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AIR QUALITY OF MONITORING SYSTEM

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I. ABSTRACT:

The system presented in this project is an advanced real time air quality reporting system supported with Internet Of things (IOT) architecture. Degrading air quality has been a matter of concern nowadays and real time monitoring of air quality helps us to keep a check on it. Air Quality is the scale to measure how polluted the air is. Greater air pollution indicates more dangerous air is for human health. The model presented here uses a combination of the ESP32 software and hardware along with a Gas sensors - MQ135, MQ7 and DHT11 sensor which help in detecting gases like NO2, CO, Ammonia, and Sulphide. Further, this research work monitor the Air Quality over an IOT analytics application BLYNK using internet connected with the hardware. It can also integrate the real time data into our mobile phone app. The circuit finally displays the PPM values as well as Air Quality level of gases on an Android application which fetches data from sensor through IoT. The current model is implemented successfully and can be deployed for real system implementations.

II. INTRODUCTION :

In this current generation, air pollution is one of the dangerous problems in human society. This is a worldwide faced problem. The ever increasing levels of carbon dioxide in the atmosphere, is leading to the temperature rise. We need an accurate air pollution monitoring system that is light in weight, easy to handle and can monitor a wide assortment of air pollutants (CO, NO2, and CO2) emitted from motor vehicles. It is obvious that those who work in a factory or plant will be far more at risk of inhalation of harmful chemicals and gases due to their prolonged exposure to emissions. Air pollution adds to the harmful condition that makes unfavorable impact on living things. It is one of the real concern for the entire world. Air pollution is a worldwide issue including international organizations, governments, and the mass media. Any utilization of natural assets at a higher rate than the nature's ability to re-establish itself can bring about contamination of plants, air, and water. Other than human exercises, there are a couple of intermittent characteristic cycles that additionally result in release of risky stuff. Beside human made activities natural disaster such as volcanic eruption may result in the contamination of air. Globalization is significant reason for contamination. In most cases air pollutants can be:

Carbon Monoxide: A gas that originates from the consuming of burning of fossil fuels, generally in autos. It can't be seen or noticed. It affect human beings feeling dizzy and tired and gives them headaches.

Toxic air pollutants: are created in chemical plants or are emitted when fossil fuels are burned. They are the causes for cancer. Other toxics can also cause birth defects.

- **Ozone (O3):** Secondary toxin framed by synthetic response of unstable natural compounds within the sight of 2 sunlight. It minimizes the lung function and causes breathing symptoms, such as coughing, asthma, and breathing related problems
- **Nitrogen Dioxide (NO2**): Fuel ignition such as vehicle fuel, electric utilities, wood burnings and industrial boilers. It is the cause for lung related diseases**.**
- **Sulfur Dioxide (SO2):** It comes from combustion of high sulphur fuel as well as natural disaster such as volcanoes .

III. LITERATURE SURVEY:

1. Siavash Esfahani , Piers Rollins , Jan Peter Specht , Marina Cole, Julian W. Gardner developed a concept, "**Smart City Battery Operated IoT Based Indoor Air Quality Monitoring System**", 2022. Indoor and outdoor air pollution is known to

cause many health problems. In order to improve air quality it is essential to monitor relevant parameters and identify sources of pollutants. This paper presents the design and development of a low-cost, portable Internet of Things (IoT) Indoor Air Quality (IAQ) monitoring system with 30 hours of battery life. The unit is intended for the monitoring of total VOCs, CO2, PM2.5, PM10, temperature, humidity and illuminance. The system can be used for both real-time measurements as well as hourly and daily averaging, in low power modes, and interfaces with a custom Blynk smartphone app, developed for easy user engagement. The device calculates a qualitative air quality index from measurements taken in-situ, based on United States Environmental Protection Agency (EPA) standards. Environmental data is used by the system to provide recommendations, such as increasing ventilation or reducing activity levels, which can help users improve their air quality. This system can be used as a node to monitor air quality in large scale networks for Smart Cities. This paper describes the design and development of a prototype for an IoT-enabled IAQ monitoring system, with a custom app for data logging and user recommendations. An IAQI 4 has been proposed to present a measure for air quality to the user. The data can be viewed in real-time or reported as an hourly or daily average. This prototype system offers advantages such as improved customization, and flexibility in selecting various low cost sensors.

