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A Study and Analysis of Air Quality Index and Related Health Impact on Public Health

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ABSTRACT

In 21st Century monitoring environmental value is a challenging and complex task but technology has changed now we can easily find the air quality index of any area. In the existing scenario, we will easily get air quality and environmental parameters on the internet. On the internet generalize statistical data is available which shows the quality of air. In a current scenario, the environmental parameter is impacting human health. In day today, the air quality index going worse and it impacts people's health. The people are facing different health issues like hair loss, asthma, lunges, and heart problems. It is important to know the environmental condition in our day-to-day traveling route. Recently air pollution is increased, the increase of harmful air particles is majorly affecting by the air quality inde x. Due to e xposure to air pollutants, affects human health and causing many hazardous diseases like asthma and many more having a major impact on the lungs. The air pollu tion is impacting public health and creating multiple health-related problems, this causes a major medical cost every year derived from the disease. To travel safely with considering the health issues is a major concern in an urban area. In this paper, hig hlighting the impact of the air quality index on the human body, where the Air Quality Index is measured using the concerned information, this information will help to suggest a safe route where the air quality index is low so it can decrease the impact on human health. To find the safest path between source and destination we are using Dijkstra's algorithm. In this paper, we have studied the different research papers and made a comparative study to find the research gaps. The proposed model is a step up in the standard of living in regard to human health. The proposed model is consisting of three main components a) Air quality index b) health impact and c) safest path. In the fi rst model the real-time data is collecting from the government agency or private agency these data will store in the database for analysis. The huge amount of data will handle by evaluation and analysis model in this model the data sanitization process will apply to get the more accurate data from sources it also calculates the different air particles and its ranges this data will transfer to the second model for identifying the health impact. The health impact model will calculate the average air quality inde x, time for traveling, and distance from the source to destination. This information will process to find short-term and long-term health impacts on public health. In the third safest path model, it will show the different nodes from source to destination at a particular distance. each node information will be stored in the form of a weighted graph in the database. Dijkstra's algorithm is applying to find the safest path from source to destination. Dijkstra's algorithm finds the node such that where its air quality value is less the algorithm will identify each node path in the graph such that the average traveling path consists of less air pollution.

KEYWOR DS: Air Quality Inde x, Air Pollution, Health Impact, Dijkstra's Algorithm, Shortest Path, Navigation , Wireless Sensor Network, Graph Theory, Google Map.

1. Introduction

Air pollution is the biggest issue for any country its badly impacting the human mostly for older age people and children. Air pollution is one of the major factors in the world. In the last few decades, the environment condition is drastically changin g and impacting on living things. People are suffering from diseases like headaches, lungs, heart, asthma, etc. because of poisonous components and gases which are present in the air. The gases like carbon dioxide (CO2), Sulfur dioxide (SO2), Nitrogen dioxid e (NO2), PM2.5, PM 10, NH3, Pb, and Ozon(O3) are badly impacting on the human health. Indian National Air Quality Index (INAQI) already defines the parameter and the range of air quality. User can get the details of different type of gases which dissolved in the air. The air quality index is classified in six different categories. These are based on air quality index parameters. These are defined as; good, satisfactory, moderate, poor, very poor, and severe. Table 1 showing standard Air Quality Index Measures in Indian context it showing the different air particles and their limits. The AQI guidelines and standard ranges are provided by Centre Pollution Board, India [1]

Table 1. Air Quality Index Measures, National Air Quality Index (Centre Pollution Control Board-2014) [1].

AQI Category	PM_{10}	$PM_{2.5}$	NO_2	O_3	CO	SO_2	NH_3
Good (0-50)	0-50	0-30	0-40	0-50	0-1.0	0-40	0-200
Satisfactory (51-100)	51-100	31-60	41-80	51-100	1.1-2.0	41-80	201-400
Moderately Polluted (101-200)	101-250	61-90	81-180	101-168	2.1-10	81-380	401-800
Poor (201-300)	251-350	91-120	181-280	169-208	10-17	381-800	801-1200
Very Poor (301-400)	351-430	121-250	281-400	209-748	17-34	801-1600	1200-1800
Severe (>401)	430+	250+	400+	748+	34+	1600+	1800+

Air pollution is a major issue globally sometimes its cause of mortality and different disease. The health-related problem is increased in humans it's also affecting public health worldwide. Worldwide ambient air pollution causes serious health proble m, Lung cancer is the major impacting the public health 29 percent of overall deaths and disease from lung cancer. Around 17% of all deaths and disease from an acute lower respiratory infection and Almost 24 percent of all deaths from stroke. 25% of all deaths and diseases impacting heart disease and 43% of all deaths and diseases from chronic obstructive pulmonary disease. Around 4.2 million deaths worldwide are caused because of bad air pollution, mainly from stroke, lung cancer, heart problems, chronic obstructive pulmonary issues, and respiratory infections in adults and children. Air pollution and its particles are badly impacting human health. The major air particles consist of Particulate Matter (PM), Ozone (O3), Nitrogen Dioxide (NO2), and Sulphur Dioxide (SO2). In that Particular Matter is a major air particle when we inhale these particles it goes into the lung and going to the bloodstream creating cardiovascular, lung cancer, and respiratory impacts these issues are observed by WHO's International Agency for Research on Cancer (IARC).[2]

