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IOT Based Air Pollution Monitoring System

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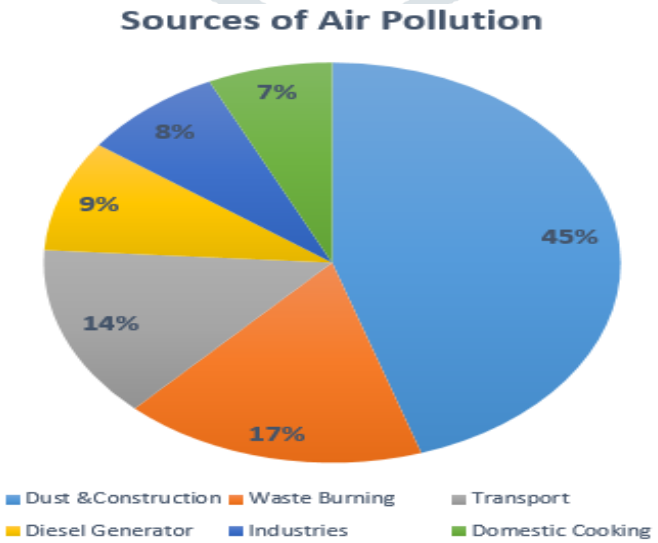
Abstract: Air Pollution is a very serious issue of the current scenario. Air pollution is increasing day by day at a very rapid manner. The world is slowly feeling the massive and diverse consequences of air pollution, leaving its effects not only on the environment but also on humans. As per the study conducted by various researchers at the University of Verona, exposure to air pollution could raise the chance of autoimmune disease in the long term. It is particularly examined that long-term exposure to PM10 and PM2.5 will be deemed toxic to humans at 20µg/m3 for PM2.5 and 30µg/m3 for PM10.Thus it is necessary to come to have some check on the quality of air surrounding us. Keeping this thing in mind in this paper, there is a solution which represent how to detect and monitor the quality of air in a particular area in terms of PPM (Parts per million).

INTRODUCTION: According to the WHO **"Air pollution is contamination of the indoor or outdoor environment by any chemical, physical or biological agent that modifies the natural characteristics of the atmosphere."** Air pollution kills an estimated seven million people worldwide every year. WHO data shows that almost all of the global population (99%) breathe air that exceeds WHO guideline limits containing high levels of pollutants, because of this low and middle income countries suffering from the highest exposures. WHO is supporting countries to address air pollution. There are many sources that contribute in directly or indirectly to pollution of air.

Major sources of Air Pollution Comprises of following:

