SMART AIR QUALITY MONITORING SYSTEM

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***Abstract--** People have been located in various places according to our future and job opportunities to make our living but have you ever wondered about the quality of the air you are breathing? In this modern era we are prone to use various chemical and harmful substances which are being emitted by things we use on a daily basis and it gradually dissolves in air without our knowledge and it can cause severe ill effects progressively like harming our respiratory track and lungs, increased tiredness, headaches ,increased heart BPM etc. These may become fatal if ignored so in order to overcome this issue we have come up with an idea which portrays a smart monitor that senses a couple of common yet harmful gases and compounds like PM2.5, carbon-di-oxide(CO2), Ozone(O3),VolatileOrganic Compounds(VOC) and it has a touch LED display and the user can get a clear idea of the substances they are inhaling also this smart air quality monitor is user friendly and have been designed in a way that commoners can use it with ease. Not only the interface is useable by commoners but also they can afford this monitor as it is way more cheaper than the pre-existing models which fails to provide this much information. So that this monitor can prove highly useful in personal rooms , offices, and even in the open environment where users are prone to dwell. The smart air monitor is run by Arduino and several sensors and are compactly packed in a way that it requires little space for installing it and to be able to carry it around with ease.*

Keywords-Beats Per Minute (BPM), Light Emitting Diode (LED)

I. INTRODUCTION

Air pollution in Indian cities is rising at an alarming rate, new data from the World Health Organization has revealed, particularly in emerging economies like India, where pollutants

harm human health. Indian cities have some of the highest concentrations of particulate pollution, with as many as 14 cities among the worst 30.China, which has been plagued by air pollution, has improved its air quality since 2011 and now has only five cities in the top 30. Peshawar in Pakistan and Dhaka in Bangladesh also amongst the worst cities .Fast growing cities are also on the list of most- polluted urban areas with the highest levels of PM 2.5, tiny airborne particles, spewed out by cars, factories and coal power stations that can lodge in the lungs or enter the bloodstream. Air pollution levels rose as much as 8% in the five years between 2008 and 2013. Cities in poorer regions are suffering the most. In Indian cities levels of larger PM10 particles (mostly dust, sand and soot) is also severe. These particles deflect heat and make urban areas warmer, contributing to climate change in lower altitudes. India has eight cities among the World's worst 30 for PM 10 levels too. Very high levels of air pollution are catastrophic for health, Air pollution causes more than 3 million premature deaths worldwide every year, as urban air quality declines, the risk of stroke, heart disease, lung cancer and chronic and acute respiratory diseases, including asthma, increases for the people who live in them. The irony in this problem is that the commoners are not aware of this situation and are entitled to the

opinion that they are breathing fresh air and are living without any harm which is not the case so to bring awareness to the people about how important their respiratory health is our prototype will help them to learn and gain knowledge about the pollutants they are inhaling at the very moment and will help stimulate the needs to reduce the pollutants and it can also be located in areas where public dwell and so it could reach to even more people and small scale industries like dying plants can also set this up to get an idea of their environment.

II. LITERATURE SURVEY

According to literature research [1] European health care reform-(1997) gives a detailed analysis of the strategies enlisted at that time of year which was proposed to save the environment from pollutants. The quality of the information sources was assessed based on five different factors, with the primary focus on each source's applicability and utility to our study. Sources ranked highest for this factor when they contained quantitative , application-focused performance requirements for air monitoring instruments

[2] Air monitoring, measuring and emissions research by EPA researchers (2001) helpsto expand our knowledge about pollutants and current ecosystem. To help improve data quality for sensors applied in a non-regulatory fashion, which is growing in prevalence, the United States Environmental Protection Agency (EPA) is considering development of a new voluntary sensor certification program for air sensors.

[3] Understanding parts per million in real time air quality index" by Malaya Ranjan, Rai Kumar in September 2009 gives a detailed procedure to

understand parts per million conversions as the conversions have a detailed explanation and it also includes the ppm output list of several sensors helped to understand the output.

[4] Indo-pollution: a public health perspective (1983) by J D.Spengler foreshadowed the rising effects of harmful air which might become a crisis in future. Substantial effort was invested to identify the information sources included in this literature review and synthesis. The process consisted of both automated and manual searches to identify relevant information sources from the peer-reviewed literature, technical reports, these and dissertations, and regulatory air monitoring standards promulgated by government agencies, among others.

[5]"IoT based pollution monitoring system with Arduino" by Poonampaul, Gupta Tiwari, Ashutosh Sharma in May 2005 sends two pollutant's data to the cloud. The system then accumulates data received from two sensors and stores it in the cloud and processes it to represent data to the user in the cloud website via a graphical representation.

III. APPROACH

A) PROBLEM STATEMENT

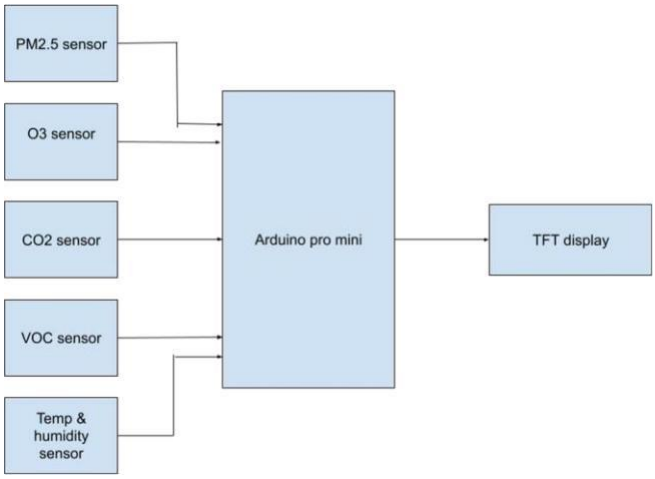
The present devices are not user friendly and have many limiting factors in terms of usage and fail to offer long term usage.Some of the difficulties present with the existing method are as follows:The existing devices are little complex in their working so the user must have a little knowledge about the device prior to the installation.In some existing devices regular maintenance of the device is mandatory thereby; Cost increases eventually , attention is needed over a period of time regularly, standby time is very low in most of the devices.Comparatively very large in size so it requires a huge space for installation. The existing devices that prevail in the market cannot be installed in public places as a common interaction device.The devices fails to give enough information and clarity to the one who is using the device.

