

Air Monitoring Device

Amanpreet Singh Khajuria¹, Vidushi Sharma², Avikash Gupta³,
Sonakshi Gupta⁴

^{1,2,3}Student, Model Institute of Engineering and Technology, Kot Bhalwal, Jammu, J&K, India.

⁴Asst. Professor, Dept. of Electronic and communication, Model Institute of Engineering and Technology, Kot Bhalwal, Jammu, J&K, India.

Abstract - As air is critical for healthy living and because of rampant air pollution becoming common it is becoming laborious for both human and other living organisms to live a healthy life. The cause for monitoring the air quality is to record different criterion related to the pollution and process this data so that appropriate steps can be taken by the authorities to make a decision on improving and managing the environment. Our project is an air quality monitoring system, measuring the quality of air by employing sensors that detect air pollutant concentration levels, which will provide meticulous data for scrutinize so that proper steps to curb pollutions and its sources.

Key Words: Air Pollution, Monitoring, GPS, Sensors Particulate Matter

1. INTRODUCTION

Monitoring is a fastidious approach for observing and studying the condition of our environment over a period of time for efficacy review. Healthy living conditions require clean air but due to increasing air pollution it is becoming arduous for both human and other living organisms to live day by day. To monitor the effect of this pollution on us and our surroundings it is necessary to track and monitor the level of pollutants in both urban and sub urban areas. Therefore, air quality monitoring is essential in order to provide useful information about the pollution and apt actions can be taken to mitigate the negative impact whenever it is necessary. The purpose of monitoring the air quality is not only to gather the data but also provide the information which is indispensable by the scientist, planners and policy makers to make a decision on improving and managing the environment.

Thus main reason for monitoring the air quality is to record different framework related to the pollution and process this data so that apt steps can be taken by the authorities. To circumvent such adverse imbalances in the nature, an air pollution monitoring system is utmost foremost. An air pollution monitoring system that is comprehensive in terms of spatial and pollutant coverage and is relatively reasonable and autonomous is the priority.

Our project will measure temperature, humidity, concentration of gases in ppm and size of the particulate matter (PM) and also provide the meticulous location using GPS. This data then will be displayed on the LCD and data can also be accessed remotely. The air pollution monitoring device developed in this project is based Arduino Nano.

2. SYSTEM OBJECTIVES

The main objectives of the system are:

- System must be easy to deploy.
- System must provide accurate data.
- System must provide real time data.
- System should be easily maintainable.
- System should be portable.
- System should be secure.

3. METHODOLOGY

3.1 BLOCK DIAGRAM

Figure 1 show the block diagram of system. The System consists of following modules:-

1. Arduino Nano
2. Gas Sensor (MQ 135)
3. Temperature and humidity sensor (DHT11)
4. PM Sensor (DSM501A)
5. GPS Module
6. Ethernet Module
7. 16×2LCD Display

