

AIR POLLUTION DETECTION USING IOT

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Abstract: This website is user friendly for end user. Air pollution affects our day to day activities and quality of life. It poses a threat to the ecosystem and the quality of life on the planet. The dire need to monitor air quality is very glaring, owing to increased industrial activities over the past years. People need to know the extent to which their activities affect air quality. This project proposes an air pollution monitoring system. The system was developed using the Arduino microcontroller. The air pollution monitoring system was designed to monitor and analyze air quality in real-time and log data to a remote server, keeping the data updated over the internet. Air quality measurements were taken based on the Parts per Million (PPM) metrics and analyzed using Microsoft Excel. The air quality measurements taken by the designed system was accurate. The result was displayed on the designed hardware's display interface and could be accessed via the cloud on any smart mobile device.

Keywords: IoT, Gas Sensor, Pollution Monitoring System.

1. INTRODUCTION

Over the past quarter century, there has been an exponential growth of industries. These industries have caused complex and serious problems to the environment. Considering the significance of air quality on human lives, the World Health Organization (WHO) has developed guidelines for reducing the health effects of air pollution on public health by setting the limits of the concentrations of various air pollutants, some of which are ground-level ozone (O₃), nitrogen dioxide (NO₂), and sulfur dioxide (SO₂). The first and the foremost is the severe environmental pollution which has caused deterioration of atmosphere, climate change, stratospheric ozone depletion, loss of biodiversity, changes in hydrological systems and the supplies of fresh water, land degradation and stress on systems of food producing, acid rain, and global warming. Stationary and mobile sources release various chemical pollutants, including suspended particulate matter (SPM), carbon monoxide (CO), oxides of nitrogen (NO), oxides of sulfur (SO), lead aerosol, volatile organic compounds (VOC), and other toxics. It is well known that some of these chemical pollutants have increased the occurrence of diseases such as lung cancer, pneumonia, asthma, chronic bronchitis, coronary artery disease, and chronic pulmonary diseases. The main objective of IOT Air & Sound Monitoring System is that the Air and sound pollution is a growing issue these days. It is necessary to monitor air quality and keep it under control for a better future and healthy living for all. Due to flexibility and low cost Internet of things is getting popular day by day. With the urbanization and with the increase in the vehicles on road the atmospheric conditions have considerably affected. Analysis of monitoring data allows us to assess how bad air pollution and sound pollution is from day to day.

2. WORKING

The sensors are used to sense the current status in the air. The sensors are connected to the controller. The controller receives the value and converts into digital form and those values are updated in the web server through GSM modem. The default values are already stored in the web server. The current data will be compared with the default values to analyze the result. The pollution status will be uploaded in the web server. So, the user can view anywhere through

internet. When there is an pollution that occurs this shows the total amount of gases which is present on the particular locality example CFC (chlorofluorocarbon) carbon-monoxide and many toxic gases can identified by the amount of percentage which is present on it. The main working principle behind this is IOT which collects information from the cloud which consists of information about the pollution status which is present in our environment. The microcontroller which is used in this device is that Adreuno microcontroller which consists of 6 outputs and 6inputs so that many sensors can be clubbed together which totally sums up together as pollution detector and monitoring using an IOT device.

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. LCD shows the data of the gases in ppm (parts per million) and Buzzer is used when ppm crosses above a threshold limit.

3. EXISTING MODEL

The commercial meters available in the market are Fluke CO- 220 carbon monoxide meter for CO, Amprobe CO2 meter for CO2, Forbix Semicon LPG gas leakage sensor alarm for LPG leakage detection. The researchers in this field have proposed various air quality monitoring systems based on WSN, GSM and GIS. Now each technology has limited uses according to the intended function, as Zigbee is meant for users with Zigbee trans-receiver, Bluetooth. GIS based system is de-signed, implemented and tested to monitor the pinpoints of air pollution of any area. It consists of a microcontroller, gas sensors, mobile unit, a temporary memory buffer and a web server with internet connectivity which collects data from different locations along with coordinate’s information at certain time of a day. The readings for particular location are averaged in a closed time and space. The Global Positioning System (GPS) module is attached to a system to provide accurate representation of pollution sources in an area. The recorded data is periodically transferred to a computer through a General Packet Radio Service (GPRS) connection and then the data will be displayed on the dedicated website with user acceptance.

