



## **IoT based Smart System to Monitor Air Quality Hazards due to Smog and Pollution**

Hina Asmat<sup>1</sup>, Amnah Firdous<sup>2</sup>, Alia Munawar<sup>3</sup>

<sup>1</sup> Department of Computer Science and Information Technology, SE College Bahawalpur, Pakistan.  
Email: hina.malik25@gmail.com

<sup>2</sup> Department of Information Technology, The Islamia University of Bahawalpur, Pakistan.

<sup>3</sup> Department of Information Technology, The Islamia University of Bahawalpur, Pakistan.

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### **ABSTRACT**

Air pollution causing dangerous effects on the environment i.e. Plants, Animals, Birds, and Humans. Air hazards causing causalities because of respiratory and cordial diseases. Smog is another air disaster that is badly affecting in cold seasons. It slows down the outdoor activities of humans. The awareness rate about the hazards of smog among people is very low. There is a need to create awareness and protection precautions among people using IoT-based smart system.



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Corresponding Author's Email: [hina.malik25@gmail.com](mailto:hina.malik25@gmail.com)

## **1. Introduction**

Air pollution badly affecting the lives of living organisms i.e., humans, animals, and plants. Air pollution is one of the biggest threats to the environment and affects everyone: humans, animals, crops, cities, forests, aquatic ecosystems (<https://solarimpulse.com/>).

Smog is one of the air pollutants that affect the health of humans. It is a mixture of fog and smoke in the air that covers the areas of region or county. The formation of smog is because of the photochemical reaction of air pollutants and the sunlight of bad ozone (Arif, 2016). While it is visible in cooler seasons i.e. autumn and winter. The visibility of smog is related to air temperature. Because warmer air does not allow the underneath cooler air to rise.

All of the agrarian, industrial, and largest vehicle holding countries i.e. Pakistan, India, China, the UK, and the USA badly hit by smog every year in the winter season (Ghauri, Lodhi, & Mansha, 2007). The World Health Organization (WHO) published a report that more than 3.7 million people die because of air pollution.

In the article "The Great Smog of 2017 should be a Wake-up Call to Government", the side effects of smog metaphorically highlighted that "Yellow, dense and lungs-wrenching smog would venture out wrapped up us like Egyptian mummies (Bates, 2017). But only our smart eyes are exposed to toxic air. In 1952 smog killed more than 12000 people and many were hospitalized.

Clean Air act declared that smog is an air disaster [4]. Many roadside accidents occur in the smoggy season. Serious medical problems i.e. asthma, respiratory disease, coughing, burning chest, blowing nose are common. People are still facing clinical diseases even after following precautionary measures like wearing a face mask and goggles (Wasif). But unfortunately, the government and AQI institute are seemed non-serious. In foggy season's shortfall of lubricant eye drops, masks and lotions are common practices (Adnan, 2016).

### 1.1. Countries having the Worst Air Quality Index

The world air pollution of the top 30 worst air quality indexed countries is shown in Figure 1. According to the World Air Quality Index (the data is collected on 20-11/2020.). Pakistan (AQI-91) is also included in the top 30 countries at no. 27. India is the topmost country having the worst AQI index (191) in the world.