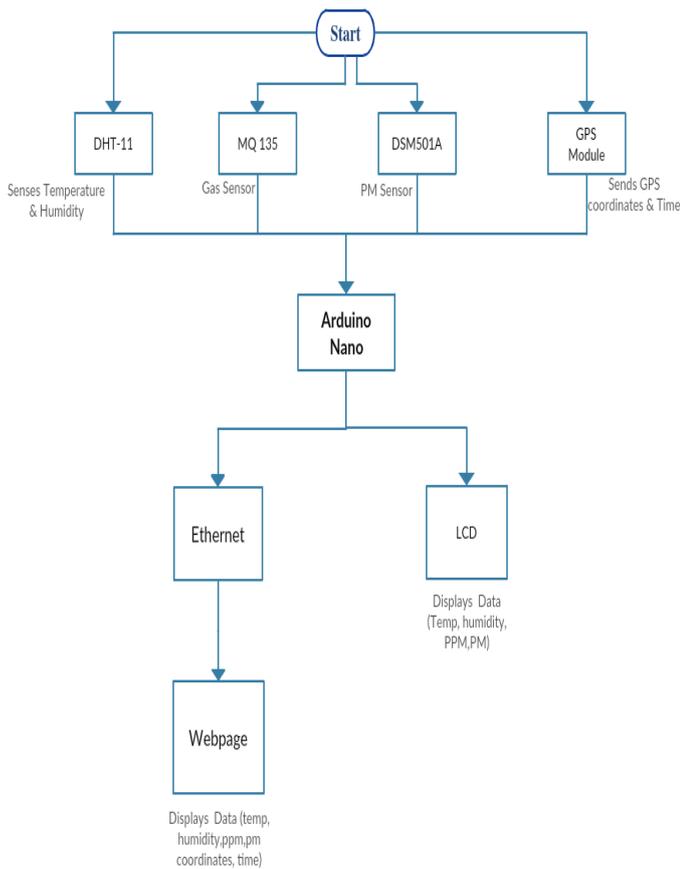


Figure 1: Block Diagram of the System

4. SYSTEM DESCRIPTION

4.1 Arduino Nano (8 bit microcontroller):

Arduino Nano is based on ATmega328. It can be easily used along with a breadboard. It is small in size as compared other Arduino controllers such as Arduino Uno r3, Arduino mega etc. It does not contain D.C power jack. It can be connected through mini-B USB cable. It is used for processing the information provided by the sensors.

- It uses ATmega328 microcontroller.
- It has 14 digital I/O pins
- It has 8 analog input pins It uses clock speed of 16MHz.
- It has input voltage of 7-12V.
- It has operating voltage of 5V.
- It has 32kb of flash memory

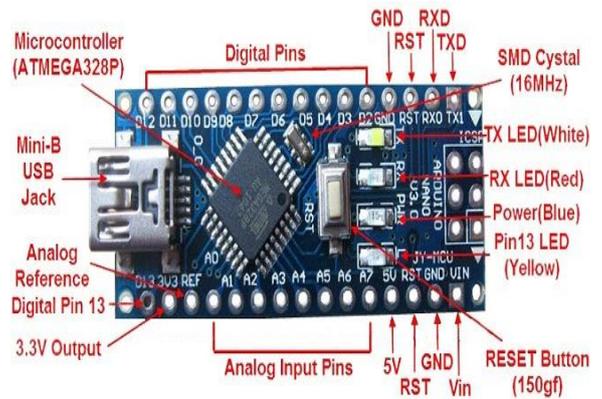


Figure 2: Arduino Nano

4.2 MQ135:

“MQ-135 gas sensor applies SnO₂ which has a lower conductivity in the clear air as a gas-sensing material. In an atmosphere where there may be polluting gas, the conductivity of the gas sensor raises along with the concentration of the polluting gas increases. MQ-135 performs a good recognition to carbon-dioxide and other harmful gas, especially sensitive to ammonia, sulfide and benzene steam.” It has an operating voltage of 2.5-5V.

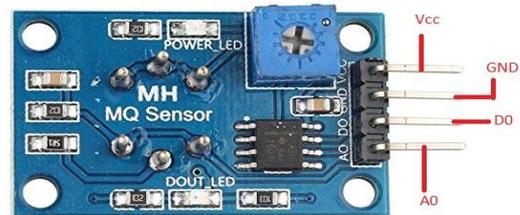


Figure 3: MQ 135

4.3 DHT11:

DHT11 is used for the measurement of two quantities temperature and humidity. It has a humidity sensing component which has two electrodes and a hygroscopic substrate between them to measure the humidity. It uses an NTC type resistor or a thermistor to measure the temperature.

- It has a temperature range of 0-50 °C.

- It has humidity range of 20-80%.
- It has sampling rate of 1Hz.
- It has operating voltage of 3-5V.

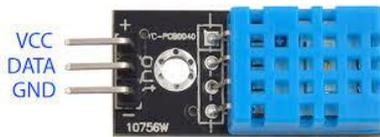


Figure 4: DHT11

- It has a LED signal indicator.



Figure 5: GPS Module

4.4 DSM501A:

- DSM501A is the dust sensor which can be used to measure the density of particles having size greater than one micron with great precision. It requires 5V of operating voltage.
- It shows density in $\mu\text{g}/\text{m}^3$.
- It uses quantitative particle density measurement with the principle of particle counter.



