# Air Pollution and Impact Diseases Monitoring

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*Abstract*—A project for an environmental air pollution monitoring system for monitoring the concentration of major air pollutant gases has been developed .The system is about air pollution and impact disease monitoring using gas sensor and node MCU. This system keep the track of some of the pollutant in the air such as co,co2,nitrogen using gas sensor. The gas sensor first detect the environmental gases and pollution content in it and it collect the information about surrounding and give the data to the node MCU. Realisation of the data gathered by the sensor will be directly displayed on node MCU. The main aspect of the proposed system is to permutated low cast infrastructure about the air pollutants and impact diseases.

Keywords—Internet of things, pollution monitoring, node MCU, disease monitoring

## I. INTRODUCTION

Air pollution occurs when harmful substances are introduced into our atmosphere. The sources of air pollution includes some of the gases like ammonia, carbon monoxide, sulphur-di-oxide, methane, chlorofluoro carbon[1] and some biological molecules. This gases not only affect human but also cause harm to other living organism like animals and plants[2] . The effect of pollution may varies from small unit of cigarettes and natural sources such as volcanic explosion [3] to large volume of emission from industries. Long term health effects from air pollution include heart disease lung cancer and respiratory disease such as emphysema. Air pollution can also cause long term damage topeoplenerves, brains, kidneys, livers and other organism[4]. Some scientist suspect air pollutants cause birth defects.

This system not only find the pollutants in the air but also detect the disease occurring from those gases.such as gases like carbon monoxide poisoning typically occur from breathing in carbon monoxide(co) at excessive levels. Symptoms are often described as “flu-like” and commonly include headache and dizziness. Large exposures can result in loss of consciousness, arrhythmias, Seizure or death. High level of methane can reduce the amount of oxygen breathed from the air .This can result in mood changes ,slurred speech, vision problems, memory loss and headache. In several cases there may be changes in breathing and heart rate, balance problems, numbness and unconsciousness.

Health effects of sulphur dioxide are wheezing, shortness of breath and chest tightness and other problems especially during exercise or physically activity. Inhalation of chlorofluorocarbon (CFC) affects the central nervous system and can disturb the heart rhythm.

Usinfg laboratory analysis, conventional air automatic monitoring system has relatively complex equipment technology, high cost and it is large in size it won’t be able to fit in small scale areas. To overcome these defects of old monitoring system and defecting methods and to reduce the cost .This system aims a method combining IOT technology with environment . This system not only detect the pollutants in the air and also detect the diseases occurs under the pollutants.

Section II gives a brief overview of IoT architecture and how each layer is realized. Section III describes the overall system architecture. Pollutants and their impact disease described in section IV.

The future scope is described in section V. Conclusion described in section VI.

## II. RELATED WORK

In monitoring system, to test system data samples were obtained around to two cities to determine the co2 concentration and particulate material levels [5].By using IOT this system can reduce the hardware cost 1/10 as before. The system can be out in a large number in monitoring area to form monitoring sensor network [6].

The [7] system uses low cost and low power devices with gas sensors to capture the air quality index from the atmosphere.

In [8] monitoring systems are important components in many smart city projects for monitoring air quality and for controlling the main pollutant concentrations in urban areas.

In the present work we have idea to use one gas sensor node MCU and Arduino. The air quality sensor will monitor the proportion of air pollutants in the air .However the sensor will monitor the co emission in the environment .Node MCU is inbuilt with Wi fi module .Via Wi fi module the detected air pollutants in the environment and the disease comes under that pollutants will send as the notification through the blynk app to the smart phones and alert them about the air pollutants and disease occurring under that pollutants.

## III. PROPOSED IOT ARCHITECTURE

According to IOT architecture our system comes under three main layer they are Perception layer (physical layer),Network layer, Application layer.