2. Tigor Hamonangan Nasution, Ainul Hizriadi, Kasmir Tanjung describes "**Design of Indoor Air Quality Monitoring Systems**" 2020. —Indoor air quality is a problem that needs attention because it will affect human health. To maintain indoor air quality, it is necessary to regularly monitor several parameters that can affect air quality. Along with the development of sensor and monitoring technology based on IoT (Internet of Things) which helps a lot in designing monitoring devices automatically and periodically. This supports us to conduct research in designing a device that can periodically monitor indoor air quality conditions. In this study we designed an air quality monitoring system using the ESP32 as a controller and several sensors to measure air quality. The result is a system that can monitor temperature and humidity, dust particles and polluting gases (H2S, NH3, CO, NO2, and SO2). From the design results, the system we have designed can display data on temperature, humidity, dust particles, and levels of polluting gases (H2S, NH3, CO, NO2, and SO2),. The data read from the sensors is also sent to the ThingSpeak Cloud via the Wi-Fi module so that data can be monitored remotely.
3. In future work, we will make developments by designing a multimode sensor system. 5 Somphop Chanthakit, Choopan Rattanapoka describes "**MQTT Based Air Quality Monitoring System using NodeMCU and Node-RED**" – 2018. —This paper present an implementation of MQTT based air quality monitoring system. The air quality measurement device is a hardware using ESP8266 NodeMCU that connects to sensors for measuring temperature, humidity, concentration of carbon monoxide (CO), ozone gas (O3), and PM2.5. The firmware of device makes the device act as a publisher that reads the sensor data and sends them to MQTT Broker. Node-RED is used to be a subscriber that subscribes to receive data from MQTT Broker. With Node-RED, we can easily make a flow to manage and handle received data. Then, Node-RED will send data to the air quality monitoring dashboard which is a responsive web application to display data in gauge, text and chart user interface. In addition, when the value of some data exceed the configured range, Node-RED will send an alarm message via LINE Notify to notify users. The air quality monitoring system consists of three main components. first component is an air quality measurement device. We connected sensors to ESP8266 NodeMCU that acts as a publisher. The ESP8266 NodeMCU will collect, parse and transform data from sensors, then publish them to MQTT Broker. The second component is MQTT Broker. We use Eclipse Mosquitto , which is an open source message broker that implements the MQTT protocol version 3.1 and 3.1.1. Mosquitto is lightweight and is suitable for use on all devices from low power single board computers to full server. The third component is an air quality monitoring dashboard and Line Notify Service. We use Node-RED that acts as a subscriber to receive data from MQTT broker. With Node-RED, we design flows to manage and handle the received data to display them in the form of gauge, 6 text and chart on the dashboard.
4. In addition, we set some constraints in Node-RED that if the value of data exceed the configure range, NodeRED will contact LINE Notify service to send a LINE message to warn users. Raoudha Baklouti, has developed a concept of " **Effective**

Monitoring of an air quality network" 2018. Air pollution in urban areas could be considered as one of the most dangerous types of pollution that can cause impact health and the ecosystem. Hence, monitoring air quality networks has captivated the interest of various research studies. In this context, this paper deals with Fault Detection of an Air Quality Monitoring Network. The proposed approach is based on nonlinear principal component analysis to cope with modeling of nonlinear data. In addition, the fault detection would be improved by combining exponentially weighted moving average with hypothesis testing technique: generalized likelihood ratio test. The evaluation was carried out on an Air Quality Monitoring Network (AQMN). The results revealed a good results compared to the classical PCA. In this paper, we developed a Nonlinear Principle Component Analysis (NPCA) based Exponentially Weighted Moving Average (EWMA)-generalized likelihood ratio test (GLRT) for FD of an AQMN: air quality monitoring network. The objective of the NPCAbased GLRT is to deal with nonlinear case to further enhance the monitoring performance of the PCA-based on the combination of EWMA and GLRT method. In the developed technique, NPCA model is constructed using nonlinear function, and then EWMA-GLRT is applied using this model to enhance the fault detection abilities. The developed NPCA-based EWMA-GLRT technique has shown improved detection with lower FAR and MDR, when compared to classical PCA technique.

