitored very easily.

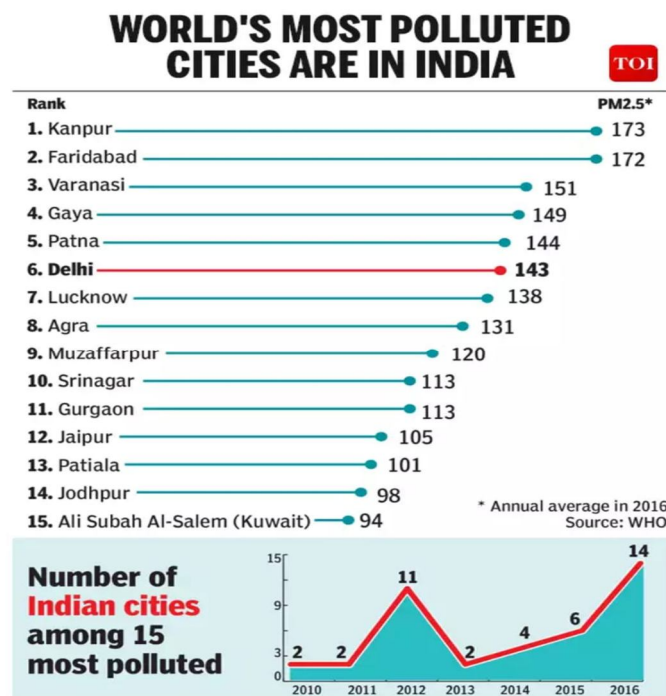


Figure 1: No of Indian cities in the list of world's most polluted cities.

