

# IOT based Smart Environment Monitoring Systems: A Key To Smart and Clean Urban Living Spaces

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**Abstract**—As increase in the environmental pollution for the sustainable and rapid growth of the world, air and sound pollution is major threat to the developing nations for the clean and healthy environment. Air pollution can't be ignored as one of the environmental problems. The pollutants cause damage to human health for a long time. Traditional methods to monitor air quality, such as the construction of air quality monitoring stations, are usually costly. This project can be used for real-time air quality monitoring. Monitoring of air quality is famous and well-established science started in the 1980s. The technique was then quite limited and the solution was used to measure the complex and high-cost air pollution. Interestingly, the solutions used to monitor air quality are now not only becoming more accurate but also being measured faster with the latest and more modern technologies. Devices are getting smaller and more cost-effective than ever. The device presented uses one of the cheapest dust sensors from the young 'DSM501A' Sam. This sensor can detect particles such as PM2.5 and PM10. This article proposes a system for air pollution control and sound monitoring and analyses it. To control pollution, the system is fully based on the internet of things (IoT) and highly desirable. This framework allows us to detect pollution levels (air or sound) occasionally. The article explores the different units such as hardware and software used in the system proposed, and also explains how IOT and its operations and its Microcontroller(Arduino Uno R3) and its architecture, gas sensor, and features are modeling and working with the basic components used in the proposed system. The ESP8266 Wi-Fi Model and the sound sensors.

**Index Terms**—IOT, air and sound pollution, sensors, smart City, clean and green environment.

## I. INTRODUCTION

Nine out of ten people breathe toxic air all over the globe. Poor air quality is also the leading cause of premature death, with more than 6 million people dying prematurely each year from lung cancer, stroke, obesity and respiratory illness. A safe, pollution free and hazardous-free environment is important for the long term survival of mankind and the development of any nation. During Covid-19 pandemic, air pollution has aggravated respiratory disorder among people and lead to an increase in mortality. The prime purpose of the IoT Air and Sound Monitoring System is to resolve the growing problem of

air and sound pollution nowadays. For a brighter life and safe living for everyone, air quality needs to be regulated and kept under control. Here, we introduce a monitoring system for air pollution as well as sound pollution that enables us to track and monitor live air pollution and sound pollution in a region via IOT. The project includes air sensors to detect the presence in the air of hazardous gases/compounds and to communicate this data continuously. It is also examined by measuring and reporting the sound level. The sensors communicate with Arduino, which handles and transmits this data over the application. This helps authorities in multiple areas to control and act against air pollution. Regulators will also keep an eye on noise pollution near schools, university campuses, hospitals, and no honking zones, and if the device senses air quality and noise problems is high, it warns authorities to take action to contain the problem. Some possible market applications proposed for IoT sound like science fiction, but some of the technology and more functional and plausible-sounding possibilities include: getting warnings on your phone or wearable device when IOT networks detect nearby physical hazards such as self-parking vehicles, automatic grocery ordering, automatic workout habits monitoring and other days. Network Components and Internet of Things(IoT) it is possible to change all sorts of ordinary household gadgets to operate on the IoT system. To allow them to operate on the Internet of Things, Wi-Fi network adapters, motion sensors, cameras, microphones, and other instrumentation can be installed in these devices. Primitive versions of this idea have already been introduced by home automation systems for items such as light bulbs, plus other devices such as wireless scales and wireless blood pressure monitors, each reflecting early examples of IoT gadgets. The biggest problem in any country, whether it is developed or developed, is air pollution. Particularly in developed countries metropolitan centers, where computerization and mechanization and the increasing figure of transportation lead to the release of a lot of hazardous gases contaminants, health problems have increased more rapidly. Light hypersensitive responses like inflammation in the mouth, eyeball, and nose-cone, moreover create certain serious problem such as bronchitis, heart diseases,pneumonia,

