

Design and Implementation of Pollution Monitoring and Recording System Using Microcontroller

Alka Dubey¹, Mohd Shamshad² and Kamlesh Patel³

¹School of Electronics, Devi Ahilya University, Indore(M.P.), 452001, INDIA

²West Central Railways, Sagar(M.P.), 470003, INDIA

³Sciencetech Technologies private limited, Indore(M.P.), 452001, INDIA

¹dr.alkadubey12@gmail.com, ²nagraja7@gmail.com, ³calltokamlesh@gmail.com

Abstract

Automobiles are a 'necessary evil', while they have made living easy and convenient, they have also made Human life and environment more complicated and vulnerable to both toxic emissions and an increased risk factors. Urban people are most affected and amongst the worst sufferers are traffic policemen who are particularly close to the fumes of automobile exhaust. Studies made in India, indicate that there is high rate of occurrence of respiratory, digestive, ocular and skin problems amongst the traffic policemen and a significant number of them become victims of lung disorders in the very first few months of their posting to a traffic department. In the present paper a microcontroller based embedded system is developed for awaking people about the air pollution at each square. This system indicates the toxic gases status in air with real time on LCD displays in each busy traffic square.

Keywords: Microcontroller, Embedded Systems, Pollution, display

I. BACKGROUND

Air pollution is the major problem facing by all over the world. The major cause of pollution is industries, automobiles, and vast use of modern equipments like AC, refrigerators etc. In our country the+e is a rapid increase in automobile industries as a consequence there is a rapid increase in number of automobiles. Fig.1 shows the Extent of Air Pollution today.

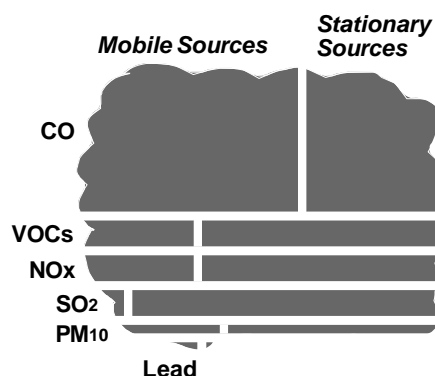


Fig. 1 extents of air pollution

Traffic congestion on inadequate road infrastructure is a daily reality of India's urban centers. Slow speeds and idling vehicles produce, per trip, 4 to 8 times more pollutants and consume more carbon footprint fuels, than free flowing traffic.[1-3]

These entire automobile are run on petrol, diesel and other fossil flues. In India, the vehicle population is growing at rate of over 5% per annum and today the vehicle population is approximately 40 million. Motor vehicles produce many different pollutants. The principal pollutants of concern those that have been demonstrated to have significant effects on human, animal, plant, and environmental health and welfare include are Ozone (O₃), particulate matter, Nitrogen Oxides (NO_x), Hazardous Air Pollutants (Toxics), Sulphur Dioxide (SO₂), Carbon monoxide (CO) etc are emitted by automobiles which are responsible for various diseases like cancer , birth defects, lungs problem in humans as well as some unusual environmental activities like uncertain variation in weather, hole in ozone layer , acid rain, melting of glassier and increase in sea level etc. Table (1) shows the pollutants data from year 1991 – 2005 in India.

Table (1): Pollutants emit by vehicles in India

Petrol Vehicles				
Three - Wheelers (g/km)				
Year	CO	HC	HC+Nox	
1991	12 - 30	8 - 12	-	-
1996	6.75	-	5.40	-
2000	4.00	-	2.00	-
2005(BS II)	2.25	-	2.00	(DF =1.2)
Two - Wheelers (g/km)				
Year	CO	HC	HC+Nox	
1991	12 - 30	8 - 12	-	-
1996	4.50	-	3.60	-
2000	2.00	-	2.00	-
2005(BS II)	1.50	-	1.50	(DF =1.2)
Car (g/km)				
Year	CO	HC	Nox	HC+Nox
1991	14.3 - 27.1	2.0-2.9		
1996	8.68 - 12.4			3.00 - 4.36
1998*	4.34 - 6.20			1.50 - 2.18
2000	2.78			0.97
B.S II	2.2			0.5
B.S II	2.2 - 5.0			0.5 - 0.7
B.S III	2.30	0.2	0.15	
B.S III	2.3 - 5.22	0.20 - 0.29	0.15 - 0.21	

In the present paper an embedded system is proposed to fix with traffic light pillars on busy traffic squares. This system have gas sensors which sense the status of toxic gases emits by automobiles and display them on LCD board to aware people.