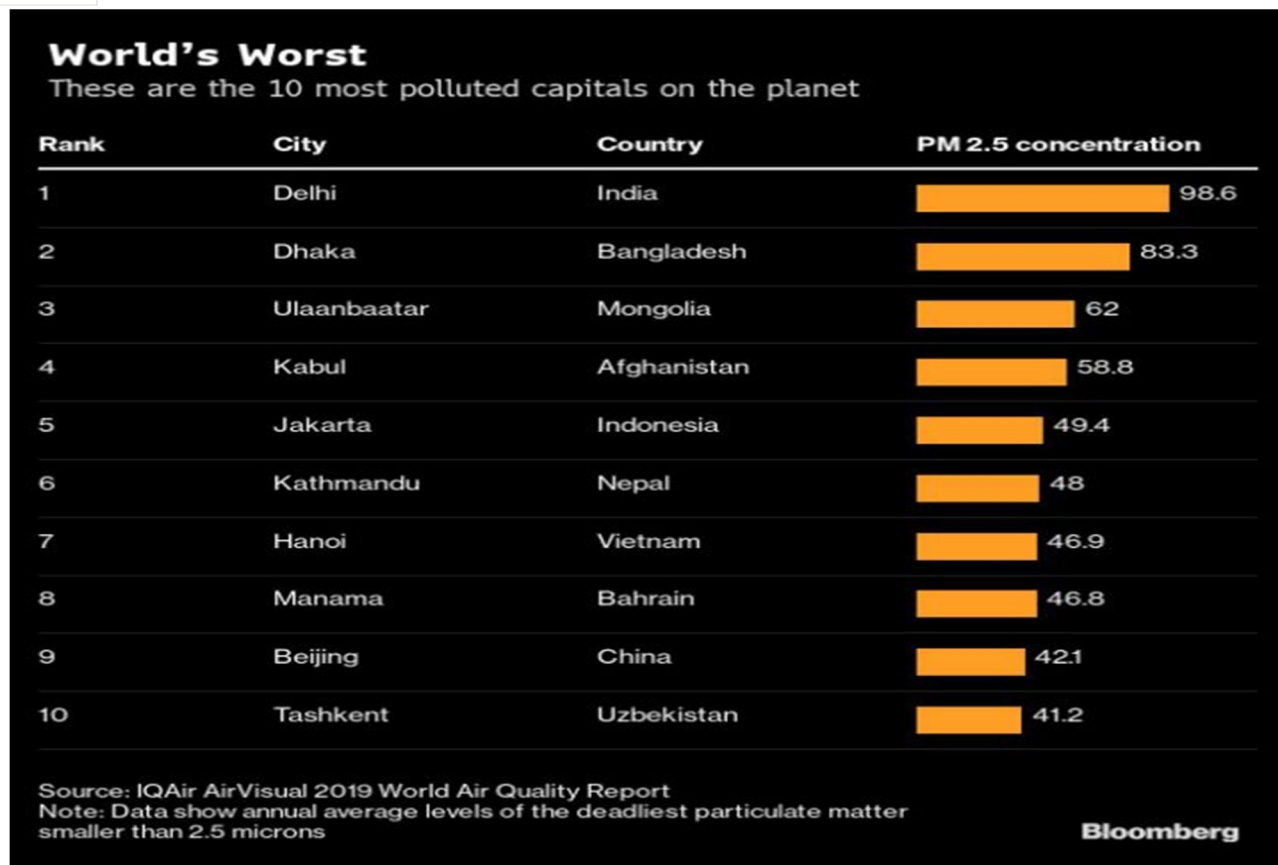


Figure 2:Top 10 Polluted capitals in this world (report by bloomberg)

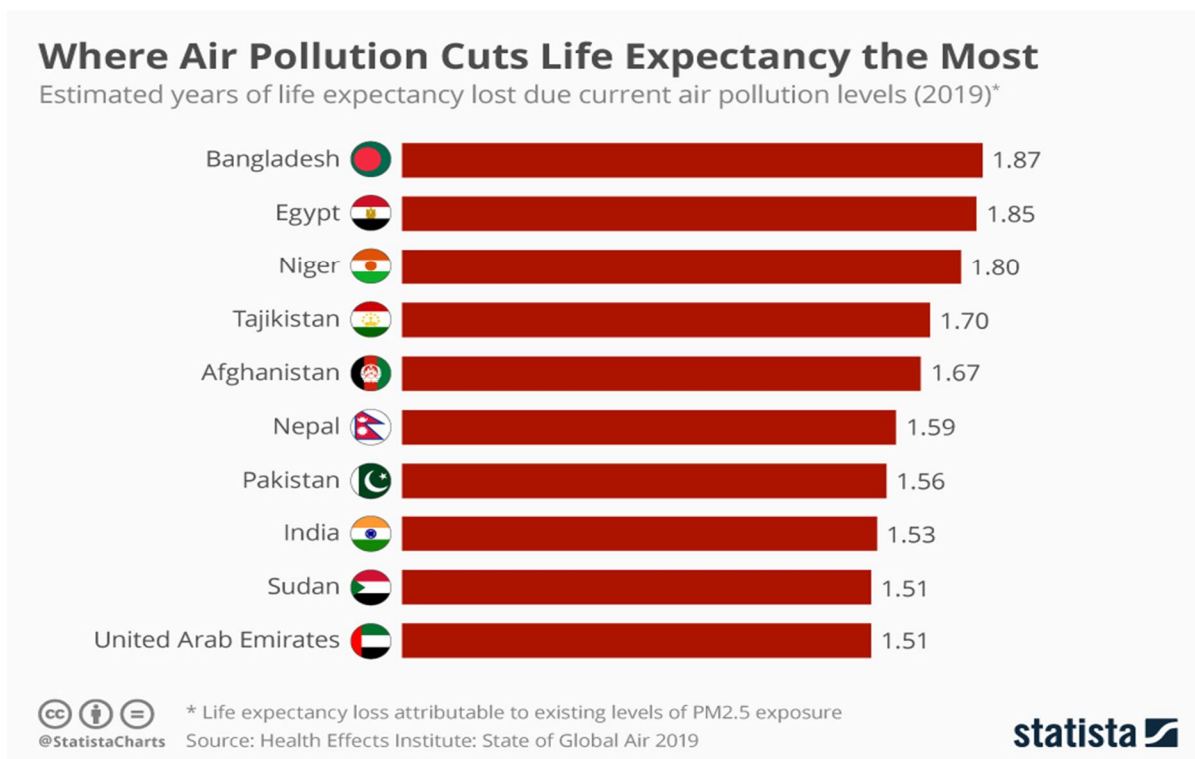


Figure 3:Chart which shows estimated years of life expectancy lost due current air pollution level.

II. LITERATURE SURVEY

In paper[1], Raspberry Pi is used as a base station. Gas sensors MQ7 and MQ135 are used to detect harmful gases present in the air. A webpage using MEAN stack was created for data visualization. Some of the advantages of this system are Low cost, portability, easy maintenance and quick response. In future, the system can be upgraded by adding more sensing nodes.

