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IoT based real time air and noise pollution monitoring and controlling

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Abstract. Air and sound pollution is the biggest problem nowadays. So It is required to monitor air quality and noise levels to keep it control for a better future and happy living for all. In order to monitor the pollution, we propose an air pollution as well as sound pollution monitoring system that allows us to monitor and automatically control the air quality and sound pollution in particular areas through IoT. Our proposed system used air sensors to sense presence of harmful pollutants in the fresh air and simultaneously transmits this data to the microcontroller and also device keeps measuring the sound level and reports it to the cloud storage through Internet. These sensors interfaced with microcontroller which senses this data and transmits it to the internet. Our system also interfaced with GPS module to find the latitude and longitude of different places. This methodology allows authorities and people to monitor the air pollution and noise pollution in different areas and take action against it. If system detects the air quality and noise issues, it alerts authorities and also living people. Once the system exceeds the threshold levels of air and noise pollution, controlling action will automatically take by its own. People are don't need to worry about this. Pollution automatically monitored and controlled by our system.

Keywords: Microcontroller, IoT, GPS, Air Pollution, Sound Pollution.

1. Introduction

In the Digital Age, all complicated devices and communication media are being simplified with the help of cutting edge technology. Here we proposed our project; Iot based real time air and noise pollution monitoring and controlling system to monitor the real time pollution levels and it also taking necessary action when the pollution level is high. Air is a mixture of gases, primarily nitrogen (78%) and oxygen (21%). It also contains small amounts of carbon dioxide (0.04%) and even smaller amount of several inert substances, among them argon (almost 1%), helium, xenon, neon and krypton. Air is the global resource, Owned by no one and used by all of us [1]. But nowadays Industrial societies, however traditionally used the air as a waste dump for hundreds of pollutants. No one has sole responsibilities for protecting our air. Pollutants inthe atmosphere arise from two major sources:

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natural and anthropogenic. Nevertheless, anthropogenic pollutants create the most significant long-term threat to the biosphere. Power plants, automobiles, factories and other human sources emit large quantities in restricted areas, making a significant contribution to local pollution levels. The higher the concentration, the greater the effect [2]. There are two types of air pollutants, primary air pollutants and secondary air pollutants. Primary air pollutants are produced directly by various sources. Primary pollutants often react with one another or with water vapor which produces a whole new set of pollutants called secondary pollutants. The major air pollutants are carbon monoxide, sulfur oxides, nitrogen oxides, particulates, hydrocarbons, photochemical oxidants etc [3]. In our country, carbon monoxide, NOx, SOx and PM-10 particulate matter is the major air pollutant because of huge transportation and burning of fuel and biogas. This is the main reason for air pollution in India. Our system also concentrates these major air pollutants for monitoring purpose [4]. MQ- 135 sensor is used to read the values of toxic gases present in the air. MQ-135 is sensitive air quality sensor that detects NH3, NOx, alcohol, benzene, smoke, CO2, etc [5].MQ-3 sensor also used in this system to monitor the major air pollutant carbon monoxide (CO). Mainly this pollutant can be produced due to the transportation [6]. LM-35 Temperature sensor is used to measure the temperature of the surroundings. Once the pollutants level gets increased, then the temperature of our earth becomes increased. So our system monitoring the temperature level and take ction against it [7]. Another important pollution is noise pollution. Sound can describe in terms of its loudness and its pitch, or frequency. Loudness measured in decibels (dB) because the human ears accept the sound in the form of logarithmic scale. The human ear is sensitive tosounds in the range of 20 to 20000 hertz (0dB to 20dB). Sounds below 20 hertz are not detected by human ear and are described as infrasonic. Sounds above the audible range are called ultrasonic. Noise is any unwanted, unpleasant sound. If the range of the sound exceeds this threshold value, then it causes the noise pollution [8]. Sound sensor module KY-038 is used to detect the sound. Once the sound level exceeds threshold value, it intimates the controller automatically. Then the people and authorities can take some necessary action against it [9]. The values read from the sensors are directly given to the Arduino microcontroller [10]. The Arduino UNO ATMEGA 328 is a single-chip microcontroller created and developed by Atmel in the mega AVR family. ATmega 328 is the 8-bit controller. It has 32 Kb flash memories and 1Kb EEPROM. It contains 32 general purpose registers and internal timers, counters [11]. We are additionally added the GPS module to the microcontroller for finding the location information to the users and authorities. This module will help the authorities for finding the polluted areas and take necessary action against it [12]. Those data from the microcontroller is pushed to the server by using the IoT module MDM-9206. Those data can be monitored by using the internet in real time [13]. IoT offers easier, efficient and secure data transfer. So the people and authorities can monitor the pollution levels in different areas through the internet [14]. This entire data is stored in to the Go-daddy dedicated server. So that we can retrieve those data at anytime and anywhere [15]. By using this storage we can view the levels of pollution at any area by using our personal digital assistants like mobile phones and laptops by using the URL link [16]. LCD (16*2) display unit also display the levels of pollution to the user for monitoring purpose. Buzzer is used to intimate alert to the user when the pollution occurs. Buzzer will beep continuously when the pollution has occurred. Our proposed system not only monitoring the pollution levels, it cans also controlling the pollution. As per Clean Air Act 1970 to 1990, clean air laws and regulations have typically prescribed many technological controls to reduce air pollution. Air pollution control devices such as typical bag filter, basic cyclone collector, electrostatic precipitator,spray collector will automatically switched on when the toxic gases present in the air. These devices purify the air automatically. Indoor air pollution can easily controlled by turn on the exhaust fan in home. So the people have no need to worry about the pollution [17]. Noise pollution can be controlled by following the noise control act 1972 [18]. Our proposed method monitoring the real time air and noise pollution levels and it will automatically takes necessary steps to control the pollution.