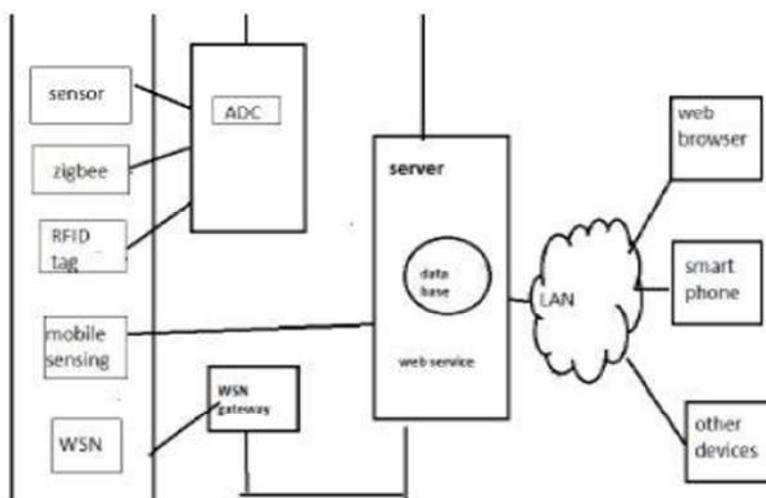


Fig 1. Existing System using Zigbee Technology

4. PROPOSED MODEL

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 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.

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, NO_x, alcohol, Benzene, smoke, CO₂. So it is dynamic gas sensed 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.

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”.

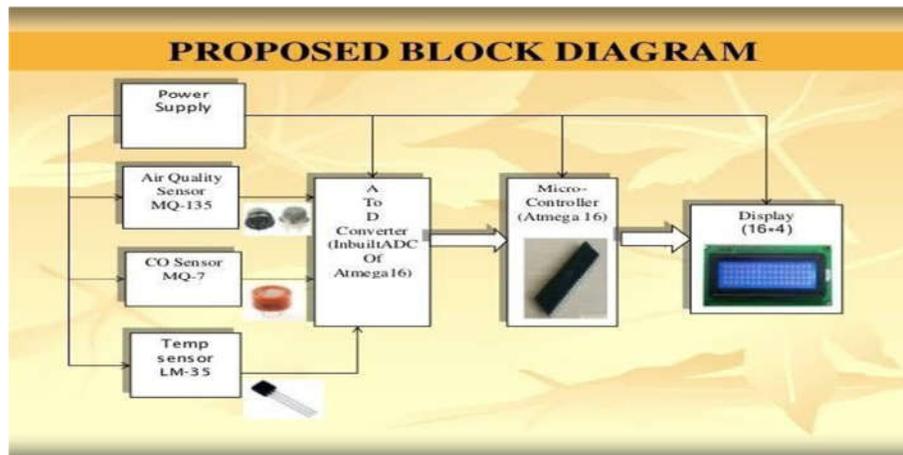


Fig 2. Block Diagram

5. BACKGROUND WORKING

Components Working:-

1) Arduino UNO:-

Arduino is a single-board microcontroller meant to make the application more accessible which are interactive objects and its surroundings. The hardware features with an open-source

hardware board designed around an 8-bit Atmel AVR microcontroller or a 32-bit Atmel ARM. Current models consists a USB interface, 6 analog input pins and 14 digital I/O pins that allows the user to attach various extension boards.