In the 2nd paper referred by us, MQ135 was used for detection of dangerous materials. According to the data transmitted by the system, a corresponding message is displayed on the webpage. Some advantages of this system are It supports the new technology and effectively supports the healthy life concept and people can monitor the amount of pollution on their phones using the application.

In the 3rd paper referred to, MQ135 and MQ6 sensors are used to monitor the quality of air. Some advantages of this system are Easy to Install Updates On mobile phone directly, Accurate Pollution monitoring and Remote location monitoring. In future, this prototype can be extended in real time implementations of urban cities.

In the 4th paper referred, The sensors are placed at different locations and the data is monitored from any remote location. Some advantages of this system are Sensors are easily available, The graphs are plotted on the android app in a tabular format and Location is also displayed with graphs. Maintenance of the equipment in all weather conditions, transmission of data effectively etc. are the challenges that need to be addressed.

In the 5th paper, MQ2, DHT11, SDS021 sensors are used for detecting air quality and humidity. The advantages of this system are Sensors are easily available, The graphs are plotted on ThingSpeak as well as on the android app in a tabular format. In future, System can be upgraded by adding more sensors like Fire detection etc .

In the 6th paper that we referred to, MQ135 and MQ2 sensors are used for detecting air quality. The advantages are Sensors are easily available, People can monitor the amount of pollution on their phones using the application. In future, System can be upgraded by adding more sensors like Fire detection and more powerful sensors for precise output.

III. SYSTEM DESIGN

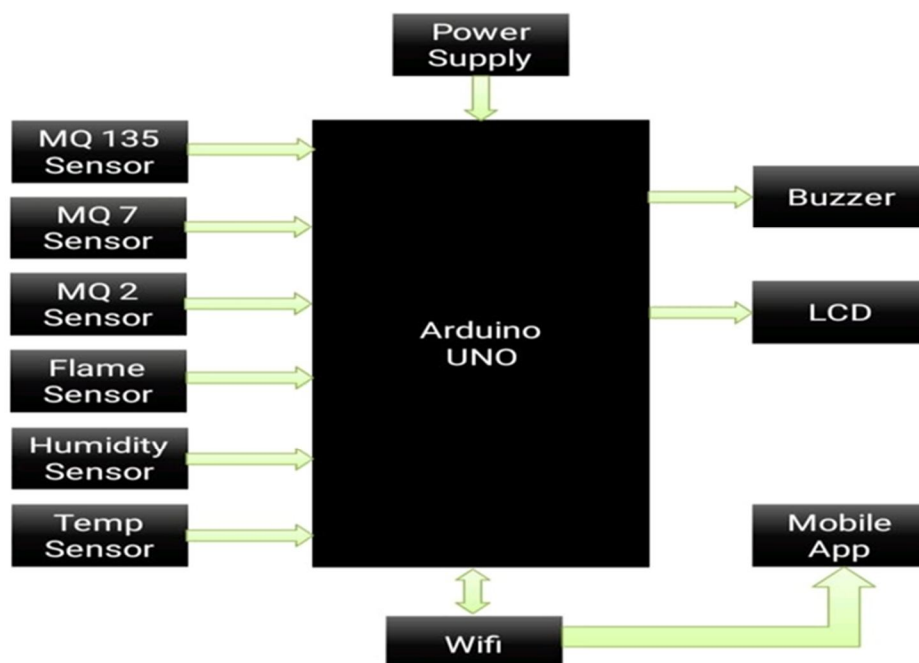


Figure 4:Block diagram of our proposed system

This proposed method is mainly based on processing, monitoring management of the data by NodeMCU. Node MCU (ESP8266Wifi) integrated module is used to communicate with the other systems and to web servers and PCs. There are two sides of communication which are commonly known as Master and slave side communication. This system is so flexible and is easy to monitor as well, also no human effort is required for this purpose.

IV. MAIN COMPONENTS USED

- 1) *MQ7 Sensor, MQ2 Sensor and MQ135 Sensor*: The gas sensors which are used here are to measure the existence of kinds of active gases in the area, which plays a smaller part in part of a support program. This kind of machinery is used to identify gas leakage or other pollutants which are responsible for these events and can communicate with the control unit so that the operation could be closed immediately. The gas sensor sounds a warning to workers in the region where the leak occurs, giving them a chance to take necessary actions and that form of system is essential for flora and fauna and also humans in this region. The process of identification of gas leakage is the method which detects dangerous gas leaks through sensors. Such detectors typically send a noticeable signal or a message through wireless networks to warn responsible officials and people where leakage of hazardous gas has been detected.



