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An Idea to design a system to detect Air pollution in different area

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***Abstract*—** Our society has many challenges related to the environment, one of them is air pollution. There are many causes to increase the air pollution percentage in different area some of them are transportation, industrialization and constructions. It creates unhealthy atmosphere. Many people are suffering from many deceases invoked from the pollution. So we planned to design an air pollution monitoring system which indicates the polluted air amount in the environment. It will help to identify the polluted areas.

***Keywords*—** Air quality, Arduino, IOT and Gas sensors

I. INTRODUCTION

Presently the fundamental problem that we are facing is air pollution, atmosphere is now remarkably different from the natural aerosphere that existed before the Industrial Revolution, growth of Human Population. Air Pollution is a significant risk factor for multiple health conditions including skin infections, eye diseases, nose illnesses and throat infections. It also causes serious health problems like heart disease, lung cancer, pneumonia, blood pressure, and bronchitis, difficulty in breathing and coughing, asthma.

Air pollution can be caused by from both human and natural actions. Natural events that pollute the air include forest fires, volcanic eruptions, wind erosion, pollen dispersal, evaporation of organic compounds and natural radioactivity. Human events that pollute the air primarily related to burning different kinds of fuel, all man-made anthropogenic emission, because they alter chemical composition of the natural atmosphere, Stationary Sources, Mobile Sources, Chemicals, dust, Fumes from paint, hair spray, varnish, aerosol sprays and other solvents, Waste deposition in landfills, which generate methane.

The growth of human population, modern lifestyle, increased the global concentrations of greenhouse emissions, CO2, CH4, and NO2 and many more gases. If the natural atmosphere is considered to be "clean", then we have to consider some mechanism which will help to measure quality of our environment.

"CPCB is currently focusing on obtaining the reports on air pollution. Figure1 indicate Middle of the year CPCB has obtained and had submitted a report of annual average air pollution (P.M.10) of 46 prominent towns and cities on February 7 on the floor of the Parliament, and the report mentions that there is a drastic and continuous fall in air pollution which is essentially a matter of discussion.

AIR QUALITY

National Air Quality Monitoring Programme (NAMP)

AMBIENT AIR QUALITY STATUS *(Million Plus Cities)*

Air quality status (Annual average ($\mu g/m^3$) of Million Plus Cities for 2015

Year 2015

Cities	State	No. of Stations	2015		
			SO_2	NO_2	PM_{10}
Agra	Uttar Pradesh	6	4	22	186*
Ahmedabad	Gujarat	8	13	21	89*
Allahabad	Uttar Pradesh	5	4	26	250*
Amritsar	Punjab	3	11	30	148*
Aurangabad	Maharashtra	4	13	40	83*
Bangalore	Karnataka	9	6	20	119*
Bhopal	Madhya Pradesh	6	3	23	158*
Chennai	Tamilnadu	11	13	20	59
Coimbatore	Tamilnadu	3	4	25	47
Delhi	Delhi	11	5	65*	220*
Dhanbad	Jharkhand	3	12	37	168*
Faridabad	Haryana	2	15	74*	105*
Ghaziabad	Uttar Pradesh	2	23	37	260*
Gwalior	Madhya Pradesh	2	10	14	125*
Howrah	West Bengal	4	15	43*	123*
Hydrabad	Andhra Pradesh	10	4	23	93*
Indore	Madhya Pradesh	3	11	20	97*
Jabalpur	Madhya Pradesh	2	9	28	90*
Jaipur	Rajasthan	6	7	36	171*
Jodhpur	Rajasthan	6	6	24	152*

Fig1: Air quality report given by CPCB

It is seen that solution efforts on pollution remain consistently a fundamental problem. This is why prevention interventions obtain consistently a more effective way of controlling air pollution. There for it is absolutely essential and mandatory to monitor and control the air pollution. The best way to control and reduce air pollution is to monitor and observe exceeding levels of air pollutants. In next sections we have discussed problems and solution where Section II shows the research work has been done by many researchers in this field. Section III provides the brief information of our proposed air monitoring system. At last we have showed the conclusion.

II. RELATED WORK

There are many researchers have been contributing in these field. In 2011, Dan Stefan Tudose, Traian Alexandru PatrascuAndrei Voinescu, Razvan Tataroiu, Nicolae Tapus, et al. [1] they presented an environmental air pollution monitoring system that measures CO2, NO2, CO, HC & NH4 concentra2tion using mobile sensors in urban environment. They created a central on-line repository system to store acquired information about air pollution in surroundings periodically. It uses a wireless GSM modem connection for transferring data to a central computer. Also, the application can share the data publicly by displaying it on a dedicated web site.