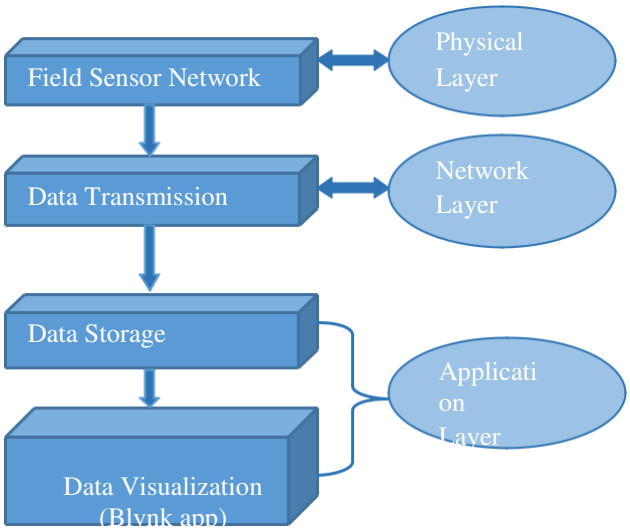


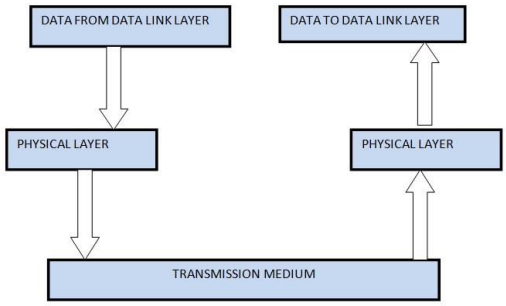

Fig. 1: IoT based System

### *A. Analysis of physical layer (perception layer) Architecture*

In the seven layer ODI model of computer networking ,the physicallayer or layer 1 is the first and lowest layer[8].The physical layer consist of electronic circuit transmission of a network[9].It is a fundamental layer underline the higher level functions in a network ,and can be implemented through great number of different hardware technologies with widely varying characteristics.

In proposed system we use Node MCU with semiconductor gas sensor to make simple node that collect and transmit a limited amount of data to a central controller which provides connectivity to the Internet.

The data link layer consist of IOT gateway router (here we have used Node MCU as router gateway) device manager and various communication protocols.



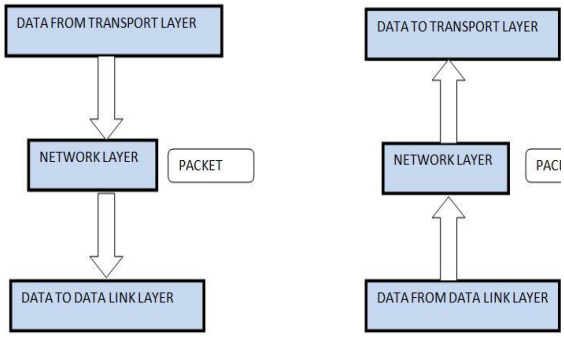

### B. Analysis of network layer

The primary function of network layer is to controls the operation of subnet .The main function of this network layer is to deliver packets from source to destination across multiple links (networks).

The network layer is the third layer in the OSI model and this layer provides data routing paths for network communication .
Data is transferred in the form of packets via logical network paths in an ordered format controlled by the network layer.

Logical connection setup, data forwarding, routing and delivery error reporting are the network layer's primary responsibilities.

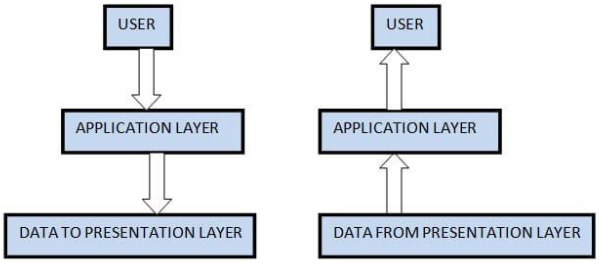
In this system we used node MCU which is inbuilt with ESP8266 Wifi module. The ESP8266 has a full TCP/UDP stack support. So, the data is transferred wirelessly in the form of TCP packets from simple node to Gateway .




