ISSN(Online) : 2320-9801
ISSN (Print) : 2320-9798

International Journal of Innovative Research in Computer and Communication Engineering

(An ISO 3297: 2007 Certified Organization)

Vol. 4, Issue 4, April 2016

Environment Monitoring on Traffic Islands

Shobhit Khandare[1], Divya Khatri[2], Pawan Kukreja[3]Sarita Jadhav[4], Suraj Achhra[5]

Assistant Professor, Dept. of EXTC, VES Institute of Technology, Chembur, Mumbai, India[1]

Student, Dept. of EXTC, VES Institute of Technology, Chembur, Mumbai, India[2]

Student, Dept. of EXTC, VES Institute of Technology, Chembur, Mumbai, India[3]

Student, Dept. of EXTC, VES Institute of Technology, Chembur, Mumbai, India[4]

Student, Dept. of EXTC, VES Institute of Technology, Chembur, Mumbai, India[4]

ABSTRACT: Healthy living is the right of every individual in the society. Everything what happens in the environment is the expression of flow of energy in one of the forms. But in this fast moving world, as the technological development and engineering solutions have been improved on a wider scale, there has been the rapid use of metals, materials, plastics, fuel etc. which have led to environmental hazards. The hazards are due to continuously varying environmental parameters. So there is a need to continuously monitor the parameters of the environment to prevent the hazards. So, our solution to this problem is to design a system such that all the varying parameters get sensed & analyzed in terms of figures and numbers, so by which a pattern of the variance of the environmental factors can be noticed, which can be prevented if found toxic and can lead to saving human lives.

KEYWORDS: Wireless Sensor Network (WNS), Freescale KL25Z (FRDM), Carbon monoxide (CO), Methane (CH4), PCI (Pollution control board).

I. Introduction

1.1 Problem Statement:

Our Ecosystems includes all humans, plant life, atmosphere, massive oceans and seas. As the days are advancing, the Ecosystems, mainly the Human life is getting affected day by day at slower rates. The most common factor resulting this is the gradual change in the Environmental conditions. Amongst the various sources that affect the Environment, the major ones are **Engineering developments -** resulting in resource and environmental destruction. Modern day technologies used in the engineering and manufacturing Industries have increased the use of materials like metals, plastic, oil and rubber which have led to drastic changes in the environment and are proving to be the dominant contributors to **Global Warming** and **Green House gases** which are the areas of discussion since years. There are various such parameters contributing to both these factors, so a continuous monitoring of all the sources disrupting the environmental conditions is required.

1.2 Aim:

As mentioned earlier, a continuous monitoring of the parameters is required, so our purpose is to design a system that will monitor some of such environmental parameters. Our areas of interest with respect to this project lies in sensing the 4 environment factors – **Carbon Monoxide (CO), Methane (CH_4), Noise levels and the Sunlight Intensity.**

Our Objective is to monitor the above mentioned parameters continuously for the distinct locations and finally transmit the data collected to the **PCI (Pollution Control Board of India)** for which the data analysis can be made to determine the area-wise safe and dangerous levels. Also, the analysis of the results stating the pollution prone areas to be declared unsafe for Human Accommodation.

ISSN(Online) : 2320-9801
ISSN (Print) : 2320-9798

International Journal of Innovative Research in Computer and Communication Engineering

(An ISO 3297: 2007 Certified Organization)

