A Review on IoT Based Air Pollution Monitoring System

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Abstract-. *Evidence shows that Smart Cities are starting to materialise in our lives through the gradual introduction of the Internet of Things (IoT) paradigm. In this scope, crowd sensing emerges as a powerful solution to address environmental monitoring, allowing to control air pollution levels in crowded urban areas in a distributed, collaborative, inexpensive and accurate manner. However, even though technology is already available, such environmental sensing devices have not yet reached consumers. In this paper, we present an analysis of candidate technologies for crowd sensing architectures, along with the requirements for empowering users with air monitoring capabilities. Specifically, we start by providing an overview of the most relevant IoT architectures and protocols. Then, we present the general design of an off-the-shelf mobile environmental sensor able to cope with air quality monitoring requirements; we explore different hardware options to develop the desired sensing unit using readily available devices, discussing the main technical issues associated with each option, thereby opening new opportunities in terms of environmental monitoring programs.*

Keywords- air pollution, smart cities, IoT, environmental monitoring

1. INTRODUCTION

Nowadays the air condition is very polluted. In recent years, car emissions, chemicals from factories, smoke and dust are everywhere. That is the reason why now air condition is very polluted. The effect of air pollution is very bad for our health, especially for place where the air in our body is taken for breathing. In our lungs may cause some diseases, such as asthma, cough, lung disorders. The air pollution cannot be detected by human feelings. The air pollution may contain a lot of dangerous substances, such as LPG gas, smoke, carbon monoxide, methane. Substances in the polluted air are very dangerous. For example, if the carbon monoxide is above 100ppm, it makes human feel dizzy, nauseous, and within minutes they could die. This research makes human find out which content of the air is polluted. With module nodemcu esp8266, we can monitor the air pollution remotely, because there is a Wi-Fi in nodemcu esp8266. This makes the air condition can be monitored every time.[1]

2. LITERATURE SURVEY

Air pollution is a mixture of solid particles and gases in the air. Car emissions, chemicals from factories, dust, pollen and mold spores may be suspended as particles. Effect of air pollution has many bad things and the others may cause problems to our health, for instance, asthma, cough, and lung disorders. In addition, the pollutant can cause global warning, acid rain,and disturbing plant growth. Basically, a human cannot determine whether the air is good or not. Hence, it is necessary to have a tool that can measure the air quality. This research is purposed to design an air quality monitoring system by utilizing esp8266 module. As the result, users can monitor the air quality using Smartphone connected through ESP8266 Wi-Fi. Therefore the air condition can be monitored every time. Currently, there is so much air pollution cases that actually can be changed if we are aware. In other words we can contribute as part of the solution instead part of the pollution.[1] 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. In order to monitor In this project we are going to make an IOT Based Air Pollution Monitoring System in which we will monitor the Air Quality over a web server using internet and will trigger a alarm when

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the air quality goes down beyond a certain level, means when there are sufficient amount of harmful gases are present in the air like CO2, smoke, alcohol, benzene and NH3. It will show the air quality in PPM on the LCD and as well as on webpage so that we can monitor it very easily. In this IOT project, you can monitor the pollution level from anywhere using your computer or mobile.[2]

The level of pollution is increasing rapidly due to factors like industries, urbanization, increasing in population, vehicle use which can affect human health. IOT Based Air Pollution Monitoring System is used to monitor the Air Quality over a web server using Internet. It will trigger an alarm when the air quality goes down beyond a certain level, means when there are sufficient amount of harmful gases present in the air like CO2, smoke, alcohol, benzene, NH3 and NOx. It will show the air quality in PPM on the LCD and as well as on webpage so that air pollution can be monitored very easily. The system uses MQ135 and MQ6 sensor for monitoring Air Quality as it detects most harmful gases and can measure their amount accurately.[3]

3. REQUIREMENTS

3.1 Hardware Requirement

1) MQ135 Gas sensor
2) Arduino Uno
3) Wi-Fi module ESP8266
4) 10K potentiometer
5) 71K ohm resistors
6) 220 ohm resistor
7) MQ 6 LPG gas sensor
8) Temperature sensor LM35

3.2 Software Requirement

1) Arduino 1.6.13 Software
2) Embedded C Language

4. METHODOLOGY

4.1 Working

Proposed Air Pollution Monitoring System is based on the block diagram as shown in Fig.1. The data of air is recognized by MQ135 gas sensor and MQ6 LPG gas sensor. The MQ135 sensor can sense NH3, NOx, alcohol, Benzene, smoke, CO2. So it is dynamic gas sensored for our Air pollution Monitoring system. When it will be connected to Arduino then it will sense all gases, and it will give the Pollution level in PPM (parts per million). MQ135 gas sensor will give the output in

form of voltage levels and we have to convert it into PPM. So for converting the output in PPM, we have used a library for MQ135 gas sensor and MQ6 sensor.

Sensor is giving us value of 90 when there is no gas near it and the air quality safe level is 350 PPM and it should not exceed 1000 PPM. When it will exceed the limit of 1000 PPM, it will cause Headaches, sleepiness and stagnant, stuffy air. If it exceeds beyond 2000 PPM then it will cause increased heart rate and many different diseases. When the value will be less than 1000 PPM, then the LCD and webpage will display "Fresh Air". When the value will increase from 1000 PPM, then the buzzer will start beeping and the LCD and webpage will display "Poor Air, Open Windows". And when it will increase 2000, the buzzer will keep beeping and give an alert message on smartphone through GSM. The LCD and webpage will display "Danger! Move to fresh Air". It will contain temperature and humidity so it will possibly show the current temperature and humidity of the air. For temperature we have used LM35 sensor and for humidity SY-HS-220.