Figure 5:MQ7 Gas Sensor for Carbon Monoxide



Figure 6:MQ2 Grove Gas Sensor



Figure 7: Air quality sensor (MQ135) for detecting a wide range of gases, including NH₃, NO_x, alcohol, benzene, smoke and CO₂

- 2) *NODE MCU*: NodeMCU is an open-source Lua based firmware and development board specially targeted for IoT based Applications. It includes firmware that runs on the ESP8266 Wi-Fi SoC from Espressif Systems, and hardware which is based on the ESP-12 module. Its microprocessor supports RTOS and operates at 80MHz to 160 MHz adjustable clock frequency. NodeMCU has 128 KB RAM and 4MB of Flash memory to store data and programs. Its high processing power with in-built Wi-Fi / Bluetooth and Deep Sleep Operating features make it ideal for IoT projects. NodeMCU can be powered using Micro USB jack and VIN pin (External Supply Pin). It supports UART, SPI, and I2C interface.

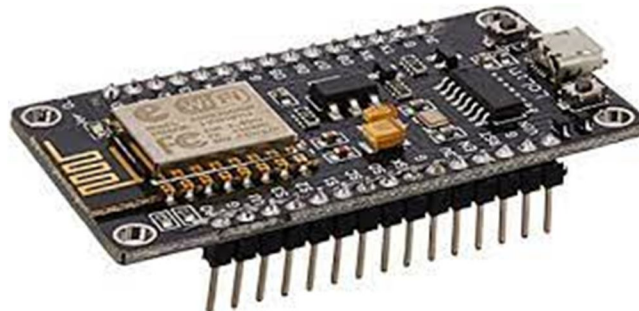


Figure 8:NODE MCU with its pin configuration

- 3) *DHT 11*: The DHT11 is a commonly used Temperature and humidity sensor. The sensor comes with a dedicated NTC to measure temperature and an 8-bit microcontroller to output the values of temperature and humidity as serial data. The sensor is also factory calibrated and hence easy to interface with other microcontrollers. The sensor can measure temperature from 0°C to 50°C and humidity from 20% to 90% with an accuracy of $\pm 1^\circ\text{C}$ and $\pm 1\%$. So if you are looking to measure in this range then this sensor might be the right choice for you.

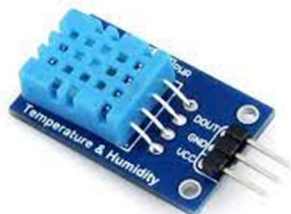


Figure 9: DHT 11 Sensor

- 4) *IR FLAME SENSOR*: Flame Detection Sensor Module is sensitive to the flame, but also can detect ordinary light. Usually used as a flame alarm. Detects a flame or a light source of a wavelength in the range of 760nm-1100 nm. Detection point of about 60 degrees, particularly sensitive to the flame spectrum. Sensitivity is adjustable, stable performance. Infrared flame sensors are designed to work within the infrared spectral band. When an explosion occurs, certain hot gasses will emit patterns in the infrared region, which can then be analysed using a specialised thermal imaging camera. The IR flame sensor is used to detect the presence of fire or other infrared source (Flame or a light source of a wavelength in the range of 760 nm to 1100 nm can be detected). It can be used in fire fighting robots or heat seeking robots.



Figure 10:IR Sensor

- 5) *Arduino Uno (ATmega 328)*: Atmel ATmega328 pre-loaded with boot loader. Atmel ATmega328 microcontroller in a DIL-28 package, pre-loaded with the Arduino UNO 16MHz bootloader. Using this device enables the use of Arduino code in a custom embedded project without having to use an actual Arduino board.