Vol. 4, Issue 4, April 2016

1.3 Block Diagram:

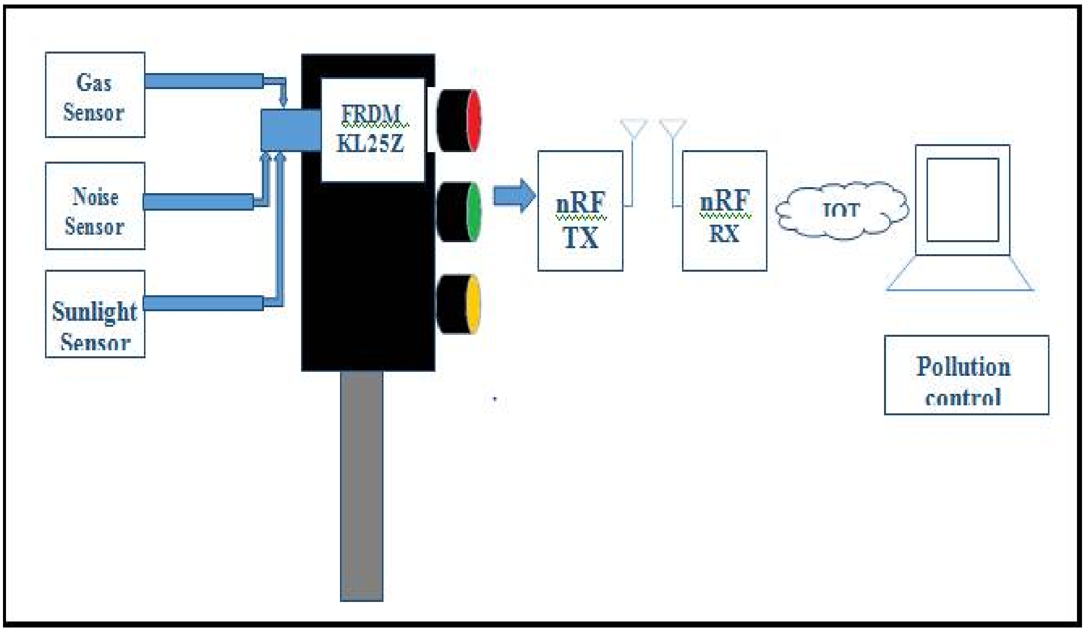


fig. 1.4 (a)Overview of the Project

II. LITERATURE REVIEW

2.1 Methane Levels:

The Methane Levels found in the recent or at the beginning of the 2015 can be stated down as in the figure.

From January 1, 2015 to March 20, 2015 the Methane levels in the Environment near the Arctic Ocean were found out to be more or less the same that is around 2300 ppb (parts per billion). With reference to this data, the corresponding housing societies was found out to be varying from 2500 ppm (parts per million) to 3700 ppm (parts per million) varying from completely domestic to industrial area.

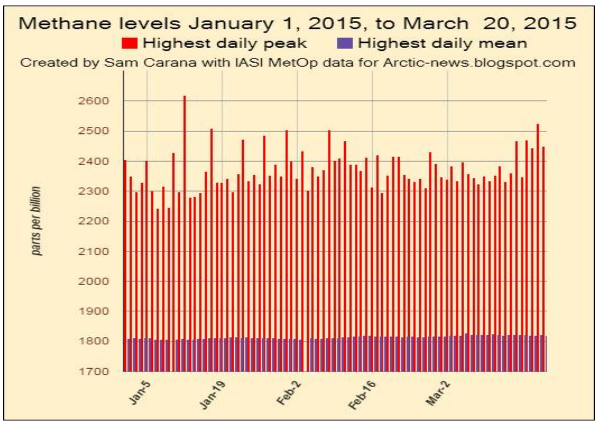


Fig2.(a)Methane level in 2015

ISSN(Online) : 2320-9801
ISSN (Print) : 2320-9798

International Journal of Innovative Research in Computer and Communication Engineering

(An ISO 3297: 2007 Certified Organization)

Vol. 4, Issue 4, April 2016

2.2 Sunlight Levels:

As can be seen, the light intensity values for different sources of light varies largely. The normal daylight ranges from 10,000 to 20,000 lux which is the area of our measurement. Based on the range, our sensor can easily sense the corresponding lux.

2.3 Carbon Monoxide

Based on the 2007 study, carbon monoxide layers were found to be as less as 50 ppm at room temperature. With reference to this data, the corresponding housing societies had CO varying from 1000 ppm (parts per million) to 1800 ppm (parts per million) varying from completely domestic to industrial area.

"Lux" - Measure of light density within the visible spectrum.

Direct Sunlight	100,000 to 130,000 Lux
Full Daylight	10,000 to 20,000 Lux
Cloudy Day	1,000 Lux
Office Lights	300-500 Lux
Candle Light/Dark	10-15 Lux

fig.2(b) Sunlight variations on Extreme Hot day

III. **IMPLEMENTATION**

The sensors MQ-4, MQ-7 and LDR are interfaced with FRDM KL25Z at the analog inputs. Different voltage values are sensed from different sensors and are given to the Analog input port (PB0-PB3) of FRDM KL25Z Board.

Through Embedded C Programming Language Logic is developed considering all the parameters and values sensed. Software program is then compiled and burned in to FRDM KL25Z Board. Logic Development is based on converting the particular analog values into ppm, dB and Lux respectively.

The Data collected from the sensors are then given to the nRF Module through serial communication. This nRF module work in 2.4GHz band, the frequency band is from 2400 to 2525 MHz which is divided into 125 selectable channels. In our project 4 nRF modules are used, out of which three work as transmitter and one work as receiver (like star topology as shown in following figure) with each transmitter uses different frequency channel such that there is no interference.