The Arduino Uno board is a microcontroller based on the ATmega328. It has 14 digital input/output pins in which 6 can be used as PWM outputs, a 16 MHz ceramic resonator, an ICSP header, a USB connection, 6 analog inputs, a power jack and a reset button. This contains all the required support needed for microcontroller. In order to get started, they are simply connected to a computer with a USB cable or with an AC-to-DC adapter or battery. Arduino Uno Board varies from all other boards and they will not use the FTDI USB-to-serial driver chip in them. It is featured by the Atmega16U2 (Atmega8U2 up to version R2) programmed as a USB-to-serial converter.

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 in Fig. 3



Fig. 3: Arduino UNO

2) MQ135 sensor:-

MQ-135 is an air quality or air pollution measuring sensor device. It can detect various chemical contents in air and give appropriate voltage variation at the output pin depending on the chemical concentration in air.

It can detect alcohol, Benzene, smoke, NH₃, butane, propane etc. if anyone of the stated chemical concentration rises, the sensor convert the chemical concentration in air to appropriate voltage range, which can be processed by Arduino or any microcontroller. It cannot tell what kind of chemical concentration rose in the air. It is 6 terminal device which is symmetric in terminal placement; both the sides of the terminal are interchangeable.

The MQ135 sensor can sense NH₃, NO_x, alcohol, Benzene, smoke, CO₂ and some other gases. It gives the output in form of voltage levels. Fig.4 shows the sensor MQ135.



Fig. 4: MQ135

3) WIFI Module (ESP8266):-

The ESP8266 WiFi Module is a self-contained SOC with integrated TCP/IP protocol stack that can give any microcontroller access to your WiFi network. The ESP8266 is capable of either hosting an application or offloading all Wi-Fi networking functions from another application processor. Each ESP8266 module comes pre-programmed with an AT command set firmware, meaning, you can simply hook this up to your Arduino device and get about as much WiFi-

ability as a WiFi Shield offers (and that's just out of the box)! The ESP8266 module is an extremely cost effective board with a huge, and ever growing, community.

This module has a powerful enough on-board processing and storage capability that allows it to be integrated with the sensors and other application specific devices through its GPIOs with minimal development up-front and minimal loading during runtime. Its high degree of on-chip integration allows for minimal external circuitry, including the front-end module, is designed to occupy minimal PCB area. The ESP8266 supports APSD for VoIP applications and Bluetooth co-existence interfaces, it contains a self-calibrated RF allowing it to work under all operating conditions, and requires no external RF parts.

There is an almost limitless fountain of information available for the ESP8266, all of which has been provided by amazing community support. In the *Documents* section below you will find many resources to aid you in using the ESP8266, even instructions on how to transforming this module into an IoT.

The ESP8266 is a low-cost Wi-Fi chip with full TCP/IP stack and MCU (microcontroller unit) capability. It runs on 3.3V and gives our system access to Wi-Fi or internet. Fig.5 shows Wi-Fi Module (ESP8266).



Fig. 5: Wifi Module

4) LPG Sensor:-

This 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. This sensor has a high sensitivity and fast response time. The sensor's output is an analog resistance. The drive circuit is very simple; all you need to do is power the heater coil with 5V, add a load resistance, and connect the output to an ADC.

LPG Gas Sensor (MQ6) Features:

- High Sensitivity to LPG, iso-butane, propane
- Small sensitivity to alcohol, smoke
- Detection Range: 100 - 10,000 ppm iso-butane propane
- Fast Response Time: <10s
- Simple drive circuit
- Heater Voltage: 5.0V

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.6 shows LPG sensor (MQ6).



Fig. 6: LPG Sensor MQ6

6. 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. Which control the entire process. Wi-Fi module connects the whole process to internet and LCD is used for the visual Output.

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The authors gratefully acknowledge the Department of Computer Science. As civilians are now equally aware and curious about their environment, this concept of IOT is beneficial for the welfare of the society. And it is implemented using the latest technology. The system to monitor the air of environment using Arduino microcontroller, IOT Technology is proposed to improve quality of air.

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