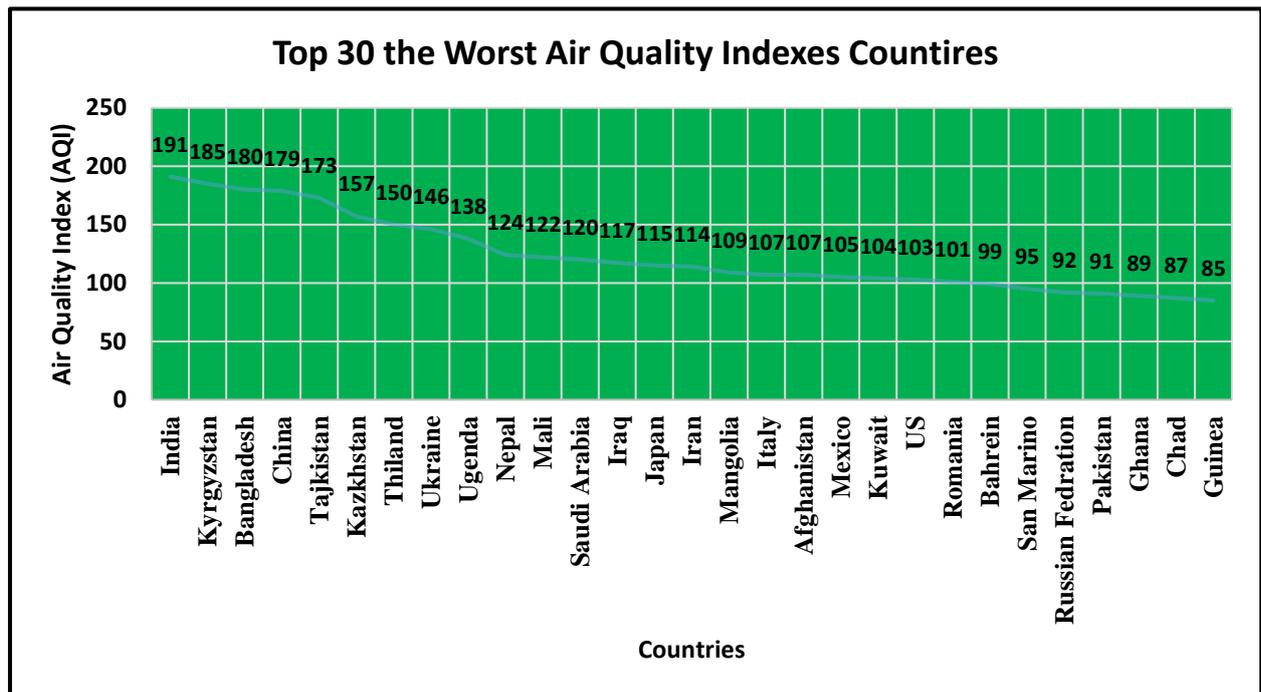


Figure 1: The Worst AQI Countries

While in figure 2 it can be visualized that in top 5 cities having most polluted air quality: three of them from South Asian countries i.e., Beijing (China), Delhi (India) and Lahore (Pakistan). It creates concerns to mitigate the air hazards of these countries to reduce the global warming effects worldwide.

