M. Chen et al developed a big data driven urban healthcare system. They proposed a method for combining multi-source air quality data in order to prepare data for AI based smart urban services. A testbed was also established by them, including the deployment of air quality aware healthcare applications, which provides health advice regarding respiratory illnesses, outdoor travel, and sleep quality to the urban residents.

M. Chen, J. Yang, L. Hu, M. S. Hossain and G. Muhammad, "Urban Healthcare Big Data System Based on Crowdsourced and Cloud-Based Air Quality Indicators," in IEEE Communications Magazine, vol. 56, no. 11, pp. 14-20, November 2018, doi: 10.1109/MCOM.2018.1700571.

M. Meli et al developed a low-cost indoor air quality monitoring and analysis system based on IoT and big data. Their system enables the deployment of many low-cost nodes throughout a building, yielding considerable location-based indoor air pollution data. The big data is transferred to the cloud-based LoRaWAN network through the MQTT protocol and stored in a cloud-based database, where it is visualized and analyzed.

M. Meli, E. Gatt, O. Casha, I. Grech and J. Micallef, "A Low Cost LoRa-based IoT Big Data Capture and Analysis System for Indoor Air Quality Monitoring," 2020 International Conference on Computational Science and Computational Intelligence (CSCI), 2020, pp. 376-381, doi: 10.1109/CSCI51800.2020.00070.

M. E. Karar et al introduced a new design and development of portable system called GASDUINO which enables the user to measure air quality using IoT. Their system can alarm the users about the dangerous levels of the air quality index (AQI) levels in the range of 0 to above 200 PPM. It uses the MQ-135 sensor to detect the AQI and visualize the data using Remote XY Arduino cloud.

M. E. Karar et al. introduced a new concept of a portable system named GASDUINO which enables the users to detect air quality via IoT. Their technology can warn users about harmful levels of air quality index (AQI) values ranging from 0 to 200 PPM. It detects the AQI with the MQ-135 sensor and visualizes the data using the Remote XY Arduino cloud.

M. E. Karar, A. M. Al-Masaad and O. Reyad, "GASDUINO-Wireless Air Quality Monitoring System Using Internet of Things," *Information Sciences Letters,* vol. 9, no. 2, 2020, pp. 113-117, doi: 10.18576/isl/090208.

P. Arroyo et al introduced a low cost and efficient air quality measurement system that is composed of a distributed sensor network connected to a cloud system forming a wireless sensor network (WSN). The system detects volatile organic compounds such as: benzene, toluene, ethylbenzene, and xylene. It uses artificial intelligence techniques for data preprocessing and analysis. Their system shows good performance in discriminating and quantifying the concentration of the volatile organic compounds.

Sensor nodes are based on low-power ZigBee motes, and transmit field measurement data to the cloud through a gateway. An optimized cloud computing system has been implemented to store, monitor, process, and visualize the data received from the sensor network. Data processing and analysis is performed in the cloud by applying artificial intelligence techniques to optimize the detection of compounds and contaminants. This proposed system is a low-cost, low-size, and low-power consumption method that can greatly enhance the efficiency of air quality measurements, since a great number of nodes could be deployed and provide relevant information for air quality distribution in different areas. Finally, a laboratory case study demonstrates the applicability of the proposed system for the detection of some common volatile organic compounds, including: benzene, toluene, ethylbenzene, and xylene. Principal component analysis, a multilayer perceptron with backpropagation learning algorithm, and support vector machine have been applied for data processing. The results obtained suggest good performance in discriminating and quantifying the concentration of the volatile organic compounds.

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| [2] | M. E. Karar, A. M. Al-Masaad and O. Reyad, "GASDUINO-Wireless Air Quality Monitoring System Using Internet of Things," *Information Sciences Letters,* vol. 9, no. 2, pp. 113-117, 2020. |