Pollution Detection and Purification using filter

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Article Info
Jenitta J and Swetha Rani L (eds.), *International Conference on VLSI, Communications and Computer Communication*, Advances in Intelligent Systems and Technologies,
Doi: https://doi.org/10.53759/aist/978-9914-9946-1-2_14

Abstract - Pollution is one of the major concerns for h all the countries. Almost all countries in this world are taking various steps to reduce the same. Air pollution is one of the major types of pollution. Pollution leads to severe health issues. It is very harmful and leads to death in few cases. Major reason for air pollution is the release of harmful gases from the vehicles and the exhaust from the industries. In this paper, a method to detect the air and noise pollution and to reduce the level of pollutant in the air is proposed. The designed device is tested in various places of Bangalore at different timings.

Keywords - Air pollution, Harmful, Noise pollution, Purification

I. INTRODUCTION

In recent days pollution has become one of the major problem of environment and it has become a danger factor for the life of human beings. The presence of harmful particles in the environment is known as pollution. There are few types of pollution. They are: Air pollution, Noise pollution, Water pollution, etc., The air pollution is caused by the addition of primary and secondary pollutants to the air. Sulphur-di-oxide from industries and Carbon monoxide from vehicles are considered as the primary pollutants. World Health Organization (WHO) considers the noise level above 65 dB as noise pollution. Noise pollution is caused by honking of vehicles on the road and from the industries [1].

In India, in metro cities like Bengaluru, the number of vehicles on road are very high and because of that the level of air pollution and noise pollution are also very high. Various trauma such as eye irritation, asthma, lung cancer and chronic respiratory diseases are the effects of air pollution. As er survey, approximately 4.2 million deaths are happening per year because of air pollution. Continuous noise can affect the human in many ways. They are increasing Blood Pressure, Psychological effects, sleep and behavioral disorders and deafness. It is mandatory to detect and reduce the air pollution and noise pollution which will improve the quality of life of the people living in metro cities.

To detect and to reduce the air pollution and noise pollution a method is proposed in this paper through which the quality of life of people can be improved. The rest of the paper is structured as follows: section II presents about the various literatures available for detecting level of pollution, Section III discuss the proposed method, section IV discuss the experimental results and section V gives the conclusion and future work.

II. LITERATURE SURVEY

Few researchers have approached the problem of detecting and reducing the pollution using various techniques.

In [1] Q Xiaoni et al., have proposed method to investigate the air pollution and emission purification. Catalytic exhaust which is used to measure purification catalyst is used as regeneration aid. Catalytic convertor is used in the proposed method and it plays a major role in result. FLUENT is the software used to carry out the interior simulation of exhaust pipe. In this method area needed to install catalytic convertor was 29 to 40cm and inlet pressure was 131722.5pa. The major drawback of this method is the combustion and emission of the engine couldn't meet emission requirement. In [2] Siva Shankar Chandrasekaran et al., have proposed a method to control air pollution in vehicles. Using semiconductor sensors, the pollutants level is detected. A smoke detector is used to identify pollutants, and then the microcontroller identifies pollutants level and checks it with the pollution level given by government. If the amount of pollutant crosses given limit, a signal is sent to the fuel injector to stop the function of engine for certain amount of time. But tracking of vehicles wasn't possible.

In [3] Suganya E et al., proposed a method to monitor pollution using Wireless Sensor Networks (WSN). This method calculates the level of gases and air contamination in and around cities. MANET is the routing algorithm which is used in the method which stands for mobile ad hoc network. Many sensors were used to monitor the pollution. The drawback of this method is it is very tough and difficult to maintain those sensors as they are very much expensive. In [4] Huang Mengtao and Feng Zunxiang, proposed a method to purify vehicle exhaust based on ARM processor. The electrostatic control system was used to purify the exhaust and pollutants were absorbed. The gas detection feedback and high-pressure feedback scheme were sued to detect concentration of vehicle exhaust purification.

In [5] Pasi Pyykonen et al., have proposed camera-based smoke and exhaust detection method to mainly identify the vehicles which emit lot of smoke and Hartridge Smoke Unit (HSU) was implemented to observe performance of vehicles.

If HSU value is less than 50 then the smoke particles weren't clearly visible. If HSU value is more than 90 then smoke particle are clearly visible. In [6] B. Ravi Subrahmanyam et al., proposed air purification method which was done with the help of distilled water. When air is passed through the distilled water without any chemical substance, the pollutants reside inside and only the clean air comes out. Though this method improves the quality of air, the quality of air still remains less.