In 2011, Diego Mendez, Alfredo J. Perez, Miguel A. Labrador, Juan Jose Marron, et al. [2] proposed a participatory sensing system for air pollution monitoring and control using cellular phones, GPS technology and sensors to form a bidirectional mobile sensing information system. It mainly uses many cellular phones to acquire large amounts of data in a simple and cost effective manner.

In 2012, Amnesh Goel, Sukanya Ray, Prateek Agrawal, Nidhi Chandra, et al. [3] discussed a wireless sensor network to monitor air pollution levels of various pollutants due to environment changes. This system proposes a method which mainly focuses on longer sustain time period of sensor network by effectively managing energy in sensor network, effectively processing of collected information and less overhead in transferring information between various sensor nodes.

In 2011, Wenhu Wang, Yifeng Yuan, Zhihao Ling, et al. [4] introduced an air quality monitoring system based on ZigBee wireless sensing technology. It uses ZigBee wireless network to send results to the monitoring center so that, if some abnormal situations happen, a quick warning will be generated to remind staff to take effective measures to prevent major accidents and protect human lives in industry.

In 2016, Navreetinder Kaur, Rita Mahajan, et al. [5] proposed a Wireless sensor network (WSN) based new framework which is based on data acquisition and transmission. The parameters of the environment to be monitored are chosen as temperature, humidity, volume of CO, volume of CO2, detection of leakage of any gas - smoke, alcohol, LPG. The values of these parameters are transmitted by using Zigbee Pro (S-2) to a base stationwhere they are being monitored.

In 2015, Ramagiri Rushikesh, Chandra Mohan Reddy Sivappagari, et al. [6] presented a design and development of IoT based vehicular pollution monitoring system for green revolution. The designed smart intelligent environmental system monitors the pollutants produced by the vehicles and also warn the vehicle owners to control the pollution. The system also sends the pollutant level data to the server for future analysis.

III. PROPOSED METHODOLOGY

Air pollution monitoring system:

Our main focus is to identify the major areas which is responsible for air pollution these are:

- Industrial zone
- construction sides,
- heavy transport area

Industrial zone

The consequence of industrial pollution has heavily increased and causing defects to our eco-system for many years. Air pollution increased various illnesses, and it is affecting us on a daily basis. An industry produces many harmful gases some of them are Carbon Dioxide (CO2), Carbon Monoxide (CO), ammonia (NH3).

Construction sides

Explosion, remotion, site preparation and construction are major points that have taken during a development period. If the proper management of effects on air quality of these points are not appropriately managed and reduced, then they will cause major significant local effects, even it started causing we are facing many problems like skin disease, throat infection, asthma and so on. Construction sides produces gases those are Carbon Monoxide, Nitrogen Oxides, Ozone.

Heavy transport area

Transportation added many toxic gases like carbon monoxide, nitrogen oxides, and almost a fourth of the hydrocarbons into our air. Vehicles are major pollution contributor and are producing significant amounts of very harmful gases for our human health and our environment. In 2013, transportation contributed more than half of the carbon monoxide and nitrogen oxides, and almost a quarter of the

hydrocarbons emitted into our air. Transportation produces following gases those are Nitrogen Dioxide NO2, Carbon Dioxide (CO2), Carbon Monoxide (CO), Particulate matter (PM), Hydrocarbons (HC).

Because of this growing problems we have planned to prepare Air pollution monitoring system, which will help to control the air pollution in the environment. The core objective of this system represents to continuous monitoring the quantity of gases presents in the environment. This work can be beneficial for health, government officials, tourist places, individuals and communal area as well.

We propose an IoT based Air Pollution Monitoring System in which we will monitor the air quality over a web server using the internet, and which will trigger an alarm or indicate on system when the air quality goes down beyond a certain level, means when it will detect sufficient amount of harmful gases are present in the air like CO, CO2, NO2, SO2, smoke, alcohol, and NH3 it will generate alarm. Figure2 shows the working of Monitoring System.

