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Mobile Air Pollution Monitoring System using Fuzzy Logic

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***Abstract* – Internet of Things (IoT) is an overall arrangement of "keen gadgets" that can detect and associate with their environment and cooperate with clients and different frameworks. Worldwide air pollution is one of the significant worries of our time. Existing checking frameworks have mediocre exactness, low affectability, and require research facility investigation. Accordingly, improved observing frameworks are required. To beat the issues of existing frameworks, we propose a three-stage air contamination observing framework. An IoT kit was readied utilizing gas sensors, Arduino IDE (Integrated Development Environment), and a Wi-Fi module. This pack can be truly put in different urban communities to checking air pollution. The gas sensors accumulate information from air and forward the information to the Arduino IDE using fuzzy logic. The Arduino IDE transmits the information to the cloud by means of the Wi-Fi module. We additionally built up an Android application named IoT-Mobair with the goal that clients.we use Fuzzy Logic is a method of reasoning that ressembles human reasoning .This method similar to how humans perform decision.**

Keywords: **Air pollution monitoring system; Android; sensors; GPS; Cloud; Distributed systems; Air-pollution safe route; Fuzzy logic.**

I. INTRODUCTION

Governments and Citizens are searching for logical keenness to challenge the normal danger of air pollution in its numerous techniques. Right now portable applications can achieve capacities like revealing status of air quality, air quality forecasts , air quality monitoring in a specific region, and dangers featuring associated with edge breaking quality, and so on.

Wireless sensor systems (WSNs) are continuously influencing everyday living. A WSN is a system comprising of sensor hubs. Every sensor can distinguish certain variables like air pressure, air composition, and water quality. WSNs are identified with the idea of IoT. In IoT gadgets are interconnected to transmit information by means of appropriated sensor systems. IOT has helpful applications in the clinical field. Gadgets, for example, cell phones and detecting frameworks can be related to create a foundation that gives access to social insurance in-arrangement and administrations. This approach is referred to as “Mobile-Health”.

II. LITERATURE SURVEY

Air pollution in large urban areas features a drastic effect on humans and therefore the environment. Ecological issues in India are growing quickly. Air contamination is especially caused by vehicles and industries which cause various respiratory diseases like asthma and sinusitis. The standard of air is inferior in metropolitan cities like Kolkata, Delhi, and Mumbai thanks to an outsized amount of CO2 and other harmful gases.

An extensive number of projects are described within the literature that utilize low- cost pollution sensing devices which will be carried by individuals or by versatile vehicles In two studies, the authors demonstrated an environmental sensing approach that reinvigorate attention and sympathy of citizens toward pollution. Exposure Sense may be a portable participatory sensing framework that's wont to screen one’s activities. In another study the authors present a cloud-based system that uses knowledge-based discovery to seek out real-time air quality data. The info are collected by monitoring stations that are placed in various geo-locations. This technique uses mobile clients for monitoring purposes.

1. Proposed Approach

The design of the air pollution monitoring system involves three main phases: Phase 1: detect the air pollutants in the area of interest via sensors.
Phase 2: develop a user-friendly – an Android application, which the user can use to know the pollution level in his/her area.
Phase 3: predict air quality using the analytical module.

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The proposed air pollution monitoring system is presented in figure 1.

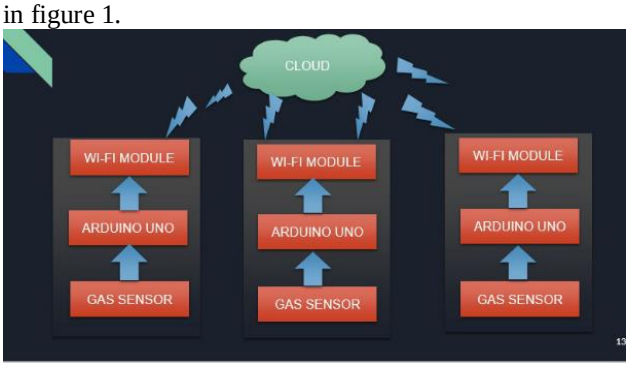

Fig.1.System Overview

1V IMPLEMENTATION

In this section, the air pollution detection system is developed in two steps using the IoT:

Step 1: Detection of air pollutants level:
Collection of data from gas sensors connected to Arduino board and information is sent to a cloud platform (i.e., Ubidots) that stores it. Accessing this information utilizing Android platform. For this purpose, the data is generated by gas sensors (MQ-3) that read concentration of gas in the region. IoT Kit is constructed in which the data generated by sensors is sent to the cloud, where it is processed and displayed to the user in the appropriate form. First, the Arduino is setup, and the connections are drawn. A Fuzzy Logic [6] program in Arduino is written that can find air quality based on gas sensor readings. For example, a CH4 sensor (MQ-3) is used to sense methane gas in the air. The output of the MQ-3 sensor is displayed as an analog value on the COM screen of Arduino. The MQ-3 sensor is connected to the Arduino board. Arduino, in turn, uses an ESP8266
Wi-Fi module to connect to the network to send data. The overview of this can be represented as shown in Figure 2.