II. AUTOMATIC SIGNALING IN URBAN AREAS

It is observed that in all the big cities where the number of automobiles increased drastically using the traffic light signal system which is fully microprocessor control. When the traffic signal system shows the red light vehicle stop for an allotted time and this is happened in all four sides of the square. Still there is air pollution and it is needed to fabricate a device which is used to aware the people. In present paper such device is proposed which displayed the current pollution rate when the traffic light signal glows red. If any pollutant exceeds its rated limit the indication of pollutants start blinking also.

This data is also recorded in external memory with real date and time which is very important for monitoring the pollution status in our country. Fig.2 shows the square of urban areas with traffic light.[2-7]

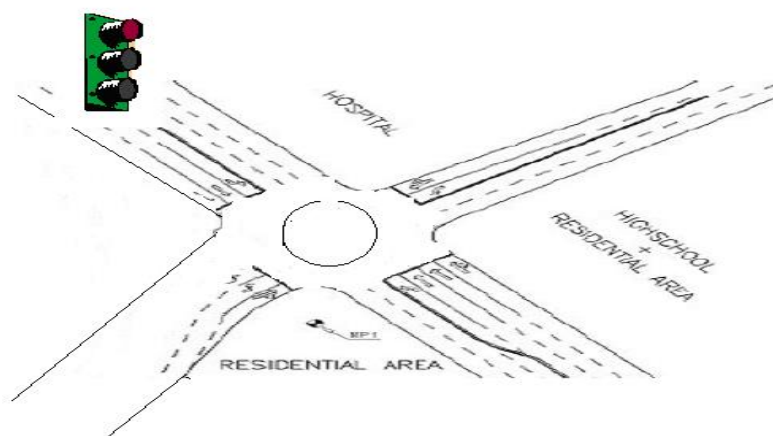


Fig. 2 square of urban areas with traffic signal

III. HARDWARE SPECIFICATION

In the present system an embedded system is designed which have multi channel gas sensor MQ2 and MQ6 having capability to sense NO₂, SO₂, Methane, LPG, CO and other toxic gases. For measurement of temperature there is temperature sensor LM35, humidity there is sensor w generate voltage signals in proportions to the percentage amount of the detectable gas, temperature, humidity in the square area with real time. Voltage data from appropriate channel is converted into digital form using 8 channels ADC 0808 this ADC is attached with port 1 of microcontroller 89C52.

There microcontroller is a signal processing unit, where signal is manipulated and transfer to the port 3 where LCD is interfaced. One external memory having capability of 1MB and real time clock (RTC) is also attached with the microcontroller for recording and display data with real date and time. Fig. 3 shows the block diagram of the present system and Fig. 4 shows the present hardware of the system.