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2. System Design

The simplified diagram of the proposed system is demonstrated in Fig.1. The main node of this proposed system is Arduino UNO microcontroller. The sensing unit is responsible for measuring the pollutants like carbon monoxide (CO), carbon dioxide (C02), nitrogen, Ammonia (NH3), alcohol, benzene, smoke, sulphur dioxide etc. The main toxic gases are monitored and measured by MQ-135 and MQ-3 sensor. The sound level of our environment is measured by KY-038 sensor. The temperature of our earth is measured by LM-35 temperature sensor. These all sensors are interfaced with arduino microcontroller. The sensors values are continuously displayed in the LCD display unit which is connected to the microcontroller. 5V DC supply is given to the arduino microcontroller and 12V DC supply is given to the GPS module. GPS module SL-100200 is connected to the microcontroller for receiving the location of the polluted areas.

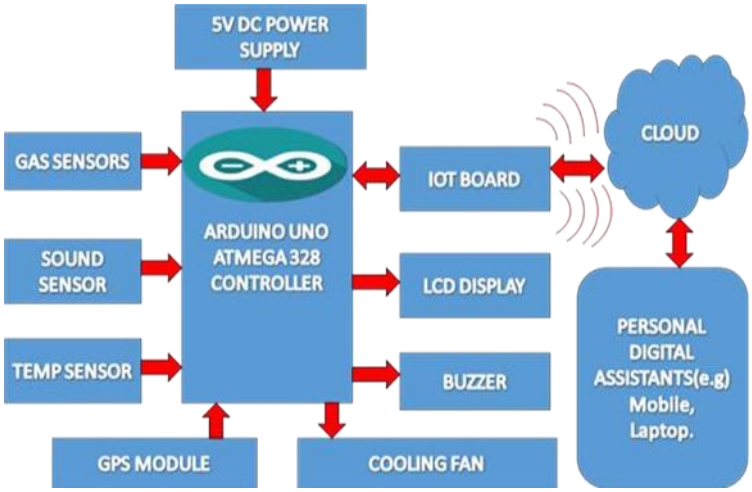

Figure 1. Block Diagram of Proposed System.