IV. PROPOSED SYSTEM:

• We have proposed a system for monitoring the real time air pollution using Internet of Things through wireless sensor network.

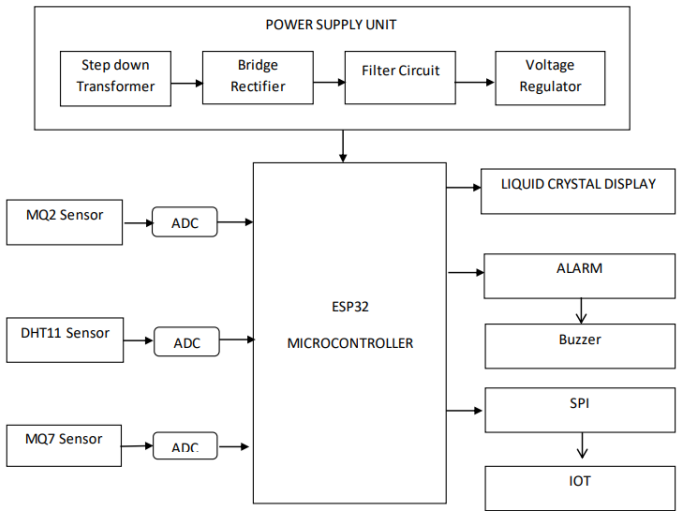
• The analog inputs are received from the analog input pins of the ESP32 from various gas sensors such as MQ2, dht 11 sensor, MQ7 etc. These data are converted into digital form by the ADC of the ESP 32. These data received are first converted into ppm of the gases and then using this ppm of gases Air Quality Index is calculated

• These data after calculations are send to controller which will transmit that information to the required person's mobile using a mobile application called BLYNK through IOT.

• With the help of IoT, real time data is sent to BLYNK APP, where this data can be accessed in a mobile phone application which uses past air quality data of places to calculate the condition of air in that area at that time and constitute an alert mechanism.

• The mobile application displays the condition of air into categories such as mq7, mq2, humidity and temperature.

V. BLOCK DIAGRAM:



VI. WORKING PRINCIPLE:

When sufficient voltage is applied to the electrodes the liquid crystal molecules would be aligned in a specific direction. The light rays passing through the LCD would be rotated by the polarizer, which would result in activating/highlighting the desired characters.

The power supply should be of +5v, with maximum allowable transients of 10mv. To achieve a better/suitable contrast for the display the voltage (VL) at pin 3 should be adjusted properly. A module should not be removed from a live circuit.

The ground terminal of the power supply must be isolated properly so that voltage is induced in it. The module should be isolated properly so that stray voltages are not induced, which could cause a flicking display. LCD is lightweight with only a few, millimeters thickness since the LCD 23 consumes less power, they are compatible with low

power electronic circuits, and can be powered for long durations.