In [7] P Arun Mozhi Devan et al., have proposed pollution monitoring and alerting system. In [8] Vladimir Shakhov et al., and Olga Sokolva et al., proposed the idea of wireless sensor network with mobile sensor.

In [9] Abhi B Amin et al., proposed method monitors the air pollution and alerts the user. In this method, parts per million (PPM) of gas is measured and alert message is given to user when gases emitted exceed threshold value limit. In [10] Vladimir Shakhov et al., proposed a method to monitor pollution using gas sensor network. It used sensor with additional mobility and this helped mobile sensor to take measurements in vast areas but cost is high.

III. PROPOSED METHOD

The proposed block diagram is shown in Fig.1. The proposed system consists of a carbon monoxide sensor and sound sensor which is connected to ESP8266, a WI-FI module, a relay is connected to the air filter since it acts as a switch to turn ON the filter and DC fan is attached to the filter which releases the purified air into the atmosphere, the LCD display is interfaced to the node MCU in order to display the digital values, WI-FI is used to get connected to the WI-FI module in order to store the pollutant data into the cloud and display it through a local server and a battery is given as a power supply to the relay.

When the system gets activated the gas sensor detects the carbon monoxide which is one of the major hazardous air pollutant presents in the atmosphere. If the concentration of CO in air which is about 9% is considered to be as safe for the civilians where as in other case if it exceeds above 35% it is considered as fatal and causes respiratory problems. So, the pollution control authority has framed certain range of permitted levels for emitting the pollutants under which a vehicle has to emit the restricted number of pollutants which is within the permissible range. So, the CO sensor is set to a threshold level of 35% and it is configured in such a way that it should start to operate when the CO concentration exceeds beyond the defined threshold level, so the sensor gets triggered and starts to push the recorded data to the node MCU ESP8266. The CO sensor senses the level of CO level in the air, and this sensed value is given as input to node MCU ESP8266. The analog sensor data is digitally converted using I2C convertor for pushing the data to the LCD display, while the concentration of CO in percentage will be displayed through the LCD. If the CO level is above the threshold value, then node MCU plays a very crucial role in sending the control pulse to the relay, and the relay gets induced and act upon the air filter to get turned ON. Now the air filter absorbs the harmful carbon monoxide and purifies the air and DC fan starts rotating in order to release the purified air to the atmosphere. The system alerts the user through a SMS notification that is sent to the user smartphone which indicates the detected pollution shows Fig.1.

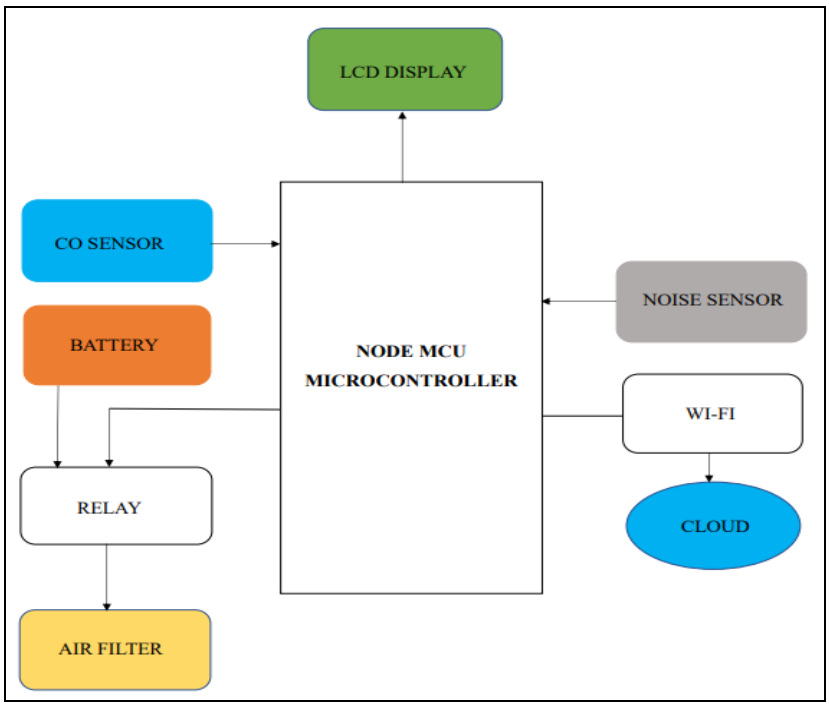


Fig 1. Block Diagram of the Proposed System

Another feature that is enabled in this system is that it consists of a noise sensor module which is used to measure and detect the noise by sensing the variation in the sound level. Noise levels below 70 dB can be considered as safe whereas

noise levels above 85 dB is very sensible for human ears that can be dangerous. The noise sensor has a microphone sensitivity ranging from 48-52 dB, when the noise levels in the atmosphere is exceeded beyond the set predefined values, the sensor gets activated and the user is alerted through LCD display, parallelly the user receives an alert text message through SMS.