Air pollution creates multiple health impacts is a serious problem it might be short and long-term. The major air pollution is impacting children and adults. short- or long -term air pollution exposure can cause serious health issues in children and adult-like reducing lung function, respiratory in fection, headache asthma, and hair losses, etc. Sometimes it will more

dangerous for old age and pregnant women. Air pollution is a major problem for pregnant women short term and long-term exposure will impact pregnant women it creates birth-related problem like premature delivery, low birth weight, pre-term birth. The air pollution is also impacting the old age people may they cause asthma, lungs, and heart-related problems sometimes it causes deaths if they have pre-existing diseases.

Considering the above fact, it is important to provide information about the air quality to the user. the air quality statistic is available on the internet and it showing only the air quality of the area, and even it shows the alert if the air quality is poor. This information is not transferred or available to individual people who are living or traveling in the polluted area. Considering this we are focusing to design a system for the user where the user should know the air quality of his/her area or the area where the people are traveling and also highlighting different health impact on their health, we also provide the air quality index for user those who are traveling from one location to another location we are calculating average air quality index of that traveling route and suggesting users choose some alternate safe route where air quality average air quality is good indirectly the system is trying to reduce the health impact of the user if he travels safe path suggested by the system. In this research we are focusing on the three main modules in the first module is the Air Quality Index where we can collect the air quality of the particular route and identify the major parameter in the air or average air quality of the route, In the second module, we are focusing the health impact on the user if he traveling in the polluted route we are identifying the air pollution components or gases and also classifying the which component or gases can impact on which part of the body and what disease can cause. In the third module, we are trying to use Navigation Maps to identify the safest path for travel to reduce the health impact. We are using the Dijkstra Algorithm to find the safest path for the user

2. Related Work

Nihal Kularatna and B. H. Sudantha proposed designs to calculate the air quality index it measures the concentration of different gases in the air like CO, NO2, SO2, and O3. It was implemented using ADuC812 as an analogy device along with 3 different gas sensors to find the gases in the air. The gas sensor will detect the gas molecules and generate the electrical signals which will send to the system for identifying the gas levels. Basically, it is a cost-effective system that will identify the air quality parameter of the different gases [3].

Mihaela Oprea et al the author has proposed a smart system for air pollution monitoring and also analyze the air quality index of 2 different cities in the selected areas near the school and the main objective of this paper to provide an alert about the air quality to protect the children health. The statistics and artificial intelligence technology are used to identify air quality and health impact on children. It was explaining the particulate matters PM2.5 and PM10 are more impacting on the health. There are calculating the concentrate of PM value and comparing it with the specified range which is defined by the European Union Emission Standard. The standard values of PM are PM 2.5-25 mg/ m3 and PM10-50 mg/ m3. The purpose of developing this system is to send the alert to parents about the air quality of the school area where their children are studying and living. The ROKIDAIR project is developing a smart system for identifying PM values in their two cities also generating an alert if the PM values exceeding the standard values. The ROKIDAIR system consists of different modules like web-based Geo-Information System module, Decision based Support System (DSS), ROKIDAIR Database, and Web Services with Database Server to monitor the real-time air quality. Eight databases are used in the system where two databases are used to monitor real-time online data of PM2.5 values. The PM monitor system i.e. microsystem is deployed in school or nearby school to monitor temperature, humidity, atmospheric pressure, and concentration level of PM2.5 through data acquisition unit and communication module all these data is storing into their database server for analysis. The alert module will provide the message for sensitive children with the health problem, these alert messages are sent to parents and teachers, and medical personnel if the air quality is poor [5]

HannanehHojaiji et al. [6] proposed a design for an air quality monitoring sensor system through a mobile application for real-time data collection the Alpansense OPC – N2 air quality monitoring sensor was integrated with a wireless system which can be sent the collected data of particulate matter through mobile phone these data can be used for analysis different parameter in the air. The Alpansense OPC-N2 will able to collect accurate real-time data of temperature and humidity and different particle count. Today's need for a personal air quality monitoring system for healthcare applications and individuals. These analyses of air quality data will help the researcher and individual about the pollution in their area this information will mostly help thos e who are having repository illnesses and some other health issues if this information is available on the user's phone then t he user can take a precautionary step before going out [7]