Figure 11:Arduino Atmega controller

V. IMPLEMENTATION

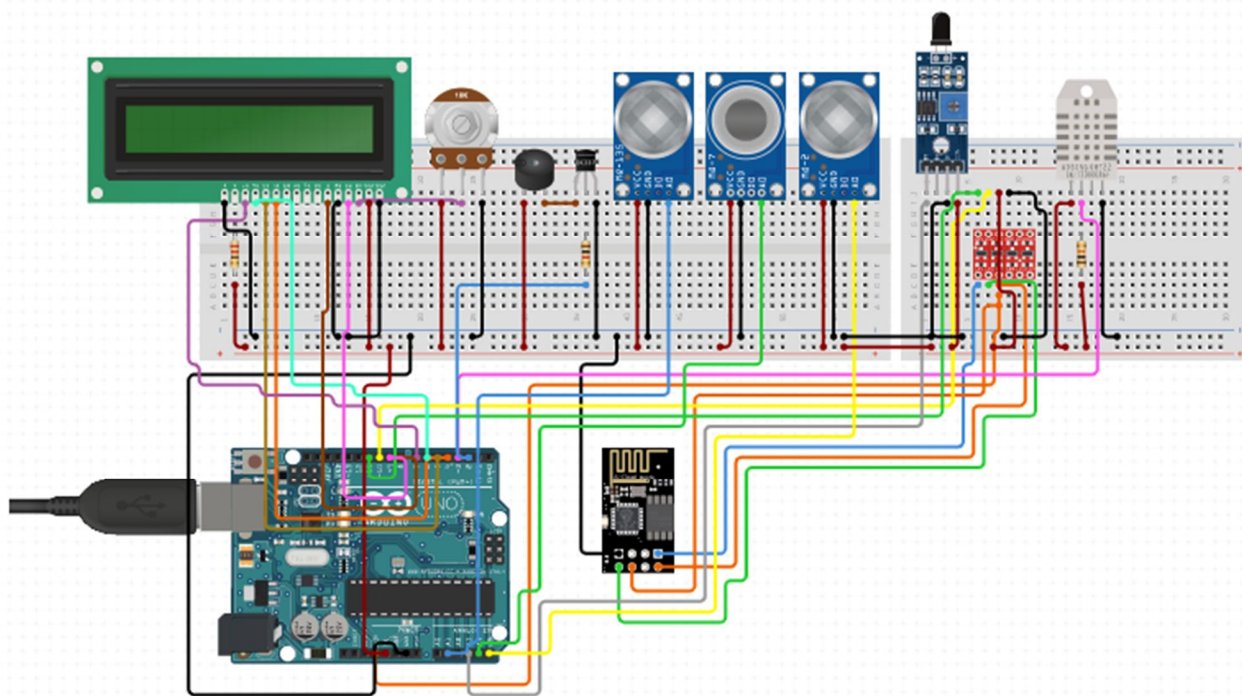


Figure 12: Circuit diagram of our system

In this system the sensors (MQ2, MQ7 and MQ135) and ir flame sensor simultaneously collect data from the environment in a systematic manner and then transfer it to the arduino board in the form of analog inputs. Then the arduino board checks if the values submitted by the sensors is less or more than that of the value which is kept constant in the memory part. If the value is higher or lower than the threshold value the arduino acts respectively. When there is presence of a flammable gas or smoke the red light glows and the buzzer beeps. When there is no presence of a flammable gas the green led glows. When there is a flame nearby the red light glows and the buzzer beeps. When there is no flame nearby there is no beeping of the buzzer and no flashing of lights.