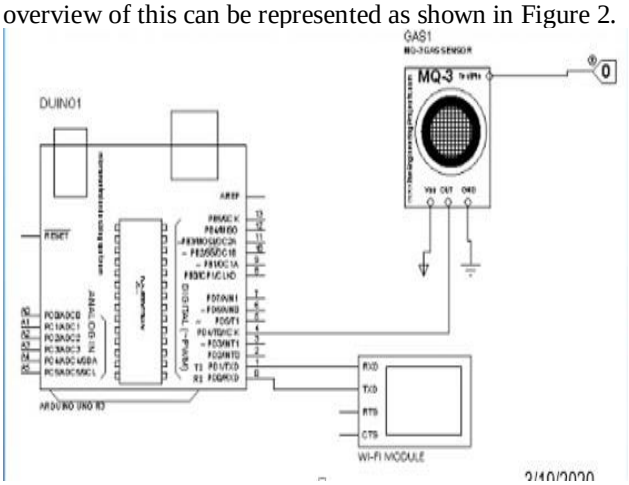

Fig.2. hardware view.

When the right sensor values are recovered, they are sent to the cloud. Arduino was connected to the cloud (i.e., Ubidots) such that sensor data is sent from the Arduino board to Ubidots. In this step, the developed Android application mobile air pollution App receives sensor data sent by Arduino using Ubidots services.

Step 2: Creating the front-end Android interface:
For a client making a trip from a source to a goal, the pollution level of the entire route is predicted shown figure 3 and a warning is displayed if the pollution level is too high so that the user can re- route his journey.

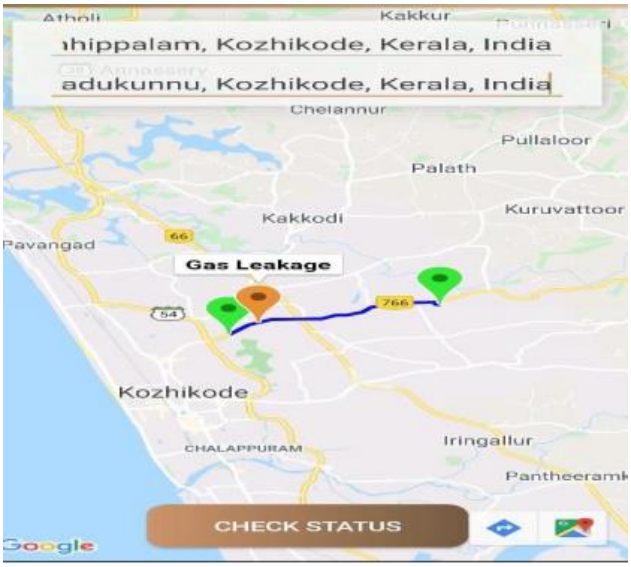

Fig.3. Android Application showing Pollution Level in the Route.

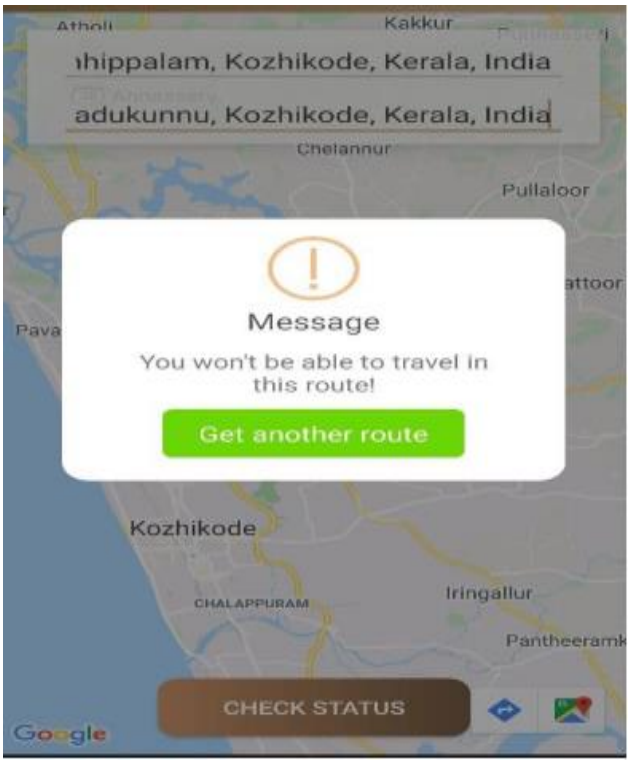

Fig.4. Android Application showing warning message.

V. CONCLUSION

Air pollution is increasing day-by-day because of various reasons such as industrial growth, development of automobile industries, and chemical industries. Therefore, to reduce the level of pollution from such sources and to protect humans and the environment from harmful gasses, this air pollution kit was developed that helps a person to detect, monitor, and test air pollution in a given area. An IoT has been integrated with the mobile application that helps the user in predicting the pollution level of their entire route. This proposed air pollution monitoring kit along with the integrated mobile application can be helpful to people suffering from respiratory diseases. The app had following features, indices of air quality for a specific city using real- time computation, air quality daily forecasts, timing outdoor activities for different recommendation of generation, air quality dips related to health risks, specific reports for air quality measures based on locations, air quality maps generation.

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