Md. Mohiuddin Ahmed et al [9] proposed a system intelligent real-time air pollution observing method with alert using IoT. It allows the end-users to observe the information on the air pollution of the selected area and send the alert message if the air quality index is not good it also explains the short-term and long-term health impact if they are liv ing in a polluted area. Mostly the children and older people's health is affecting no diseases like heart, lungs, and asthma, the author took Dhaka, Bangladesh city air quality index as a case study. In the proposed system developed IoT based microcontroller system with 3 types of MQ Sensor for finding air quality if the quality of air e xceeds the normal range, it will send the alert message through an android device. The hardware devices are used for this system are Microcontroller Board, MQ-2 Sensor for detecting H2, LPG, CH4, CO, Alcohol, Smoke or Propane, MQ-3 alcohol gas sensor for detecting Alcohol, Benzine, He xane and CO. MQ-7 gas sensor for CO sensor, used for collecting CO content in the air, Buzzer is used for generating the alert if air pollution is high. The controller is connected to the Wi-Fi. User will connect their device through Wi-Fi by using SSH Protocol Once user device is connected it run the python code of micro framework called flask and also imported different libraries of python for data processing the flask and mraa library functions are used for collecting the data from sensor these data are converted with the numerical value of the air particle these value are stored in the JSON object the script run over the microcontroller for sending the HTTP request to ro uter address so data can be sent through JSON object for further application. [9]

Changhai Peng, Kun Qian, design an application for a Vo latile Organic Compound (VOC) monitoring system using a wireless sensor network for indoor environment the objective is to implement an optimized power ZigBee sensor structure and internode-based framework is used in the current data collection and identifies the level air pollution from VOCs network. In the designed network node consist of different sensors and the communication network system is to communicate to the centralized system with a remote system. A microcontroller and network-based system used to efficiently process communication data with minimum power utilization. [10]

Yang Feng el al [2] proposed a system and technique for monitoring the air quality index using IoT in the e xisting system of air quality index facing the issues like huge power utilization, less life, short area, and require more maintenance. The IoT bas ed technology and Sigfox low power wide area network (LPWAN) technology can sort out the existing issues. Th e system consists of a hardware-based component like the MQ-135 system. Sigfox based air monitoring communication system used to monitor the air particles in the air. The system implements different nodes for monitoring indoor and outdoor air quality. IoT based system will handle the incoming nodes data using Wi-Fi or GSM, which require low power to specified communication distance so it is easy to maintain and keep the system stable. These features make this API a to control the system that uses LPWAN tech nology useful for observing the air pollution in a bigger range in distributed environmental condition. [11]

Lili Chen et al [3] proposed a model for a personalized air quality health advisory system using big data analytic to e xplore the issues of air quality index monitoring sites. The air pollution mixtu re affects public health and the lack of customized air quality health guidance is creating a serious health-related problem on public health. It mainly focuses on dissolved air particles in the air these concentrations of air pollution data will be observed using big data analytics, In the second issue is on the health effect s of

air pollution on how air pollution is impacting public health is e xp lore, and the third designed personalized advisory for th e user. A broad study shows the health effect of air pollution which causes different diseases such as stroke, heart problems, respiratory, cancer, and lungs problem. Air particles like SO2, O3, NO2, PM are a major impact on the human body. These multipollutant gases are damaging human organs. In this system, a big data analytic based model is developed for creating an individual AQI monitoring system. This system based on an air quality concentration parameter used to calculate health -related issues. One of the air quality modules will take the existing air quality data for processing in another module they calculate air quality estimates and in the last module, they analyze the different air particle's concentrate values along with the patterns to understa nd the different health issues.[12]

Wang Zhenquan et al [2] Proposed a model for air pollution and its side effects on human health. The basically data collected from hospital and meteorology for analysis of health impact. The analysis has been done with different genders and ages. Generalized Additive Model (GAM) is used for the nonparametric process for air quality variables with nonlinear confounding effects of weather variables and other air quality parameters. The data is collected from different public hospitals these data consist of respiratory disease and some other diseases and it also included personal information of the patients like age, ge nder. It also consists of different diseases of patients like respiratory infection, pneumonia, colds, influenza, nasopharyngitis, etc. The air quality index, and air quality status information collected from different weather inde xes and environmental protection agenc y including air pressure, air humidity, wind speed, temperature, and rainfall. These data are available from the meteorology department in different formats. The data is collecting from different locations and stored in the database. In another module stored data will be processes and statistical analysis has been done through GAM and finally, it identifies the impact of the different statistics on health. [13]

In the related work, most of the papers are used as a different technique, methods, and air quality index evaluation in Table 2 summarize the key factors of related work which consist of research objective, approach, contribution, and limitation.