lung, and exacerbated asthma, are the harmful outcomes of pollutions. Because of pollution caused by air, "50,000 to 100,000 early loss of life each year occur in the U.S.alone", according to a study. Whereas the EU number approaches 300,000 and more than 3,000,000 worldwide IOT Based Air Pollution Monitoring System tracks the standard of the air over a central server with using the Internet and activates an alert when the quality of air crosses some certain level when there is a sufficient quantity of harmful gases present in the air, such as "CO<sub>2</sub>(carbon dioxide), smoke, alcohol, benzene, NH<sub>3</sub>, LPG, and NO<sub>x</sub>". In PPM, it will display the quality of air on the LCD and the website so that it can be tracked very easily. In this device, which is mostly used in houses, an LPG sensor is added. The temperature and relative humidity of the device will be revealed. The device can be mounted anywhere but mainly in factories and homes where most gases are discovered and the system reaches the threshold limit with an alarm[4]. The cause of air pollution in all developed areas is the automobile and the other is the factory. The most common use of automobiles is to increase pollutants in the environment. This is the source of environmental pollution that threatens human health. This has also caused other breathing problems, such as chest infections and sore throats. The air quality monitoring system is mounted in a specific location and there is an air pollution monitor(tracking) system to track the component of air particle smell(hazardous gases) which may have adverse effects on human health and other living beings. This device uses Arduino and dust sensors to evaluate the amount of unfavorable environmental vapors such as CO, NH<sub>3</sub>, particulate matter, and smoke. Carbon monoxide has the greatest preference since it is a greenhouse gas and a significant pollutant that heats the earth. The amount of pollution is shown on the LCD screen, which allows users to update their current air quality. Users can display the air quality status is numeric. In comparison, the Air Quality Index (AQI) for the current level of pollution is calculated and shown in the application along with the health consequences. Thus this program helps users to take appropriate precautions in advance to safeguard themselves from adverse effects[20]. As the quality of life continues to increase, in the twenty-first century, the respiratory condition has now become a key subject of contention for researchers. It has been verified by several researchers that the indoor environment is more lethal than outdoor air. Today, 90 percent of the rural population in the most industrialized nations and about 50 percent of the global population use open fire unpasteurized fuel and indoor combust stoves that are not functioning properly. The indoor(internal) air pollution (TAP) and poor and ill health of children and pregnant women and who are most vulnerable to such a polluted environment are responsible for these faulty cooking techniques. A broad range of toxic pollutants such as "particulate matter (PM), nitrogen dioxide (NO), carbon monoxide (CO), sulfur oxides, polycyclic organic matter, and formaldehyde", are generated by waste and coal smoke. A general source of many injurious and unfavourable diseases in economically-developing nations is

prolonged exposure to IAP due to solid fuel combustion. Chronic pulmonary disease (COPD), bacterial infections, respiratory infections, pneumonia, influenza, cancer of the lung, larynx, and digestive nematodes, low birth rate, maternal and neonatal conditions, and severe eye disorders that may also contribute to blindness are included in the group. In this, we proposed a system for monitoring quality of air as well as a system for monitoring sound(noise) pollution that allows us to track and regulate via IoT both real time air quality and sound pollution in the area. To confirm the existence of dangerous gasses/compounds in the air and to continuously transmit these information, the system uses air sensors. Also, the system continues to calculate and report the sound level, the sensors communicate with the Arduino that processes and communicates these data over the framework. It helps the authorities in various areas to monitor and counteract air pollution. In schools, hospitals, and no honking zones, the systems can also detect noise pollution, and if the unit detects air quality and noise concerns, it alerts the regulators so that they can take action to address the issue.

#### A. INTERNET OF THINGS

The Internet of Things ( IoT) symbolizes an Internet interlinked object device, capable, without human interference, of gathering and sharing data over a Wi-Fi Network. The Internet of Things ( IoT), in simple terms, refers to a continuous movement towards connecting any form of physical objects, particularly those that could not be anticipated. This may involve daily household products including coolers and lightbulbs, company properties such as shipping labels and medical equipment, unimaginable wearables, mobile devices, and even smart cities that only exist because of the Internet of things. Another internet of things can be an implanted person, a farmer with a biochip transponder, a vehicle with integrated sensors, a tire pressure sensor. Any man-made or normal object that can be attributed to a web protocol ( IP ) address and can communicate information over a network. IoT businesses increasingly use IoT to function more effectively, provide consumers with better understanding and improved customer support, enhance inference and resolution, and increase the profitability of their business- province and concern[1].

An IoT eco-system provides web-based, intelligent systems that via integrated devices such as processors, sensors, and wireless communications, can collect, transmit, and act on information acquired from their environment. IoT systems share the sensor information they gather through a connection to an Embedded controller or another border system, where information is sent for quick analysis or analysis to the cloud. Sometimes, like other similar devices, they communicate and act on the knowledge they get from each other. For instance, the devices do many other functions beyond human interaction, while individuals may communicate with the devices- to set them up, provide feedback, or access data. On these web-enabled computers, the networking, authentication, and communication protocols used to depend in large part on the specific IoT apps that are used. Artificial intelligence (AI) and