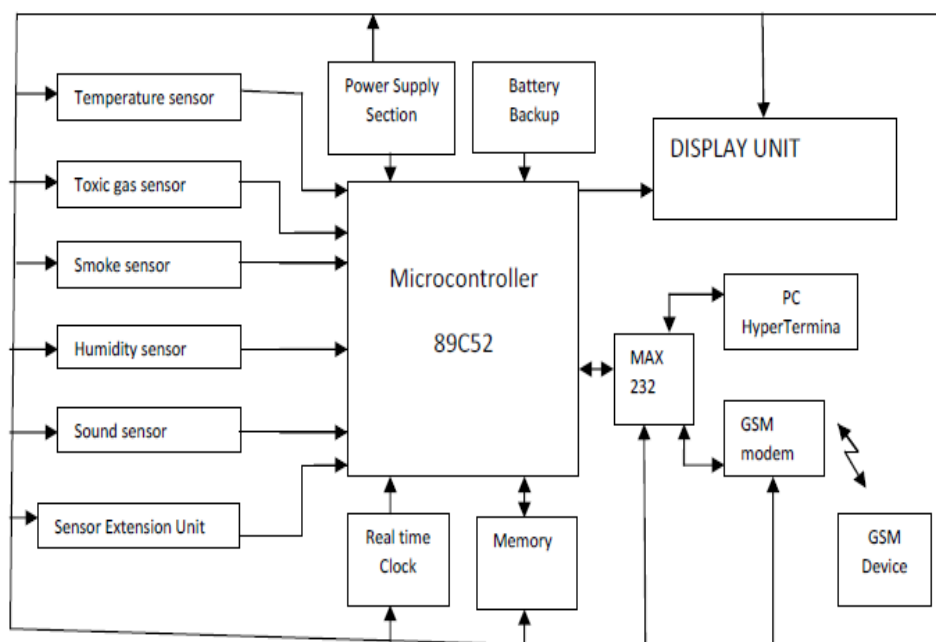


Fig. 3 Block diagram of the present system

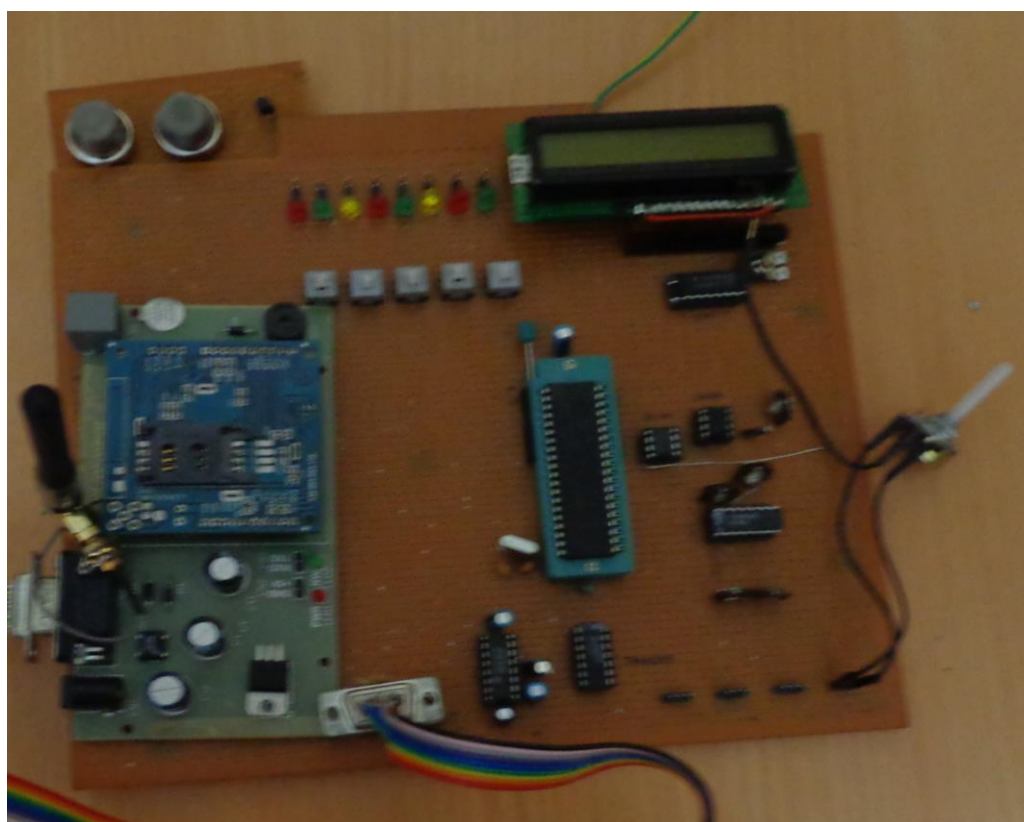


Fig. 4 Circuit diagram of the system

IV. SOFTWARE SPECIFICATION

Present system is an air pollution monitoring & awaking system. This system is an application of embedded system. Fig. 5 shows the system circuit diagram for simulation made on Proteus software of Labcenter Electronics. There microcontroller is programmed in embedded C language using Keil compiler. Fig. 6 shows the logical flow diagram of the present system.