Table 2: Key factors of Related work

References	Objective	Approach	Contribution	Issues / Limitation
Nihal Kularatna et al (2008) [3]	Air Pollution Monitoring System with low-cost requirement	Air Pollution Monitoring using IEEE 1451 Std	• Measures concentration of CO, NO, SO2 gases • STIM was implemented with ADuC812 microcontroller	• Preventive measure is not mentioned • Not suitable for wide area
Young Jin Jung, Yang Koo Lee et al (2008) [4]	Monitoring Air Pollution using Geo Sensor	Air pollution monitor using data acquisition policy	• Air pollution data will be collected from a different module • Data acquisition policy is used for analysis	• Data is collecting from WSN node suitable for a specific area •
Mihaela Oprea et al (2015) [5]	Monitor Air quality in the selected area and generate alert	PM Air Monitoring system	• Generate Early warning systemto prevent health issues • Analysis was done through ROKIDAIR system	• A generalized air pollution data is monitored • Only PM values are considered for analysis

Hannaneh Hojaiji et al (2017) [6]	Wireless and secure AQI monitoring system	Real-time AQI monitoring system	• Implemented Hardware-based wireless system using OPC-N2 air pollution monitoring module	• Suitable for indoor air monitoring • Preventative measure is not mentioned
Norsuzila Ya'acob1 et al (2016) [7]	To monitoring air pollution through GIS	Air pollution Analysis using GIS data MDOE	• ArcGIS software is used to analyze the air pollution • Data processing by using IDW technique	• Generalized AQI data is used for analysis • Health impact is not defined
S. Soussilane et al (2017) [8]	Monitor air quality while Saving energy	Using of HVAC system can maintain air quality smartly	• Determine the PM2.5 size using fixed angle calculation • Cumulant method and Fourier transform used to identify the PM values	• Pre-existing data is used for analyzing the PM values • Generalised preventive method is not sufficient to reduce the health impact
Nicola da Schio et al (2018) [16]	Smart system to control the air pollution	Control the air pollution generated by road traffic using CEP and Petri Net Technology	• CEP technology is used to analyse the correlation between air pollution and road traffic • Petri Net provides the visual and mathematical model of the behaviour of the system	• Analysis done on only road traffic • Health impact and preventive measure not defined
Matthew Cole et al (2020) [18]	Analyses relation of Air Pollution and Covid-19	Evaluation Covid-19 Cases and AQI	• Air pollution data analyzed with the region of the covid-19 • Data evaluated with Hospitalized patent record with air quality index in the particular region	• Analysis have been done through the patient record with air quality index • Preventive measures not specified
Kyuhyun Lee et al (2019) [19]	Poor air quality is impacting the bicyclist's health	Bicycling on road can impact bicyclist's health because of poor air quality	• Air quality index data collected from Strava • Strava data examine with air pollution exposure during the cycling	• Study is suitable for specific area or small area • Health impact is not specified
Venkata Dodla et al (2017) [21]	To analyze the air quality index near thermal power plant	How the thermal power plant is impacting human health because of poor air quality	• ARW model is used to calculate trajectory and dispersion with different radius	• Identified the air particles in the air near thermal power plant but not highlighted the health impact of poor air quality

Dong-Her Shih et al [2] proposed an Azure cloud-based computing module for identifying multi-pollutant air quality detection and early warning system. The air quality index data is collected from government and private agencies and stored this data into the databases. Basically, the data which are stored in the databases consist of air particles like SO2, NO2, PM values. Also, analysis has been shown for health impact on the human body if these gases and particles are exceeding their limits. In another model, the big data concept is used for the analysis of multi-pollutant air particles and determining the level of air pollution. The big data framework is used for generating the reports. In the next part blockchain and the perpetual system are used to perform an evaluation of air quality. The complete system is divided into three models one for data collection the real-time data will collect from different sources and stored in databases for evaluation. Data processing module and training module use Spark Big Data framework for evaluation the gathered AQI information is processed as data sanitization, and extraction through big data predicting method. This method collects different AQI values and processes these data for the prediction of AQI in the real-time scenario. A Prediction System will generate the alert with the help of the Microsoft Azure Cloud Platform.[14]

Bin Zou et al [5] proposed a new method to identify the air quality index of the traveling route. Finding a minimum polluted path is essential to protect public health or can avoid the major health impact on humans. A new technique is used for mapping of air pollution particles concentration, also calculated risk weight graph of roadside exposure to air pollution, A Dijkstra algorithm is used for updating and finding the new route where the air pollution is less or less exposure of air pollution, in this study proposes a new methodology is healthier route planning (HRP). In this, it calculates the personalized healthier route to minimize polluted air exposure during the travel time. HRP based model is calculating no of the nearest node points that have less air pollution it will calculate all the nodes between source to the destination of traveling route. A mapping module can calculate accurate AQI values using different methodology Mapping require correct and real-time AQI data the mapping module can collect these data from different agencies and collected data will process by the LUR model in a real-time scenario. A safe route search module uses the LUR model data for finding the safe route for users. A safe route search module is used as a dynamic Dijkstra algorithm for finding the real-time safe route where AQI is low [15].

