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AIR QUALITY ESTIMATION USING MQ135

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Abstract - Air pollution is the impurity of air due to the presence of substances in the atmosphere that are harmful to the health of humans and others living or causes harm to the climate or to materials. Air pollution can be avoided if we reduce the release of contaminants. Harmful effects of air quality on earth born health can be avoided if there was a way to monitor the air quality across the area they live. Air quality estimation is a tool for atmosphere control and human health welfare, as air pollution significantly affects the quality of life of the population causing various diseases. It is essential that nations encourage the fulfilment of air quality estimation networks to enable their populations to know and monitor the levels of pollution in the region where they live. Air quality estimation is one of the major concerns due to its influence on human health. With the advancement in sensing and embedded equipment, Internet of Things(IoT) has become one of the economic alternatives to implement air quality estimation systems(AQMS)compared to costly and fixed air quality monitoring stations.

I. INTRODUCTION

The contamination of air and sound is increasing abruptly. To bring it under control its monitoring is majorly recommended. To overcome this issue, we are introducing a system through which the level of sound and the existence of the harmful gases in the surroundings can be detected. The growing pollution at such an alarming rate has started creating trouble for the living beings, may it be high decibels or toxic gases present in the atmosphere leaves a harmful effect on earth born health and thus needs a special attention.

To reduce Air and Sound pollution car manufacturers consider today various alternatives: manufacturing of electrical cars, the creation of new environmentally friendly fuels (Sovacool 2010). Unfortunately, today the reality is that cars do pollute. Even though
manufacturers try to reduce this problem, people behind the wheel are also responsible for creating a better future for themselves and their children. The solution to environmental degradations involves unselfish and compassionate behaviour, a scarce commodity.

Problem Statement

Air detects, such as carbon monoxide (CO), sulfur dioxide ($SO_{(2)}$), nitrogen oxides (NO_x), volatile organic compounds (VOCs), ozone (O(3)), heavy metals, and respire able particulate matter (PM2.5 and PM10), differ in their chemical composition, reaction properties, emission, time of disintegration and ability to diffuse in long or short distances.

Air and Sound pollution has both acute and chronic effects on earth born health, affecting a number of different systems and organs. It ranges from minor upper respiratory irritation to chronic respiratory and heart disease, lung cancer, acute respiratory infections in children and chronic bronchitis in adults, aggravating pre-existing heart and lung disease, or asthmatic attacks.

II. LITERATURE SURVEY

[1] People usually spend more time in the indoor environment. The indoor environment has become the main exposure environment for people and the sleep time in the bedroom accounts for half of indoor life. This study was carried out before and after central heating in a university in northern china in the cold winter of 2020.The purpose was to obtain the

IAQ changes of students during sleep without intervention. Through the combination of field experimental measurement and questionnaire survey, this study was guided.

[2] Real Time System control and Analysis-Based on Internet of Things Technology in Measuring Outdoor Air Quality. Air contamination is the biggest surroundings and public health challenge in the society today. Air disease causes adverse effects on human health, climate and ecosystems. One of the main causes of global warming is the emission of carbon dioxide into the atmosphere.

[3] Air pollution is one of the biggest problems for every developing country. Health problems related to air pollution have been increasing at a faster rate. Because of the air pollution, up to a hundred thousand lives are going out per year in the United States. For instance, deforestation for recent migration has threatened the environment due to COVID-19 pandemic that is defining the area in the southeast part of Bangladesh.

[4] In order to contribute to the estimation of air quality, this article presents a hardware solution based on the Internet of Things (IoT) using low cost sensors, as a way to the measure of contaminant indices in the atmosphere. The advanced solution is a viable tool for large-scale deployment in a scenario of smart cities, because as it is a low cost device, it can be installed in homes, schools, hospitals, companies, etc.

[5] This system provides real time air quality reading, transfers the data through a wireless network to the Internet and displays the data in a dedicated webpage. Atmosphere parameters such as the temperature, relative humidity, CO, carbon dioxide (CO2) and luminosity is sensed by using SHT10, MQ7, T6615, LDR respectively.

[6] The sensor's used are DHT11 and MQ-2. In this system a one-way communication between ThingSpeak, an open source cloud platform, and an Android Application has been developed. Raspberry Pi has been used as a gateway to interface the hardware system.

[7] The system e-nose is produced with an open source, low price, easy installation. The air quality data measured by the GP2Y1010AU, MH-Z14, MICS-4514 and DHT22 sensor array can be monitored via the 32-bit ESP32 Wi-Fi controller and the mobile interface developed by the Blynk IoT platform, and the received data are recorded in a cloud server.

[8] In today's world, air contamination, climate change, and its consequences are of a great concern to the environmentalists and climate change scientists. Health problems arising due to poor air quality are in increase like stroke, heart diseases, lung cancer, respiratory diseases including asthma, Real-time estimation of the air quality requires the live information transfer between the devices over the internet and it can be visualized using an Android Application.