3.1 HARDWARE

3.1.1 MQ-4

This sensor has a high sensitivity and fast response time. The sensor's output is an analog voltage across the load resistance (**R_L**). 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 [2]. The sensor needs the preheat time of around 10 minutes. The heater provides necessary work conditions. The enveloped MQ-4 have 6 pins, 4 of them are used to fetch signals, and other 2 are used for providing heating current. The connections are as follows:

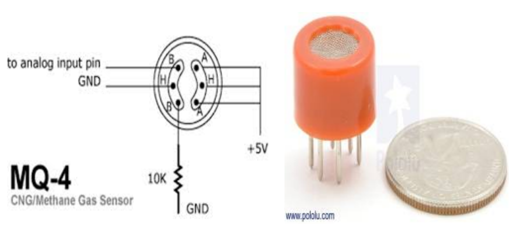


fig. 3.1 (a) MQ-4 Pin Configuration

ISSN(Online) : 2320-9801
ISSN (Print) : 2320-9798

International Journal of Innovative Research in Computer and Communication Engineering

(An ISO 3297: 2007 Certified Organization)

Vol. 4, Issue 4, April 2016

3.1.2 MQ-7

This is a simple-to-use Carbon Monoxide (CO) sensor, suitable for sensing CO concentrations in the air. As already mentioned the MQ-7 can detect CO-gas concentrations anywhere from 20 to 2000ppm [1]. The sensor's output is an analog voltage across the load resistance. The drive circuit is very simple; all you need to do is power the heater coil with 5V, apply a load resistance, and connect the output voltage terminal to the ADC of Development Board. The connections are as follows:

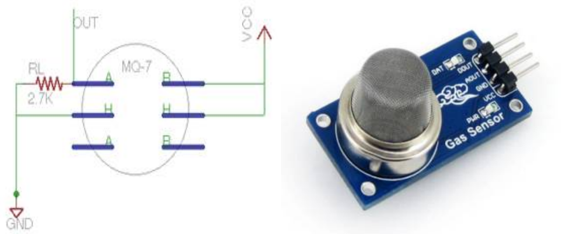


fig. 3.1(b) MQ-7 Pin Configuration

3.1.3 LDR

Light Dependent Resistors have a particular property in that they remember the lighting conditions in which they have been stored. This memory effect may be minimized by using them in light for a suitable period of time to get appropriate Lux values. So, after the equilibrium takes place, the accurate Lux value is obtained. While operating, a LDR operates as non-polarity resistor, voltage across which varies due to the amount of the Light incident on it. The Lux and resistance values are inversely proportional to each other.