Gregorio Diaz et al [5] proposed an efficient transport model based on complex processing methodology. In this approach, it is considered and correlated the different level of air pollution and traffic on the road are used for analysis. The air quality index is compared with standard air quality index parameters which are recognized by the international community. A CEP method is used to observers the event these events are classified into a two-part simple event and complex event. A CEP basically used the software to compare and match the event and pattern from a distributed event stream and generate the alert if patterns of events are not matching. In another module, these events are also processed by EP Languages. CEP is executed in 3 parts first event capture—In this part generated events are received and analyzed by the CEP module, second analysis—In this part analysis will be considered on the event structure that defined in the CEP method, and in the last part it will process the data which consist of events in order to identify critical situations in the current time and finally critical even will detect notify to the system[17].

Xinlin Ma et al [3] studied the neighborhood air pollution and its health impacts. A study carried out on the real-time AQI on different participants in polluted is in Beijing, China. The polluted air exposure can cause different health-related problems it adversely affecting human health. The air pollution factors are creating major health issues and impacting public health. The module uses AQI data collected from different sources like GPS-based system and mobile sensors-based survey in the city. Also consider data from GPS tracking System, air pollutant sensors, and activity-travel dataset, these data collected on personal activity and air exposures at a particular time. The air pollution data is collected from 35 different AQI monitoring stations in the city along with the survey day. These collected data are analyzed through NEAP. NEAP module consists of two parts In the first part, it examined different patterns of AQI, actual participants, and their exposures. The second part, it observer the different groups related to their activity during the study. The test module is used to examine air pollution exposure patterns and analyze their differences. A regression method is used to explore the correlation between high air exposure and low air exposure in the

residential area of participants.[20].

Krishna Chaitanya Atmakuri and Y Ven kata Raghava Rao designed model air quality prediction. an optimized Bayesian network-based probabilistic inference model is designed and implemented on the air quality data. In the proposed model, the data is init ially gathered from the ICAO records of Safdarjung weather station and pre-processed. An IoT enabled Air pollution monitoring system includes a DSM501A Dust sensor which detects PM2.5, PM 1.0, MQ series sensor interfaced to a Node MCU equipped with ESP32 W LAN adaptor to send the sensor reading to the cloud. In the proposed model, the data normalization is applied to input data and the data transformation method is applied to the normalized data to improve the data distribution for the joint probability estimation of the Bayesian networks. The Bayesian networks consist of two phases parameter estimation phase and statistical learning phase. In the first phase, numerical or continuous attributes are estimated using the numerical parametric estimation and in the second phase nominal or categorical attributes are estimated using the discrete parameter estimation measures. [22]

3. Comparative Study on Related Work

1.1. Comparative Study on Technology and Implementation on Related Work

The comparative study is summarized in Table 3 to understand the different methods that are used for implementation for identifying the air quality index and health impact. The objective of this study is to understand the different components that are used to identify the air quality index and related health issues. Most of the papers are used the wireless sensor network and microcontroller bases devices to identify the air quality index in few cases the air quality index data set used from meteorological deplanement or weather forecasting department as input for evaluation. Some of them are used big data analytics and machine learning for predicting the air quality index.

Table 3: Comparati ve Study on Technology & Implementation

References	Network Model	Methodology	Data Processing Model	Air Pollutants	Sensor Type	Health Impact Identified	Navigation System
Nihal Kularatna et al (2008)	STIM	IEEE 1451.2 Interface	ADuC812/ NCAP	NO2, CO, SO2, O3	MMOS	Not Identified	NA
Young Jin Jung, Yang Koo Lee et al (2008)	Geosensor Network	Sensor Network Control System	Context model and flexible data acquisition	Dust	Not Used	Not Identified	NA
Mihaela Oprea et al (2015)	WSN	Web based ROKIDAIR	Control Module	PM10, PM2.5	Not Used	Partially Calculated	GSM/GPRS
Hannaneh Hojaiji et al(2017)	WSN & XBEE	ARM mBed controller	Serial Peripheral Interface	Temperature, Humidity, PM	Alphasense OPC-N2 /DHT22	Not Identified	NA
Norsuzila Ya'acob1 et al(2016)	Web based API	GIS and IDW	ArcGIS	Not Specified	NA	Not Identified	NA
S. Soussilane	Web based API	Cumulant method/ Fourier	HVAC System	PM10, PM2.5	HVAC	Not Identified	NA

