INTELLIGENT RETRIEVAL OF AMBIENT AIR QUALITY

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Abstract: Air quality prediction focuses mainly on industrial areas. Major air pollutants include particulate pollution, carbon monoxide (CO), Sulphur-di-oxide (SO2) and nitrogen oxide (NO2) by WHO Results. In addition to these mentioned gases, PM or Particulate Matter and VOC or Volatile Organic Compounds components also cause serious threats. Long and short-term exposure to air suspended toxicants has a different toxicological impact on humans. Some of the diseases include asthma, bronchitis, some cardiovascular diseases, and long-term chronic diseases such as cancer, lung damage and in extreme cases diseases like pulmonary fibrosis. In this proposed system, an IoT prototype of a large-scale system which uses high-end sensors that measures the various air pollutants in the atmosphere is designed. Gas sensors are used in this prototype to record the concentration of the various pollutants that are encountered in the air on a regular basis. The framework uses stored data to train the model using Resnet(Residual Network)algorithm in the local system. The real time data obtained using the different sensors is tested and the results obtained would be used to predict the possibilities of diseases such as asthma, lung cancer, ventricular hypertrophy etc. and the Air Quality Index (AQI) are calculated. In addition to this, predicted disease can be displayed in LCD and AQI values can be obtained by graphical representation through website. Predicated disease can be conveyed to the people using speaker.

Keywords: Machine Learning (ML), Internet of Things(IoT),carbon Monoxide(CO),Nitrogen Oxide (NO), Ammonia(NH3)

INTRODUCTION

Air pollutants are responsible for meticulous air pollution which hampers the human life.The pollution level in the air is measured using the Air Quality Index or AQI. Air pollution may cause severe problems in the respiratory system of human body, Asthma diseases, Eye irritation, Lung cancer, Heart disease, Acute respiratory infections

According to the World Health Organization (WHO), some of the world most polluted cities are Karachi, Pakistan; New Delhi, India; Beijing, China; Lima, Peru; and Cairo, Egypt. Smart cities can be developed with low carbon usage in a sustainable way. Long-term effects of air pollution can last for years or for an entire lifetime. They can even lead to a person's death.
Worldwide air pollution accounts for:

DISEASE& DEATHS	PERCENTAGE(%)
Lung Cancer	25%
Acute Lower Respiratory Infection	18%
Stroke	24%
Heart Disease	25%
Chronic Obstructive Pulmonary Disease	43%

Ambient air pollution accounts for an estimated 4.2 million deaths per year due to stroke ,heart diseases, lung cancer and chronic respiratory diseases. Around 91% of the world's population lives in places where air quality levels exceed WHO limits. Maternal exposure to ambient air pollution is associated with adverse birth outcomes, such as low birth weight, preterm birth and small gestational age births. Emerging evidence also suggests ambient air pollution may affect diabetes and neurological development in children. Considering the precise death and disability toll from many of the conditions mentioned are not currently quantified in current estimates, with growing evidence, the burden of disease from ambient air pollution is expected to greatly increase.

EXISITING WORK

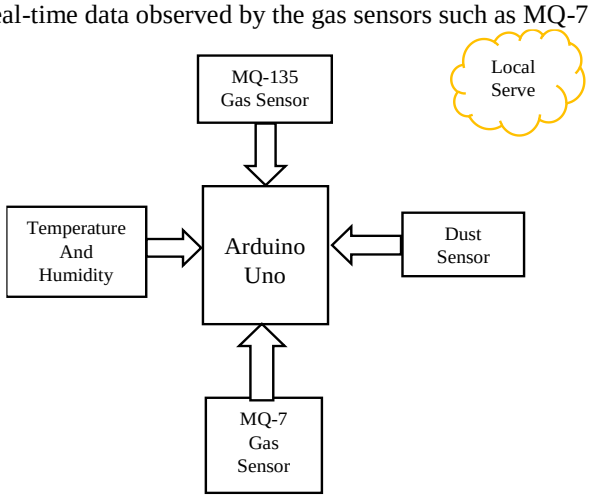
In the past, many methods have been proposed for predicting air quality and their effects on people's health and a number of diseases caused.