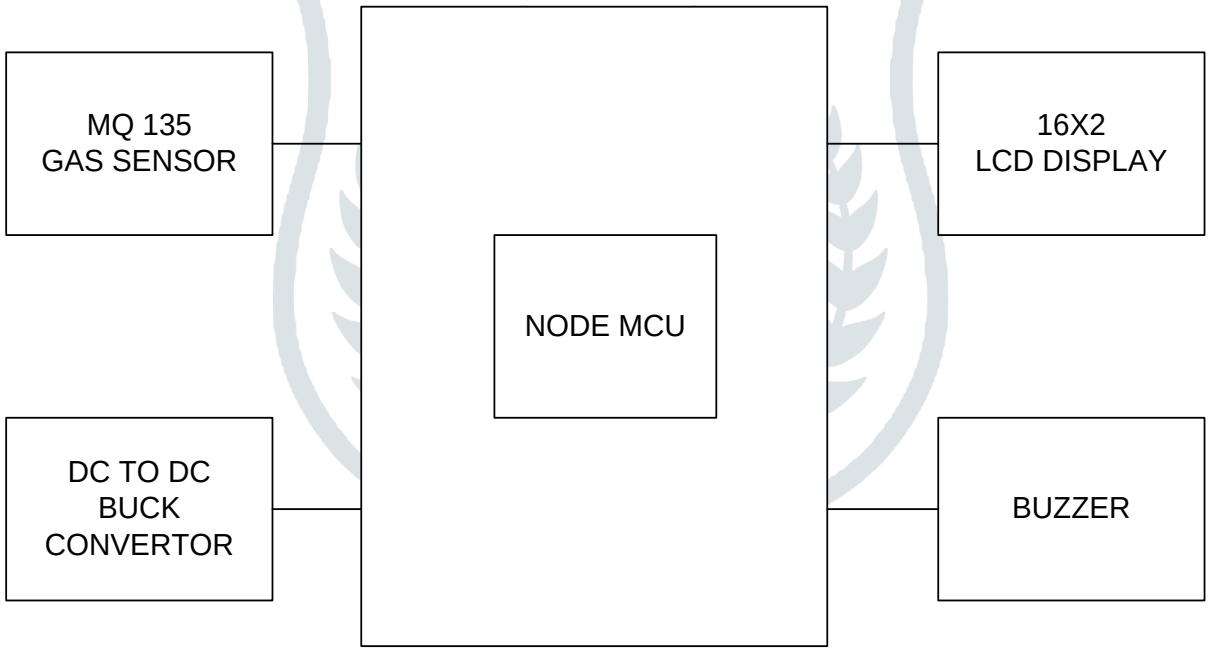


Hence, this diagram clearly shows the adversities of air pollutant which is extremely harmful to not just only humans but all kinds of living organisms present in the environment. In addition to this, air pollutant has also its significant effect on metals and non-metal causing corrosion and rusting.

Therefore, all this creates a need for measurement and analysis of real time air quality monitoring so that appropriate decision can be taken in a timely period. This paper deals with a project which is an implementation of IoT (Internet of Things) Based Air Pollution Monitoring System. In this we will be using MQ 135 Gas sensor and ESP8266 Wi-Fi module for the detection and monitoring of harmful gases like NH3, NOx, alcohol, Benzene, smoke, CO2 and some other gases. We have connected the Wi-Fi module with LCD display screen which shows the real time updated the data in terms of PPM(Parts Per million) and there will be three different kind of messages which will be displayed depending on the quality of air namely as "Good Air" when the value of PPM is below 1, "Normal Air" when PPM value is equal to 1 and lastly "Dangerous Air" when the value of PPM is above 1.This data will also get real time updated on a digital(IOT) platform BLYNK where we have created a dashboard to show the real time changes in quality of air which is easily accessible to public so that everyone can come to know about the Air Quality there location where the system is installed.

Aim of the Project: This paper deals with an implementation of IoT (Internet of Things) Based Air Pollution Monitoring System Using ESP8266 Wi-fi module. Air pollution is a growing issue and it is necessary to monitor air quality for a better future and healthy living for all. Thus Analysis of monitoring data allows us to understand how bad air pollution truly is from everyday life. We can compare this data day-by-day to adopt some measures to stop or reduce pollution in that particular area.