The latitude and longitude of the areas is received by GPS receiver. These entire data's are sent to the MDM-9206 IoT module by using serial communication in the controller. MDM-9206 is the next generation IoT module and it is used for developing IoT products. This module has wide range and multi- mode connectivity. The separate URL link is getting by using this IoT module. Using this link we can view those data at anytime and anywhere. Those data are pushed in to the Go-Daddy dedicated server. This cloud storage is used for maintaining our data in a secured manner. We can view those data by using separate link. Buzzer will beep continuously once the temperature of our earth increases the threshold level. The simple DC motor is connected to the microcontroller with a relay circuit. This motor rotates continuously when the level of the pollutants increases the threshold level. Indoor air pollution can be controlled by rotating this motor. Using our personal digital assistants (like mobile, laptop etc) we can view those data's at anytime and anywhere or else we can view the data's by LCD display module. Our system sends the real time sensor data's to the server continuously. Through the separate link we can view the data's by using our personal digital assistants. Wide range and multi-mode connectivity has provided by our device. Our system continuously monitoring and controlling the air and noise pollution.

3. Methodology

Our IoT based Air quality monitoring system measuring the ambient pollution is highly accurate, affordable, and easy to use. In our system MQ-135 gas sensor is connected to the analog pin A1 of the arduino board. 5V DC supply is commonly given to the arduino and relay circuit. 12V DC supply is given to the IoT module. MQ-3 gas sensor is connected to the analog pin A2 of the arduino board. KY-038 sound sensor and LM-35 temperature sensor is connected to the analog pins A3 and A0 respectively. All the sensors have interfaced with arduino microcontroller. These all sensor values

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continuously displayed in the LCD module. LCD module is connected to the digital pins 13, 12, 11, 10, 9, 8 of thearduino microcontroller.

Location of the polluted areas can be viewed by GPS module. The TTL pin of the GPS module is connected to the receiver pin (RX) of the microcontroller. The sensors data from the arduino board and GPS location is transmitted to the internet by using the IoT module MDM-9206. This can be possible by connecting the transmitter pin of the arduino to the IoT module. So the TX pin of the arduino is connected to the IoT module. Those data's are continuously monitored by using the separate link provided by the module. We can monitor the data's from anywhere in the world. Once the level of pollutants is increased from the particular areas, then the controlling action has taken automatically. This can be done by connecting the digital pin 2 of the arduino to the relay circuit. Relay circuit is connected to the simple DC motor for controlling the indoor airpollution. Buzzer is connected to the digital pin 3 of the arduino microcontroller. Buzzer is used to alert the people and authorities when the pollution level gets increased. The datas from the IoT module is stored in the Go-Daddy dedicated server. So that we can view those data's from anywhere. The separate html page has created in the server.MDM-9206 IoT module is sends the datas to the server directly. The only requirement is that the IoT module and connected devices should have the network connectivity.

4. Experimental Setup

As shown in Fig.2 the complete setup for the system consisting of sensors, Arduino, IoT module has been shown.