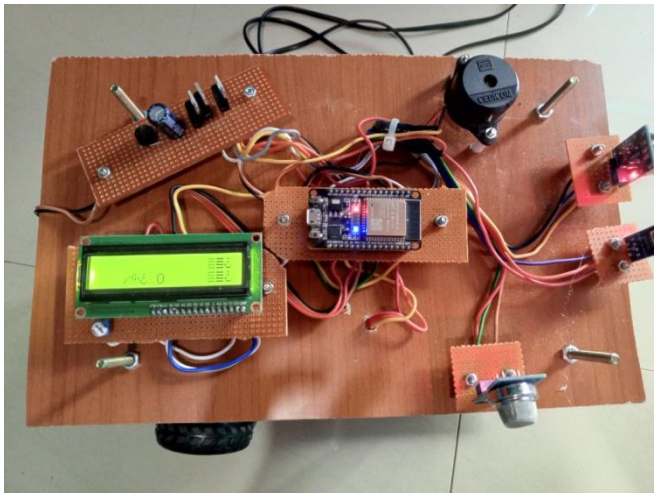


Fig 1: Connection of Sensors, Controller ,LCD and Power supply unit

LCD does not generate light and so light is needed to read the display. By using backlighting, reading is possible in the dark. LCDs have long life and a wide operating temperature range. Before LCD is used for displaying proper initialization should be done. LCDs with a small number of segments, such as those used in digital watches and pocket calculators, have individual electrical contacts for each segment.

An external dedicated circuit supplies an electric charge to control each segment. This display structure is unwieldy for more than a few display elements. Small monochrome displays such as those found in personal organizers, or older laptop screens have a passive-matrix structure employing super-twisted nematic (STN) or double-layer STN (DSTN) technology—the latter of which addresses a color-shifting problem with the former—and color-STN (CSTN)— wherein color is added by using an internal filter. Each row or column of the display has a single electrical circuit. The pixels are addressed one at a time by row and column addresses.

This type of display is called passive-matrix addressed because the pixel must retain its state between refreshes without the benefit of a steady electrical charge. As the number of pixels (and, correspondingly, columns and rows) increases, this type of display becomes less feasible. Very slow response times and poor contrast are typical of passive matrix addressed LCDs. High-resolution color displays such as modern LCD computer monitors and televisions use an active matrix structure .

A matrix of thin-film transistors (TFTs) is added to the polarizing and color filters. Each pixel has its own dedicated transistor, allowing each column line to access one pixel. When a row line is activated, all of the column 24 lines are connected to a row of pixels and the correct voltage is driven onto all of the column lines. The row line is then deactivated and the next row line is activated. All of the row lines are activated in sequence during a refresh operation. Active-matrix addressed displays look "brighter" and "sharper" than passive-matrix addressed displays of the same size, and generally have quicker response times, producing much better images.

A general purpose alphanumeric LCD, with two lines of 16 characters. So the type of LCD used in this project is16 characters * 2 lines with 5*7 dots with cursor, built in controller, +5v power supply, 1/16 duty cycle.

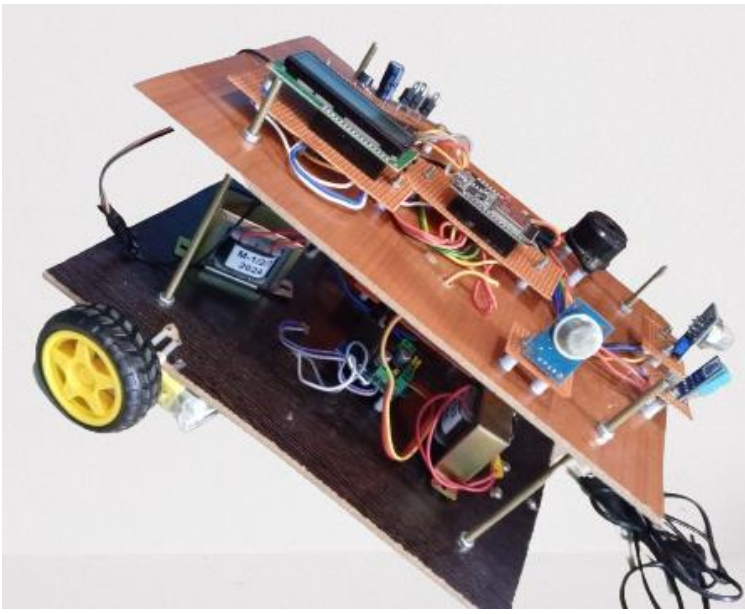


Fig 2:Hardware Setup

VII. RESULT AND DISCUSSION :

The hardware model of the proposed system is shown in the below figure. The proposed system is developed to detect the fire in car parking and to alert the concerned person using Iot.