[9] Excessive industrialization has disrupted the balance of the natural atmosphere, causing the reduction of air quality and resulting in serious causes for citizens health This paper is organized as ,it describes pollutants with a mention to their implication in human health causes. the focus is given to popular sensors in air quality monitoring.in presents the hardware trends in this field.

[10] With the quality of air degrading everyday there is a big necessity of an air quality estimation system that not only could sense the quality of air, but also inform people through their cellular devices so that they are aware of the quality of air where they are living in. The objective of this project is to measure the quality of air in real time and sending this data of air quality through a Wi-Fi module to mobile phone and various other devices.

III. METHODOLOGY

Preprocessing-

The Mq135 gas sensor can sense CO,NOx, alcohol, Benzene, smoke, CO2 and some other gases, so it is perfect gas sensor for our **Air Quality Estimation Project**. When we will connect to Arduino Uno then it will sense the gases in air, and we will get the Contamination level in PPM (parts per million). Mq135 sensor gives the output in form of voltage levels and we need to convert it into PPM. So for converts the output in PPM level, here we have used a library for Mq135 sensor, it is explained in detail in "Code Explanation" section below.

Sensor was giving us value of 100 when there was no gas surrounding and the safe level of air quality is 4000 PPM and it should not exceeding 1000 PPM. When it exceeds the limit of 1000 PPM level, then it starts cause Headaches, throat infection and stagnant, stale, stuffy air and if exceeds beyond 2000 PPM then it can cause increased heart rate and many other diseases.

When the value will be less than 1000 PPM, then the LCD and webpage will display "Fresh Air". Whenever the value will increase 1000 PPM, then the buzzer will start buzzing and the LCD and webpage will display "Poor Air Quality, Open Windows". If it will increase 2000 then the buzzer will keep buzzing and the LCD and webpage will display "Danger! Move to fresh Air".

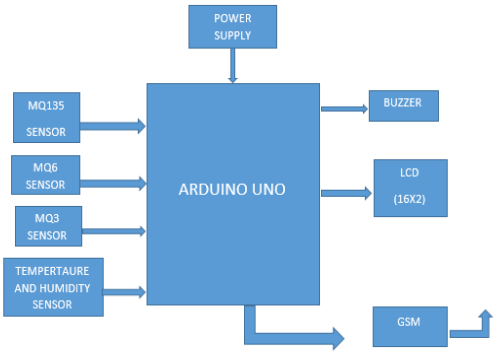

Figure 3.5: Block Diagram of Air Quality Monitoring

Feature Extraction-

The CO and NO sensor placed in the contaminants emitted by the air. These analog values sensed by the sensor will be sent to the ARM processor and ARM processor converts these analog values digital values which are inbuilt.

Flow Chart-

Figure below shows the flow of algorithm used in the system. According to the model the 4 sensors work as input data, they transmit data for knowing which gas it is, what is the temperature and humidity. LCD, GSM and Buzzer are the output devices. LCD shows the data of the all gases in ppm level and Buzzer is used when ppm crosses above a threshold limit.

Value = 90 —> no gas nearby.350 PPM —> air quality is safe.

Limit = 1000 PPM and should not exceed this range. If it exceeds then it will cause headaches, sleepiness and stuffy air. <1000 PPM fresh air. Beyond 2000 PPM increased heart rate.

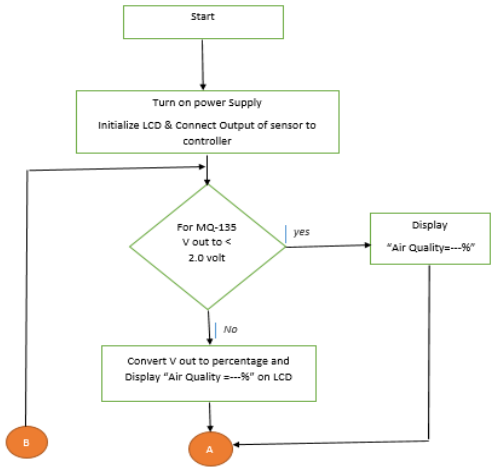

Figure 3.1: System Flow Chart

IV. IMPLEMENTATION

Hardware:

Arduino Uno -

Figure 4.1: Arduino Uno

Arduino/Genuino Uno is a microcontroller board based on the ATmega328P. It has 14 digital input/output pins (of which 6 can be used as PWM outputs), 6 analog inputs, a 16 MHz quartz crystal, a USB connection, a power jack, an ICSP header and a reset button. It contains everything needed to support the microcontroller; simply connect it to a computer with a USB cable or power it with an AC-to-DC adapter or battery to get started.

MQ135 sensor –

Figure 4.2: MQ135 Sensor

A **nitrogen oxide sensor** or **no$_x$ sensor** is typically a high-temperature device built to detect nitrogen oxides in combustion environments such as

an automobile or truck tailpipe or a smokestack.