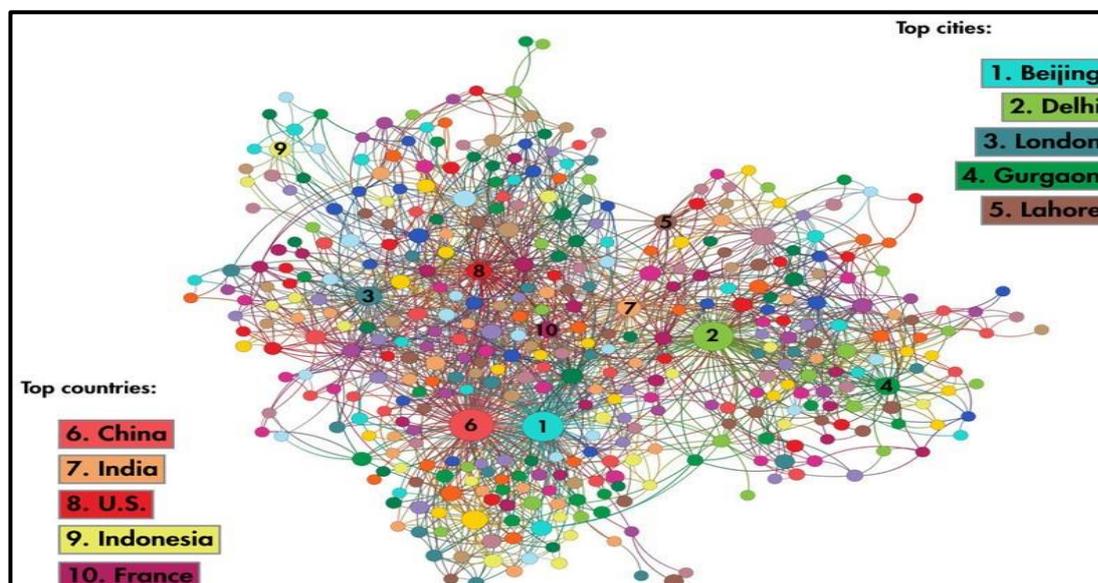


Figure 2: The Worst Top 5 AQI Countries and Cities

## 2. Causes of Air pollution

Air pollution is caused by the presence in the atmosphere of toxic substances, mainly produced by human activities, even though sometimes it can result from natural phenomena such as volcanic eruptions, dust storms, and wildfires, also depleting the air quality (<https://solarimpulse.com/>).

### 2.1. Anthropogenic air pollution sources are

1. Combustion of fossil fuels, like coal and oil for electricity and road transport, producing air pollutants like nitrogen and sulfur dioxide
2. Emissions from industries and factories, releasing a large amount of carbon monoxide, hydrocarbon, chemicals, and organic compounds into the air
3. Agricultural activities, due to the use of pesticides, insecticides, and fertilizers that emit harmful chemicals
4. Waste production, mostly because of methane generation in landfills
5. Smog

## 3. Sources of Smog

Many sources are causing to produce air disaster smog. For example, Seasonal burning (See figure 3) of *Triticum aestivum* / Wheat and paddy crops. Agrarian, industrial and largest vehicles holding countries are major stakeholders in the world to produce smog.



**Figure 3:** Burning of Seasonal Crops

Some of the sources for the smog include vehicular pollution that occurs because of very poor fuel quality being used along with lack of pollution control technologies in our vehicles, industrial pollution, burning of municipal and even industrial waste, and brick kilns which again use dirty fuel such as rubber and tires”(<https://www.dawn.com/>).

The mixture of vehicle exhausts, secondary pollutants formed in the atmosphere, evaporative emissions from vehicles, and non-combustion emissions (e.g., road dust, tire wear) is referred to as traffic-related air pollution (TRAP) (Matz et al., 2019).

## 4. Purpose of the Study

The main purposes of this study are

1. To draw the attention of the world towards another air disaster i.e. smog
2. Create awareness among people to prevent the side effect of smog
3. To engage the researchers and scientists to control the smog
4. To develop IoT based system to monitor the air hazards and ultimately intimate timely precautions to humans.

## 5. Related Work

A cross-sectional survey was conducted to determine the awareness and prevention of smog. A questionnaire is designed that consists of 46-items. People of different education levels, ages, and areas were selected for participation in the survey (Saleem et al., 2019). Majority of the participants having science qualification exhibits good awareness about smog. The survey showed that awareness and prevention related to the following factors

- Level of education
- Employment status
- Family income

Those families which are well educated and having adequate sources of income following the precautionary measures to prevent the side effect of smog (Saleem et al., 2019). In contrast, families having low income and non-science education are unaware of the side effect of smog on human health.

The Smog was overblown in Pakistan larger than 35,400 km<sup>2</sup> in 2006- 2010(Ghauri & Zafar, 2016). It badly affected the outdoor activities i.e. school going students, workers, transporters, and laborers (Mukhtar, 2017).

## 6. Solutions

All the agricultural strictly banned the crops burning, industrial counties should clean the smoke before releasing it in the air. Manufacturing should be shifted from fuel to solar and electricity instead of burning coal/fuel.

An appealing campaign should be lunch to create awareness among people to aware and prevent the fatal effect of smog. An IoT-based system can be developed using sensors that can help to monitor the air quality in smog season. The system further should have the capability to intimate and provide the precautions to prevent the influence of the smog.

## 7. Conclusion

Traffic, industry, agriculture major polluters with 43, 25, and 20pc share, respectively. To protect the people from the hazards of smog, an awareness campaign should be launch by the government and disaster management authorities. The use of IoT bases smart systems is very helpful to protect humans from the side effects of smog.

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