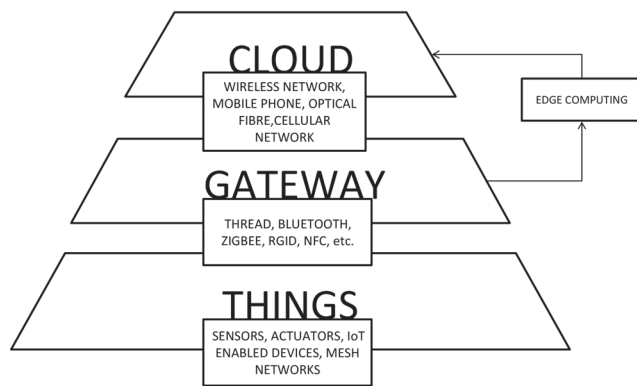


Fig. 1. IOT

machine training[21] can be used by IoT to enable and optimize data collection. The IoT definition was by a member of the Radio Frequency Identification (RFID) development group in 1999 and has recently ornament more applicable to the real scenario, primarily because of the growth of mobile systems and ubiquitous networking, cloud computing, and big data. Imagine a society where millions of entities can sense, connect, and exchange knowledge, all interconnected through publicly or privately Internet Protocol (IP) networks. These accommodations have routinely obtained, processed, and used data to take initiatives, providing a lot of information for scheduling, analysis, and decision-making[2][3]. This is the Internet of Things (IoT) world. The definition of the Internet of Common Things is described as a network of physical objects called the Internet of Things (IoT). The Internet is not just a network of machines, but also a network of devices of all levels and backgrounds, vehicles, phones, household items, gadgets, sensors, medical devices and industrial equipment, animals, people, structures, all connected devices, all wireless routers, all network devices, all mobile applications, all wearable technology, all wireless networks, all smart devices, all communication and exchange of information based on stipulated protocols, to achieve smart restructuring, tracking, monitoring. IoT is defined in three classes as follows: The IoT is 3 things:

- (1) Persons to persons,
- (2) Application to people/things,
- (3) Things/Machines/Machines, Communicating on the Internet. The IoT(internet of things), relates to the broader concept of things, In particular, everyday objects that can be readable, identifiable, located, addressed via an informational sensing system and/or monitored through the Internet, irrespective of the means of communication (whether via RFID, wireless LAN, wide area networks, or other means)[22]. Daily days products include not only electronic devices that we

experience or products of higher technological growth, such as vehicles and machinery, but also things that we do not generally consider to be electronic-such as food, clothes, chair, animal, flowers, water, etc. The IoT(internet of things) is a modern Internet movement. Things make themselves identifiable and gain knowledge by making or allowing context-related decisions by enabling them to transmit data about themselves. They may have permission to access data that has been consolidated by other thing complex actions. This development is correlated with the advent of cloud computing abilities and the transfer from the Internet to IPv6 with an almost infinite potential for addressing. The aim of the Internet of Things(IoT) is to make it possible for things to be linked at every time, anywhere, with anything and anyone who preferably uses any direction and service.

## B. APPLICATIONS OF IOT

- Smart living:- In smart living, it consisted mainly of remotely control devices that are used to remotely switch on/off any device and save power. A smart forecast system is used to show whether parameters such as temperature, humidity, rainfall, wind speed. Smart Home Appliances used for the LCD screen on the microwave shall indicate the items that are present inside and the license number of the items, the products to be purchased in the future, and all the data given on the application. Washing machines allow monitoring systems of the laundry by trying to adjust the temperature monitoring and controlling the self- cleaning functionality. The safety tracking device is used to supervise cameras, alert systems at houses, and build a better life. Network Security device is used to detect intruders by opening doors. It is used to monitor water and energy consumption at home to reduce costs and assets [23].
- Smart farming:- To increase fresh fruit and vegetable production, smart farming consists of nursery and segments and sub controls. To avoid the occurrence of infectious and other toxins, fertilizer is used to control temperature and relative humidity levels. Animal Tracking is used to locate and identify grazing animals in open fields, as well as to study the quality of air and airflow in farms. In animal farms, Offspring Treatment is used to monitor the offsprings and growing season and to protect the plant lives and health. Via daily reporting of proper data collection and field planning, field management reduces waste and plant waste[23].
- Smart parking lot:- Smart Parking is used to track the available city parking spaces and to allow the user to find the nearest parking spaces or Usable parking spaces. Management of waste allows the identification of waste concentrations in containers so that they can improve waste disposal routes. Garbage Containers are equipped with RFID tags that warn the worker and signify that the waste has been decomposed successfully [23].
- Smart City:- In a smart city, systemic health is used for tracking Material conditions for houses and bridges. It