IV. EXPERIMENTAL RESULTS

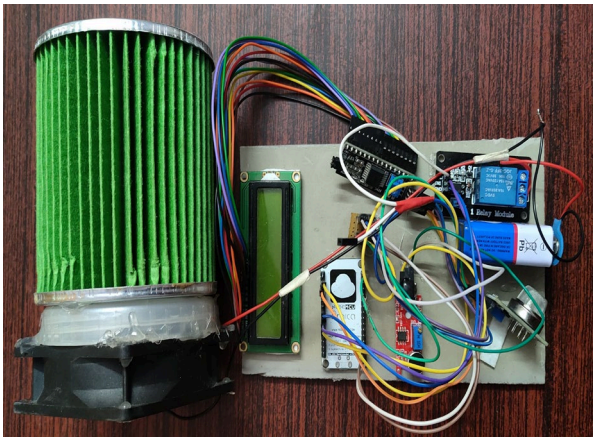
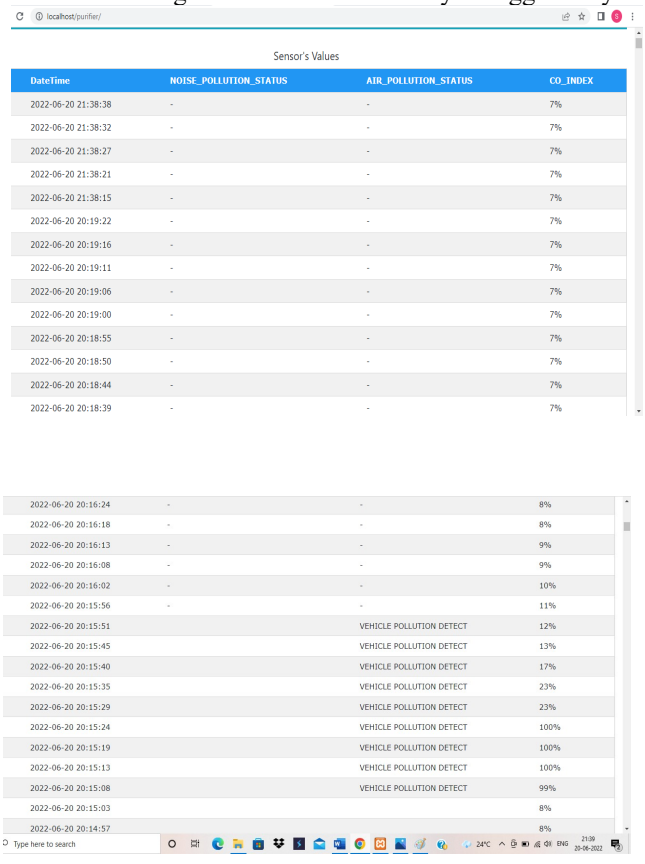


Fig 2. Hardware Setup

Fig.2 shows the hardware setup of the proposed method. The setup is fixed in various places in Bangalore at various timings of day and night and checked for its efficiency. Whenever the air pollution and noise pollution is detected, the message is displayed in LCD, SMS is sent to registered user and the relay is triggered by the node MCU.



Sensor's Values

DateTime	NOISE_POLLUTION_STATUS	AIR_POLLUTION_STATUS	CO_INDEX
2022-06-20 21:38:38	-	-	7%
2022-06-20 21:38:32	-	-	7%
2022-06-20 21:38:27	-	-	7%
2022-06-20 21:38:21	-	-	7%
2022-06-20 21:38:15	-	-	7%
2022-06-20 20:19:22	-	-	7%
2022-06-20 20:19:16	-	-	7%
2022-06-20 20:19:11	-	-	7%
2022-06-20 20:19:06	-	-	7%
2022-06-20 20:19:00	-	-	7%
2022-06-20 20:18:55	-	-	7%
2022-06-20 20:18:50	-	-	7%
2022-06-20 20:18:44	-	-	7%
2022-06-20 20:18:39	-	-	7%
2022-06-20 20:16:24	-	-	8%
2022-06-20 20:16:18	-	-	8%
2022-06-20 20:16:13	-	-	9%
2022-06-20 20:16:08	-	-	9%
2022-06-20 20:16:02	-	-	10%
2022-06-20 20:15:56	-	-	11%
2022-06-20 20:15:51		VEHICLE POLLUTION DETECT	12%
2022-06-20 20:15:45		VEHICLE POLLUTION DETECT	13%
2022-06-20 20:15:40		VEHICLE POLLUTION DETECT	17%
2022-06-20 20:15:35		VEHICLE POLLUTION DETECT	23%
2022-06-20 20:15:29		VEHICLE POLLUTION DETECT	23%
2022-06-20 20:15:24		VEHICLE POLLUTION DETECT	100%
2022-06-20 20:15:19		VEHICLE POLLUTION DETECT	100%
2022-06-20 20:15:13		VEHICLE POLLUTION DETECT	100%
2022-06-20 20:15:08		VEHICLE POLLUTION DETECT	99%
2022-06-20 20:15:03			8%
2022-06-20 20:14:57			8%