1. Air Quality monitoring using raspberry pi[1] - uses a sensing unit, raspberrypi board, Arduino uno and cloud environment to collect data to display on the laptop and phone application
2. A system that monitors air for indoor environment[2].

- A drawback of their system is that long-term pollution patterns are not discovered.[1]

- Data was collected using different gas sensors and sent to the cloud associated with the prototype, but no analysis was done as well as there were no health concerns addressed.[2]

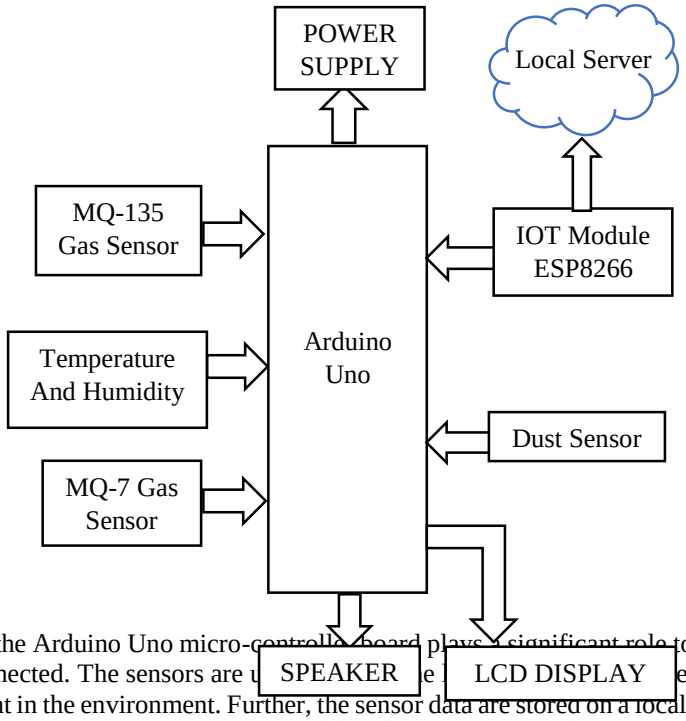
The Air Quality Index is measured and its impact on human health is predicted in industrial areas. The major function is to predict the health issues based on the real-time data observed by the gas sensors such as MQ-7 and MQ135.



PROPOSED WORK

The Air Quality Index is measured and its impact on human health is predicted in industrial areas.The real time data (i.e. measure of pollutants sensed by the sensors in the prototype) can cause more than one disease. The major function is to predict the health issues based on the real-time data observed by the gas sensors such as MQ-7 and MQ135.Preventive measures are suggested to reduce the effects of pollutants.

BLOCK DIAGRAM



Arduino Uno:

In this model, the Arduino Uno micro-controller board plays a significant role to which various sensors like MQ135, MQ7 and dust sensor are connected. The sensors are u e , carbon monoxide, temperature, humidity and dust particles present in the environment. Further, the sensor data are stored on a local server and excavated whenever necessary.

Figure 1 : Arduino Uno

DHT11 Sensor :

The DHT11digital temperature and humidity sensor is a basic, low cost digital temperature and humidity sensor.DHT11 sensor. DHT11 sensor is used to measure the temperature and humidity in a particular region, and it is connected to Pin 7 of the Arduino Uno module.

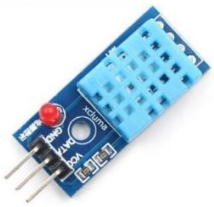


Figure 2 : DHT11 Sensor

Dust Sensor :

In this work, to know the level of dust particles in the air, GP2Y1010AU0F is used. It detects the reflected light from dust particulate in air and it is especially effective in detecting very fine particles such as smoke from cigarette. Additionally, it can distinguish smoke from the house dust. It is mainly used in air purifier, air conditioner and air monitor.

Figure 3 : Dust Sensor- GP2Y1010AU0F

MQ-7 Gas Sensor :

It is a Carbon Monoxide (CO) sensor, which is used in this work. It is suitable for sensing Carbon Monoxide concentrations (PPM) in the air. The MQ-7 sensor can measure CO concentrations ranging from 20 to 2000ppm.It makes detections by method of cycle high and low temperature, and detect CO at low temperature.