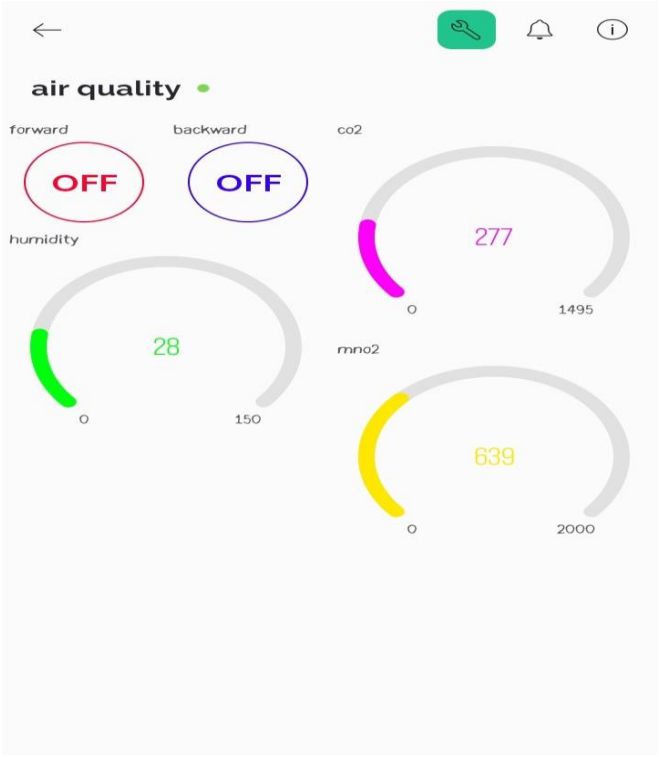


Fig 3:Mobile Application Dashboard

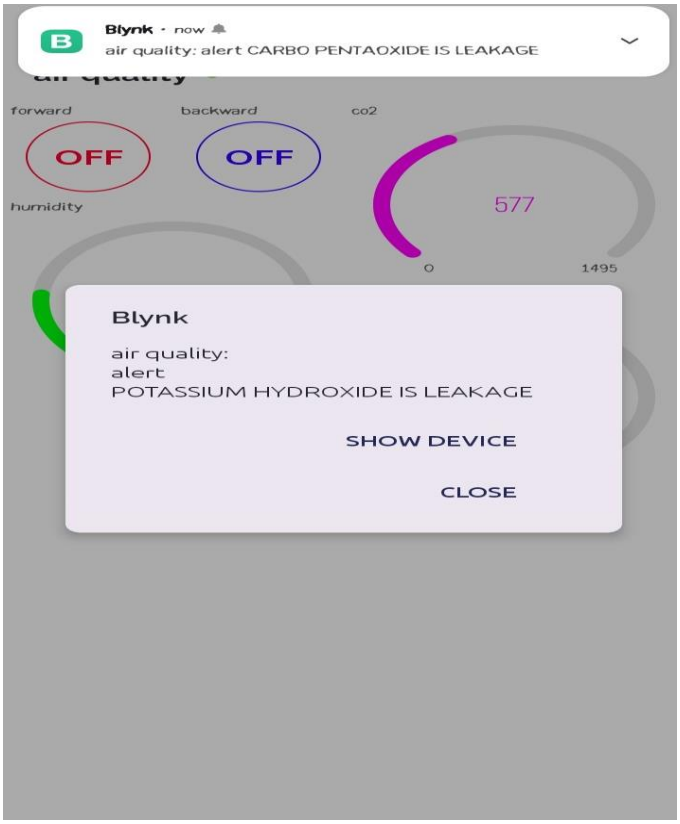


Fig 4: Notification Alert on Mobile Application.