Fig 3. Status of air pollution displayed on XAMPP server

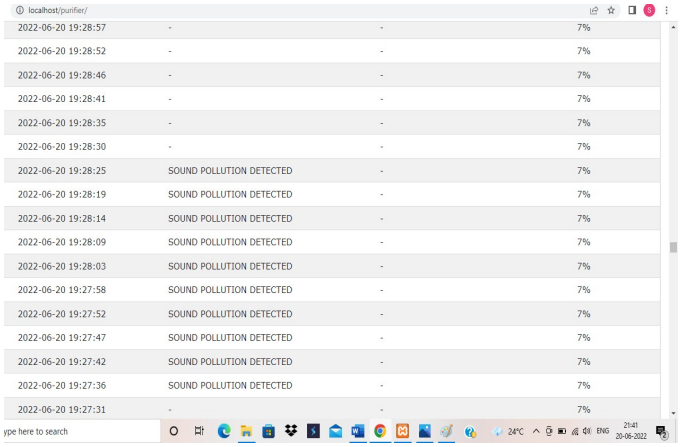


Fig 4. Status of sound pollution which is displayed on XAMPP server

The recorded data which has been collected from the CO and sound sensor is stored in the cloud server. The stored data from the cloud is fetched by the local XAMPP server. The status of air pollution and noise pollution is display on XAMPP server are shown in fig 3 and 4. It is achieved by calling the HTTP client. As a result the recorded data values starts appearing on the XAMPP webpage. XAMPP is a free and open-source cross platform web server solution stack package.
As we observe from the above figure the real time data is being represented, it also indicates the status of the detected pollution along with the date and time at which the user data that is being recorded in real time and to add further it displays the composition of CO in percentage and also the noise levels in percentage are portrayed. Table I and II shows the sample reading taken at various places at different timings.

Table 1. Readings of pollution taken in Srinivas Nagar, Banashankari, Bangalore

Sl no	Status of air pollution	Status of noise pollution	CO Percentage	Reading Time
1	-	Sound pollution detected	10%	2022-06-21 07:39:28
2	Air pollution detected	Sound pollution detected	39%	2022-06-16 13:24:35
3	-	Sound pollution detected	22%	2022-06-16 19:26:46

TABLE II: Readings of pollution taken in Adugodi, Bangalore

Sl no	Status of air pollution	Status of noise pollution	CO Percentage	Reading Time
1	-	-	12%	2022-06-20 07:19:27
2	Air pollution detected	Sound pollution detected	45%	2022-06-20 12:35:15
3	Air pollution detected	Sound pollution detected	52%	2022-06-21 20:23:56

V. CONCLUSION AND FUTURE WORK

Detecting the pollutants which causes the air pollution and purifying those pollutants is very much essential in reducing air pollution in the atmosphere. Our proposed work not only detects the Carbon Monoxide content in the atmosphere, but also purifies it when the detected concentration of CO reaches beyond the given threshold level. In addition to that it has a sound sensor module which helps in detecting the noise pollution. The key enabling feature of this system is that it acknowledges the user about the detected pollution through SMS and also depicts the pollutants level in percentage, pollution status and real time record of the pollutant data through a local web server platform. The future enhancement for the current work can be made by upgrading the CO and noise sensor which can be used to estimate the pollutants for a large scale geographic area and also using the advanced sensors which detects CO in PPM and noise levels in dB that can be incorporated to this system for an enhanced way of analysis approach, and this system can be mainly implemented at the traffic signal post since there is a large frequency of moving vehicles and also it can be implemented in the densely populated areas which are more prone to air pollution. An android application can be developed for a smartphone which

provides a user interface where user gets a feed of the monitored pollutant data so that user can get awareness to take the necessary measures for controlling the air pollution.

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