et al (2017)		transform					
Md Mohiuddin Ahmed et al (2015)	IoT	Micro Framework Flask	Python Library	H2, LPG, CH4, CO, Smoke	MQ2, MQ3, MQ7	Identified to through PPM level	NA
Changhai Peng et al (2015)	WSN Ad Hoc	ATmega16 microcontroller	Atmel RF230 ZigBee Module	VOC, Temp, and Humidity	PID-AH Sensor	Not Identified	NA
Yang Feng et al (2018)	Low Power Wide Area Network	MQ-135, Sipy and Sigfox	Atom in python & Sigfox cloud	PM10, PM2.5	MQ-135	Not Identified	NA
Lili Chen et al (2017)	Web based	Big Data Analytics	Cognitive Computing Algorithm	SO2, NO2, O3, PM10, PM2.5	Not Used	Health Advisory Model	NA

There is a number of different approaches are used like network architecture, network protocol, Sensor, and data processing modules that are used to calculate AQI. The comparative studies show that different techniques or modules are used to identify AQI and health impact on the human body. Most of the papers are identify AQI and also identifies different health issues. And few papers designed the methods for AQI prediction using machine level and cloud -based system.

3.2 Study of Air Quality Index and its Associated Health Impacts

Air pollution is a major problem for health, sometimes healthy people also e xperience health impacts from air pollution. Air pollution can cause respiratory irritation, asthma, breathing problem during outdoor work. Air polluted related health risks is depending on the current health problem and impact is also varies from person to person. The different health problem may cau se by different air particles present in the air also consider the factor of pollutant type, the time duration of e xposure, and air particles concentration. It is essential to measure the air quality parameter to identify the level of air pollution and every country has its own standard measuring parameters and guidelines of air quality index. A country like India having a Central Pollution Control Board (CPCB), a government organization. CPCB provides the air quality index guideline and also monitors the air quality inde x this information and technical services provided to the different departments Under the CPCB the National Air Monitoring Program (NAMP) has been established for monitoring and analysis of current air quality index in different regions in India. t he objective of NAMP is to calculate and observed the air quality index in different locations in India. NAMP is set the guideli ne for industries and another source for regulating and controlling air pollution to maintain the air quality standard. The major air particles in the air like Nitrogen Dioxide (NO2), OZON(O3), Particulate Matter (PM), Carbon Monoxide (CO), and Sulphur Dioxide (SO2) are being monitored regularly. The NAMP classifies the different Air Quality Index categories, like Go od, Satisfactory, Moderately polluted, Poor, Ve ry Poor, and Severe. Each of these categories having some standard values which are based on its concentration values of air pollutants and it also helps to measures the impact if the values e xceed the limits. The Health impact on AQI is summarized in Fig 1. The statistic range of air pollution and its impacts on health is summarized below its easy to understand the health impact of air pollution on the human body if exceeding the range.