OUTPUT ON BLYNK APP

VIII. CONCLUSION :

The car parking fire smoke alert monitoring system is developed in order to generate a more systematic and efficient parking system by using ESP 32 and android application. This system that able to track and trace the fire smoke in the parking area by processing the smoke sensitivity value that are taken by the MQ-2 natural gas smoke sensor. Then, this prototype system will notify the student by generating fire smoke information by using a multiple and distinct Arduino devices. Moreover, the student also needs to register their information by using an android application and the information will be stored into the database. This IoT system is easy to install and maintain as it requires very low technical skills and knowledge for device handling.

IX. REFERENCES:

• Air Quality Monitoring Systems using IoT 2020 International Conference on Computational Performance Evaluation (ComPE) North-Eastern Hill University, Shillong, Meghalaya, India. Jul 2-4, 2020

• Air pollution monitoring and prediction using IoT Proceedings of the 2nd International Conference on Inventive Communication and Computational Technologies (ICICCT 2018) IEEE Xplore Compliant - Part Number: CFP18BAC-ART; ISBN:978-1-5386-1974-2

• M. Centenaro, L. Vangelista, A. Zanella, M. Zorzi, “Long-range communications in unlicensed bands: the rising stars in the IoT and smart city scenarios,” IEEE Wireless Communications, Vol. 23, No. 5, October 2016, pp. 60-67. DOI:10.1109/MWC.2016.7721743. 74

• Bor, Martin and Vidler, John Edward, Roedig, Utz, “LoRa for the Internet of Things.” In Proceedings of the 2016 International Conference on Embedded Wireless Systems and Networks. Junction Publishing, Canada, 2016, pp. 361-366.

• Y.-S. Lin, Y.-H. Chang, Y.-S. Chang “Constructing PM2.5 Map Based on Mobile PM2.5 Sensor and Cloud Platform,” 2016 IEEE International Conference on Computer and Information Technology (CIT), 8-10 Dec. 2016, Nadi, Fiji, DOI:10.1109/CIT.2016.82.

• Y.-S. Chang, K.-M. Lin, Y.-T. Tsai, Y.-R. Zeng, C.-X. Hung, “Big data platform for air quality analysis and prediction,” In proceeding of the 27th Wireless and Optical Communications Conference, April 30-May 1, 2018, Hualien, Taiwan.

• Liang-Yu Chen, Hsiao-Shih Huang, Cheng-Ju Wu Yi-Ting Tsai YueShan Chang , "A LoRa-based Air Quality Monitor on Unmanned Aerial Vehicle for Smart City", 2018 International Conference on System Science and Engineering (ICSSE). doi:10.1109/ICSSE.2018.8519967.

• V. C. Koo et al. "A new unmanned aerial vehicle synthetic aperture radar for environmental monitoring," Progress In Electromagnetics Research, Vol. 122, 2012, pp. 245-268. doi:10.2528/PIER11092604.

• S. d'Oleire-Oltmanns, I. Marzolff, K. D. Peter, J. B. Ries, "Unmanned Aerial Vehicle (UAV) for Monitoring Soil Erosion in Morocco," Remote Sensing, 4(11), 2012, pp. 3390-3416. doi:10.3390/rs4113390. 75

• C. A. Trasviña-Moreno, R. Blasco, Á. Marco, R. Casas, A. TrasviñaCastro, "Unmanned Aerial Vehicle Based Wireless Sensor Network for Marine-Coastal Environment Monitoring," Sensors, 17(3), 2017, 460; doi:10.3390/s17030460.

• J. Gubbi, R.Buyya, S. Marusic, M. Palaniswami, "Internet of Things (IoT): A vision, architectural elements, and future directions," Future Generation Computer Systems, Vol. 29, No. 7, September 2013, pp. 1645-1660. https://doi.org/10.1016/j.future.2013.01.010.

• A. Zanella, N. Bui, A. Castellani, L. Vangelista, M. Zorzi, "Internet of Things for Smart Cities," IEEE Internet of Things Journal, Vol. 1, No. 1, Feb. 2014, pp. 22-32. DOI:10.1109/JIOT.2014.2306328.