IoT Based Allergy Tracking System Based On Location

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***Abstract*— Dhaka city is cited as the most polluted city in all Bangladesh. Everyday millions of people are affected by the amount of dust and contaminated air exerted by the heavily industrialized city. Hence, in order to mitigate its effects on people, an IoT based Allergy Tracking System is introduced. The main goal of IoT Based Allergy Tracking System Based on Location is to target the people with unusually high sensitivity towards dust particles and make their travel through the city area more comfortable. The system will be able to track the Air Quality Index of a given area and will simultaneously notify the user of the condition of that said area. Along with remote access of the data, this proposed system will also be integrated into smart devices through app which will be discussed in the later part of this paper. Through the introduction of the system, it will sincerely raise the awareness and compressive understanding towards environment.**

Keywords*— *Air Quality Index, IoT, Remote, Dust Allergy, Air Pollution, Geolocation.

I. INTRODUCTION

Dust particles are a major contender in human respiratory illnesses. Respiratory allergies induced by dust particles are the most frequent cause of persistent allergic rhinitis, affecting approximately 400 million people on a global scale, and the number one cause behind bronchial asthma in the world. Our location-based allergy tracking system would therefore fall under the category of a general use device for health regulation, capable of providing information to the user about the air quality index of any location and possible allergic reactions according to the particle pollution level present in the atmosphere in real time.

According to the pre-survey we conducted on a small group of people representing the citizens of Dhaka, around 77 percent of Dhaka dwellers agree that the air quality in Dhaka affects the general people, 66 percent of them suffer from dust-related allergy issues, and 80 percent agree that our proposed system would be useful to mitigate this problem.

While existing devices related to air pollution detection attempt to deal with the reality of dust particles affecting the human respiratory system by measuring and categorizing pollution levels in the air based on how healthy or unhealthy it might be to breathe in, none of them are specifically catered to people with allergies, or how specific pollution levels may affect certain allergy patients. Most don't measure all the components required for effective allergen detection.[1] A majority of the existing devices also fail to utilize their data to send alerts to the device user if or when the air is too dangerously polluted to breathe in.[2] Systems that use GPS modules often fail to synchronize with sensors, which failed to produce correct data visualization. A few devices were unable to detect real time data in ppm.[3] Some chose to take periodic measurements instead of continuous readings, resulting in data inaccuracies.[4]

Our device plans to rectify these shortcomings by using individual user data to cater to the severeness and type of their allergic conditions based on pollutants present in the air and general air quality index, sending them alerts using IoT based technology consisting of cost-efficient sensors if the conditions could trigger allergic reactions, additionally recommending possible precautions, if any.

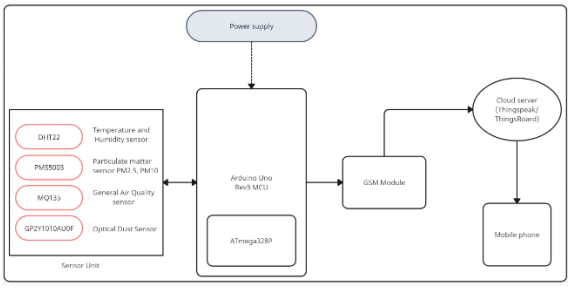

Fig 1: General block diagram of our proposed system.

The system employs a PMS5003 sensor to measure fine particles and larger particles ranging PM1, PM2.5 and PM10, that can trigger dust allergies. Additional sensors, such as a dust sensor, carbon monoxide sensor, and the versatile MQ-135 gas sensor, contribute to comprehensive air quality monitoring which is sensitive to gases such as ammonia (NH3), nitrogen oxides (NOx), carbon monoxide (CO), and benzene (C6H6), among others. A DHT22 sensor is included to measure temperature and humidity, which can influence allergen distribution and respiratory health.

The system collects data on particulate matter, gases, and environmental conditions relevant to allergies. The collected data is processed by the microcontroller and transmitted to the Arduino Uno, which acts as the central hub for data analysis.[7]

The system can identify high pollution levels and allergenic particle concentrations. The collected data is then processed and analysed to calculate the AQI in real-time. The AQI provides a measure of the associated health effects that can occur within a short time frame after exposure to polluted air, typically within a few hours or days.[5]

To calculate the AQI, we consider the concentrations of five major air pollutants identified by the Environmental Protection Agency (EPA): ground-level ozone, particulate

matter, carbon monoxide, sulphur dioxide, and nitrogen dioxide. Each pollutant is measured in parts per million (PPM), and the EPA has established national air quality standards for each of these pollutants to safeguard public health. When the AQI threshold exceeds predefined levels, our system triggers real-time notifications to users in the corresponding area.[8]

These notifications serve as timely alerts, enabling individuals to be aware of deteriorating air quality and take necessary precautions to safeguard their health. By incorporating the AQI and providing real-time notifications, our system ensures that users stay informed about changes in air quality and can make informed decisions about their activities based on the potential health risks associated with polluted air. This feature empowers individuals to take proactive steps towards maintaining their well-being in the face of changing air pollution levels.

II. Literature Review

The previous proposals of similar systems included harmful gas detecting connected to suitable microcontrollers like Arduino uno, ESP8266 etc.[5] Typical sensors used were DHT22 for temperature and humidity, PM2.5 for particulate matters, GP2Y1010AU0F for dust, and the MQ sensor family for harmful gases like carbon monoxide, sulphur dioxide, nitrogen dioxide etc.[6]

The data from the sensors would then be fetched, and transferred to an IoT platform such as Thing Speak or Things Board to monitor the data in real time. A Wi-Fi module or a GSM800 or equivalent sim module would be used to transfer the data to the servers. The fetched data would then be used to calculate the air quality index around the device. The measured data was then compared with the AQI chart to see if the quality of the air is within the safe range.[6] Further work was done, for allergic patients at home, where they would get SMS alerts if the air quality in their rooms were above safety levels. The device was connected to air purifiers, which would prompt the purifiers to spray if the standard density of particulate matter in the air was above the safety levels for an allergy patient.[5]

However, each past similar proposal had some kind of limitation. Most devices focused on measuring the air pollution, and less on the allergic patients. Datasets used in some of the papers were short ranged, which gave less accurate results overall. The cost associated with the hardware components, sensors, and system infrastructure can be a limiting factor, particularly for large-scale deployment.[7]

Additionally, regular maintenance, sensor calibration, and software updates may be required to ensure optimal performance, which can incur additional costs. None of the papers focused on the location aspect of allergy prone areas, which is where we are trying to innovate in.[8] Ultimately, this literature review aims to contribute to the existing knowledge base by identifying research gaps and highlighting areas where the IoT-based Allergy Tracker with location feature can make significant contributions. We want to use existing research to improve our system, making it more accurate, reliable, and user-friendly. Our aim is to create a valuable tool that helps people manage their allergies.

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