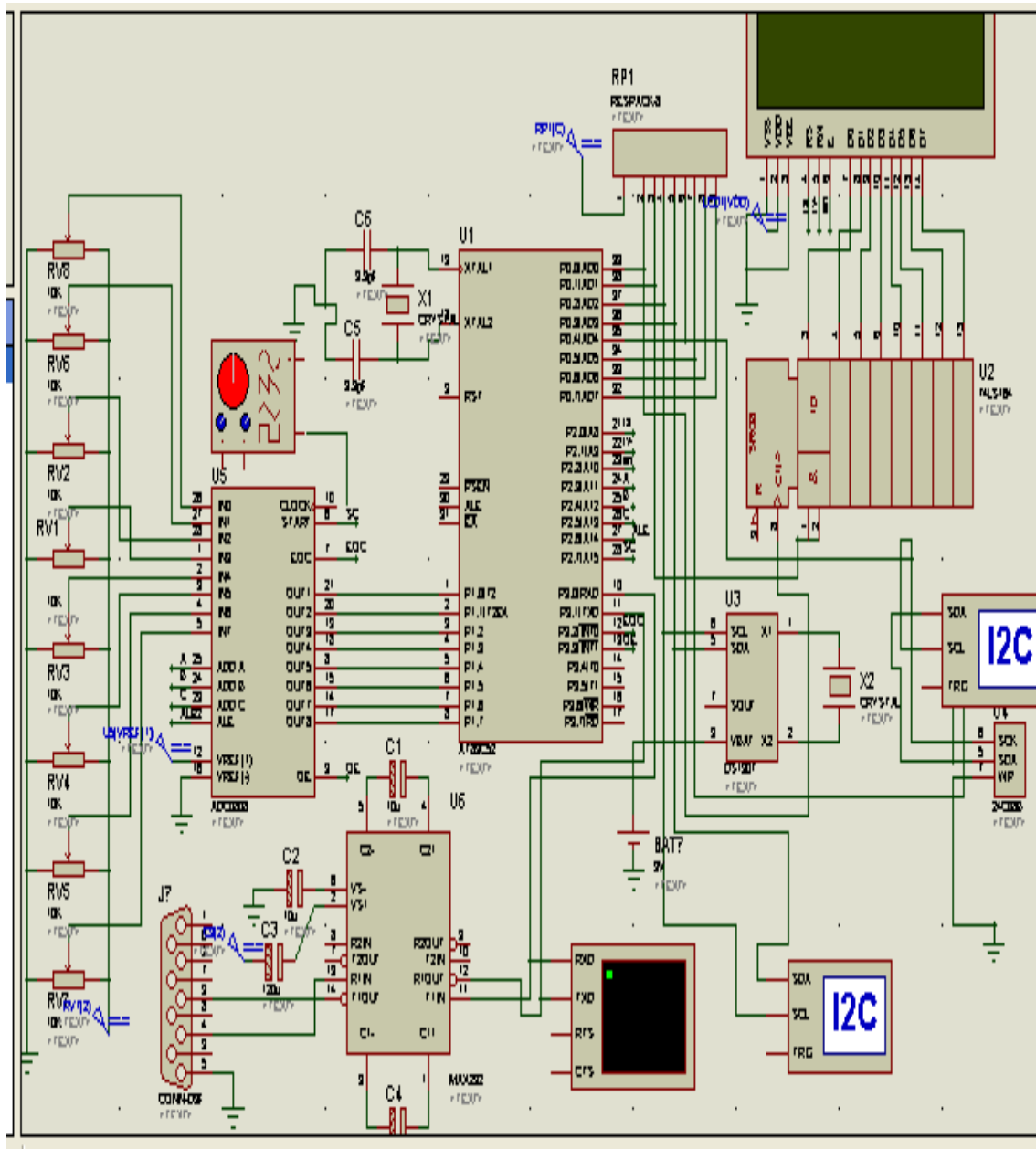


Fig. 5 : Circuit diagram of Pollution Monitoring Unit

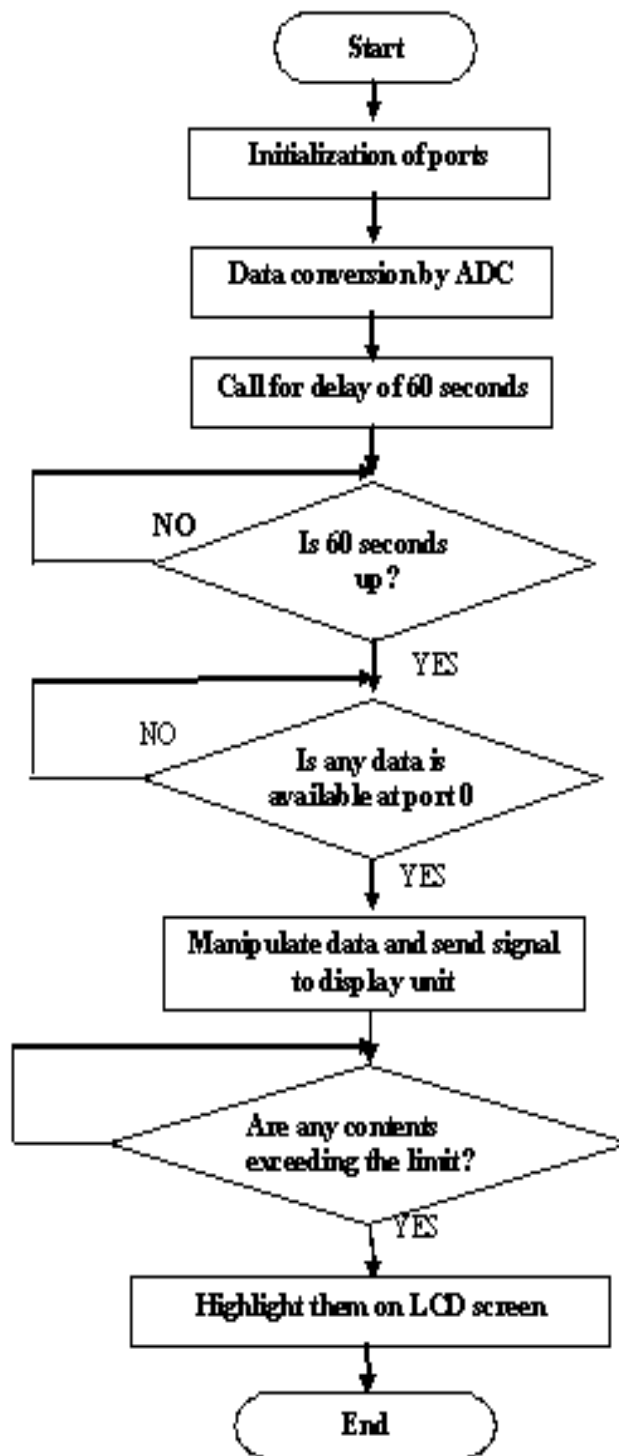


Fig. 6 flowchart of the present system

V. RESULTS AND DISCUSSION

In the present system data display on 16X2 LCD in the given format successfully as shown in Fig.7 in the first row date is displayed first in DD/MM/YY format with the help of RTC 1307 as well as two sensors reading also displayed on this row that is T for temperature and H for Humidity there N denotes for Normal Condition and D for Danger condition. In the second row of LCD time displayed in the form of HH:MM:SS as well as two more sensor reading included there in the form of LPG sensor there is L and for smoke detection there is alphabet S is used.

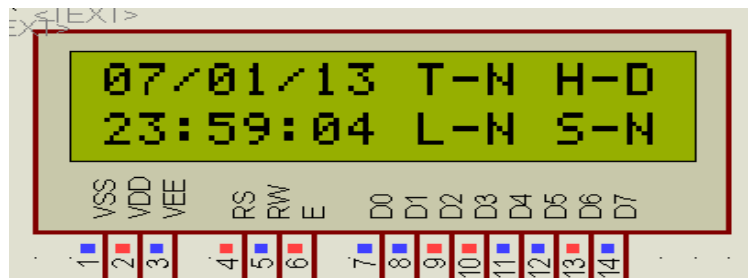


Fig. 7 Sensor unit display on LCD

There real time clock DS1307 is used to obtain date and time Fig. 8 shows the I2C debugger status of RTC DS1307.

