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A Smart Application of IoT for Green Environment

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Abstract: ***Currently Internet of Things (IoT) changes the world a lot. It helps many other science domains. At everyday in any peoples live in city face different health related problem due to pollution. Air pollution is one of the most vital amongst pollution. It is required to find solution for this problem..***
IoT sensors can read air condition in some locality and predict presence of air pollution in that locality. Also IoT sensors can predict oxygen level in a room. This paper proposed a method which can give information about available oxygen or other gases in a particular location.
Keywords- IoT); Particles Matter); wi-fi; Air Quality Index; Embedded System;

I. INTRODUCTION

IoT becomes most emerging field of the current days. IoT devices senses data and send them over Internet for analysis. It is now present everywhere. IoT provides a smart and sweet interface using Internet for connecting some object, machines and environment [1-2].Remote communication helps not only to collect data but also help automated remote operation. The term IoT was first use by Kevin Ashton in 1999 in the context of supply chain management [3]. It is now used in many fields. In this paper a framework of IoT is proposed that can be used in the domain of environment and pollution. For Today's world air pollution is one of the most essential problem. 4.2 million deaths every year as a result of exposure to ambient (outdoor) air pollution" according to World Health Organization (WHO). WHO data describes that every 9 out of 10 people breath polluted air. The problem is of taking very serious for metro cites. Now a days the English world "smog" become popular to the sub-urban areas. [4-7] Every year 4.3 millions of people death as result smoke from fuels. From many solutions "Oxygen Bar" is one of the solutions. In this paper, a method is proposed for measuring room atmosphere from remote location by using IoT sensors.

A. State of Art of Motivation of the Work

The motivating about natural elements with measurement index and relevant researches are presented. It shows the needs for such system and its characteristics. Air Quality Index (AQI) is efficient way to measure air quality status. It is very helpful for urban and cites where pollution is required to measured and reduced it accordingly. Table -1 states the details of AQI index. Figure 1 shows day wise AQI and their index. The air in atmosphere is mostly contain nitrogen and oxygen as well as it contains some other gasses and particles. AQI tracks five major air pollutions:

1) Ground level ozone
2) Carbon monoxide
3) Sulfur dioxide
4) Nitrogen dioxide
5) Airbone particles or aerosols

The AQI Index is based on measurement of particulate matter, Ozone, Nitrogen Dioxide and Carbon Monoxide emissions. Most of the stations on the map are monitoring both PM [2,5] and PM [10] data, but there are few exceptions where only PM[10] is available.

Table 1 Air Quality Scale

AQI	Air Pollution Level
0-50	Stander
51-100	Moderate
101 – 150	Unhealthy for some cases
151 – 200	Unhealthy
201 – 300	Very serious unhealthy
300 and more	Hazardous

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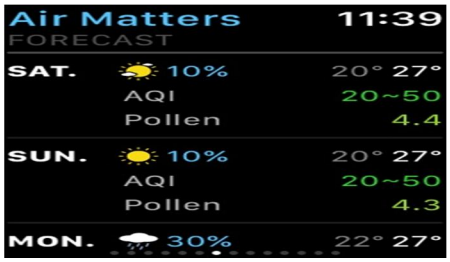

Figure – 1 Air Matters

OSHA (Occupational Safety and Health Administration) OSHA defines as Oxygen deficiency as when in any atmosphere contains less then19.5 percent oxygen that is oxygen deficiency. And Oxygen-enriched in any atmosphere when it contains more than 22 percent oxygen. And the safety percent of oxygen is 19.5 to 21.5. But due to high air pollution in many cites are normally observed 15 to 19 percent oxygen. Now Oxygen deficiency on human health is described in table-2 [8-9].

Table 2 Oxygen Percentage and its effect on health

Oxygen percentage	Effect on Health
>22	No short-term damage but may long-term effect; But serious change of fire and high risk
21.5-19.5	Safe and sound situation
19.5-19	Some physical effects occur but ignorable in some time.
15-19	Alarming situation; increased pulse and breathing rate; difficult to work; different problem in eyes.
12-15	Poor judgment, mental- emotional upset; with other physical problem.
10-12	Very poor condition; permanent heart damage emotional upset; highly breathing problem.

From Table[2] this is very clear Oxygen level has an direct impact on human health. So, some-how it is necessary to make control environment system or rooms that can easily inform about the necessary indexing.

II. LITERATURE REVIEW

The authors describe about Cyber-physical system (cps). In cps IoT based sensors are collect raw factors of data from Air and send it to intelligent network system [2]. "MegaSense cyber-physical" system is used for monitoring urban air quality. The Framework – MegaSense is the first end-to-end system providing coverage of air pollution exposure in different urban micro-environments used continuously throughout the day. To monitor air pollution, end-user can use mobile app to see current status [3].