## II. LITERATURE REVIEW

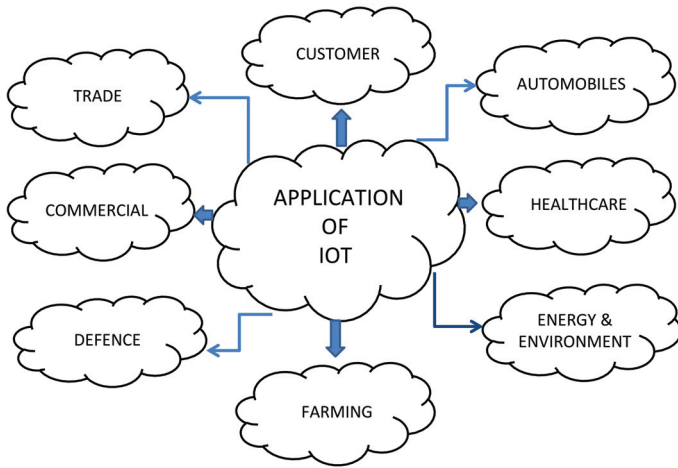


Fig. 2. Application of IOT

also tracks whether there are any irregularities in the buildings. safety prevention consists of fire control, emergency alert systems, wireless video surveillance. For any unexpected incident, the transportation system consists of sensor roads and highways with warning signals and diversions[23].

- **Smart Industries:-** The smart Industries is composed of volatile and hazardous gases, consisting of the identification of gas level and emission in industry, the control of toxic gas and oxygen levels in petrochemical industries, and the tracking of oil and gas levels in pumping stations and reservoirs. Repairs and Maintenance provide early identification of any fault units in the smart industry and service maintenance may be automatically allocated to a specific malfunction[23].
- **Smart Environments:-** In the smart world, monitoring of air pollution regulates the emission of CO<sub>2</sub> from factories And emissions from vehicles. Forest Fire Monitoring is used to track the gas and to establish warning zones. Climate monitoring involves moisture, temperature, pressure, early earthquake warning. The quality of water and the assessment of water adequacy in rivers are controlled by Water Quality. River floods are used often during the rainy season to regulate water levels in dams and reservoirs[23].
- **Smart Energy:-** In the case of smart energy, it is made up of a power system that determines the regulation and management of the industries and energy use. The Turbine Machinery is used to control and track the flow of energy from windmills and power plants. Bi- directional communication with clients is also provided. To evaluate usage trends, smart meters are then used. All Power Supply Controllers The AC-DC Power Supply Controllers are related to consumer, digital, and telecommunications applications..

The air quality is the main indicator attentively monitored for climate in real-time. That's why it got a huge effect onto Antoninaninans, protection, and convenience. pollution caused by air can contribute to infant deaths in newborn babies and Alzheimer in older people. Air pollution causes human irritation and other living species harm, such as agricultural products or the natural habitat, by releasing toxic gas into the environment [24].

HaroPrasaath [1][24] "designed Arduino-based monitoring of air quality device using an MQ 135 sensor" that is resistant to natural gas and liquefied petroleum gas (LPG). This computer Equipment combines the MQ 135 sensors, the LCD Panel and the Arduino Uno Microprocessor, Wi-Fi modules. All information is stored in the <http://thingspeak.com> in which ThingSpeak is a platform that allows the user to store all sensor data in the cloud. Also, this system used only one gas sensor, the MQ 135 sensor. This device incorporates Wi-Fi modules as a network adapter. Although these devices need to be mounted close to the Wi-Fi. In comparison, this device only shows the information and results on the ThingSpeak website[24].

"IoT-based Air Pollution Monitoring System using Arduino" built by DarshanMirajkar [2] just used a smoke sensor and specially built to spot and alert any harmful air pollutants caused by an open fire. Authors have used Wi-Fi Module, Smoke Sensor, digital LCD Monitor, and Buzzer embedded as their microprocessor into Arduino Uno. This device allowed information to be communicated from the sensor to the local database(DB) via Wi-Fi Module and the information will be displayed on the tracking page. Outdoor(external) air quality tracking instead of being a low-cost network module, the Wi-Fi module is not suitable for use. Also, a local database such as XAMPP is not appropriate for this system, because a local DB can only be linked to Arduino for a LAN. The creation of, there was no login feature on the admin page for this device and the computer was unable to generate any statistical reports[24].

In towns or metropolitan areas, automobiles and factories are the main source of air pollution that produces smoke and toxic emissions. The emitted smoke is combined with dust/fog throughout the winter and lead to the creation of fumes(smog). Adverse weather and lack of clarity in the atmosphere are the product of such harmful gases and fumes [7].