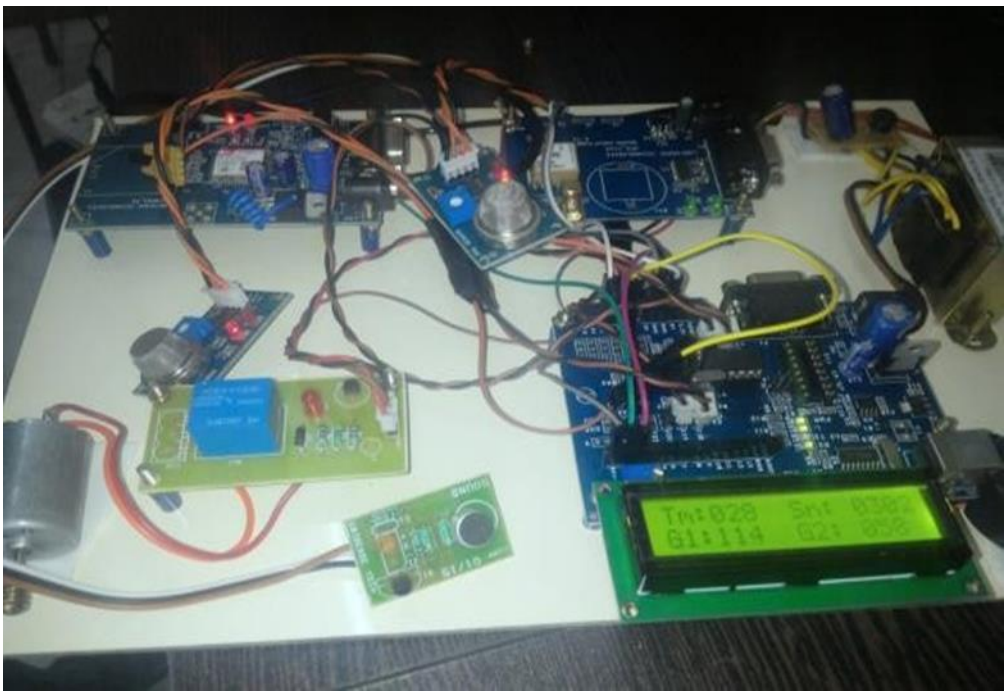

Figure 2. Experimental Setup.

5. Results

The complete result of our system that consists of all sensor readings displayed in LCD display unit has shown in Fig.3

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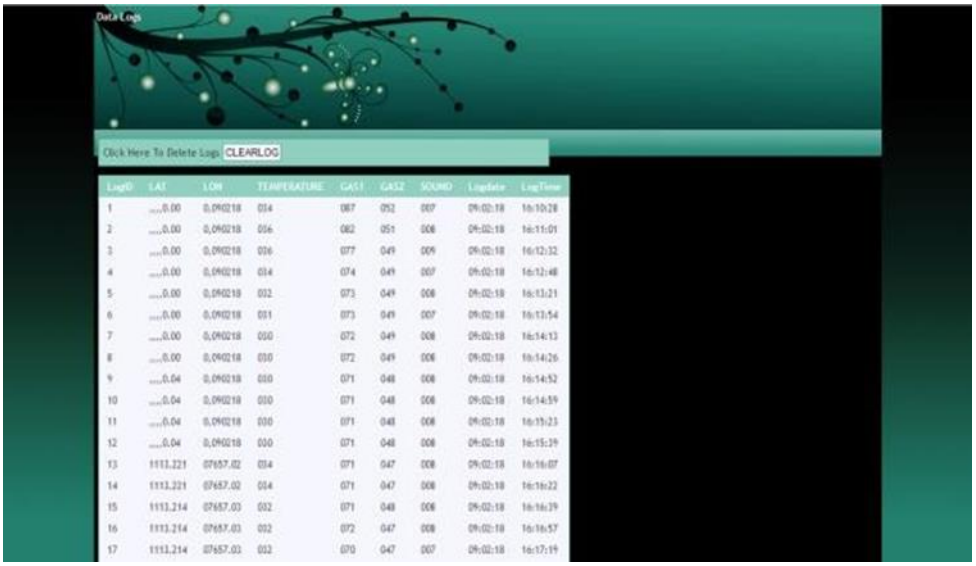

Figure 3. Sensor Readings of our System.

The Go-Daddy dedicated server webpage consists of our sensor values and GPS location has shown in Fig.4.

Figure 4. Go-Daddy Dedicated Server Webpage.

6. Conclusion and Future Work

Thus the real time air and noise pollution levels are continuously monitored and some controlling action has taken by our proposed system. Our system provides low cost, low power and long range of network connectivity. This system provides accurate results about all the pollutants and alerts the people immediately. With the help of internet connectivity we can view all the sensor datas anywhere in the world. Due to increase in pollution in our country, our system alerts the people from the pollution. This proposed system definitely creates a great impact to our society. The future work of this system is to find the certain relationship between the air pollutants and the sensors need to be more calibrate against the range of temperature and humidity. Self-calibration techniques needed to be implemented in future.

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References

[1] Reddy, B. S., Maurya, A. K., Sathishkumar, V. E., Narayana, P. L., Reddy, M. H., Baazeem, A., ... & Reddy, N. S. (2021). Prediction of batch sorption of barium and strontium from saline water. Environmental Research, 197, 111107.

