Design of Air Pollution Detector using Arduino

Pandimadevi Ganesan, Thushara Hameed ,Maheswari Maruthakutti and Dr.Selvakumar Vairamuthu
College of enginerring and technology
University of Technology and Applied Sciences, Nizwa, Oman

Abstract— Where pollution has become a major problem around the world, air pollution is the most dangerous, shocking and severe pollution among other pollutions e.g. water pollution, soil pollution, noise pollution, light pollution, thermal pollution etc. Air pollution is the major cause of diseases like asthma, cancer, bronchitis, birth defects and immune system like diseases. This system implements the combination of an arduino, gas sensors (CO2, CO, LPG) and particle detector PPD42 to sense the air quality of the environment and shows the real condition of air using a LCD I2C display unit. This device can be used to monitor various gasses at a time. The system will give the user the indication of the air quality and based on given parameters it will let the user know how much the environmental air is polluted or safe.

Keywords: **Arduino, Air pollution, Gas sensors, particle detector.**

I. INTRODUCTION

Considering the daily newspapers and any other electronic or print media, a devastating news which is spreading day by day is people is becoming sick and the climate is changing such a way that it has become miserable for living of people. From the aspect from top to bottom, every people are suffering the curse of climate change. The main reason for the climate change and people health is air pollution. It has brought changes in climate like global warming, global dimming, over raining, drought, storms, acid rain, foggy weather etc. The living things on earth and under water are suffering many problems like change in life due to lack of proper facilities of life.

Air is the most useful thing for every living thing. Researching on this serious issue this system's main purpose was to estimate the quality of air for people and any other living thing which exist on earth. Very important to know for our living is that how much safe we are now and how the weather and climate has changed for air pollution and it will sustain sound. This system will ease to know the answers for air quality.

Four major gas sensors, which are responsible for the most air pollution mostly, are being used in the system to know the best result of the whole condition of the air. CO2, CO, LPG, Humidity are declared to be the most responsible for air pollution and in the system all are used.

II EXISTING SYSTEM

Some previous works like Smart environment monitoring system [1] on vehicles was introduced on 2015. It basically figured out the emission rate of poisonous gasses which are responsible for air

pollution. Industrial air pollution [2] monitoring system for safety and health enhancement was introduced to know the hazardous gasses and their impact. Low cost air quality system [3] was discussed on 2008 as because at that time the sensors were quiet expensive and also the system. By using mobile GPRS [4] system air pollution could be detected. Wireless sensor network based pollution monitoring system in metropolitan cities was introduced to know the air quality [5].Pollution Dynamic Monitoring System [6] is also done previously.

III .BLOCK DIAGRAM OF PROPOSED SYSTEM

The block diagram is shown in Fig1. The entire operation Air Pollution Detector is based on the following of major parts:

- Shinyei PPD42
- DHT11
- Arduino UNO
- LCDI2C
- Gas Sensors

A. Shinyei PPD42

Based on the light dispersion method, it detects the particles in the air continuously.Pulse output that agree to focus per unit volume of particles can be obtained, by using an original detection method based on light scattered principle similar to the particle counter. It has some feature like It work to detect Stable and sensitive cigarette smoke in addition to the detection of house dust, which is cause of asthma , High sustainable sensitivity and Easy maintenance and Air is self-aspirated through the generation mechanism air current with a built-in heater.

B. Keyes DHT11

DHT11 temperature and humidity sensor countenance standardize digital signal output with the temperature and the humidity sensors. Integrated with eight (8-bit high-) execution microcontroller. Their technology ensures rise reliability and stealer long-term stability. This sensor is contains resistance element and also has a sensor for wet the temperature adjust devices in NTC. It is actually has perfect quality, also its fast in response, anti-interference capacity and good performance.

C. Arduino UNO

It is the most commonly used in the construction of projects and it is due to its ease of use, especially for beginners. This circuit provides ports for connecting electronic components such as sensors directly to the controller via 14 Digital In / Out. Six ports can be used for PWM (Pulse-Width modulation). The circuit also has a 16MHz Crystal Oscillator, in addition to a USB port for communication with the computer, and a separate power input.

D. LCD I2C

To link a standard 16×2 LCD directly with the microcontroller, for instance Arduino, we would need at least 6 I/O pins to talk to the LCD. However, if we use an LCD module with I2C interface, only need

2 lines to process the display information. Now a days, it is not necessary to buy an expensive I2C LCD for this task because readymade serial backpack modules for standard LCDs are available at reasonable rates. we can use them with LCD modules that have a HD44780 compatible interface with various screen sizes by attaching to the back of the LCD module. This allows connection to Arduino (or other microcontroller) using only four channels.