VI. RESULTS



Fig13: Air Quality Display through Blynk App

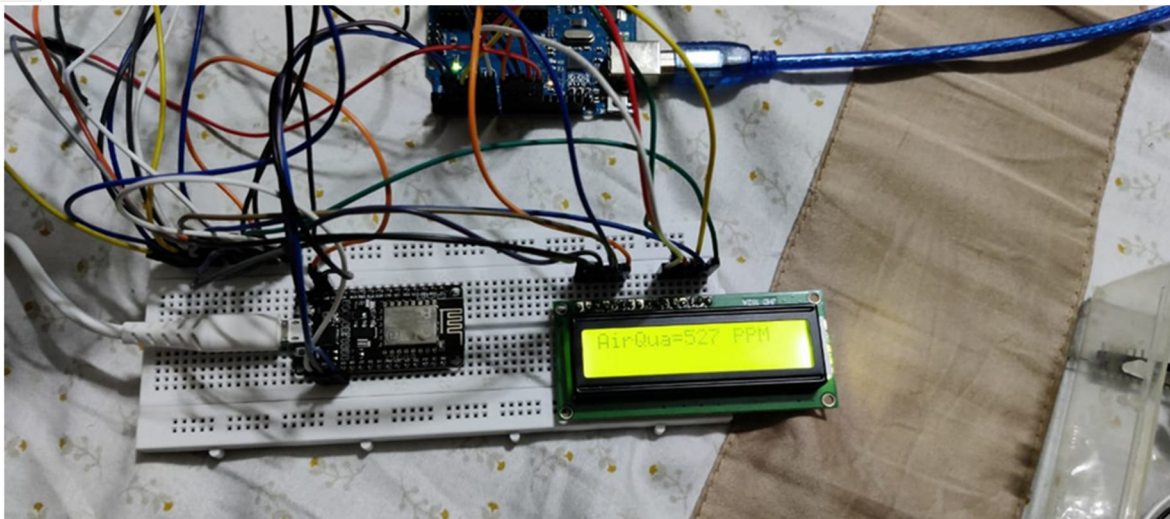


Fig 14: LED Display

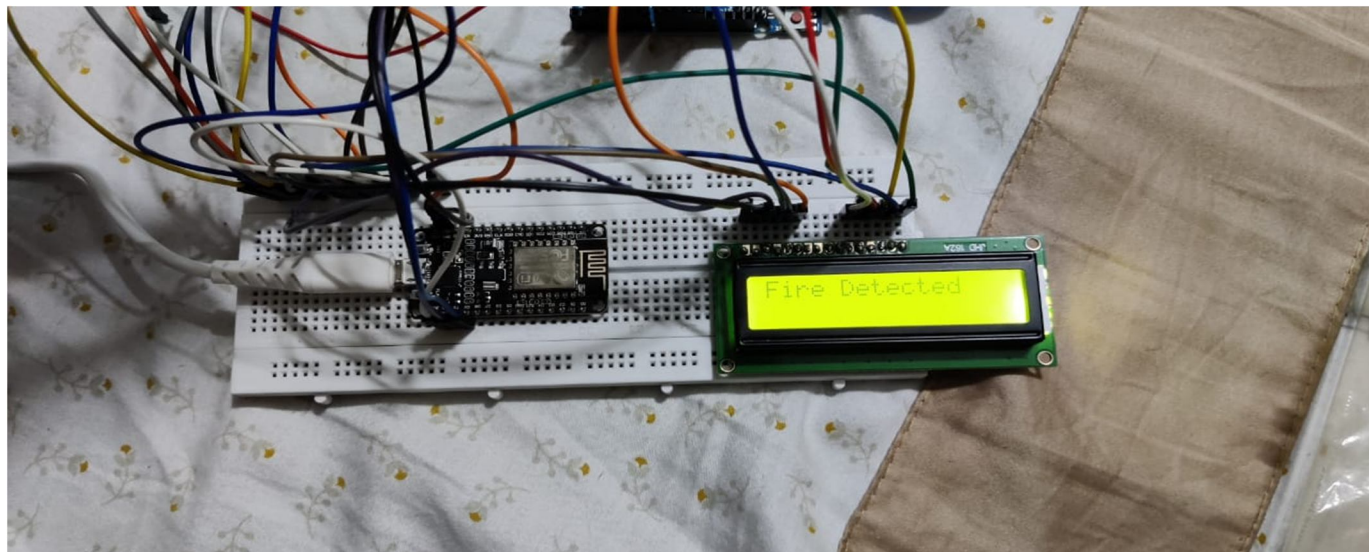


Fig 15: Fire alert shown Led display

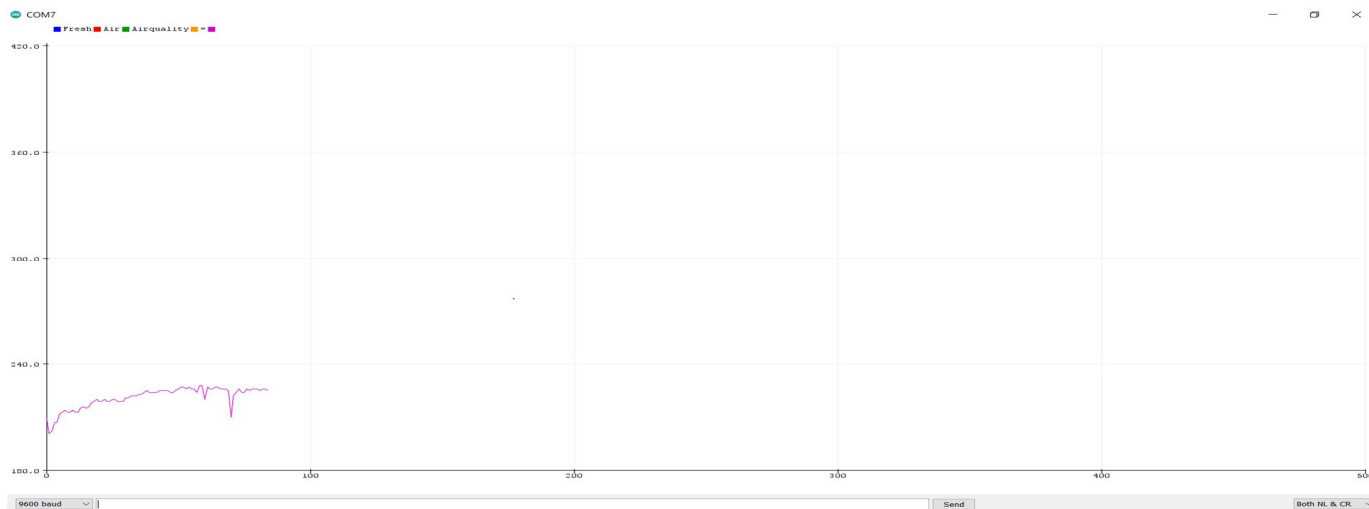


Fig 16: Graphical depiction showing us changes in air pollution level in terms of ppm

VII. CONCLUSION

This paper is all about the internet of things and its application for building fire and gas detection systems which can be installed in residential complexes, offices and warehouses in order to prevent these kinds of disasters from happening in near future. Fire detectors use various sensors, generally a smoke sensor and temperature and humidity sensor. The sensor input data is connected with an Arduino controller. LCD display, Buzzer and Node-MCU module also are connected with Arduino for output result. Buzzer is notified for the fire alarm and LCD displays the fire detection status. Nodemcu modules can be informed to specific users to know or prevent their home, office or building. This system can be applied in residential places, offices and hotels. With this system safety is assured. The system can perform different parameter measurements for early detection of building fires. According to our study we suggest that there should be atleast of one of these systems for the same purpose.

REFERENCES

- [1] <https://timesofindia.indiatimes.com/home/environment/pollution/7-of-the-top-10-most-polluted-cities-in-the-world-are-in-india-study/articleshow/>
- [2] <https://www.bloomberg.com/news/articles/2020-02-25/china-clears-air-to-leave-indian-cities-unrivaled-smog-centers>