According to the model the 4 sensors works as input data, they transmit data for knowing which gas it is, what is the temperature and humidity. LCD and Buzzer are the output devices. LC
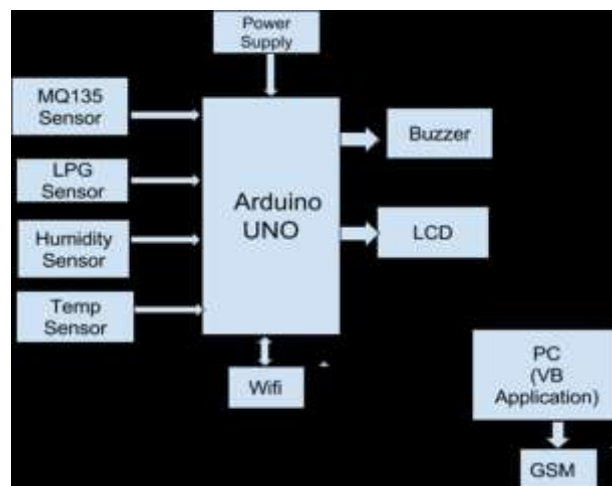

Fig. 1: Block Diagram

4.2 System Hardware

The chip first came to the attention of western makers in August 2014 with the **ESP-01** module, made by a third-party manufacturer Ai-Thinker. This small module allows microcontrollers to connect to a Wi-Fi network and make simple TCP/IP connections using Hayes-style commands. However, at the time there was almost no

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English-language documentation on the chip and the commands it accepted.[2] The very low price and the fact that there were very few external components on the module, which suggested that it could eventually be very inexpensive in volume, attracted many hackers to explore the module, chip, and the software on it, as well as to translate the Chinese documentation

4.2.1 ESP8266

ESP8266. The **ESP8266** is a low-cost Wi-Fi microchip with full TCP/IP stack and microcontroller capability produced by Shanghai-based Chinese manufacturer Espressif Systems. The ESP8285 is an **ESP8266** with 1 MiB of built-in flash, allowing for single-chip devices capable of connecting to Wi-Fi.

Fig 1 : ESP8266 Model

Wifi Module

4.2.2 Arduino UNO:-

Arduino Uno is a microcontroller board based on the ATmega328P. It has 14 digital input/output pins 6 analog inputs, a 16 MHz quartz crystal, a USB Connection, power jack, an ICSP header and a reset button as shown fig.
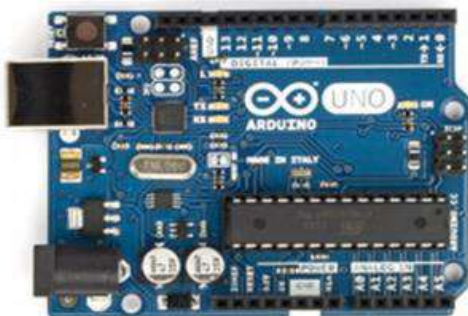

Fig. 2: Arduino UNO

4.2.3 MQ135 sensor:-

The MQ135 sensor can sense NH3, NOx, alcohol, Benzene, smoke, CO2 and some other gases. It gives the output in form of voltage levels.

Fig.3 shows the sensor MQ135.

4.2.4 Humidity Sensor:-
The humidity sensor is of capacitive type, comprising on chip signal conditioner. However, it is mounted on the PCB, which also consists of other stages employed to make sensor rather smarter. The PCB consists of CMOS timers to pulse the sensor to provide output voltage.

Fig.10 shows SY-HS-220 sensor for Humidity.

4.2.5 LPG Sensor:-
MQ-6 sensor is a simple-to-use liquefied petroleum gas (LPG) sensor, suitable for sensing LPG (composed of mostly propane and butane) concentrations in the air.
The MQ-6 can detect gas concentrations anywhere from 200 to 10000ppm.

Fig.7 shows LPG sensor (MQ6).

4.2.6 Temperature Sensor:-

The LM35 is precision integrated-circuit temperature sensor, whose output voltage is linearly proportional to the Celsius (Centigrade) temperature.

It can be used with single power supplies, or with plus and minus supplies. Fig.9 shows LM35 sensor for Temperature.

Fig. 9: LM35 (Temperature sensor)

5.APPLICATIONS

1) Industrial perimeter monitoring
2) Indoor air quality monitoring.
3) Site selection for reference monitoring stations.
4) Making data available to users.

6. ADVANTAGES

1) Easy to Install
2) Updates On mobile phone directly
3) Accurate Pollution monitoring
4) Remote location monitoring C++ .

7. CONCLUSION

The system to monitor the air of environment using Arduino microcontroller, IOT Technology is proposed to improve quality of air. With the use of IOT technology enhances the process of monitoring various aspects of environment such as air quality monitoring issue proposed in this paper. Here, using the MQ135 and MQ6 gas sensor gives the sense of different type of dangerous gas and arduino is the heart of this project.

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