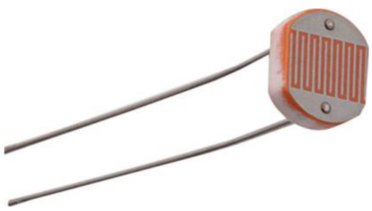


fig 3.1(c) LDR

3.1.4 FRDM KL25Z

- 6x ADCs
- 3x UART
  Capacitive touch sensor
- M0+

fig 3.1(d) FRDM KL25Z

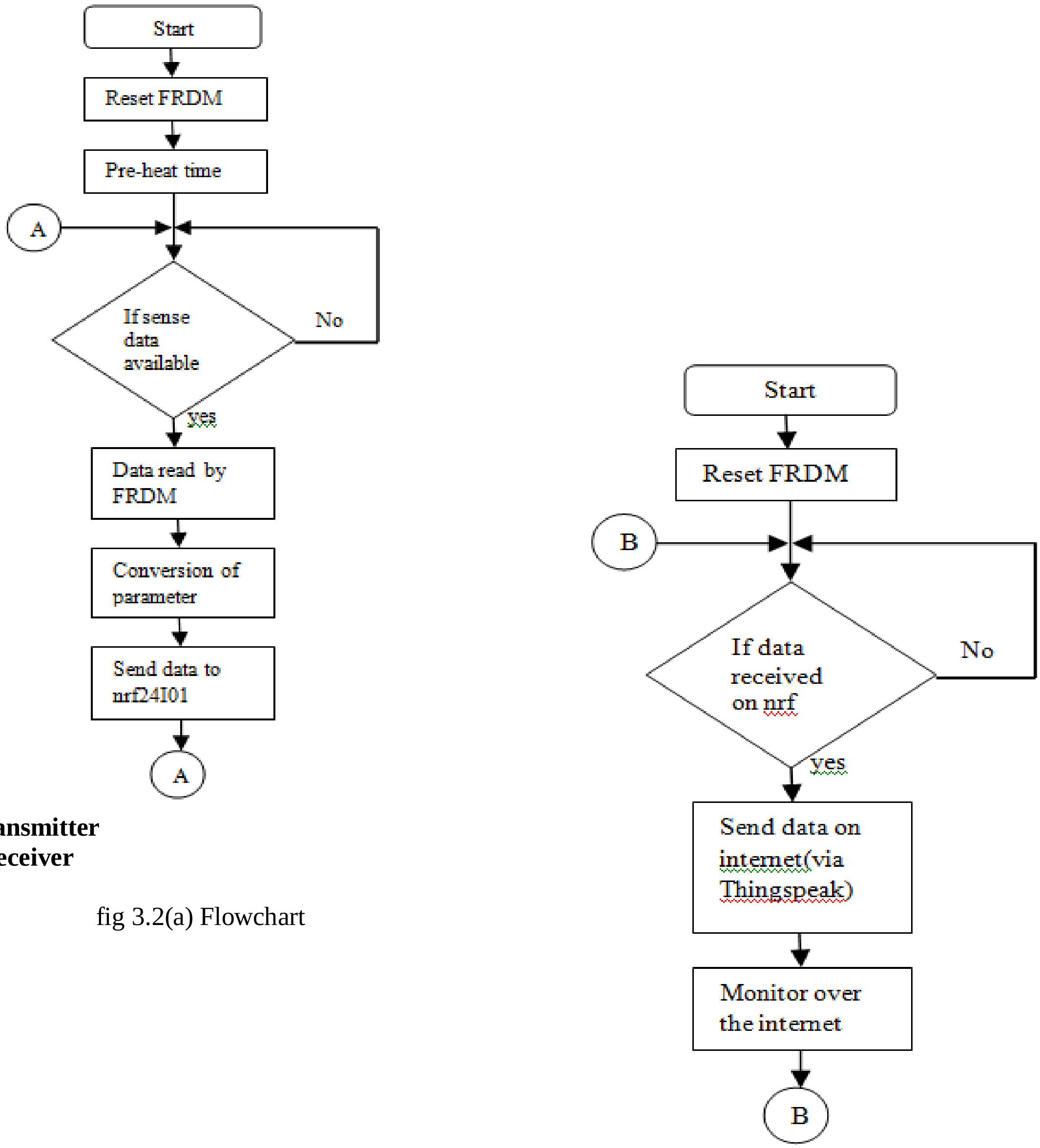
ISSN(Online) : 2320-9801
ISSN (Print) : 2320-9798

International Journal of Innovative Research in Computer and Communication Engineering

(An ISO 3297: 2007 Certified Organization)

Vol. 4, Issue 4, April 2016

3.2 SOFTWARE IMPLEMENTATION



Transmitter
Receiver

fig 3.2(a) Flowchart

IV. RESULTS

4.1 Methane:

Using the same concept of Rs/Ro which is the requirement of MQ sensors, the output load voltage was found to be 1.38v in the air conditioned room, and it was about 1.15v in the non-air conditioned room at the room temperature. So, the factor Ro was calculated to be. So, the calibration was found to be around 250 ppm in the Air conditioned room. The corresponding levels at the height of fourth floor were found to be around 800 ppm (at around 33°C)

ISSN(Online) : 2320-9801
ISSN (Print) : 2320-9798

International Journal of Innovative Research in Computer and Communication Engineering

(An ISO 3297: 2007 Certified Organization)

Vol. 4, Issue 4, April 2016

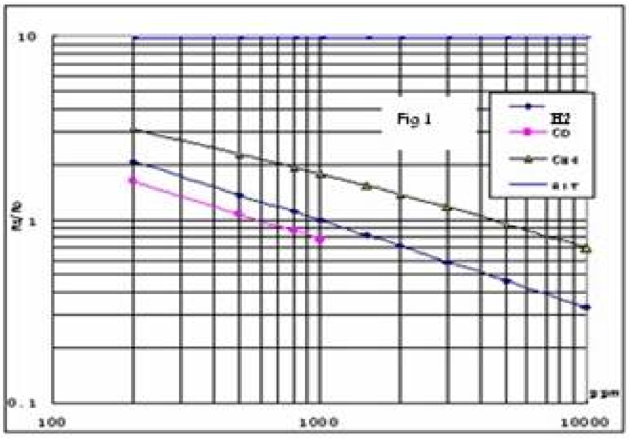


fig 4.1(a)Sensitivity Characteristics [2]