- [3] <https://www.statista.com/chart/19835/where-air-pollution-cuts-life-expectancy-the-most/m/chart/19835/where-air-pollution-cuts-life-expectancy-the-most/>
- [4] G. Parmar, S. Lakhani and M. K. Chattopadhyay, "An IoT based low cost air pollution monitoring system," 2017 International Conference on Recent Innovations in Signal processing and Embedded Systems (RISE), Bhopal, 2017, pp. 524-528, doi: 10.1109/RISE.2017.8378212.
- [5] Poonam Pal, Ritik Gupta, Sanjana Tiwari, Ashutosh Sharma. (2017) "IoT Based Air Pollution Monitoring System Using Arduino", International Research Journal of Engineering and Technology (IRJET), Volume: 04 Issue: 10.
- [6] Harsh N. Shah, Zishan Khan, Abbas Ali Merchant, Moin Moghal, Aamir Shaikh, Priti Rane, "IOT Based Air Pollution Monitoring System", International Journal of Scientific & Engineering Research, Vol. 9, Issue 2, Feb.2018, pp. 62-66.
- [7] C. Xiaojun, L. Xianpeng and X. Peng, "IOT-based air pollution monitoring and forecasting system," 2015 International Conference on Computer and Computational Sciences (ICCCS), Noida, 2015, pp. 257-260, doi: 10.1109/ICCCS.2015.7361361.
- [8] S. Kumar and A. Jasuja, "Air quality monitoring system based on IoT using Raspberry Pi," 2017 International Conference on Computing, Communication and Automation (ICCCA), Greater Noida, 2017, pp. 1341-1346, doi: 10.1109/CCAA.2017.8230005.
- [9] S. Dhingra, R. B. Madda, A. H. Gandomi, R. Patan and M. Daneshmand, "Internet of Things Mobile-Air Pollution Monitoring System (IoT-Mobair)," in IEEE Internet of Things Journal, vol. 6, no. 3, pp. 5577-5584, June 2019, doi: 10.1109/JIOT.2019.2903821



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