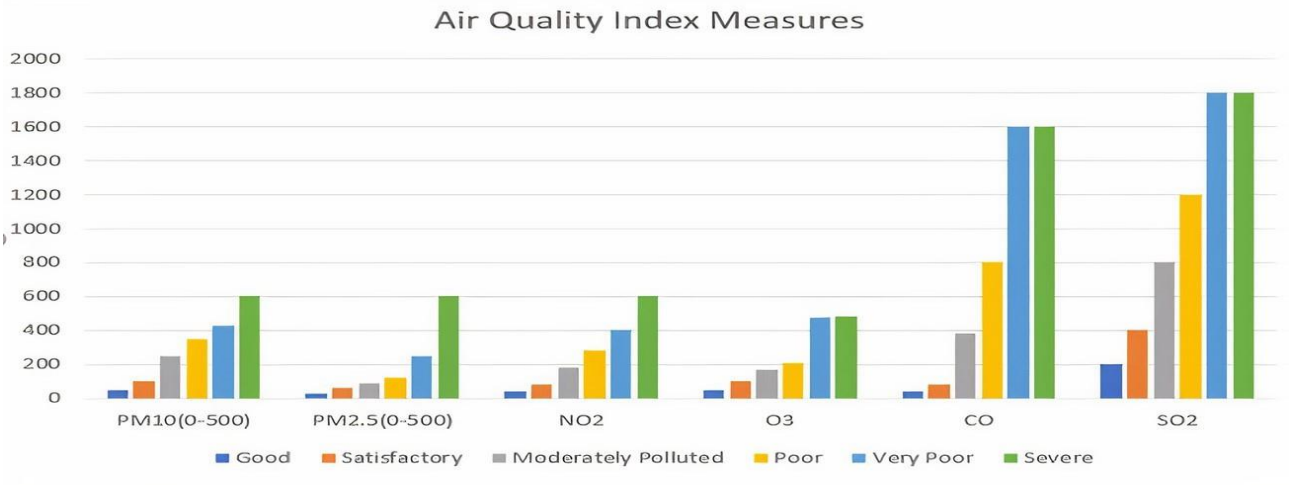

Fig 1 Air Quality Index Measures Source: National Air Quality Index, India

Considering the major air pollution partic les like Nitrogen Dioxide (NO2), Ozon (O3), Sulphur Dioxide (SO2), and Particulate Matter (PM) are causing serious health issues. Long-term e xposure to some air particles can increase the risk of heart and lungs related problems. it's important to e xplo re and understand these air pollution threats. Fig 2. Associate Health Impact of Air pollution is summarized it shows how air pollution is impacting human health. The above ranges are specified in the National Air Quality Index by Central Pollution Control Board, the board is maintaining the air quality index and provides air quality guidelines.

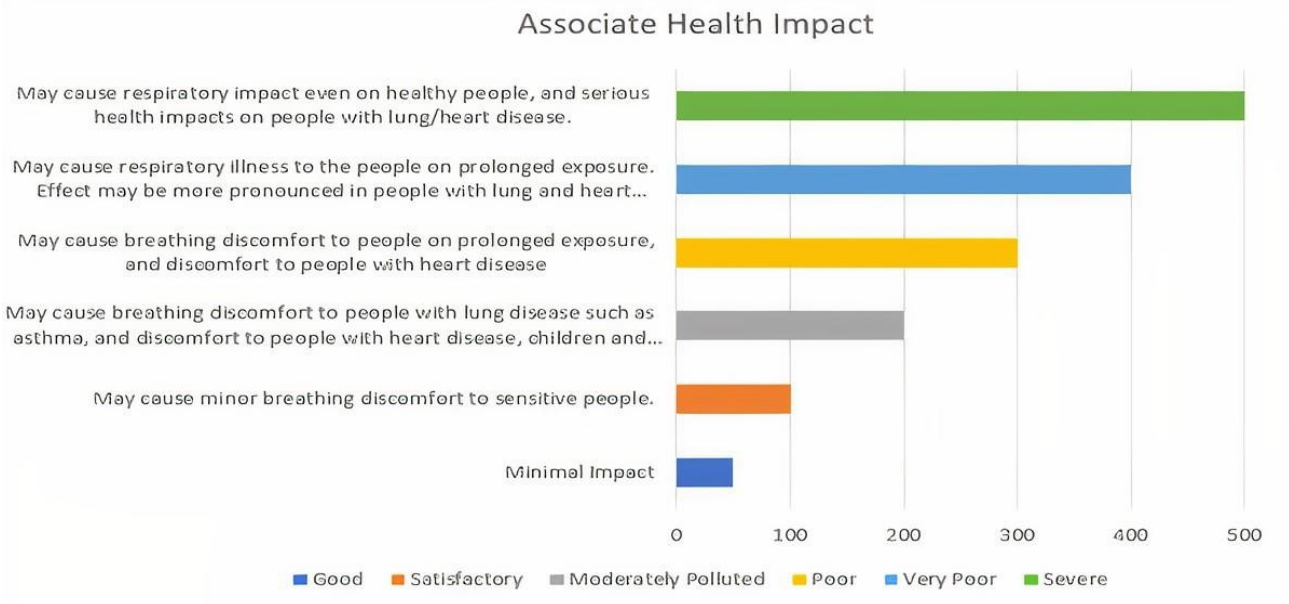

Fig 2 AQI Range and Health Impact

3.3 Analysis of Short-term and Long-term health effect of Air Pollution

Air pollution is adversely impacting public health. The impact may be short-term and long-term. The health impact including heart and lungs related problems, respiratory and cardiovascular-related issues are identified. To better understand the health-related issues are classified into two parts short term and long-term effects in the table. Table 4 summarized air pollution's short-term effect and long-term effect on human health. The different gases are impacting the different parts of the body, which will create a serious cause for the human body.

Table 4. Analysis of Short-Term Effect and Long-Term Effect of Air pollution [23]

Name of Air Particles	Short Term Effect	Long Term Effect
Nitrogen Dioxide	Inflammation of airways at high levels	Decrease lung functions, increased risk to respiratory conditions and allergies.
Carbon Monoxide	Fatigue, Headache, Impaired Vision	Coma, Brain Damage, Death
Formaldehyde (HCHO)	Sneezing, Skin irritation, a sore throat, teary eyes, blocked sinuses.	Eyes irritation, corrosion of the cornea, and possibly blindness.
Sulphur Dioxide (SO2)	Impact on chest, throat and nose irritation, coughing and breathing issues	Long term coughing, wheezing and shortness of breath.
Carbon Dioxide (CO2)	Drowsiness, Dizziness, Dimed Sight, Reduced Hearing, Shortness of Breath, Confusion.	Blood pressure and faster heart rate, sometime Coma or Death
Tabaco Smoke	Asthma attacks In infants and children, eye, ear and respiratory in fection and sudden infant death syndrome (SIDS).	Coronary heart disease, stroke, Cardiovascular Diseases and lung cancer
Wood Smoke	Eye irritation, breathing problem, irritation in throat, asthma and coughing asthma.	Abnormal lung function, cardiovascular impact.