4.2 Carbon Monoxide:

Based on the Rs/Ro value (mentioned in Appendix I), the output load voltage at room temperature was found to be around 0.75v in an air conditioner room, and it was about in room temperature in non-air conditioner room. So, the factor Ro was calculated to be. So, calibration on the rough scale gave us the ppm value to be around 200-300 ppm in the Air conditioner room. The corresponding levels at the height of fourth floor were found to be around 1000 ppm (at around 33℃)

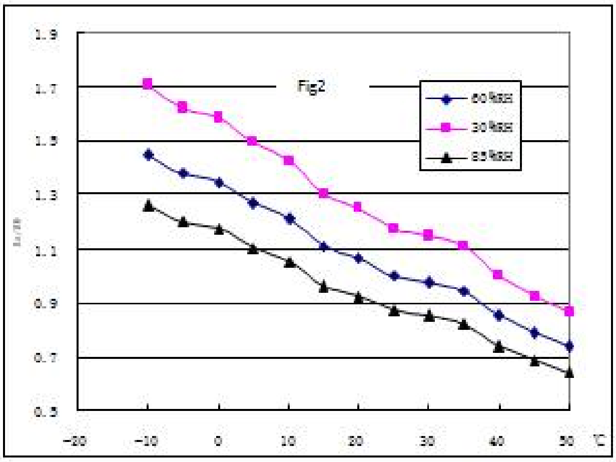


fig 4.2(a) Influence of temperature/humidity [1]

ISSN(Online) : 2320-9801
ISSN (Print) : 2320-9798

International Journal of Innovative Research in Computer and Communication Engineering

(An ISO 3297: 2007 Certified Organization)

Vol. 4, Issue 4, April 2016

4.3 LDR

The sunlight was measured continuously for 5 minutes, so that the LDR be in equilibrium. The light intensity during the noon time was found to be around 50,000 lux and in the evening time it dropped to around couple of thousands of lux.

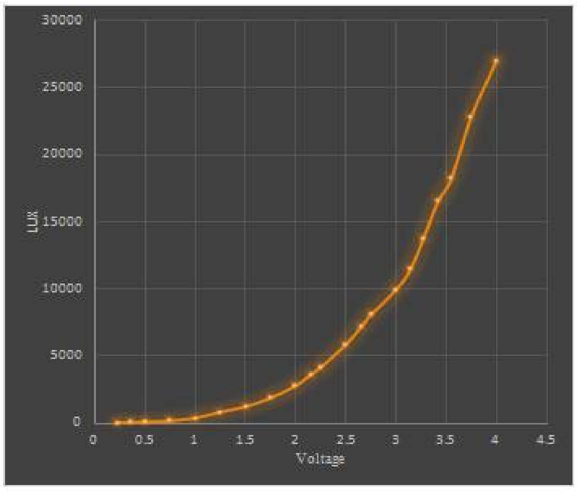


fig 4.3(a) Voltage Vs Lux

V. CONCLUSION

- The ARM development board FRDM-KL25Z has huge repositories, which are freely available online. Also, it has online compiler which is easy to use, and the compatible sensors are available, which are used in our case.
- The value of Ro in MQ sensors was difficult to find, so 3 cases were assumed based on the Rs/Ro vs. Temperature characteristics.
- Based on the value of R0 at room temperature, MQ sensors reliably provided the data at room temperature and outside comparable with the previously measured experiments.
- The sunlight LDR sensor provided the exact Lux value comparable with the Intensity value measured by the Lux Meter application.
- The LDR is accurate enough to detect the intensity unless an extreme hot day occurs.
- The sunlight sensor or the LDR based on its resistance could offer the maximum value of up to 50k lux (which is highly appreciable in case of evening hours).

Noise sensor used highly depends on the Potentiometer on the module, once set correctly, it was providing the relative noise, but was varying from the exact values, hence it needs modification.

REFERENCES

1. https://www.sparkfun.com/datasheets/Sensors/Biometric/MQ-7.pdf
2. https://www.sparkfun.com/datasheets/Sensors/Biometric/MQ-4.pdf
3. https://www.sparkfun.com/datasheets/Components/SMD/nRF24L01Pluss_Preliminary_Product_Specification_v1_0.pdf
4. https://developer.mbed.org/compiler
5. https://developer.mbed.org/platforms/KL25Z/#getting-started-with-mbed
6. C.M.Nguye, J.Mays,D.Plesa, S.Rao, M.Nguyen, J.C.Chiao'Wireless sensor nodes of Environment Monitoring in Internet of Things', 2015 MTT-S International, 2015
7. Dunfan Ye, Daoli Gong, Wei Wang, 'Application of wireless sensor networks in Environment Monitoring', 2009 2nd International Conference on power electronics & Intelligent Transportation system, Volume 1