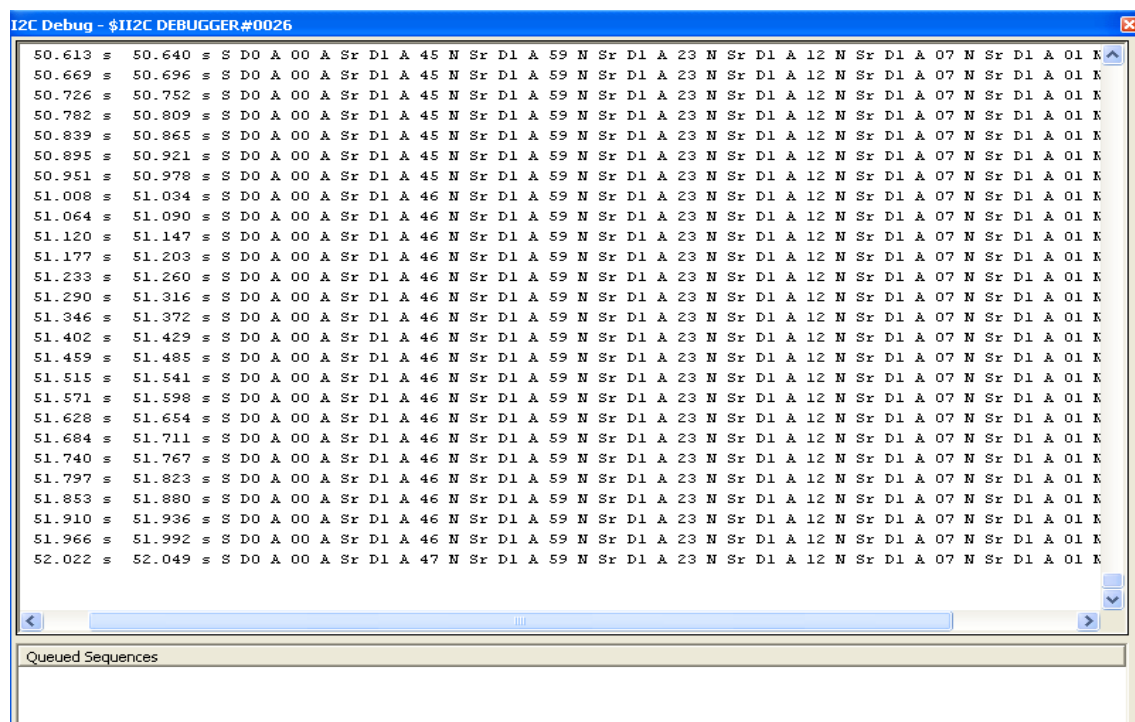


Fig. 8 RTC 1307 display on I2C debugger

Data displayed on LCD is also saved in EEPROM AT24C64 automatically after each 15 seconds as shown by simulator's I2C debugger in Fig.9.

