ISSN (ONLINE): 2395-695X
ISSN (PRINT): 2395-695X

International Journal of Advanced Research in Basic Engineering Sciences and Technology (IJARBEST)
Vol.3, Special Issue.24, March 2017

Industrial Atmospheric Affluence Screening Using Zigbee Technology

M.Shyamalagowri**

P. Thamilarasan, J. Sugasini, A. Sandeep Kumar, S. Murugan

**Associate Professor, Erode Sengunthar Engineering College, Thudupathi, Tamilnadu

*UG scholar, Erode Sengunthar Engineering College, Thudupathi, Tamilnadu

Abstract - **The purpose of this paper is to acquire the remote industrial parameters like CO2 and methane levels and send these real time values over Zigbee. The remote monitoring system using zigbee undergoes three stages signal conditioning circuit, analog to digital converter and with zigbee the message is send to remote office or any other control unit. Here in this project the parameters are monitored with the use of sensors. The sensed output s are then sent to the controller and then the remote unit via wireless devices. It is a tedious process which is commonly seen in many industries the co2 and methane levels monitoring and control. Hence this model can give a better idea to keep everything in control. This project makes use of an onboard computer which is commonly termed as microcontroller. This onboard computer can efficiently communicate with the different sensors being used. The controller is provided with some internal memory to dump some set of assembly instructions into the controller. The functioning of the controller is dependent on these assembly instructions. The controller is programmed using Embedded C language**

Keywords : CO2 and methane levels, microcontroller, Zigbee.

I. INTRODUCTION

The objective of this paper is to design and develop a wireless communication link to monitor and control equipment's that are far away from the user and also develop a high security system to keep a check on them. In an industry during certain hazards it will be very difficult to monitor the parameter through wires and analog devices such as transducers. Embedded system plays a vital role in this paper. It is a user-friendly application system. Zigbee plays a key role for transmitting the data. The main advantage of this concept is the real time direct measurement of the parameter. The stoppage and some accidents caused by increased co2 and methane levels in air can be avoided. Here, the co2 and methane levels are monitored directly which is simultaneously displayed in the LCD. The sensing is as usual done by sensors and then analysed by the controller, then the controller will take necessary steps regarding the received information. The parameters are transmitted via zigbee modules to a control room or office which is located far away from the plant.

II. SYSTEM ANALYSIS

In the previous research, a single master-multi slave microcontroller communication method has been developed. The microcontroller is able to communicate using unicast communication, i.e. the master gave orders to one slave address via the master-slave network that has star topology. Then the

ISSN (ONLINE): 2395-695X
ISSN (PRINT): 2395-695X

International Journal of Advanced Research in Basic Engineering Sciences and Technology (IJARBEST)
Vol.3, Special Issue.24, March 2017

slave who has the same address which is requested will respond or take action in accordance with the master command. Modbus Protocol is the rules of data communication with the master-slave technique. In these communications there is only one master and one or several slave which form a network. Master only do one communication at a time. Slave will only communicate if there is a command (query) from the Master and cannot communicate with another slave. Addressing modes used by the Modbus there are 2, i.e., unicast and broadcast.

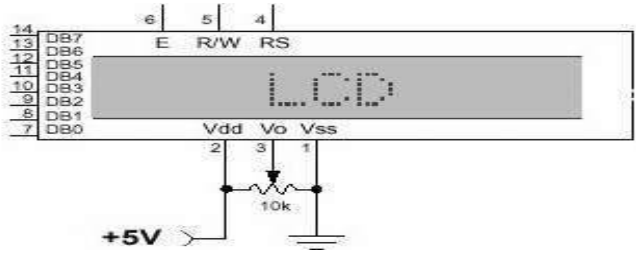


Fig. No. 1 LCD Display Unit

III. PROPOSED SYSTEM

The design and implementation of industrial parameter monitoring & controlling system is the model with the ability to perform data acquisition on co2 and methane level detector sensors attached. They can sent to the controller and then to the control board members or technicians who are far away from the machines. [5] proposed a system about Efficient Sensor Network for Vehicle Security. Today vehicle theft rate is very high, greater challenges are coming from thieves thus tracking/ alarming systems are being deployed with an increasingly popularity .

