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# Pollution and Climate Monitoring System

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**ABSTRACT:** In recent years pollution and global warming have increased rapidly. Air and sound pollution is more in urban areas as compared to rural areas due to denser vehicular traffic and rapid industrialization. Air pollution causes long term health effects like lung cancer and heart diseases, and also it causes short term health issues such as headaches, eye infections and throat infection. Air pollution increases the temperature of the Earth's atmosphere which results in global warming. Hence it is necessary to monitor the various climate and pollution parameters such as temperature, humidity, atmospheric pressure, sound, toxic content of hazardous gases, and light intensity. As we need to know the location of the data, we also normally measure the latitude and longitude of the place. Humans can be adversely affected by exposure to air pollutants in ambient air. Hence, health-based standards and objectives for some pollutants in the air are set by each country detection and measurement of contents of the atmosphere are becoming increasingly important. Careful planning of measurements is essential. One of the major factors that influence the representativeness of data collected is the location of monitoring stations. In this paper, a pollution and climate monitoring system is developed which can measure the above parameters at regular intervals using appropriate sensors and uploads them on to the webpage using Internet of Things (IoT) technology. The webpage is developed using HTML, CSS and JavaScript. computer is the central component used for data collection from the sensors and uploading parameters on to the webpage. Python language is used development of the software code. The uploaded pollution and climate parameters of a particular place can be viewed by logging on to the webpage from anywhere in the world.

**KEYWORDS:** Pollution monitoring, Climate monitoring, Global warming, Micro-controller.

## I. INTRODUCTION

Air pollution increases the temperature of the Earth's atmosphere which results in global warming. Global warming increases the water level in sea due to thermal expansion, melting of glaciers and ice sheets. Atmospheric changes are a raising concern across the globe. These changes include global warming, air pollution, pressure and humidity changes. It is necessary to keep an eye on the equilibrium of the atmosphere. The proposed pollution and climate monitoring system monitors the above parameters at regular intervals and provides dynamic data sheet on the webpage which can be accessed from any part of the world. This data sheet can be considered as a reference by the government and other organizations that bother to reduce atmospheric changes. This system has developed in the approach to promote a decent quality of life to people, a clean and sustainable environment. In author has stated that focus is on sustainable and inclusive development with the help of the IT and electronics development. The emerging concept of IoT plays a vital role to help in attaining this mission. Policy decisions can be made based on real data. And more importantly, their impact can be monitored almost in real time. The IoT concept was put forth in 1999 by a member of the Radio Frequency Identification (RFID) development community. The increasing growth of the mobile devices and development in the area of communication, cloud computing, embedded systems has made the IoT concept more relevant. In it is stated that IoT is a converging technology to create the smart environment and the integrated ecosystem. Analysts predict that new IoT products and services will grow exponentially in next few years. IoT will boost the economic growth while improving our citizen's life.

The general architecture of the IoT is complex to define because it involves the variety of devices and different link layer technologies. The system helps in providing the open access to the particular set of data. The citizens as well as the administrative authority are going to get the idea about the city environment at any remote place with the help of internet. The use of the smart and compact mini-computer kind of device that is very useful in giving good internet connectivity and the use of it is also going to boost the speed of operation. This framework mainly envelopes the urban environmental information from the sensory level and also involves the networking, data management and integrates the real time data. In authors state that the system can help in the great transformation in the city management and improve the life of citizens. The idea will also help in creating the public awareness among the people about the climate



changes in the city. The formatter will need to create these components, incorporating the applicable criteria that follow.