*C. Analysis of Application Layer*

The main purpose of application layer in this system is to analyse the air pollutant in the air and to assess the air quality It will analyse the presence of pollution in the air and also indicate that which type of disease causes when pollution in the air goes higher than certain limit.

In our proposed system, Application layer consist a Base Station (Arduino uno) which handles the data transmitted from nodes. To collect data, we have used blynk app to indicate the user about the air pollutants in their breathing air and the surrondings and indicate the disease caused by that pollutant .




The complete system is an application of "Internet of things" because it uses Node MCU which is inbuilt with Wifi module for pollution monitoring in real time and using a wireless network to process data in a distributed information system. Node MCU is a low cost open source IOT platform[10][11].It initially included firmware which runs on the ESP8266 wifiSoC from Espressif systems, and hardware which was based on the ESP-12 module[12][13].

## IV. SYSTEM OVERVIEW

In this section, we describe the different components of pollution Monitoring system and impact disease. The overall system architecture is depicted in figure 3. In this system we used a node MCU which is inbuilt with wifi module and gas sensor to detect the air pollutant and we have used a bio sensor to detect the disease coming from that

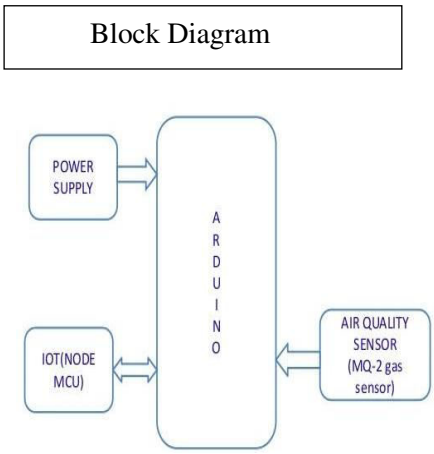



Fig. 4: Overall System architecture

*A. Gas Sensor*

It is a type of device to detect the presence of gases in the environment and around us,often as a part of safety system[1].this device is very sufficient because there are many gases which cause harmful to human beings as well as other living organisms. They are commonly used to detect toxic are explosive gases nd measure the gas concentration.[2]one of the most widely used gas sensor for toxic identification and smoke detection is the metal oxide based gas sensor[3].To measure the pollutant concentration together with other physical parameters, with the advantage of better calibration of the gas sensor.[4]. The gas sensor works on the principle of measuring the Attenuation of infrared radiation [14] with a specific wave length in the air. The signal from the infrared detector is further amplified and then using other electronic devices evaluate the attenuation of radiation, which is caused by some gases in the environment and on the basis the cause for pollution is detected[15].

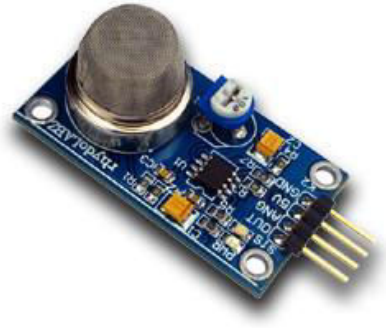


TABLE I
COMPARISON BETWEEN ANALYTICAL INSTRUMENTS AND GAS SENSORS[12], [13]

| **Features** | **Analytical Instruments** | **Gas sensors** |
|---|---|---|
| Resolution | Excellent | Comparable |
| Cost | Very high | Fair |
| Size | Bulky | Compact |
| Rigidity | Fragile | Rigid |
| Process Control | Difficult | Easy |
| Mass Production | Difficult | Easy |
| Measurement | Instantaneous | Continuous |

*B.Node MCU*

Node MCU is an open source LUA based firmware developed for ESP8266 wifichip.By exploring functionality with ESP8266 chip, NodeMCU firmware comes with ESP8266 Development board/kit.Node MCU hasanalog and digital pins and also supports serial communication protocols
(UART,SPI,I2C). In this system we use Node MCU to run blynk app with network connectivity. Arduino can control and run the program but doesnot possess wificonnectivity,so we are using Node MCU along with arduino.