In another study authors present wireless sensor Network (WSN) for gather data using wireless technology. In this paper CO2, CO, and CH4 gases are considered as parameters of air quality. For this application IoT devices like Arduino and Gas sensors were applied. This application works in such a way that IoT based sensors are Collect data from atmosphere and according to proposed algorithm send's information to the mobile app. The app displays result based on the proposed algorithm [4].

Researcher observed on participants of a hospital in Boston city. Continuous oxygen saturation and pulse monitoring were performed using oximeter. The author performed statistical analysis in two phases of analysis. In the first phase author uses fixed-effect modelling and in second phase does random effects models. The study briefly describe result about oxygen saturation effect PM2.5 and other effort due to air pollution [5-6]. Air pollution increases rapidly as well as size of data also increases. Authors use statistical model and Bayesian networks based probabilistic inference model for calculation air pollution. IoT dust sensor used in this study to detected PM2.5 and PM1.0. Authors proposed prediction of air quality based on parameter and optimization. They also uses Regression tree and B-tree for prediction purpose [5].

Researchers describe about air pollution and its effect in the content of PM2.5 and PM2.5. It is cocktail of natural compound and chemical reagent. Different geographical regions have different health problem associated to the air pollution related with of PM2.5. It is shown in figure 2.

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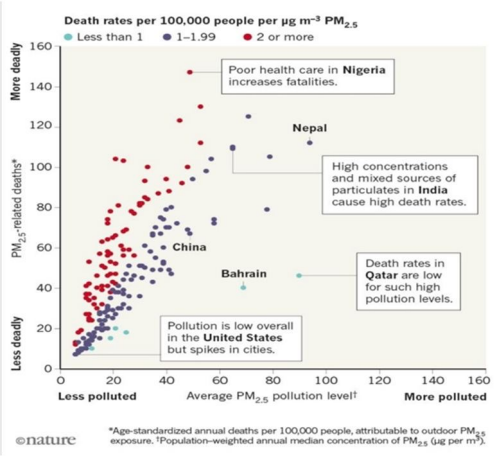

Figure–2 It shows death rate

Some researchers observed on humans about tobacco smoking. It can be responsible for a number of premature deaths. They also describe some effective solutions using WHO data.

"oxygen bar" or "oxygen plural" are the smart and effective solution for reducing air pollution. This provides 95 percent purified oxygen for breath. In the natural air 20-21 percent should present but due to air pollution the concentration of oxygen become low and it drops-down under 19-19.5 percent due to pollution. In such condition people should alert and concerned about pollution [9-12]..

Oxygen bars provide purified oxygen for breath and its important can highly observed in any polluted cites. It also provides following Benefits -

1) Help to better sleep and physical fitness.
2) Reduce stress and energy levels
3) Improve moods and mental freshness
4) Relief for headache and migraine.

Here the idea is to create one mobile application that can show real time environment and presences oxygen in the Oxygen bar or if one IoT based smart room that can help User remotely calculate atmosphere and can aware about different atmospheric element such as oxygen,co2,co and so on, as now in this days world is witness of 'wireless' time[8].

A. Proposed Method

In this paper a method is proposed to alert people about AQI level in outdoor of an oxygen bar and Oxygen percentage of indoor (of the oxygen bar) as well as outdoor. This is a smart framework because one can watch the result and prediction and alert using one small mobile application through IoT. It is divided into two part- Receiver end and Sender end. In the transmission end the method used embedded systems and IoT technology. Arduino Uno is a microcontroller board It contains MQ-7 carbon Monoxide sensor, MQ2 Methane sensor, NDIR carbon dioxide sensor MQ-135 Air Quality Gas sensor, NODEMCU-ES8266, Grove and Oxygen Sensor (ME2-O2-Φ20).The sensor is shown in figure 3 to figure 6. Table-3 shows sensors characteristics.

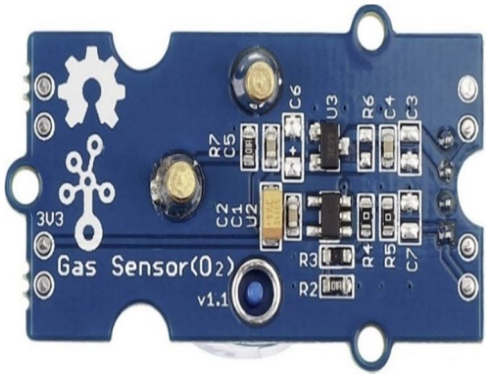

Figure-3 Sensor- ME2-O2-Φ20

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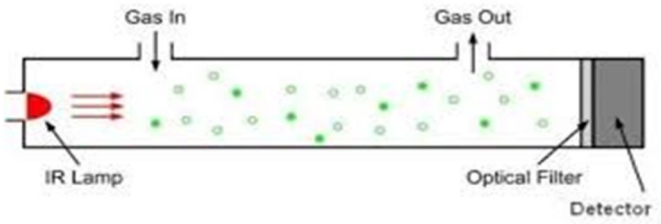
Figure – 4 Sensor- MQ-135