E.MQ135

MQ135 Semiconductor Sensor MQ135 is a stable, low cost electrochemical gas sensor suitable for detecting a wide range of VOCs and gases. It is extremely sensitive to Ammonia, Sulph.ide and Benzene, also sensitive to smoke and other harmful gases. The MQ series of gas sensors use a small heater inside with an electro-chemical sensor and are usually used indoors at room temperature. Their calibration preferably requires a known concentration of the measured gas. Absence of any electronic components allow usage of both AC and DC voltages. The MQ135 gas sensor detects a number of gases like ammonia, CO2, SO2 etc. collectively but is unable to identify the individual gas concentration in a polluted environment. The sensor also uses an inbuilt heater to warm up air near thesensitive part for oxidation or reduction to take place.

F. MQ9

MQ9 is a Semiconductor Sensor for CO/Combustible Gas. Sensitive material of MQ-9 gas sensor is SnO2, which with lower conductivity in clean air. It makes detection by method of cycle high and low temperature, and detect CO when low temperature (heated by 1.5V). The sensor's conductivity is higher along with the gas concentration rising. When high temperature (heated by 5.0V), it detects Methane, Propane etc. combustible gas and cleans the other gases adsorbed under low temperature.

G. MQ2

The Grove - Gas Sensor(MQ2) module is useful for gas leakage detection (home and industry). It is suitable for detecting H2, LPG, CH4, CO, Alcohol, Smoke or Propane. Due to its high sensitivity and fast response time, measurement can be taken as soon as possible. The sensitivity of the sensor can be adjusted by potentiometer.

IV.DESIGN MODEL

In general, the circuit is used to measure and detect the percentage of pollution gases in the atmosphere, which has significant impact on the atmosphere and living organisms. In this circuit we use 5 different sensors, each one measure different gases. MO2 sensors use to detect carbon monoxide, smoke and methane. The MQ9 sensor is similar to MQ2 which is detect carbon monoxide and LPG gases. MQ135 measures the carbon dioxide. DHT11 is mainly use to detect the humidity and temperature. Shinyei PPD42 is used to measure the dust concentration in environment. Finally, the result of detecting all these sensors shown in RGB 16*2 LCD, and the result it will change depending upon the percentage of smoke in atmosphere.

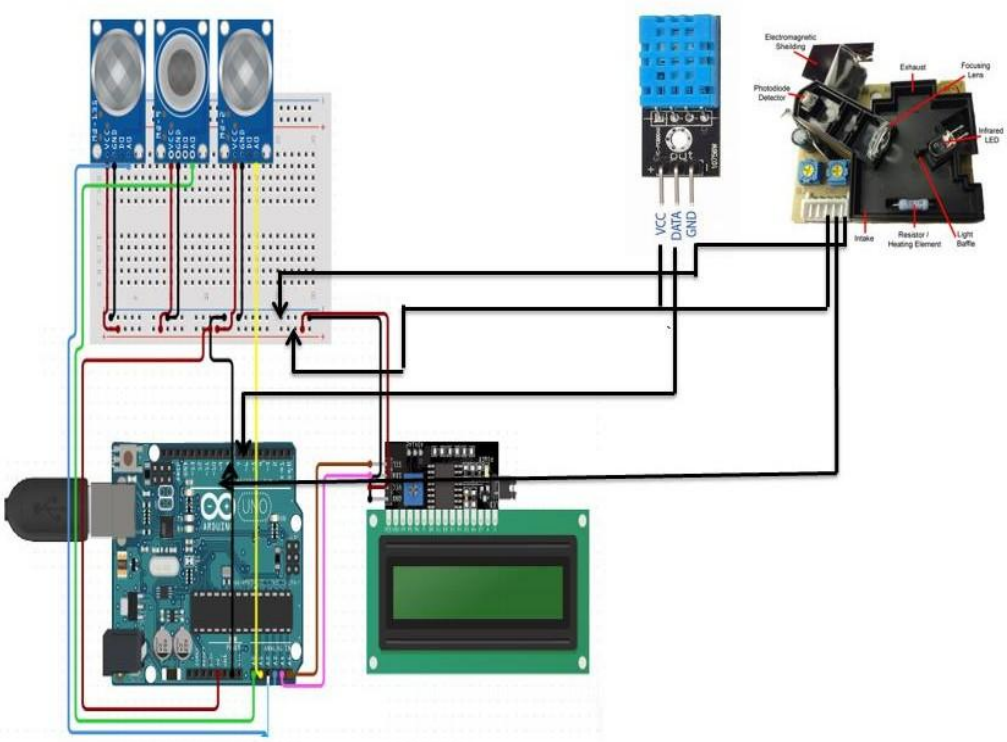

Figure 2 Circuit Diagram

V.RESULT

After tested all the components, we assembled all the parts as per the circuit diagram. we uploaded the coding into the arduino and then applied the smoke near to the sensor assembly. The sensors sensed the smoke and gave the result in the LCDI2C display. The final assembly of the project in bread board is shown in figure 3 and then we placed these components inside a box as shown in figure 4 (a&b).The results are tabulated in Table1.