[2] Subramanian, M., Shanmuga Vadivel, K., Hatamleh, W. A., Alnuaim, A. A., Abdelhady, M., & VE, S. (2022). The role of contemporary digital tools and technologies in Covid-19 crisis: An exploratory analysis. Expert systems, 39(6), e12834.

[3] Chen, J., Shi, W., Wang, X., Pandian, S., & Sathishkumar, V. E. (2021). Workforce optimisation for improving customer experience in urban transportation using heuristic mathematical model. International Journal of Shipping and Transport Logistics, 13(5), 538-553.

[4] Environmental laws of India", in Air Act.[online].Available:https://www.environment

[5] VE, S., Park, J., & Cho, Y. (2020). Seoul bike trip duration prediction using data mining techniques. IET Intelligent Transport Systems, 14(11), 1465-1474.

[6] Zhang, R., VE, S., & Jackson Samuel, R. D. (2020). Fuzzy efficient energy smart home management system for renewable energy resources. Sustainability, 12(8), 3115.

[7] Interfacing GPS module with arduino, inInsructables.[online].Available:https://www.in strctables.com/id/how-to-interface-GPS Module- with-arduino.

[8] VE, S., Shin, C., & Cho, Y. (2021). Efficient energy consumption prediction model for a data analytic-enabled industry building in a smart city. Building Research & Information, 49(1), 127-143.

[9] Liu, Y., Sathishkumar, V. E., & Manickam, A. (2022). Augmented reality technology based on school physical education training. Computers and Electrical Engineering, 99, 107807.

[10] VE, S., & Cho, Y. (2020). Season wise bike sharing demand analysis using random forest algorithm. Computational Intelligence..

[11] Kogilavani, S. V., Sathishkumar, V. E., & Subramanian, M. (2022, May). AI Powered COVID-19 Detection System using Non-Contact Sensing Technology and Deep Learning Techniques. In 2022 18th International Conference on Distributed Computing in Sensor Systems (DCOSS) (pp. 400-403). IEEE.

[12] Noise Control Act", in Wikipedia. [online].available:https://en.wikipedia.org/wiki/n oise-control-act. Accessed: April 20, 2017.

[13] Subramanian, M., Sathishkumar, V. E., Ramya, C., Kogilavani, S. V., & Deepti, R. (2022, May). A Lightweight Depthwise Separable Convolution Neural Network for Screening Covid-19 Infection from Chest CT and X-ray Images. In 2022 18th International Conference on Distributed Computing in Sensor Systems (DCOSS) (pp. 410-413). IEEE.

[14] VE, S., & Cho, Y. (2020). A rule-based model for Seoul Bike sharing demand prediction using weather data. European Journal of Remote Sensing, 53(sup1), 166-183.

[15] Easwaramoorthy, S., Thamburasa, S., Samy, G., Bhushan, S. B., & Aravind, K. (2016, April). Digital forensic evidence collection of cloud storage data for investigation. In 2016 International Conference on Recent Trends in Information Technology (ICRTIT) (pp. 1-6). IEEE.

[16] Easwaramoorthy, S., Thamburasa, S., Aravind, K., Bhushan, S. B., & Rajadurai, H. (2016, August). Heterogeneous classifier model for e-mail spam classification using FSO feature selection method. In 2016 International Conference on Inventive Computation Technologies (ICICT) (Vol. 1, pp. 1-6). IEEE.

[17] Babu, J. C., Kumar, M. S., Jayagopal, P., Sathishkumar, V. E., Rajendran, S., Kumar, S., ... & Mahseena, A. M. (2022). IoT-based intelligent system for internal crack detection in building blocks. Journal of Nanomaterials, 2022.

[18] Shanthi, N., VE, S., Upendra Babu, K., Karthikeyan, P., Rajendran, S., & Allayear, S. M. (2022). Analysis on the Bus Arrival Time Prediction Model for Human-Centric Services Using Data Mining Techniques. Computational Intelligence & Neuroscience.