A) PROPOSED SYSTEM Considering and analyzing all the problems and flaws in the pre-existing models we came up with the prototype which is fine tuned to overcome the flaws.To avoid any inconvenience to the user in terms of understanding the prototype displays the information in the simplest form possible that a commoner could easily understand just by looking.In the proposed prototype there is no maintenance needed so;It reduces the cost needed to replace components, It requires no constant attention from the user, once installed the user need not worry about giving attention, stand by time is comparatively very high the prototype can even continue to sense for a whole day, the prototype is very small in size that it is designed in a way that it requires very less space to be kept at providing versatility.As said the proposed system is very versatile we can install it in public places
like malls, industries etc. as well as can be used in

indoor private rooms or personal workspaces.

IV.BLOCK DIAGRAM

The components required for the monitoring system are enlisted in the block diagram. Where all the inputs are received through sensors namely PM2.5 sensor which uses laser light scattering to identify the dust particles, Ozone sensor which identifies Ozone gas using varied resistance heating, Carbon-di-Oxide sensor which uses Infrared light scattering principle to identify the Carbon-di-Oxide composition present , VOC sensor which also uses varied resistance heating to capture the VOC present around, and temperature humidity sensor and these inputs are transmitted to the controller (i.e.) the Arduino pro mini where the received inputs are further processed and transmitted to the TFT display where the data is displayed to the user.



V. WORKING

The prototype is kept in an indoor environment to detect the pollutants namely PM2.5, O_3, CO_2, VOC and the surrounding temperature and the humidity present is also detected and displayed as expected. As given if the concentration of the pollutant comes under good condition then the values will appear in a green figure, if the values are moderate then it will appear in yellow color, if the values are sensitive it will appear in orange color, if the values come under unhealthy conditions then it will appear in red color and if the values fall under hazardous condition it will appear in violet color. For instance, in the above shown picture the prototype was kept in a certain environment. If that environment was healthy all the pollutant values should have been green indicating good (i.e.) healthy environment but as we can observe that only VOC is harmless and the other pollutants suchas O3 is in Hazardous state and PM2.5 concentration is in the sensitive state and CO2 indicates a moderate state clearly explaining that it was not an ideal environment.

VI. RESULT

Once all the sensors were connected to the Arduino board the complete setup was then soldered onto the designed PCB board and then the TFT display is connected to the Arduino pro mini board thereby completing the hardware setup.

Fig 1: Display setup

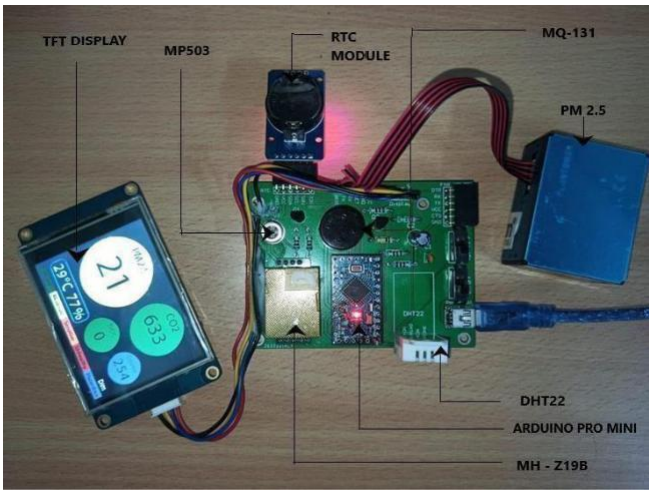


Fig 2:Total hardware setup

CONCLUSION AND FUTURE SCOPE

We have successfully collected data of the various gases with the help of various sensors and have fed the data into the controller and relayed the processed datato the display thereby completing the prototype which has been fine-tuned and has met all the conditions which was previously failed by the pre-existing models. And the prototype will be more efficient and fast result providing than the rest available in the market. The prototype also offers a vast opportunity in terms of upgrades as it can be enhanced for example using an additional Wi-Fi module or any transmitter the data can be made to be accessed by anyone at any time and since it is versatile the device can be equipped with even more sensors if little tweaks are done

providing even more data. And the module can be altered in a way that it can be fixed in vehicles permanently thereby offering even more purpose.

REFERENCES

[1]Indo-pollution: a public health perspective (1983) by J D.Spengler foreshadowed the rising effects of harmful air which might become a crisis in future.

[2]Indoor air pollutants in homes and schools (2001) by R.A.Etzel are a study of how indoor atmosphere iscontaminated and people are ignoring theirenvironment.

[3]Elsevier Paediatrics (2001) provides a study of infants and new born being affected by indoor pollution every year.

[4]Air monitoring, measuring and emissions research by EPA researchers (2001) helps to expand our knowledge about pollutants and current ecosystem.

[5]"IoT based pollution monitoring system with Arduino" by Poonam paul, Gupta Tiwari, Ashutosh Sharma in May 2005 sends two pollutant data to the cloud.