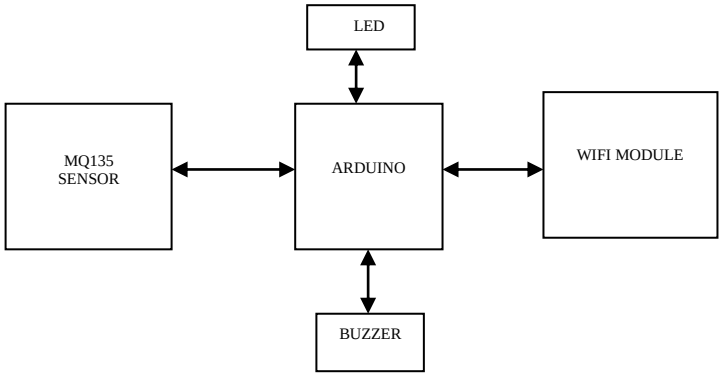

Fig.: 2. The block diagram shows Air Pollution Monitoring System

IV. COMPONENTS OF AN AIR POLLUTION MONITORING SYSTEM

A. Arduino Uno R3 microcontroller

It is the most flexible and reliable hardware platform. It is based on ATmega328P which can be easily programmed according to the function and requirement where it is going to be used. The Arduino microcontroller is not only limited for technical users but is planned for designers and artists as well because of its focus to usability based on its design which helps to achieve the intended goal. It is compatible with many sensors available and can work with reliability.

B. Wifi Module

We will use ESP8266 WiFi Module is a self-contained SOC with integrated IP protocol stack that can give any microcontroller access to your WiFi network. Wifi module is capable of either hosting an application or offloading all Wi-Fi networking functions from another application processor. This module is powerful for storage capability that allows it to be integrated with the sensors and other application specific devices. The wifi module supports many applications and Bluetooth co-existence interfaces; it contains a self-calibrated RF allowing it to work under all operating conditions, and needs no external RF parts.

C. LCD

We will use a 16x2 LCD (Liquid Crystal Display). The result will be shown on this display.

D. Gas Sensor

There are many gas Sensors are available in the market. They can detect a wide range of gases. The conductivity of this material is lower in clean air. The sensor conductivity increases with the increasing concentration of target pollution gas. Sensors have less cost, long life and can be easily handle. We will prefer many gas sensors. It will work when we connect it to Arduino after this it will sense gases present in the atmosphere, and then it will give the result i.e. Pollution level in PPM (parts per million).

We will use gas sensors *to monitor the primary pollutants:*

A. The **MQ-7** can detect CO-gas concentrations anywhere from 20 to 2000ppm. Carbon Monoxide is produced by incomplete combustion of fuel such as coal or wood, natural gas and is very harmful for the environment.

B. **Nitrogen Dioxide NO2 2E N Gas Sensor**, can detect from 0-20ppm. Nitrogen dioxide is produced from high temperature combustion in industry and vehicles. When nitrogen is released during fuel combustion, it combines with oxygen atoms to produce nitric oxide (NO). This further combines with oxygen to produce nitrogen dioxide (NO2). Nitrogen dioxide is an important air pollutant because it contributes to the formation of photochemical smog, which can produce significant impacts on frail health.

C. **MQ 135 gas sensor:**

a) **MQ 135 gas sensor** can detect Carbon dioxide (CO2). Carbon dioxide is considered as "the leading pollutant" and "the worst climate pollution." Trees and other plants help keep the planet cool, but rising levels of carbon dioxide in the atmosphere are turning down this global air conditioner. According to a recent study, in some regions more than a quarter of the warming from increased carbon dioxide is due to its direct impact on vegetation, in addition to its better-known effect as a heat-trapping greenhouse gas.

b) **MQ 135 gas sensor** can detect Ammonia (NH3). Ammonia is produced by agricultural processes. The liquid or gas may cause severe irritation and/or burns to the eyes, nose, throat, and the skin. NH3 has an odor threshold of 5-50 ppm and can cause eye irritation at 20 ppm; therefore, its presence may be sensed in concentrations below the exposure limits. Excessive concentrations can cause persistent injury to the eyes, extensive damage to the throat and upper respiratory tract and may affect heart action or cause cessation of respiration by reflex action.

D. **MQ2 Gas Sensor** it is suitable for detecting Smoke, Smoke is a collection of airborne solid and liquid particulates and gases emitted when a material undergoes combustion or pyrolysis, together with the quantity of air that is entrained or otherwise mixed into the mass.

E. **MQ3 Gas Sensor** it is suitable for detecting alcohol. Alcohol interferes with the brain's communication pathways, and can affect the way the brain looks and works. These disruptions can change mood and behavior, and make it harder to think clearly and move with coordination.

V. CONCLUSION AND FUTURE SCOPE

We will design an air pollution monitoring system using various gas sensors and tracking of the various polluted area, it will be serviceable to air quality management and to pinpoint major polluting sources at various places inside of a city. The government agencies can equally benefit from the very large amount of analyzed data which may result in better understanding of the many pollutants affects the urban environment. The system uses public transport areas, Industrial areas to acquire air pollutants levels, construction area.

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