The new vehicles are now using sensors based on a semiconductor that is mounted in vehicle smoke emission channels. The sensor senses [8] the levels of the pollutants and sends an alert to specify that the released contaminants have reached the threshold(commencement) and that the vehicle from time to time. This structure arrangement is effective for individual users, but it doesn't allow the public to get into the knowledge territory.

Arushi Singh [4] used the sound and Air Emission tracking System based on the Internet of things, using Raspberry Pie and Arduino. In its suggested model, it is possible to store the device in classrooms, hospitals, and no honking areas that

monitor the quality of air, sound, and warnings using the Raspberry Pie Server. It is also possible to change the usage of network equipment and the Internet of Things framework to operate on an IoT(internet of things) system. Since the Raspberry Pie is costly and more in weight, the cost is therefore expensive.

Yamunathangam [11] has built a framework using a Thingspeak (IoT platform) over a TCP/IP link. Arduino Uno and Ethernet shielding is incorporated with gas sensors to track gases such as CO, NH<sub>3</sub>, particulate matter, moisture, and smoke. The unit shall calculate the level of each gas separately. The scale of the Arduino Uno and Ethernet shields are of significant concern.

GaganParmar [6] had used the form of hardware to monitor the device using a Raspberry Pie and STM32/8 Arm Controller. The MQ's series sensor is used to calculate CO(carbon monoxide), CO<sub>2</sub>(carbon dioxide), SO<sub>2</sub>(sulfur dioxide), and NO<sub>2</sub>(nitrogen dioxide) using semiconductor-based sensors. Raspberry Pie provides a database server in which the information can be tracked.

VijayakumarSajjan [7] had used a recent Wi-Fi chip called Node MCU ESP8266. The MQ's Series sensor gathers information from the measuring Quality of air and transfers the information to the Thingspeak Server. The device is cost-effective and uses a very low amount of energy. The machine learning(ML) technique was used to forecast the subsequent gas values and the air quality index values.

Harsh N. Shah [8] has built an "air quality monitoring and tracking system using Arduino", a gas sensor, a temperature, and a humidity sensor using Wi-Fi modules. Information exchange has been carried out using Modbus. The PC port help to observe the data via the Vb.net application developed. The information can also be transferred via GSM(global system for Mobile communication) modules.

David Brooks [10] has created a method that uses Arduino to measure the airborne particle levels. As per the research done by him, the laser dispersion method can be used to define the amount or diameter of the atom. This approach shows through a beam of the laser through a channel through which air flows. Here the beam of laser hits airborne particles of varying dimensions. During effect, the component of the beam is redirected which gives a quantity corresponding to the dimensions of the particles. This process too much tricky.

S. Muthukumar [9] in his paper he direct Internet of things(IoT) originated "Air Pollution Monitoring and tracking system" given a sensor grounded hardware device that can be installed by sides of the roads. As per him the devices can be mounted on light poles and transmitted quality of air info wirelessly to cloud services. This knowledge can also be used for control of traffic.

This paper [12] explores the future of the Internet of Things which will turn things of the real world into smart practical things. IoT works on the main to integrate all in our universe under the same infrastructure and to monitor not just the objects around us, but also to ensure that we are aware of the state of the objects. This article aims to present in our everyday

lives an abstract of the Web of Things, architecture, and fundamental technologies. Therefore, for the new researchers who would like to research on the Internet of Things, the paper will have a clear understanding.

This paper [13] addresses the emerging field of research in the fields of intelligent sensor networks that combine a range of computer sciences, wireless, and electronic communication. This research paper proposes the solution for the monitoring of noise and air emissions in industrial environments or any other interest area using wireless, embedded computing systems to test the execution of the originally mounted hardware, consisting of the Arduino UNO board, sun sensor-based or-based on MATLAB fitted with the support package of the Arduino hardware. The hardware is evaluated for the normal behavior of 2-3 limitations, for example, noise, CO<sub>2</sub>, and radiation emission, or given requirements to regulate the environmental monitoring intelligently.

This paper [14] deals with the IoT(internet of things) Based "Air Pollution Monitoring and Tracking system", which uses the internet and the WLAN module to collect air values in ppm as well as sound levels on the web and to produce an alert when air quality goes down, implies that there are enough noxious gases present in the atmosphere, including carbon dioxide(CO), smoke, alcohol, etc... It is indicating the quality of air in PPM on and on the LCD 16x2 monitor so that information can be collected easily. MQ-135 gas sensor is used to track air quality as it detects most hazardous gases and can accurately quantify their importance. In this IoT based project, air pollution and noise can be gathered from any part of the world using your mobile device or device, and we can even activate a few items, such as when the pollution goes above those particular thresholds, we can turn on the exhaust fan.