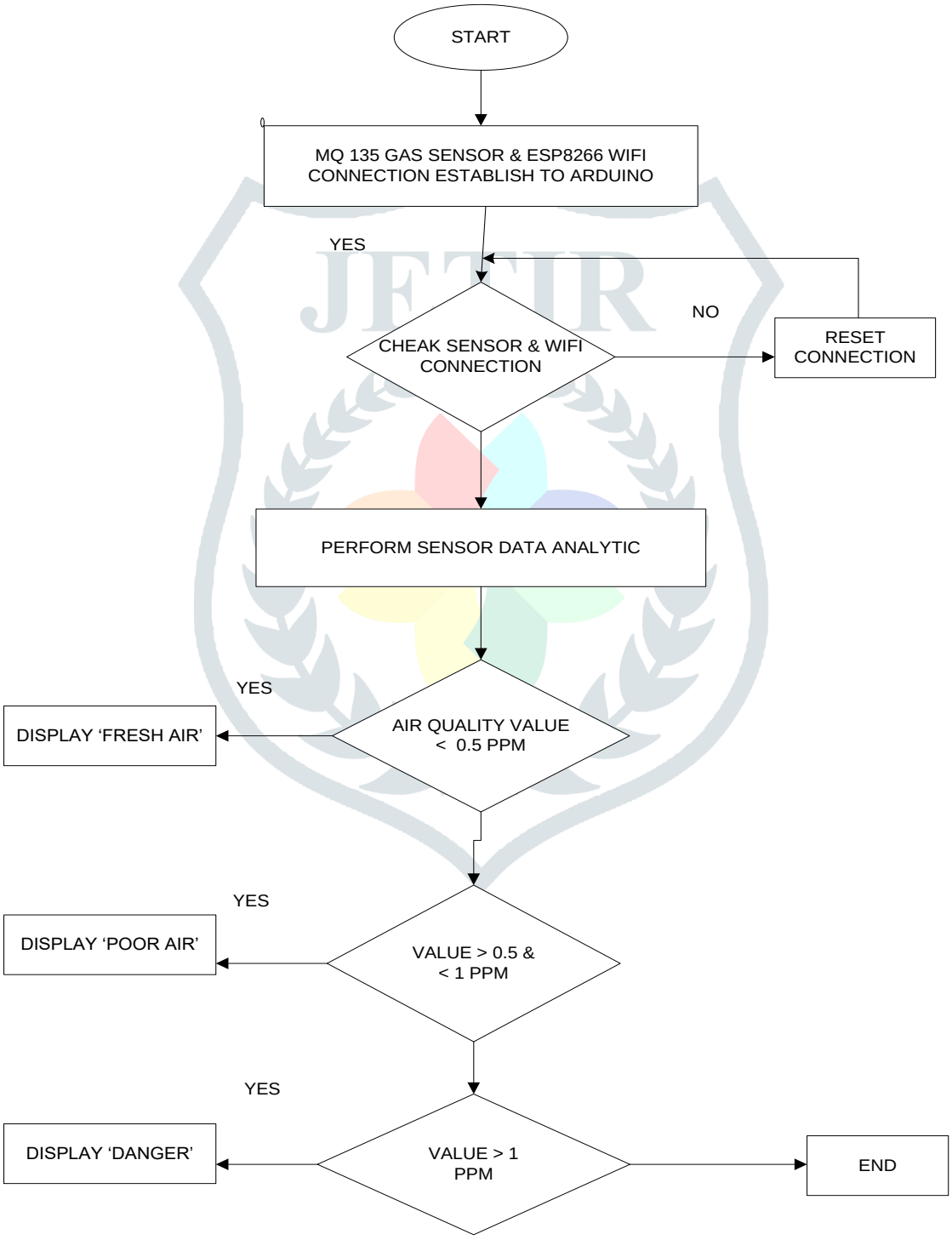
Block Diagram:



Working: The MQ135 gas sensor and ESP8266 both are connected with a Wi-Fi device and Arduino. Connect the V_{CC} and the ground pin of the sensor to the 5V and ground of the Arduino and the Analog pin of sensor to the A_0 of the Arduino. After connecting a buzzer to the pin 7 of the Arduino, a beep occur when the condition becomes true. The MQ135 sensor can sense NH3, NOx, alcohol, Benzene, smoke, CO_2 and some other gases, so it is faultless gas sensor for our air quality observing detection project. When is is connected with Arduino then it senses the gases, and observe the pollution level in PPM (parts per million). MQ135 gas sensor gives the output in form of voltage levels and we need to convert it into PPM. The sensor provide value of 0.1 when there is no gas near it and the safe level of air quality is **0.5 PPM** and it is not exceeding 0.5 PPM. When it exceeds the limit of 0.5 PPM, then it starts cause headaches, sleepiness and stagnant, stale, stuffy air and if exceeds beyond **1 PPM** it can cause increased heart rate and many other diseases. When its value is being less than **0.5 PPM**, then the display unit both LCD and serial monitor displayed **"Fresh Air"**. Whenever the value is increased **0.5 PPM**, then serial monitor is displayed "**Poor Air**". If it is increased **1 PPM**, then the buzzer is kept beeping and the LCD is displayed "**Danger!** .Move to fresh Air". After uploading the code, we

have connected to the Wi-Fi of our ESP8266 device, the data get real time updated on a digital platform BLYNK.We have to refresh the page again if we want to see the current Air Quality Value in PPM. If the value is being less than **0.5 PPM**, then the LCD and digital platform BLYNK displayed "Fresh Air". If the value is increased **0.5 PPM**, then the LCD and digital platform BLYNK will displayed **"Poor Air**, Open Windows". And lastly if value is increased **1.00 PPM** then the buzzer is kept beeping and the LCD and Web Browser are displayed **"Danger!** Move to fresh Air". We also get an email informing about the quality of air in that particular area is dangerous.