Figure 4: DSM501A

4.5 GPS Module:

We are using GPS module to get the physical location. It will provide us the latitude and longitude coordinates of the location. We are using Neo-6 as our GPS module.

- It has power supply range of 3-5V.
- It has a ceramic antenna. The antenna size is 25 x 25mm.
- It uses SPI communication.

4.6 Ethernet Module:

“The ENC28J60 is a self-contained Ethernet controller with an industry standard Serial Peripheral Interface (SPI). It is plotting to serve as an Ethernet network interface for any controller equipped with SPI.” It is based on IEEE 802.3 specifications. ENC28J60 is used here to connect the Arduino Nano to the internet. The data processed by the microcontroller is sent to the webpage through the Ethernet module ENC28J60. It has supply voltage of 3.3-5V. It has 25MHz clock.



Figure 6: Ethernet Module

4.7 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. This LCD has two registers, namely : Command and Data. The command register stores the command instructions given to the LCD. A command is an instruction given to LCD to do a predefined task like initializing it, clearing its screen, setting the cursor position, controlling display etc. The data register stores the data to be displayed on the LCD.

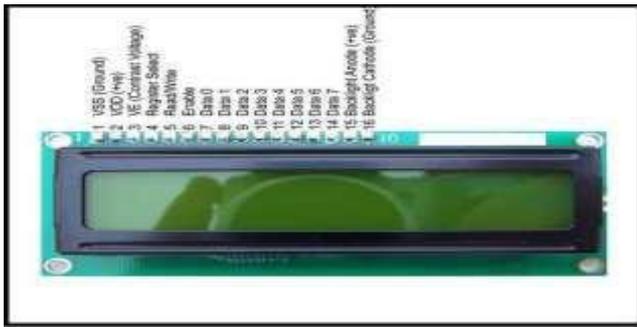


Figure 4: LCD Display

5. RESULT FROM WEBPAGE

We can see the following things from the webpage which are :

Concentration Of gases in PPM

Temp in C

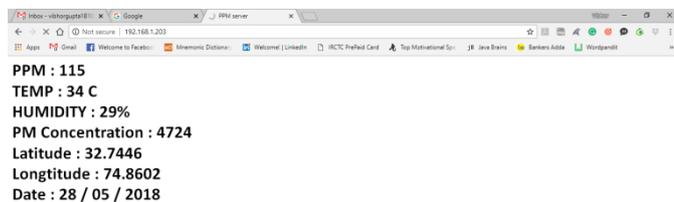
Humidity

PM concentration

Latitude

Longitude

Date



CONCLUSION

Environmental science as well as our health is intensively affected by that air pollution. This has lead to the death of many naive lives as they fall victim to diseases like lung cancer, asthma etc. So the people strive for new breaths of clean and transparent air. This project provides information to the public about projected levels of environment pollution, with extra stress on reduction of outside action and avoidance of car driving and other petrol vehicles in such highly polluted areas. Threshold Values have already been defined by the scientists long

ago. When the levels of PM (2.5 and 10) and ammonia in air cross these threshold values it becomes harmful for people causing various heart and lung diseases. A remote survey is conducted to accumulate the data for future reference. Installing reference air quality monitoring systems root on gas analyzer technology is one way to compute road, motorway and highway emissions. But their cost and magnitude limits the number of monitoring locations.

REFERENCES

- [1]. <http://www.iosrjournals.org/iosr-jece/papers/Vol.%2011%20Issue%202/Version-2/F1102022740.pdf>
- [2]. <https://plot.ly/arduino/air-quality-tutorial/>
- [3]. <http://www.learningaboutelectronics.com/temperature-sensor-LCD-arduino-circuit>
- [4]. <https://www3.epa.gov/region1/airquality/pm-aq-standards.html>
- [5]. <https://www.rapidonline.com/pdf/73-4443.pdf>
- [6]. <https://link.springer.com/article/10.1186/2193-2697-1-10>
- [7]. <https://electronicsforu.com/electronics-projects/iot-enabled-air-pollution-meter>
- [8]. <http://electronicsforu.com//hardware-diy/make-air-quality-meter>
- [9]. <https://www.engineersgarage.com/contribution/arduino-based-air-quality-monitoring-iot-project>