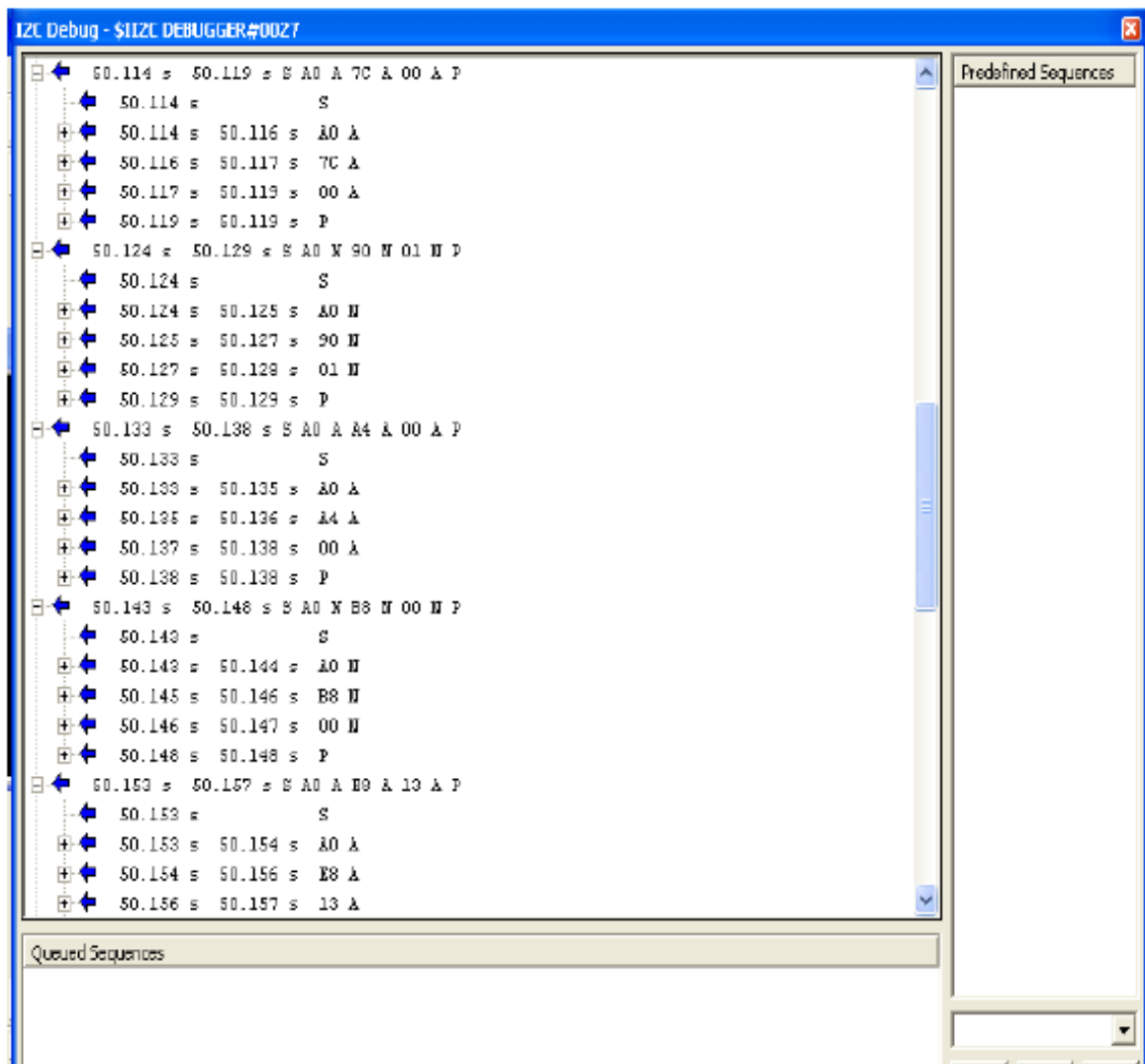


Fig. 9 Memory 24C08 display on I2C debugger

In the present system we try to send an SMS to preinstalled no of Honor about any ridicules' situation inside the home via GSM Modem using AT commands it is performed by the present system successfully. The data of memory could also shift in laptop or PC using HyperTerminal that is also performed successfully by the present system. Fig 10 shows the data display on virtual terminal and fig. 11 shows the SMS format on user mobile.