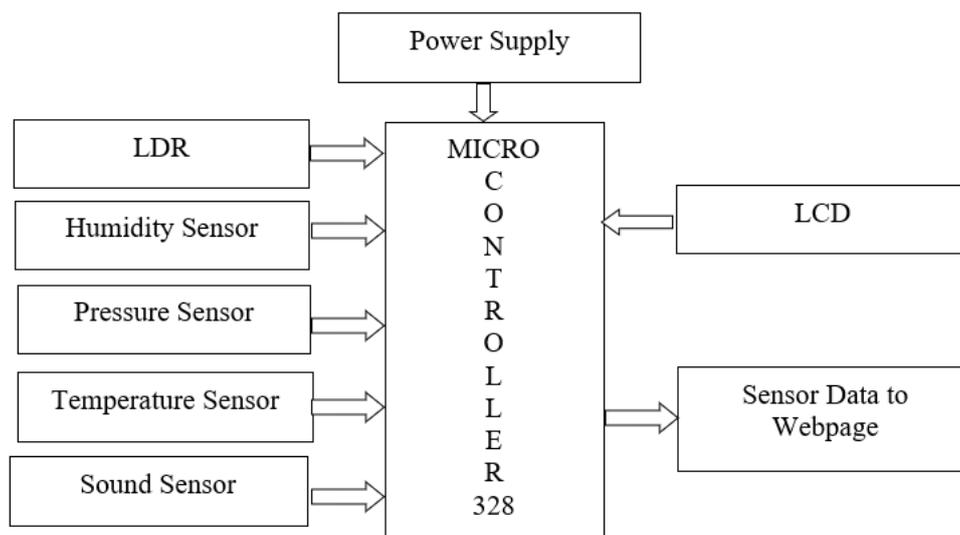
## II. RELATED WORK

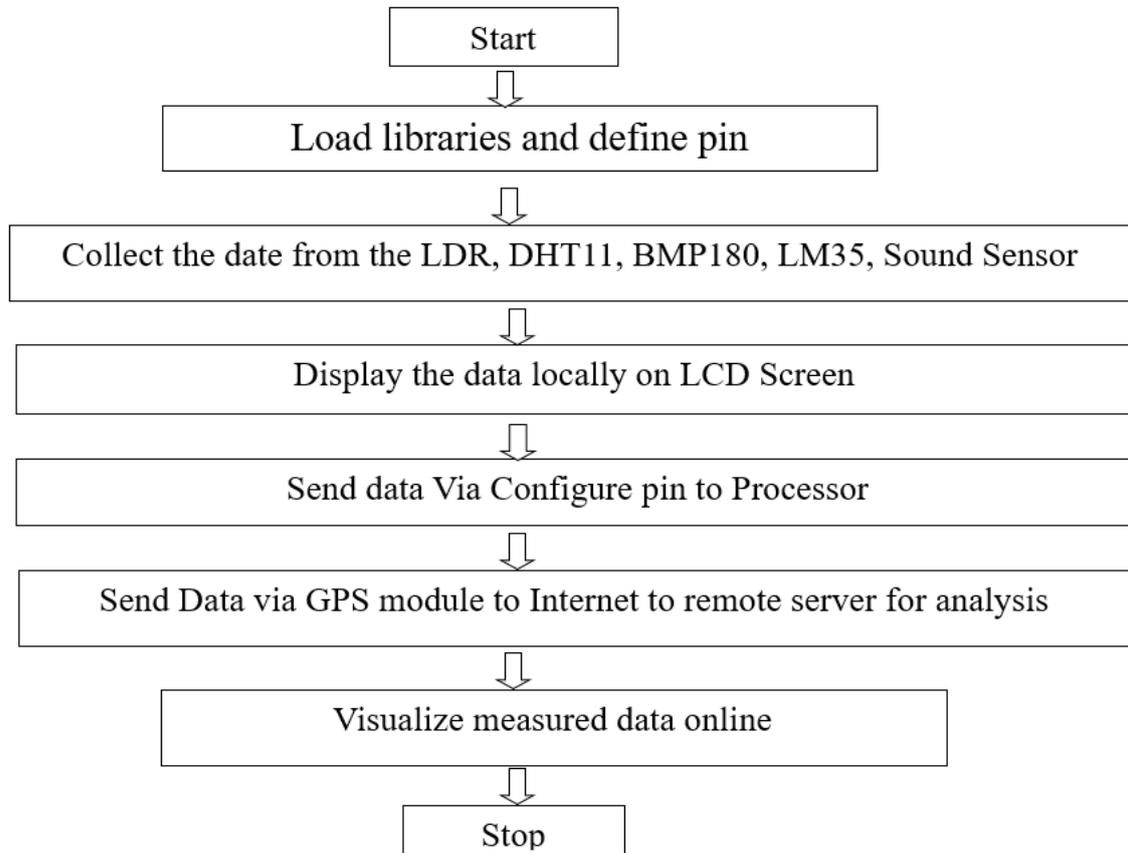
**Air quality using ZigBee** - This paper discusses a monitoring system that gives information about environmental conditions and briefly touches the technological advancements in monitoring the environment and bringing out the new scope in monitoring the current environmental problems. The system is developed using Arduino, Raspberry Pi 3, and Zigbee which proves to be cost-ineffective and having low power consumption. The sensors will gather the data of various environmental parameters and provide that data to Raspberry Pi via Zigbee from the Arduino. The sensors will gather the data of various environmental parameters and provide it to the raspberry pi which acts as a base station. Realization of data gathered by sensors is displayed on Raspberry pi 3 based Webserver. Experimental results demonstrated that the system can accurately measure the concentrations of carbon monoxide, carbon dioxide, combustible gases, smoke, and air quality.