Flow Chart:



Technological Specification:

- NODE MCU ESP8266
- MQ 135 GAS SENSOR
- 16x2 LCD
- I2C MODULE
- Passive Buzzer
- LEDs
- 220k Resistance
- 12V 1 Amp Adapter
- DC -DC Convertor Power module
- Blynk App

NODE MCU ESP8266: The NodeMCU (Node Microcontroller Unit) is an opensource software and hardware development environment built around an inexpensive System-on-a-Chip (SoC) called the ESP8266. The ESP8266, designed and manufactured by Espressif Systems, contains the crucial elements of a computer: CPU, RAM, networking (WIFI), and even a modern operating system and SDK. That makes it an excellent choice for Internet of Things (IoT) projects of all kinds.

MQ 135 GAS SENSOR:MQ-135 gas sensor can be implementation to detect the smoke and other harmful gases. It has potential to detect different harmful gases, including NH3, NOx, alcohol, benzene, smoke and CO2. MQ135 gas sensor has high sensitivity to Ammonia, Sulphide and Benzene steam, also sensitive to smoke and other harmful gases.

16x2 LCD:A 16x2 LCD display is a very basic module and is very commonly used in various devices and circuits. 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.

Passive Buzzer: Buzzer is also known as Piezo Speakers (buzzers). We want to generate sound in our project so we have used this simple magnetic buzzer. This one generates a continuous beep usually when supplied with power. It's a "piezo buzzer" which basically a tiny speaker that you can connect directly to an Arduino. From the Arduino, we can make sounds with a buzzer by using tone. You have to tell it which pin the buzzer is on, what frequency (in Hertz, Hz) you want, and how long (in milliseconds) you want it to keep making the tone.

LEDs: A light-emitting diode (LED) is a semiconductor light source that emits light when current flows through it. Electrons in the semiconductor recombine with electron holes, releasing energy in the form of photons. The colour of the light (corresponding to the energy of the photons) is determined by the energy required for electrons to cross the band gap of the semiconductor. White light is obtained by using multiple semiconductors or a layer of light-emitting phosphor on the semiconductor device releasing energy in the form of photons. The colour of the light (corresponding to the energy of the photons) is determined by the energy required for electrons to cross the band gap of the semiconductor. White light is obtained by using multiple semiconductors or a layer of light-emitting phosphor on the semiconductor device.

Blynk App – It provides us various widgets to visualize the data send by the microprocessor. Here we have used the output block to display the air quality value (in ppm) and air quality status.

Advantages of Proposed Project:

Portability: It is a compact device which consists of many sensors including cloud which are all combined by using internet of things (IoT).

Safety: One can avoid from going to particular location by redirecting themselves or by taking safety protections such as wearing mask and can reduce over dumped wastages in a particular locality area.

Cost: Compared to others it's efficient and low cost because sensor is clubbed by using internet of things (IoT) and Arduino microcontroller.

Simple: Maintenance as the Project deals with the software embedded C, so maintenance will be easy and this can also be installed in Arduino.

Accurate Pollution monitoring

Remote location monitoring

Disadvantages:

- Accurate measure of contaminating gases cannot be detected in gases.
- Monitoring of air pollution only.
- No individual vehicle monitoring system

Applications:

- Industrial perimeter monitoring
- Indoor air quality monitoring.
- Site selection for reference monitoring stations.
- Making data available to users

Conclusion:

- The system to monitor the air of environment using Arduino uno.
- IoT technology proposed to improve quality of air.
- Gas sensor gives the sense of different type of dangerous gases.
- It supports new technology and healthy life concept.

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