In this paper [15], failure to reach the parameter amount( e.g. noise, CO<sub>2</sub>), systemic environmental control hardware is required for control conditions. As the environment with sensor devices becomes self-controlled and self-monitoring environments, the microcontroller, and different software applications are used. People need different types of hardware for monitoring, be controlled by on the type of data tracked by the sensor based on Event Detection, whereas the two groups for Spatial Process Estimation are classified. Initially, sensor devices used in the environment to detect different limits ( e.g. noise, CO and radiation levels, etc.) while data acquisition, calculation, and control ( e.g. changes in noise and C level about specified levels) are located at different locations, to collect data to predict the behavior of the specific area of interest. Sensor devices are located in various locations. This paper main focus is on developing and implementing efficient monitoring hardware to remotely calculate the necessary values on the network and to store the information collected from sensors in the cloud server and to project the projected web browser tendency.

The proposed system is made up of a transmitter and a reception part. This paper [16] provides brief information on vehicle pollution. The transmitter is built-in with the use of

only one single chip air pollution sensors array, a general radio service modem packet (GPRS modem), and a GPS module to transmit the information.

This paper [17] includes embedded devices that measure atmospheric noise and air levels and render the environment throb and more interactive. To calculate the parameters of the environment, the proposed model is versatile and allocatable. The smart sensor network is the new research and study area which can lead to new opportunities in computer science, wireless, and electronics. The architecture is developed for noise and air pollution monitoring using sensors and sound modules.

This paper [18] discusses, as stated by "The World Health Organization (WHO)"; Study, air pollution represents a serious of health, including skin allergic, eye infection, nose, throat irritation. It is also a big public concern in most metropolitan areas, and it causes severe issues including heart disease, lung cancers, and many parking managers, and it is also a cause of many problems. The main objective is to use a variety of sensors, The GSM/GPRS module and cloud service are designed to create an efficient and centralized system to control the levels of emissions of different pollutants, minimize the effect of these parameters, and provide live warnings to avoid conflicts without affecting the environment.

### III. COMPONENT USED

#### A. Micro-controller B. Sensors C. Communication tool

##### A. Micro-controller

A micro-controller is a small compact and economical micro- controller design in such a fashion it performs a set of tasks such as displaying the information of microwaves, receiving remote signals, etc The micro-controller consists of the following parts, the CPU or processor, the memory (RAM, ROM), serial ports, counters, timers. It is used for different analog functions(performance) and is breadboard friendly. The automatic air amp; noise monitoring system used various sensor's communication tool and micro-controller(Arduino /Raspberry Pi).

Arduino is an open-source platform, consist of an IDE(integrated development environment) amp; a physically Programmable Board of Circuits that can run on our device amp; practice for Computer Code Writing amp; Uploading to the physical computer board. The Raspberry Pi is a very low-cost computer that uses regular keyboards and a mouse to plug the computer or TV. It is a small scale tool which permits a person of all ages to survey programming in languages like Scratch and Python and to learn how to program. we can do everything we would imagine a desktop computer to do from internet browsers and video streaming to smartphones, word-processing, and games.

##### B. Sensors

- DS3231 Sensor:- It is a Real-time Clock(RTC) Sensor. It is used for time and date, which have a battery configuration that keeps the module running in the absence of

eternal electricity. It updates all time and data continuously. We can therefore have precise RTC modules time and date anywhere, whenever we want.