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Virtual Terminal
AT+CMGS=9685538147
DATE : 07/01/13 TIME : 23/59/01 T-N H-D L-N S-N
DATE : 07/01/13 TIME : 23/59/04 T-N H-D L-N S-N
DATE : 07/01/13 TIME : 23/59/04 T-N H-D L-N S-N
DATE : 07/01/13 TIME : 23/59/04 T-N H-D L-N S-N
DATE : 07/01/13 TIME : 23/59/04 T-N H-D L-N S-N
DATE : 07/01/13 TIME : 23/59/04 T-N H-D L-N S-N
DATE : 07/01/13 TIME : 23/59/05 T-N H-D L-N S-N
DATE : 07/01/13 TIME : 23/59/05 T-N H-D L-N S-N
DATE : 07/01/13 TIME : 23/59/05 T-N H-D L-N S-N
DATE : 07/01/13 TIME : 23/59/05 T-N H-D L-N S-N
DATE : 07/01/13 TIME : 23/59/06 T-N H-D L-N S-N
DATE : 07/01/13 TIME : 23/59/06 T-N H-D L-N S-N
DATE : 07/01/13 TIME : 23/59/06 T-N H-D L-N S-N
DATE : 07/01/13 TIME : 23/59/06 T-N H-D L-N S-N
DATE : 07/01/13 TIME : 23/59/17 T-N H-D L-N S-N
DATE : 07/01/13 TIME : 23/59/17 T-N H-D L-N S-N
DATE : 07/01/13 TIME : 23/59/18 T-N H-D L-N S-N
DATE : 07/01/13 TIME : 23/59/18 T-N H-D L-N S-N
DATE : 07/01/13 TIME : 23/59/18 T-N H-D L-N S-N
DATE : 07/01/13 TIME : 23/59/18 T-N H-D L-N S-N
DATE : 07/01/13 TIME : 23/59/19 T-N H-D L-N S-N
DATE : 07/01/13 TIME : 23/59/19 T-N H-D L-N S-N
DATE : 07/01/13 TIME : 23/59/19 T-N H-D L-N S-N
DATE : 07/01/13 TIME : 23/59/19 T-N H-D L-N S-N
DATE : 07/01/13 TIME : 23/59/19 T-N H-D L-N S-N
DATE : 07/01/13 TIME : 23/59/19 T-N H-D L-N S-N
DATE : 07/01/13 TIME : 23/59/20 T-N H-D L-N S-N
DATE : 07/01/13 TIME : 23/59/20 T-N H-D L-N S-N
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DATE : 07/01/13 TIME : 23/59/20 T-N H-D L-N S-N
DATE : 07/01/13 TIME : 23/59/20 T-N H-D L-N S-N
DATE : 07/01/13 TIME : 23/59/21 T-N H-D L-N S-N
DATE : 07/01/13 TIME : 23/59/21 T-N H-D L-N S-N
DATE : 07/01/13 TIME : 23/59/21 T-N H-D L-N S-N
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Fig. 10 Data Display on Virtual Terminal

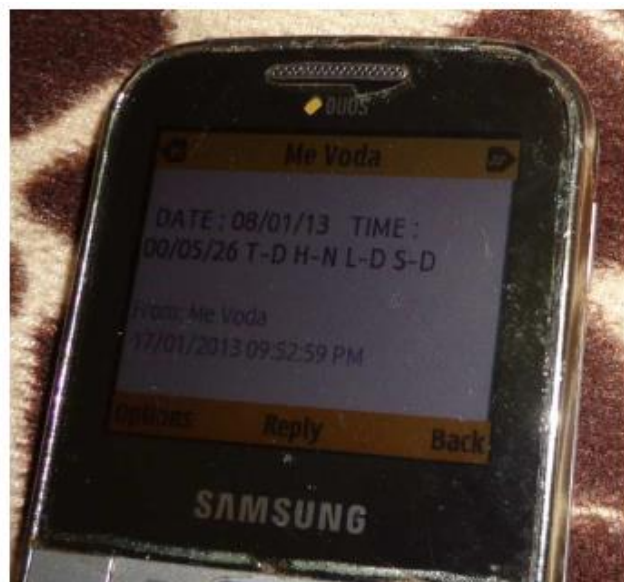


Fig. 11 Sensor data display on GSM unit

V. CONCLUSION

Present system is an embedded system which is supportable for monitoring air pollution in urban areas and also for aware people. This system has capability to

record the air pollution data with respect to real date and time; hence it generates the report of air pollution status in any city which is an important data for health and environmental department. With the help of this system air pollution could be reduce and we can make a healthy environment.

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