IV. REQUIREMENTS

A. *Power Supply*

Transformer: A transformer is an electromagnetic static device, which transfers electrical energy from one circuit to another, either at the same voltage or at different voltage but at the same frequency. *Rectifier*: The function of the rectifier is to convert AC to DC current or voltage. Usually in the rectifier circuit full wave bridge rectifier is used. *Filter:* The Filter is used to remove the pulsated AC. A filter circuit uses capacitor and inductor. The function of the capacitor is to block the DC voltage and bypass the AC voltage. The function of the inductor is to block the AC voltage and bypass the DC voltage. *Voltage Regulator:* Voltage regulator constitutes an indispensable part of the power supply section of any electronic systems. The main advantage of the regulator ICs is that it regulates or maintains the output constant, in spite of the variation in the input supply.

B. *LCD Display*

A liquid crystal display (LCD) is a thin, flat display device made up of any number of color or monochrome pixels arrayed in front of a light source or reflector. Each pixel consists of a column of liquid crystal molecules suspended between two transparent electrodes, and two polarizing filters, the axes of polarity of which are perpendicular to each other. Without the liquid crystals between them, light passing through one would be blocked by the other. The liquid crystal twists the polarization of light entering one filter to allow it to pass through the other.

C. *Zigbee*

ZigBee is a specification for a suite of high level communication protocols using small, low-power digital radios based on an IEEE 802 standard for personal area networks. Applications include wireless light switches, electrical meters with in-home-displays, and other consumer and industrial

equipment that requires short-range wireless transfer of data at relatively low rates. The technology defined by the ZigBee specification is intended to be simpler and less expensive than other WPANs, such as Bluetooth. ZigBee is targeted at radio-frequency (RF) applications that require a low data rate, long battery life, and secure networking. ZigBee has a defined rate of 250 kbps best suited for periodic or intermittent data or a single signal transmission from a sensor or input device.

In 2009 the RF4CE (Radio Frequency for Consumer Electronics) Consortium and ZigBee Alliance agreed to jointly deliver a standard for radio frequency remote controls. ZigBee RF4CE is designed for a wide range of consumer electronics products, such as TVs and set-top boxes. It promises many advantages over existing remote control solutions, including richer communication and increased reliability, enhanced features and flexibility, interoperability, and no line-of-sight barrier.

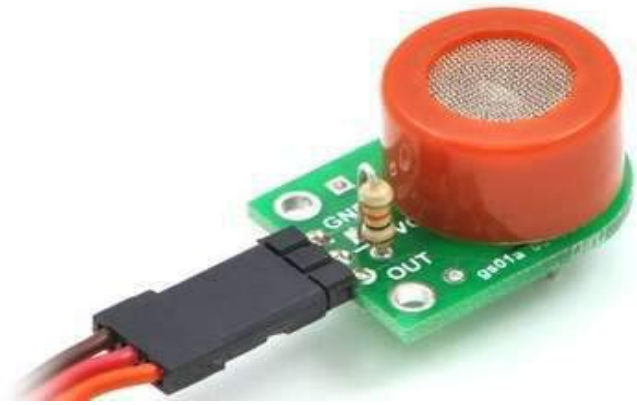
The radio design used by ZigBee has been carefully optimized for low cost in large scale production. It has few analog stages and uses digital circuits wherever possible. Though the radios themselves are inexpensive, the ZigBee Qualification Process involves a full validation of the requirements of the physical layer. All radios derived from the same validated semiconductor mask set would enjoy the same RF characteristics. An uncertified physical layer that malfunctions could cripple the battery lifespan of other devices on a ZigBee network. ZigBee radios have very tight constraints on power and bandwidth. Thus, radios are tested with guidance given by Clause 6 of the 802.15.4-2006 Standard. Most vendors plan to integrate the radio and microcontroller onto a single chip getting smaller devices. This standard specifies operation in the unlicensed 2.4 GHz (worldwide), 915 MHz (Americas and Australia) and 868 MHz (Europe) ISM bands. Sixteen channels are allocated in the 2.4 GHz band, with each channel spaced 5 MHz apart, though using only 2 MHz of bandwidth. The radios use direct-sequence spread spectrum coding, which is managed by the digital stream into the modulator. Binary phase-shift keying

(BPSK) is used in the 868 and 915 MHz bands, and offset quadrature phase-shift keying (OQPSK) that transmits two bits per symbol is used in the 2.4 GHz band.