Temperature and Humidity Sensor -

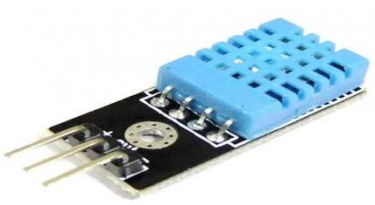

Figure 4.3: Temperature and Humidity Sensor

Temperature and humidity sensor work by measuring the capacitance or resistance of air samples. Most of these sensors utilize capacitive measurement to determine the amount of dampness in the air.

GSM Module-

Figure 4.4: GSM Module

A customised Global System for Mobile communication (GSM) module is designed for wireless radiation monitoring through Short Messaging Service (SMS). This module is able to receive serial data from radiation monitoring devices such as survey meter or area monitor and transmit the data as text SMS to a host server.

LCD Display-

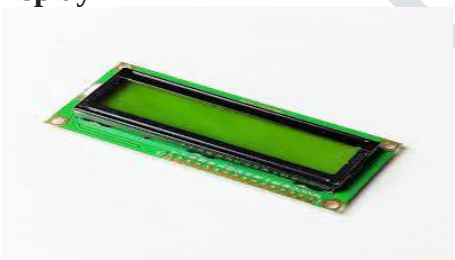

Figure 4.5: LCD Display

A 16x2 LCD means it can display 16 characters per line and there are 2 such lines. In this LCD each character is displayed in 5x7 pixel matrix. The 16 x 2 intelligent alphanumeric dot matrix display is capable of displaying 224 different characters and symbols. This LCD has two registers, namely, Command and Data.

Software:

Arduino IDE –

Figure 4.4 : Arduino IDE

The Arduino integrated development environment (IDE) is a cross-platform application that is written in the programming language C. It is used to write and upload programs to Arduino compatible boards, but also with the help of third party cores, other vendor development boards.

V. RESULT

The propose Air Quality Estimation System provides real-time information about the level of Air and pollution in these regions, as well as provides alerts in cases of drastic change in quality of air. This information can then be used by the authorities to take prompt actions such as evacuating people or sending emergency response team. A wireless distributed mobile Air and pollution monitoring system was implemented using the GPRS public network along with GPS. The system utilizes city buses to collect pollutant gases such as CO, NO2, and SO2. The pollution data from various mobile sensor arrays is transmitted to a central several that make this data available on the Internet through a Google Maps interface. The data shows the pollutant levels and their conformance to local Air quality standards.

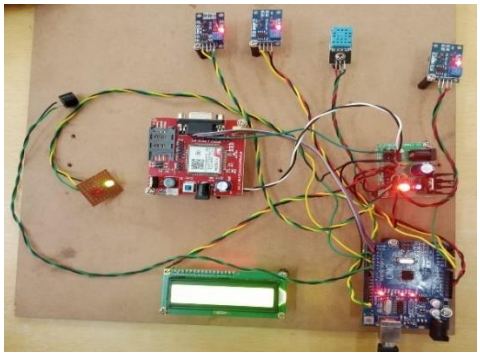

Figure 5.1: Final View of our project

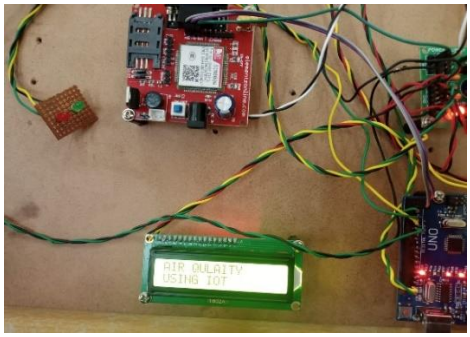

Figure 5.2: LCD display

Figure 5.3: Sensing value of Mq135 Sensor

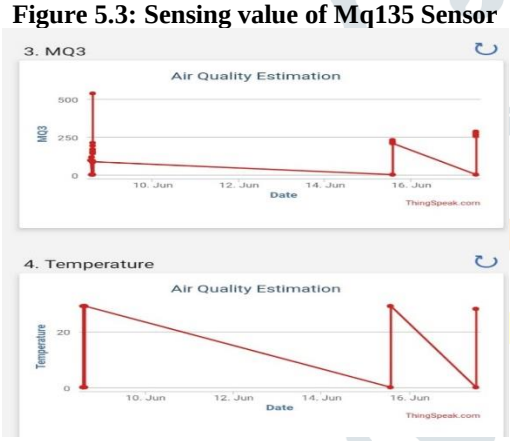

Figure 5.4: Temperature and Humidity value.

VI. CONCLUSION

The proposed Air Quality monitoring system provides real time information about the quality of air, as well as provides alerts in case of drastic changes in air quality. This information can then be used by the authorities to take prompt actions, such as evacuating people or sending emergency response team. It uses an air quality index to categorise the various levels of ppm and other gases present in the air. Constituents such as particulate matter and gases determine the quality of air. These pollutants depreciate the quality of air, that causes severe diseases when inhaled continuously. With air quality monitoring systems, industries can detect the presence of these toxics and monitor air quality to take intelligent measures to improve the quality of air for their workers. This leads to an increase in productivity, reduced equipment damage, and effective regulatory compliance.

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