*C.Arduino*

Arduino UNO is an open source microcontroller board which is developed arduino.c.c based on the microshipATmega 328P microcontroller.The board consists of both input and output pins.The board has 6 analog pins and 14 digital pins.In this we use arduino to control and run the program complied in arduino IDE(Integrated Development Environment).Node MCU is connected to Arduino because arduino does not possess network connectivity.NodeMCU has wifi connectivity to access the blynk app to receive the message in our mobile phone about the diseases caused by the air when it crosses the limited proposition.

*IV Polllutants and their impact diseases*

| **Pollutant** | **common sources** | **maximum acceptable concentration in the atmosphere** | **environmental risks** | **human health risks** |
|---|---|---|---|---|
| carbon monoxide (CO) | automobile emissio, fires, industrial processes | 35 ppm (1-hour period); 9 ppm (8-hour period) | contributes to smog formation | exacerbates symptoms of heart disease, such as chest pain; may cause vision problems and reduce physical and mental capabilities in healthy people |
| nitrogen oxides (NO and NO2) | automobile emissions, electricity generation, industrial processes | 0.053 ppm (1-year period) | damage to foliage; contributes to smog formation | inflammation and irritation of breathing passages |
| sulfur dioxide (SO2) | electricity generation, fossil-fuel combustion, industrial processes, automobile emissions | 0.03 ppm (1-year period); 0.14 ppm (24-hour period) | major cause of haze; contributes to acid rain formation, which subsequently damages foliage, buildings, and monuments; reacts to form particulate matter | breathing difficulties, particularly for people with asthma and heart disease |

| | | | | |
|---|---|---|---|---|
| ozone (O3) | nitrogen oxides (NOx) and volatile organic compounds (VOCs) from industrial and automobile emissions, gasoline vapours, chemical solvents, and electrical utilities | 0.075 ppm (8-hour period) | interferes with the ability of certain plants to respire, leading to increased susceptibility to other environmental stressors (e.g., disease, harsh weather) | reduced lung function; irritation and inflammation of breathing passages |
| particulate matter | sources of primary particles include fires, smokestacks, construction sites, and unpaved roads; sources of secondary particles include reactions between gaseous chemicalsemitted by power plants and automobile | 150 µg/m3 (24-hour period for particles <10 µm); 35 µg/m3 (24-hour period for particles <2.5 µm | contributes to formation of haze as well as acid rain, which changes the pH balance of waterways and damages foliage,buildings, and monument | irritation of breathing passages, aggravation of asthma, irregular heartbeat |
| lead (Pb) | metal processing, waste incineration, fossil-fuel combustion | 0.15 µg/m3 (rolling three-month average); 1.5 µg/m3 (quarterly average | loss of biodiversity, decreased reproduction, neurological problems in vertebrate | adverse effects upon multiple bodily systems; may contribute to learning disabilities when young children are exposed; |

## V. FUTURE SCOPE

- In future the project can be upgrade in more than one way:
- Interface more number of sensors to know detail content of all gases present in air.
- Design webpage and upload data on webpage with date and time.
- Interface our mobile SD card to store data.
- Interface GPS module to monitor the pollution at exact location and upload on the webpage for the users.
- Replacing a pollution causing process by non pollution process
- (eg ) Removal of lead from petrol-unleaded petrol.
- Wireless sensor networks have been deployed in
- Several cities to monitor the concentration of dangerous gases of citizens.

## VI. CONCLUSION

In this paper, the development of IOT based air pollution and its impact diseases monitoring system is presented. In this project we use gas sensor to identify the pollutant present in the air. This is system can be automatically operated to increase the efficiency of the air whenever we need because the cost of the system is low.

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