**Air Quality Monitoring Using Raspberry Pi** - A prototype for an Environmental Air Pollution Monitoring System for monitoring the concentrations of major air pollutant gases has been developed. The system uses low-cost air-quality monitoring nodes comprised of a low-cost semiconductor gas sensor with a Wi-Fi module. This system measures concentrations of gases such as CO, CO<sub>2</sub>, SO<sub>2</sub>, and NO<sub>2</sub> using semiconductor sensors. A MEAN stack is developed to display data over a website. The fundamental aspect of the proposed work is to provide a low-cost infrastructure to enable data collection and dissemination to all stakeholders.

## III. METHODOLOGY

Figure shows the block diagram of the system. The ATMEGA328P is a popular microcontroller due to it being a major component in the Arduino board products. The ATMEGA328P-PN is the 8-bit RISC heart of the Arduino Uno and Nano, with a maximum clock frequency of 20MHz, 32KB program FLASH, and 2KB of RAM. UNO R3 SMD is the open-source Embedded Development board based on Atmega328 SMD Package Microcontroller. Because Atmel is moving more and more of their production capacity to surface mount ICs, the DIP packaged ATmega is becoming more and more difficult to get. To keep up with demand, we now offer the Uno R3 with an SMD ATmega. The board is identical to the PTH version of the Uno, but you won't be able to remove the ATmega without some hot air. This change shouldn't affect most users.





In the required libraries for the communication are found which is installed on raspberry pi using the commands `sudo pip install adafruit-io`. These will automatically install the Adafruit IO python client code for our python script. The simple commands like  `aio.send ('feed', parameter value)` and  `aio.receive ('button', status of button on dash board)` are used in our python code for server to client communication. The figure depicts that user gets the data by entering the URL and visits the dashboard. The data will be continuously fed to the server and timely updating is shown on dashboard as well as a graph will also be generated.

#### IV. EXPERIMENTAL RESULTS

An experimental setup of based pollution and climate monitoring system using IoT. The various sensors including temperature sensor, humidity sensor, sound sensor, gas sensor, pressure sensor, and LDR are interfaced to the Raspberry Pi along with the LCD and GPS module. All the sensed data from various sensors and GPS location are uploaded onto the webpage continuously. In the webpage along with relevant data, date and time stamp are also provided. By using this feature, user can easily understand the environment condition at a particular time. Figure shows the Webpage view of the results of Raspberry Pi based pollution and climate monitoring system using IoT.

Proposed Air Pollution Monitoring System is based on the block diagram as shown in Figure. The data of air is recognized by MQ135 gas sensor and MQ6 LPG gas sensor. The MQ135 sensor can sense NH<sub>3</sub>, NO<sub>x</sub>, alcohol, Benzene, smoke, CO<sub>2</sub>. So, it is dynamic gas sensed for our Air pollution Monitoring system. When it will be connected to Arduino then it will sense all gases, and it will give the Pollution level in PPM (parts per million). MQ135 gas sensor will give the output in form of voltage levels, and we must convert it into PPM. So, for converting the output in PPM, we have used a library for MQ135 gas sensor and MQ6 sensor.

