



## DESIGN AND ANALYSIS OF IOT BASED AIR QUALITY MONITORING SYSTEM

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### ABSTRACT:

Recent aggressive scientific and technological developments all these focus on a global environmental issue considering air quality system, reveals the fact that India is facing severe health hazards. The level of pollution has increased with times by lot of factors like the increase in population, increased vehicle use, industrialization and urbanization which results in harmful effects on human wellbeing by directly affecting health of population exposed to it. The present paper develops an Internet of Things (IoT) that enabled air quality monitoring system mobile in nature analyzing real-time surrounding data measuring Carbon Monoxide, Smoke, methane and Humidity level. The system can measure local area air contamination and generate analyzed data based on which it alerts the people through a buzzer device integrated into the system. The system can be installed in houses and in small places.

### KEYWORDS:

**IOT, AUTOMATED MONITORING, SMOKE, POLLUTION CONTROL, PIC, GSM.**

### INTRODUCTION

The worldwide ongoing projects to mitigate environmental problems at present are focusing more on the clean energy resources in order to meet the UN SDG goals 11.7 to cut down air pollution and improve the air quality to provide a safe environment for human habitat. The recent reports by WHO show that 7 million people die each year caused by air pollution. Thus, poor air quality causes several health hazards like heart disease, lung cancer, and respiratory problems. The need of the hour is not only to control air pollution but also materializing technologies, devices and software systems to keep a close check on rapidly growing air pollution. The efforts in this paper are made to develop one of such systems by which the real time air quality monitoring can be done to take preventative measures to make our living environment safe to live a good life. Considering the complexities, operational difficulties, poor resource management issues, and cost-efficiency, the proposed system provides a user-friendly less complex a much cheaper solution that works as a preventative mechanism to generate real-time alerts on air quality. Our main contribution is to develop a cost-efficient air quality monitoring system that senses the real-time data of surrounding various parameters like smoke, carbon monoxide, and humidity level and alerts the people when the quantity of these elements goes beyond a certain limit and shows the data in an easily

understandable format. A Wireless Sensor Network consists of many inexpensive wireless sensors, which are capable of collecting, storing, processing environmental information and communicating with the neighboring nodes. The access method of the WSN gateway node is convenient because it allows data to be received from the WSN via the gateway at any time and place. The gateway acts as the network coordinator and it can fetch process and communicate the received data. Smart building, Smart vehicle management, forecasting, Polluting Control and Quality monitoring are the sample emerging applications using Internet of Things (IoT). IoT devices not only sense the data, but also act on the sensed data. In almost all the IoT based applications, data analytics will play a major role to take the dynamic decisions for better performance. Embedded devices, such as sensors, actuators, and smart-phones, provide a great business potential towards the new era of IoT, in which all the devices are able to interconnect and communicate with each other using Internet. The huge number of smart devices plays an important role in bringing about the IoT revolution.

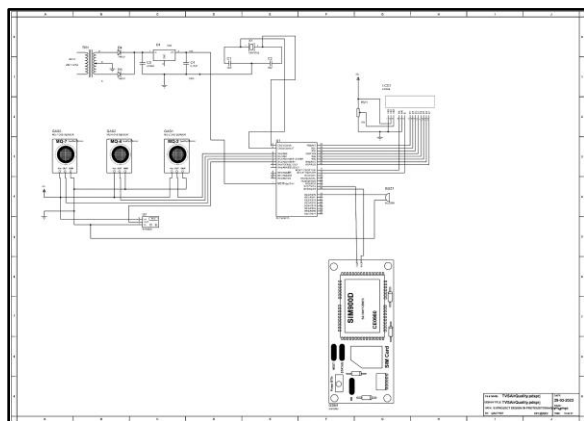
### MATERIALS AND METHODS:

The materials required for this proposed system contains both hardware and software which includes hardware such as Power supply, PIC16F877A Microcontroller, 16x2 LCD display, Carbon monoxide sensor(MQ-7), Smoke

sensor(MQ-2), Methane sensor(MQ-4), Humidity Sensor and a GSM module. The software used here is the MPLAB – IDE and the logic is coded in the ide using embedded C programming language. This system is proposed to monitor pollution using the concept of IoT and its associated techniques. Such a system would monitor the damages done to the environment and the degree of the damage to enforce the corresponding control and prevention practices. The system would then notify the concerned authorities about the issue to enable them to take the necessary steps. The controller then processes this data and transmits it via the internet. This system enables authorities to be alerted in case of dire air quality in a region, thereby facilitating a quick response to control such a situation. An additional advantage offered by which acts as a sensor node to monitor the external environment factors such as temperature, moisture, humidity and Gas sensors. The model is designed using the IoT technology. It is inexpensive, mobile IoT based Air quality monitoring system which senses the real-time surrounding data with the help of three sensors these are MQ7 gas sensor which is used for sensing carbon monoxide, MQ4 sensor which is used for sensing methane, MQ-2 sensor which is used for sensing smoke giving readings to PIC microcontroller as a processing unit and sends this detected data to the internet through GSM module.