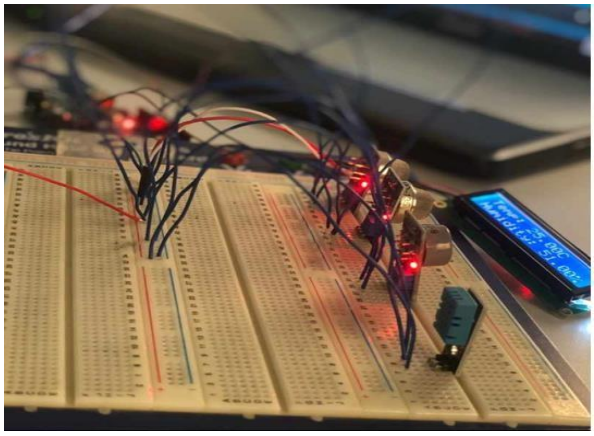

Figure 3.Breadboard Testing

Figure 4 (a) Final Assembly

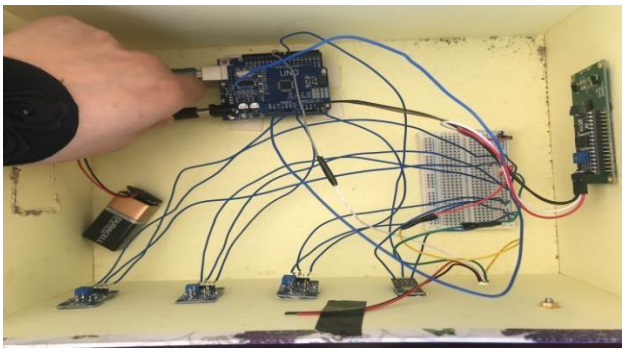

Figure 4 (b) Inside View of Detector

Table .1 Results

Parameter	Before applied smoke	After applied smoke
SENSOR VOLT	15.70PPM	13.71PPM
TEMPRATIOR	25C	26C
CO	31	49
HUMIDITLY	50%	51%
CO2	0.59PPM	0.82PPM

VI CONCLUSION

The air pollution detector was implemented and tested successfully. We first checked the working of components by using Arduino Uno. Then we assembled all the components together and tested by applying smoke near to the detector. The project is working fine and displays the values in the LCDI2C. In future, we can incorporate even more accurate devices for temperature and humidity sensing in the sensor's environment than DHT11 will also be covered in future. We can monitor the pollution detection system in real time by using wireless technology. Also we can add the alert system to indicate the quality of air.

REFERENCE

[1]. Jamila,M.S., Jamilb,M.A., Mazharc,A., Ikrama,A., Ahmeda, A., Munawa, U "Smart Environment Monitoring System by employing Wireless Sensor Networks on Vehicles For Pollution Free Smart Cities" Procedia engineering ,107,pp 480-484,2015.

[2]. Leman,A.M., Omar, A.R., Jung,W., Yusof, M.Z.M. " The development of an industrial air pollution monitoring system for safety and health enhancement and a sustainable work environment using QFD approach", The Asian Journal on Quality Vol. 11 No. pp. 165-182,2000.

[3]. Kularatna,N., " An Environmental Air Pollution Monitoring System Based on the IEEE 1451 Standard for Low Cost Requirements", ieee sensors journal, Vol. 8, No. 4, 2008.

[4]. Al-Ali, A.R., " A Mobile GPRS-Sensors Array for Air Pollution Monitoring", ieee sensors journal, Vol. 10, No. 10, 2010..

[5]. Raipure,S., Mehetre,D , "Wireless Sensor Network Based Pollution Monitoring System in Metropolitan Cities",IEEE ICCP conference ,pp. 124-134,2015.

[6]. Boscolo,A., Mangiavacchi,C.(1998) " Pollution Dynamic Monitoring System for City Air Quality Control" ,IEEE instrumentation and measurement Technology Conference,1998.