NDIR CO2 Sensor

Figure – 5 NDIR- CO2 sensor

Figure – 6 Sensor- NODEMCU-ES8266

Table 3 Sensor details

Sensor	Gas	Description
MQ -7	Carbon Monoxide	The sensor can measure concentrations of 10 to 10,000 ppm. It takes an analog input. CO is detected by method of cycle high and low temperature
MQ-2	Methane, Butane, smoke	Useful for detect gas leakage in home or in offices or in any smart created places. It Useful for detection harmful gas like methane, alcohol, hydrogen and smoke.
MQ-135	Air Quality	To detect air quality, nanoparticles.
ME2-O2-Φ20	Oxygen	To measure oxygen concentration in air
NDIR	carbon dioxide sensor	This is a perfect solution for measuring CO2 in indoor air Quality.

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IoT-Mobile application is used to control oxygen level in an oxygen bar it can use in general room also where oxygen is present. In this application , it can show risk that occurs due to air pollution both outside and inside of room as a notification. Real time environmental can observed in this mobile application. This will fix many types of health risk.

In this framework, sensors collect row data and send data to dedicated mobile application. It used logical methods to produce result. The flowchart is shown Figure-7.

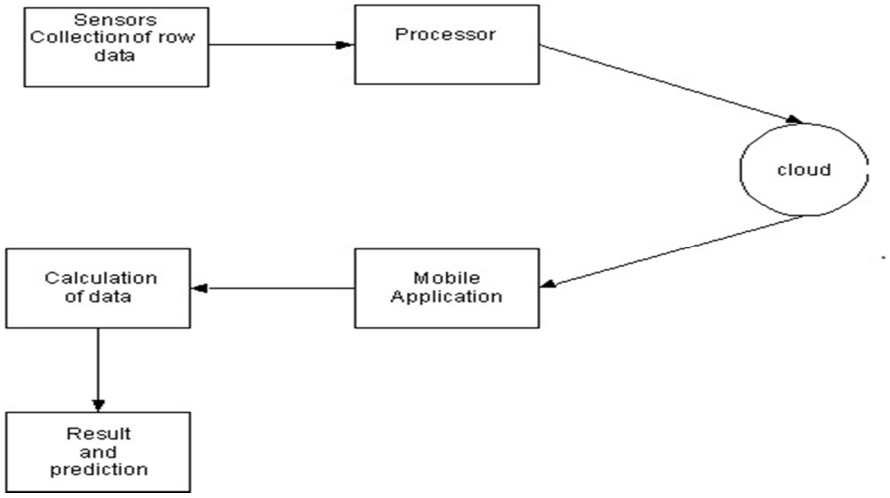

Figure 7 Proposed Method

Sender side uses sensors that mention in Table-2. In the inside of the room it measured Oxygen level, carbon dioxide and so on. All sensors are attached with Arduino bord and from there all data are sent to mobile Application. In the Outside of the room AQI level also requires to measure Arduino bord. This data also sends to mobile Application with previous mention data. The algorithm is shown below:

1) *Input:* pin
2) *Output:* sending data
a) Step 1: collect data from sensor.
b) Step 2: processing values in Arduino bord.
c) Step 3: send all row using wi-fi shield ESP8266.
d) Step 4: impose security and stability factor.
e) Step 5: received by mobile application.

For exciting algorithm required, First, setup Arduino sketch, complete hardware connections A program that can control all connections. The output of all sensor's read data should receive by a dedicated mobile application using ESP8266 Wi-fi module.

Once the correct sensor values are retrieved using wi-fi module. Then process data to get correct result. Receiver site logical Algorithm is as follows:

1) *Input:* Collecting data Using Internet
2) *Output:* Produces result
a) *Step1:* Read data from Internet it may from cloud also
b) *Step2:* Accept correct data.
c) *Step3:* Store data in proper data structure must insure that data access speed should very high.
d) *Step4:* processing of data will occur into some sub part as Step 5 to Step8 (it mainly follows divide conquer combine approach).
e) *Step5:* Find the pollution level of the outside of the room.
f) *Step6:* Find Oxygen level of the room.
g) *Step7:* Find CO2 level of the room
h) *Step8:* IF in the room any gas leakage or any harmful gas present in the room then go to step 9
i) *Step9:* Make all alarm on and Reset all data store one copy in memory.
j) *Step10:* Display all result. And Suggest necessary action.

To execute algorithm it is required to write android deployment code and set up SKD version which is comfortable for both mobile and ESP8266.

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III. RESULTS

Received information must should produces correct result. And according to result it must to display correct suggestions.