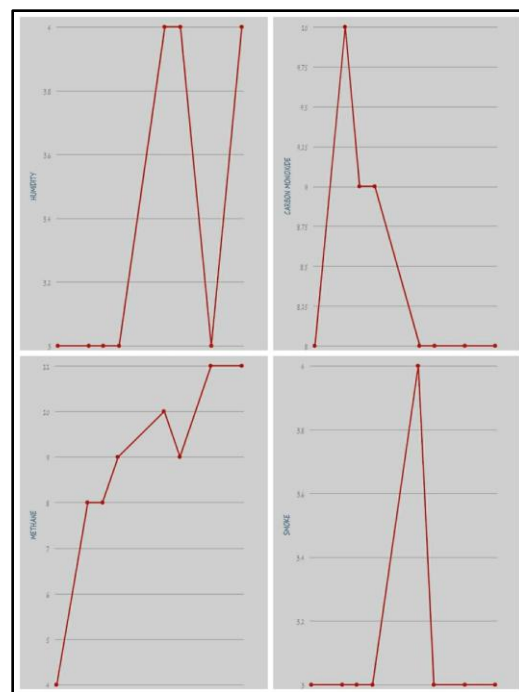
### RESULTS AND DISCUSSION:

The connections are made appropriately according to the following illustration (Fig 3.1) :



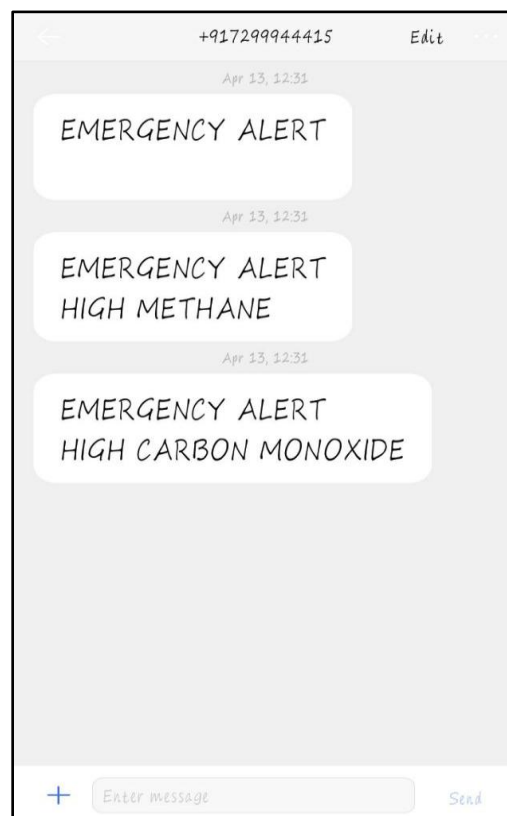
**FIG 3.1 PROJECT ILLUSTRATION**

The parameters such as Smoke, Methane, Carbon monoxide and Humidity are continuously monitored and sent to the third party IOT storage for a frequency of every minute (60 seconds) and the statistics are monitored using a mobile application of the same IOT provider in the form of a graph. The sample snapshot of the graph is shown in Fig 3.2:



**FIG 3.2 SAMPLE SNAPSHOT (GRAPH)**

As this process is going on suddenly when any one or more or all of the parameters that are being monitored breaches the preset threshold level then immediately an emergency alert message is sent through the GSM module to the particular mobile number which is already given as a input to the system. The samples of the alert message which are received while testing the model is shown if Fig 3.3.



**FIG 3.3 MESSAGE ALERT SAMPLE**

**CONCLUSION:**

In this paper, we have designed the efficient air quality monitoring system using sensor module based on IoT technology. Our system has the ability of monitoring the air pollution of any required area by fitting our module. The result gives us more information about the performance and efficiency of the system. The concentration of air pollutants can be monitored by the individual or government concerns for taking necessary actions regarding the pollution and put emphasize regarding in regulations concerning air pollution. This project has a wide scope in the industrial areas where gas, carbon monoxide, smoke and humidity are to be continuously monitored and reported. The emergency alert will be a very useful feature for the industries. Mobile Application shall be designed and created in such a way that the users can monitor the conditions and stay alert using the mobile itself. In the future the IOT can be replaced by using Cloud Technology for achieving better results and efficiency.

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