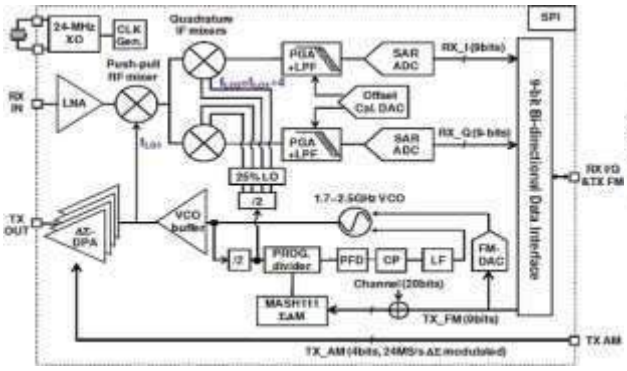
ISSN (ONLINE): 2395-695X
ISSN (PRINT): 2395-695X

International Journal of Advanced Research in Basic Engineering Sciences and Technology (IJARBEST)
Vol.3, Special Issue.24, March 2017

The raw, over-the-air data rate is 250 kbit/s per channel in the 2.4 GHz band, 40 kbit/s per channel in the 915 MHz band, and 20 kbit/s in the 868 MHz band. The actual data throughput will be less than the maximum specified bit rate due to the packet overhead and processing delays. For indoor applications at 2.4 GHz transmission distance may be 10–20 m, depending on the construction materials, the number of walls to be penetrated and the output power permitted in that geographical location.[29] Outdoors with line-of-sight, range may be up



to 1500 m depending on power output and environmental characteristics[2][citation needed]. The output power of the radios is generally 0-20 dBm (1-100 mW).



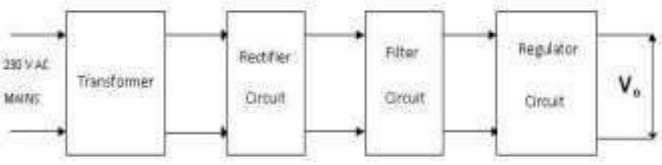
D. Microcontroller – ATMEGA 8A

The high-performance, low-power Atmel 8-bit AVR RISC-based microcontroller combines 8KB ISP flash memory with read-while-write

capabilities, 512B EEPROM, 1KB SRAM, 23 general purpose I/O lines, 32 general purpose working registers, three flexible timer/counters with compare modes, internal and external interrupts, serial programmable USART, a byte oriented two-wire serial interface, 6-channel 10-bit A/D converter (8-channel in TQFP and QFN/MLF packages), programmable watchdog timer with internal oscillator, SPI serial port, and five software selectable power saving modes. The device operates between 2.7-5.5 volts. By executing powerful instructions in a single clock cycle, the device achieves throughputs approaching 1 MIPS per MHz, balancing power consumption and processing speed.

E. Methane Sensor

This methane gas sensor detects the concentration of methane gas in the air and outputs its reading as an analog voltage. The concentration sensing range of 300 ppm to 10,000 ppm is suitable for leak detection. For example, the sensor could detect if someone left a gas stove on but not lit. The sensor can operate at temperatures from -10 to 50°C and



consumes less than 150 mA at 5V. Connecting five volts across the heating (H)

ISSN (ONLINE): 2395-695X
ISSN (PRINT): 2395-695X

International Journal of Advanced Research in Basic Engineering Sciences and Technology (IJARBEST)
Vol.3, Special Issue.24, March 2017