Sensor is giving us value of 90 when there is no gas near it and the air quality safe level is 350 PPM and it should not exceed 1000 PPM. When it will exceed the limit of 1000 PPM, it will cause Headaches, sleepiness, and stagnant, stuffy air. If it exceeds beyond 2000 PPM, then it will cause increased heart rate and many different diseases. When the value will be less than 1000 PPM, then the LCD and webpage will display "Fresh Air". When the value will increase from 1000 PPM, then the buzzer will start beeping and the LCD and webpage will display "Poor Air, Open Windows". And when it will increase 2000, the buzzer will keep beeping and give an alert message on



smartphone through GSM. The LCD and webpage will display “Danger! Move to fresh Air”. It will contain temperature and humidity so it will possibly show the current temperature and humidity of the air. For temperature we have used LM35 sensor and for humidity SY-HS-220.

Parameters Monitored	Operating Voltage	Measuring Range
Carbon Monoxide	5 Volts	10 – 100000ppm
Ammonia, Sulphone, Benzene, Smoke	5 Volts	10 – 10000ppm

Table : Air Quality Parameters

Parameters Monitored	Operating Voltage	Measuring Range
Humidity	3.3 – 6 Volts DC	0-100 % RH
Temperature	1.8 – 3.6 Volts DC	-40 to +85 degree Celsius
Pressure	1.8 – 3.6 Volts DC	300 – 1100hPa
Light Intensity Level	1.8 – 4.5 Volts DC	1-65535 LX

Table Weather Quality Parameters

Sensor	Observed Value	Excepted Value
Temperature (Degree Celsius)	28.1	27
Pressure (Kilo Pascal)	95.67	97.28
Humidity (Percentage)	45	42
Pollutant Concentration (ppm)	110	104
Carbon Monoxide (ppm)	260	300
Light Intensity (Lumens/sq .m)	45	50

Table Comparative Results in Morning Time



Sensor	Observed Value	Excepted Value
Temperature (Degree Celsius)	29.9	30.7
Pressure (Kilo Pascal)	94.37	96.58
Humidity (Percentage)	43	39
Pollutant Concentration (ppm)	124	115
Carbon Monoxide (ppm)	506	400
Light Intensity	36.67	40

Table Comparative Results in Evening Time

#### V. CONCLUSION

The proposed system gives a compact, low power and low-cost system for the monitoring data remotely. The use of the low-cost mini-computer makes it efficient and reliable. The system aids in the sustainable growth of the city and improves the lives of the citizens. The ubiquitous availability of dynamic datasheets on the dashboard and the time-to-time graphical representation can help in planning the control measures against increasing pollution levels and create awareness among the people.

A prototype of Pollution and Climate monitoring system is implemented using the concept of Internet of Things. The various parameters of environment including temperature, humidity, atmospheric pressure, light intensity, and presence of hazardous gases are measured, along with user location continuously at regular intervals. This system monitors above listed factors and provides dynamic data sheet on a Webpage which can be accessed from any part of the world. Such a data sheet is useful to monitor the atmospheric changes and take appropriate action with the parameters exceed certain threshold.

The system bases on IoT bearing low cost empower giving feasible results. It makes the use of air quality better by detecting major pollutants like carbon dioxide, carbon monoxide, temperature humidity and air pressure to give detailed information about environmental condition. The system is very efficient and highly accurate. With this data, appropriate measures can be taken to regulate proper environmental conditions, for example, regulation of traffic, banning the use of firecracker son any occasion treatment of factory emissions, etc.

The integrated IoT air pollution system is developed to overcome the issues in air quality. The sensors mainly sense the various dangerous gases present in the environment. These sensors can likewise be executed in automatons which can move around and recognize the contaminating gases in the earth. Safety efforts can be upgraded to secure the information that is being sent through the segments by presenting new conventions.

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