A. If the oxygen level of the room is 20-21%, then no required for more new oxygen as it already a safe atmosphere.
B. If oxygen level of the room is less then 19% , then required immediate new fresh oxygen in the room.
C. When AQI levels of outside of the room is not under 0 – 100, then take situation more careful as the day or that time is very much polluted than safe atmosphere. Persons who are at outside must facing trouble for air pollution suffering from different health related problem.
D. Not only oxygen level of a room is not sufficient but also it required to measure both CO and CO2 percentage of the room
E. It should ensure that in the room (oxygen bar) there should not any smoke any gas leakage or there should not any harmful gas. If it happens then immediately alter user about this. The application view is shown in figure 8.

Figure – 8 Application View

IV. CONCLUSIONS

Currently, pollution in the world is increasing day-by-day. Many studies are made on air pollution. Air pollution is harmful gases and at the same time oxygen level of air is also decreased. In this article it is proposed a system that predicts different air element presence with index that can help to control level of air pollution.

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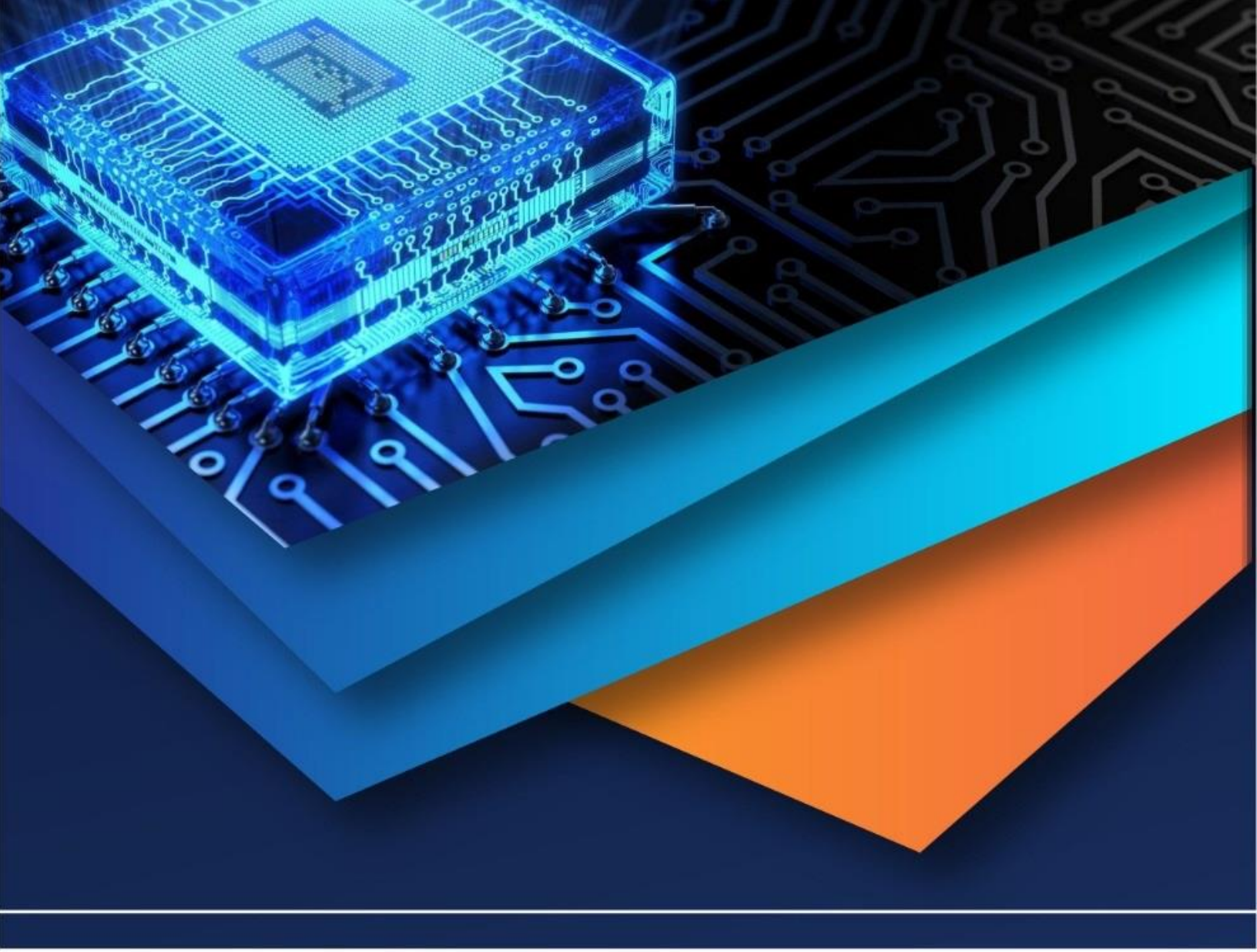

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