Figure 4 : MQ-7 Gas Sensor

MQ-135 Gas Sensor:

MQ-135 for monitoring the air quality, a gas sensor, MQ135 is used. It measures the level of NH3, NOx, alcohol, Benzene, smoke, CO2 in air. The resistance connected to MQ135 is different for various kinds of concentrated gases, so the sensitivity adjustment of components is necessary at time of using. The sensor has wide detecting scope, due to its fast response, high sensitivity, stability and long life. It is mainly utilized in office, buildings and homes for air quality control**.**

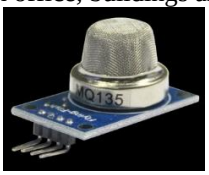


Figure 5 : MQ-135 Gas Sensor

ESP8266 Module :

It is a self contained SOC with integrated TCP/IP protocol stack that can give any microcontroller access to your Wi-Fi network. The ESP8266 is capable of either hosting an application or offloading all Wi-Fi networking functions from another applications processor.

Figure 7 : ESP8266 Module

PREDICTIVE MODELING :

Disease prediction mainly deals with computational methods that enhance the execution of automating the securing of learning from encounter. For training our model we have used an authorized pollution dataset provided by Pollution Control Board.We aim to accurately predict the Air quality and diseases caused by the abnormal concentrations of PM 2.5, PM 10, SO2, NO2 and CO

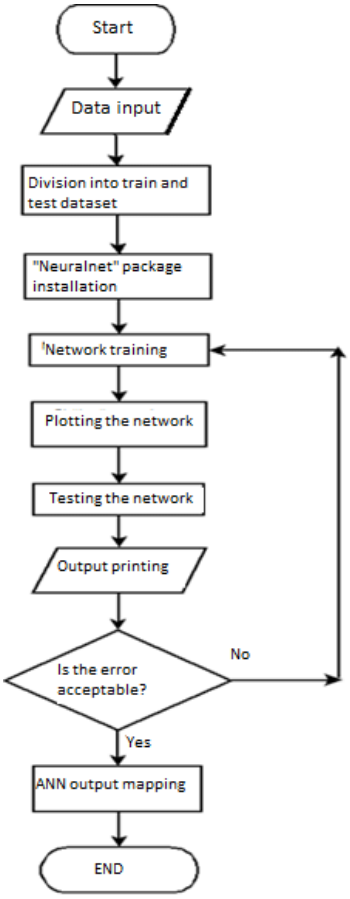
From the aggregated AQI value, AQI is categorized based on the table,

Air Quality Index – Particulate Matter

301 – 500	Hazardous
201 – 300	Very Unhealthy
151 – 200	Unhealthy
101 – 150	Unhealthy for sensitive Groups
51 – 100	Moderate
0 – 50	Healthy(Good)

ALGORITHM(RESIDUAL NETWORK):

Our proposed deep learning model integrates Residual Network (ResNet) with Long ShortTerm Memory (LSTM), extracting spatial-temporal features of sequential value taken from sensors instead for estimating c02 and temperature values of a particular location at a particular time.



METHODOLOGY:

STEP 1 : Readings are obtained constantly with regular time intervals.

STEP 2 : Verified experimentally that any c02 and temperature values obtained remain constant within a radius of 500 meters.

STEP 3 : The proposed ResNet-LSTM was constructed and extended by incorporating meteorological information and health issue classification .

Our deep-learning air pollution estimation system will incorporate sequential readings obtained from 24-hr operating hardware. the readings will be stored in web server.

CONCLUSION

Air quality is a critical issue that straightforwardly influences human wellbeing. Air quality information are gathered remotely from checking bits that are outfitted with a variety of vaporous also, meteorological sensors. This information is investigated and utilized as a part of anticipating fixation estimations of contaminations utilizing savvy machine to machine stage.The stage comprises of deep learning based calculations to construct the estimating models by training from the gathered information. However we can conclude that we can use Residual Network (ResNet) with Long ShortTerm Memory (LSTM) method for disease prediction.

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