- DTH 11:- It measures both humidities as well as temperature. It is a low cost, easy to use the digital sensor. Any micro-controller like Arduino / Raspberry Pi can be easily interfaced with to quickly calculate moisture and temperature in the air. DTH 11 has 2-degree precision in temperatures between 0-50 degrees celsius. This sensor has a humidity range between 20-100% i.e. for each second, it gives one reading. DTH 11 is small and runs voltage between 3-5 volts for calculating the map. Current is 2.5 ma.
  - MQ7:- It is a sensor used for sensing carbon monoxide concentration in the air. It can measure carbon monoxide concentration between 10 to 500 ppm. MQ7 sensor is highly responsive and easily reacts having a very fast response time.
  - MQ135:- The MQ-135 Gas sensors are applied to measure/control the quality of air and is also capable of detecting amp; measuring NH<sub>3</sub>, NO<sub>x</sub>, alcohol, benzene, smoke, CO<sub>2</sub>. The module of sensor MQ-135 comes with a digital pin that allows the sensor to operate even without a micro-controller amp; is useful if we only try to detect a specific gas. The analog pin must be employed if you have quantified the gas in PPM. The AOC pin works with 5V, so it can be used with any micro- controller.
- Features of MQ135 Sensor:-
- I. Wide scope for detection
  - II. Highly sensitive and quick response time
  - III. Long-lasting and reliable
  - IV. The voltage of operation is +5V
  - V. Analog performance voltage:- 0V to 5V
  - VI. Digital performance voltage:- 0V to 5V
  - VII. 20 seconds of preheat time
- DS501A Dust Sensor:- It is used to measure PM2.5/PM10. The DS501A is a low- cost small-size sensor for particle density. It is used for measuring particles in a quantitative (gt;1 micron), way using smoke amp; pollen, dust controller principle. It is made up of a light-emitting diode lamp, detector, signal amplifier amp; heater and can easily be used by users with PWM sensor output in applications such as air cleaners or air purifiers.
  - MG811 sensor:- It is used to detect carbon dioxide concentration in the air. It is a metal oxide sensor that must heat the tank to the required level of amount. The heated vapor amp; the separation of CO<sub>2</sub> from the air are produced by the power supply. This module has a sensor part MG811 on board. The MG811 is an extremely CO<sub>2</sub> sensitive amp; less alcohol amp; CO sensitive signal device for a heating sensor. purifiers.
  - MQ4 sensor:- It is used to detect the methane, CNG gas levels in the air. It can track down the concentration of natural gas between 300- 1000 ppm. It is highly sensitive amp; having a quick response time.
  - MQ4 sensor has SnO<sub>2</sub> as sensitive material which can

TABLE I  
AIR QUALITY INDEX- PARTICULATE MATTER

Index value(Ozone conc.Range)	Air quality index(Level of health concern)	Color	Denotation	Who should think about this and what should they do about it
300-500 (>200 ppb)	Hazardous	Maroon	Emergency health alert:- there is a greater chance of impacting the whole population.	N/A
201- 300 (100-200 ppb)	Very unhealthy	Purple	Health warning:- every person may have a more severe effect on health.	Any outdoor exercise should be avoided by active children and adults as well as by people with a respiratory disorder such as asthma and by exercise else particularly children
151-200 (86-105 ppb)	Unhealthy	Red	Almost every person may start experiencing health effects, vulnerable groups may have more severe health effects.	The prolonged external exercise should be avoided by children and adults and persons with respiratory conditions such as asthma. Anyone else especially children should be restricted long term outside exercise.
101-150 (71-85 ppb)	Unhealthy for sensitive group	Orange	The health of sensitive members can affect. It is doubtful that the general population is affected.	The long-term outdoor work should be limited by active children and adults and by persons with respiratory conditions such as asthma.
51-100 (55-70 ppb)	Moderate	Yellow	Air quality is appropriate, but a very limited number of individuals who are exceptionally sensitive to air pollution might cause mild health problems for certain pollutants.	Extraordinary disabled people should think about restricting long door exercise.
0-50 (0-54 ppb)	Good	Green	Air quality is deemed to be adequate with less or no risk posed by air pollution.	When air quality is in the range, no health effect is expected.

clean air conductive power. The conductivity of the sensor increase with the rise of gas concentration when the target gases.

- Sound module by REES52:- It is used to measure the sound level. The sound level sensor module offers a simple Way to sound monitoring and is commonly used for the detection of sound intensity. The sound sensor module is preferable for various programs and functions like security, switching amp; tracking. Its precision can easily be modified for usability. The input to an amplifier, peak detector, and the buffer is provided by a microphone. It uses when the sound sensor senses a tone, the signal strength sent to the micro-controller amp; is interpreted.

### C. Communication tools

- GSM:- GSM offers advanced multimedia and universal Mobile technology for voice and data services delivery. GSM operates about 900mhz - 1800mhz on mobile communication frequency. It is a highly powerful and mobile network technology that integrates. GSM has enhanced spectrum, low- cost mobile collection, high standard voice. GSM helps to reduce time by controlling the soil moisture level to remove the human inaccuracy and to exaggerate its net production. Some features of GSM include international roaming, improved spectrum capacity, integration with the digital network integrated services (ISDN) (FDN).
- Bluetooth:- Bluetooth is a wireless technology designed to link computers and portable devices. It needs low



TABLE II  
NOISE LEVEL

DB level (sound level)	Common area noise
0	The threshold of human hearing (100 Hz), breathing
10	Desert
20	Whisper, light snoring
30	Library or silent countryside or silent study room
40	Moderate snoring, whisper (5ft. away), silent urban area at night
50	Large electrical transformer(100ft. away), urban area day time
60	Conversation (3ft. away), large business office, a busy street through the open window.
70	Alarm clock
80	The freight train (100ft. away)
90	Boiler room, heavy truck(15m away)
100	Construction site, subway train
110	Rock band music or music at a night club, riveting machine
120	Operating heavy equipment, gunshot, ambulance siren
130	Aircraft while taking off(200ft. away from or 100m)
140	Threshold of painol.

power and is very easy to run. In theory, Bluetooth links devices over a short period using low power radio. It is about 10 meters high (30 feet). The frequency band of 2.45GHz is sponsored.