4. **Research Gap**

In the literature study, it is identified some research gaps in the area of air quality index that impacts public health, the basic objective of this study is to identify the methods or model on air pollution and how this air pollution is impacting public health. Existing systems are used different approaches to identify the air quality index some of them even study further on health impact that how the air quality index is inversely affecting the public health. Few types of research are e xp lorer the air qu ality prediction technique using machine learning and cloud-based model. The study of the existing system on air quality index is generalized which is not sufficient to identify the actual health impact on humans. Most of the searches are done on the air q uality index parameter and how these parameters are impacting human health. The study shows the generalize the statistics and results in a ir quality and health impact which is not sufficient to tackle air pollution and health -related issues. The data which they are collected from microcontroller-based wireless sensor devices or they collected from weather forecasting department these data is used to study the air quality of a particular region or area. If the quality of air is not good in a particular regio n or area then what are the preventive measures need to take is not clear to specified or mentioned some of the research are done on the air quality inde x and some of the paper has studied on health impact. But in the current scenario, it is a need for a n ew approach that can broadly cover air quality index and health impact on human health with preventive measures. So, it is essential for the user about the real-time air quality and what are the short-term and long-term health issues that will cause if he/she will travel in polluted air.

In the 21st century, most people are traveling every day for daily work from one location to another location without knowing the air quality of their travel route. Most of the people are traveling in an urban area for their daily work and the traveling distance

and time are also more because of the geographical location. Traveling through the polluted area is dangerous for health and it is seriously impacting public health and it will create short-term and long-term health issues. Mostly children and old age people or the people are having some pre-existing diegeses are impacting more. Considering this fact, it is the current need of the new system where the people get the air quality index information of daily traveling ro ute on their mobile phone before traveling and also suggests the safest path for safe traveling where the air quality is good or the safest path which can reduce the health impact or health risk.

5. Conclusion and Future Work

Air Pollution is the biggest problem for living things and its really bad impact on human health. The air quality in the urban area is worst and most of the people are traveling regularly for their work without knowing the quality of air which are adversely affecting their health during the personal traveling time. The existing system is not sufficient to tackle health-related issues caused by air pollution. Most of the research done on identifying the air quality index and predictive analysis on the air quality index is not sufficient to solve health-related issues. Mostly software and hardware approaches are used to identify the accurate air quality index and analyze the data patterns of air quality index which help us to understand the level of air pollution in the air. S ome of the existing systems are there to calculate the real-time data of air quality index that somehow helping us to get information about the air quality index but the system is not supported to identify the health impacts on the health. People are suffering from different diseases like asthma, hypertension, blood pressure, heart, and lungs related problems also the number of people is dyin g because of poor air quality. It is essential to identify an accurate air quality index and related health impact if the air q uality is poor. The existing systems are helping us to identify the air quality index but not sufficient to improve the health issues b ecause most of the time analysis is done on generalizing air quality parameters but there are different air particles are mixing in the air and each particle can impact on different parts of the body. It is important to understand which air particles can impact which part of the body, so it is easy for us to take preventive measures or take some necessary action before going out .

A new approach is needed to overcome air pollution-related health issues and reduce air pollution e xposure by identifying the safest route to travel. It is essential to develop a customized model that helps the individual user to understand air qualit y before traveling or moving out. It will minimize or avoid health issues impacting air pollution during the personal traveling time. To consider this major issue we will propose a new system to provide the safest path for the public during their journey depe nding on AQI value. It is possible to calculate the optimum path based on user-defined constraints. The new system will return the safest path considering user inputs based on Air Quality Index value alongside with values of harmful air particles causing a ir pollution. To identify the path which consists of minimum air pollution from source to destination route. Dijkstra's Algorithm can use for finding the safest path. Dijkstra's algorithm can use to implement weather forecasting data along with environment al parameter data that can be used at each point of the traveling route and calculate the average air quality of the given route. The calc ulated safest path will give some idea about the quality of air of the planned traveling route so the user can avoid t raveling if the quality of air is not good. This air quality information will help the people who want to travel specified routes and also identify t he impacts on health if they travel in the polluted route where air quality is poor. The proposed system wi ll help the old-age people, heart patients, and pregnant women to know the environmental condition of their route so they can avoid traveling or they can find some other route where the minimum pollution in the alternate route to reduce the impact on their health.

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