- Wi-Fi module ( ESP8266):- Esp8266 is an affordable Wi-Fi module for adding wireless internet access, functionality via UART serial connection to an existing microcontroller project. The module can also be rewritten to operate as an individual Wi-Fi computer. Features of ESP8266:-
  - 802.11 b/g/h protocol
  - TCP/IP optimized stack
  - Direct WiFi (P2P)
  - Output power +19.5 dBm in mode 802.11 b
  - Encourage diversity of antenna
  - Integrated sensor for temperature
  - Leak current of less than 10 uA.
  - As an application processor, an integrated low-power CPU of 32 bits can be used.

#### IV. PROPOSED MODEL

Air and sound pollution is increasingly growing. To have it under oversight. We are proposing a method to solve this problem that can be observed in the surroundings, sound level, and presence of dangerous gases. Creating problems for living individuals, whether it is high-decibel or Pollutants gases which propagate in the atmosphere, has started to create rising pollution at such an alarming pace which hurts human health and hence a required more vigilance and alertness.

IoT based Air and Sound control system's primary aim is to ensure air and sound pollution increases day by day. Air quality must be identified and preserved Power for a prosperous and healthier future. For this reason, we proposed an air amp; sound pollution monitoring(tracking) device that recognize us via the internet of things(IoT) to get the measure

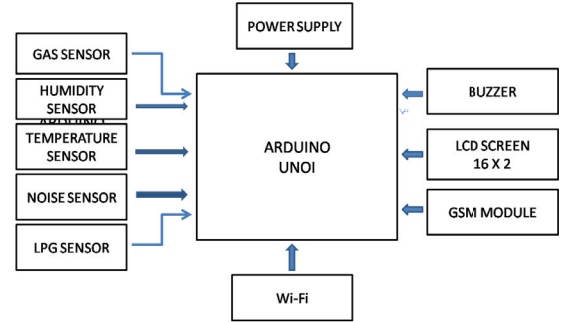


Fig. 3. block diagram of proposed model

of and to interpret the quality of the living air as well as noise pollution in an environment. The model uses various type of gas sensors to identify and relay the data on a variety of occasions to noxious gases found in the atmosphere. The system also tracks and records sound levels.

#### V. ADVANTAGES OF THE AIR AND SOUND MONITORING SYSTEM

As we know, the air quality is not similar all over the place and varies in geographical state or condition and air emission, as well as air pollution source, contribute to air quality. Following are the benefits of an air monitoring system:-

- The data obtained from the monitoring of air quality/ index assist to determine the effect on public health from inadequate air quality.
- Data on the air index/quality enables us to assess if a region complies with the air quality principle formulated by WHO, CPCB, OSHA.
- The data gathered from the regulation of air quality will mainly enable us to the areas contaminated, emission level, and air quality.



- Simple and easy to instate and aid in the precise pollution index calculation.
- Air quality data helps to understand deaths from air pollution everywhere. we can also evaluate and compare short and long-term air pollution diseases/disorders.
- Based on the collected data, control measures can be developed to protect the environment and health of all living organisms.

## VI. CONCLUSION

To improve air quality, IoT technology is proposed as the device to track the air of the atmosphere through the Arduino micro-controller. By using IOT technology, the process of observing and examine various environmental aspects in the same manner as keeping track of air quality and the sound level is present in this paper.

The use of MQ-135 and MQ-6 gas sensor gives the impression of various hazardous gas types. Wi-fi links the entire internet operation and LCD for visual performance is used.

The automated air quality and noise control system represents a step forward in solving the greatest link. The sound monitoring system solves the problem that is critical in the highly polluted of life is supported.

## VII. FUTURE SCOPE

The air quality and noise monitoring system will help us to examine the level of pollution and noise in a peculiar zone. By study and examine the level of air pollution and noise, we can also measure and compare short-term and long-term diseases/disorders caused by this.

This model will help establish it in the industrial zone and developing cities to control the level of air pollution and noise. We can use the ozone layer sensor, to determine the ozone layer but it will be very costly. To monitor and check continuously we can develop- web system or ios/android application.

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