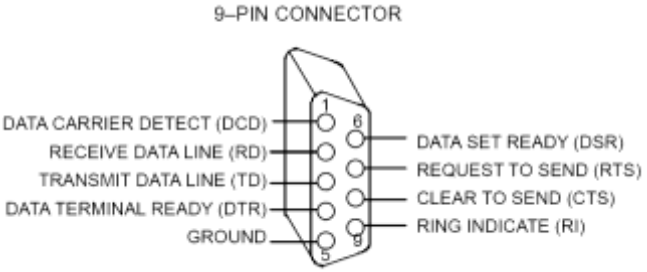
pins keeps the sensor hot enough to function correctly. Connecting five volts at either the A or B pins causes the sensor to emit an analog voltage on the other pins. A resistive load between the output pins and ground sets the sensitivity of the detector.

F. ***CO_2 Sensor***

With this sensor, you can easily monitor changes in CO_2 levels occurring in respiration of organisms ranging from peas to humans. A 250 mL respiration chamber with probe attachment is included for running controlled experiments with small plants and animals. On the high range, you can explore human respiratory changes in CO_2 levels. The lower range offers more sensitivity for cellular respiration and photosynthetic metabolism studies.

G. ***RS 232***

Due to its relative simplicity and low hardware overhead (as compared to parallel interfacing), serial communications is used extensively within the electronics industry. Today, the most popular serial communications standard in use is certainly the EIA/TIA–232–E specification. This standard, which has been developed by the Electronic Industry Association and the Telecommunications Industry Association (EIA/TIA), is more popularly referred to simply as "RS–232" where "RS" stands for



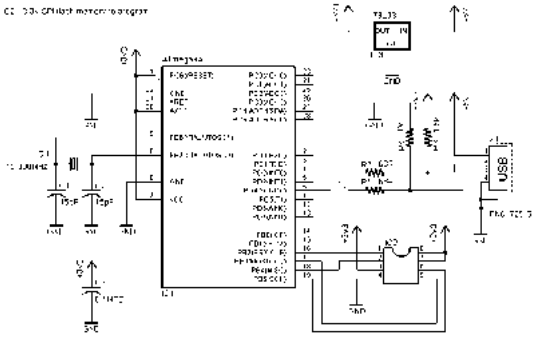
"recommended standard". In recent years, this suffix has been replaced with "EIA/TIA" to help identify the source of the standard. We use the common notation "RS–232".

V. DESIGN

A. ***Network Layer***

The main functions of the network layer are to enable the correct use of the MAC sublayer and provide a suitable interface for use by the next upper layer, namely the application layer. Its capabilities and structure are those typically associated to such network layers, including routing.

On the one hand, the data entity creates and manages network layer data units from the payload of the application layer and performs routing according to the current topology. On the other hand, there is the layer control, which is used to handle configuration of

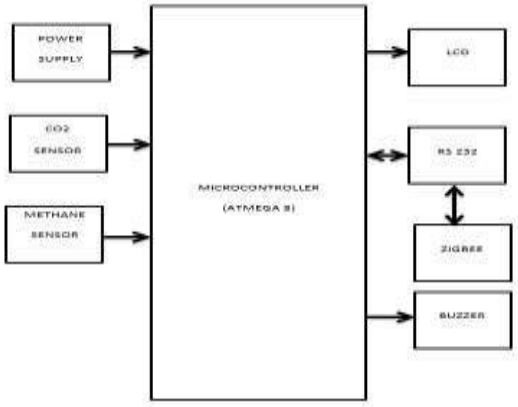


ISSN (ONLINE): 2395-695X
ISSN (PRINT): 2395-695X

International Journal of Advanced Research in Basic Engineering Sciences and Technology (IJARBEST)
Vol.3, Special Issue.24, March 2017

new devices and establish new networks: it can determine whether a neighboring device belongs to the network and discovers new neighbors and routers. The control can also detect the presence of a receiver, which allows direct communication and MAC synchronization.

The routing protocol used by the Network layer is AODV. In order to find the destination device, it broadcasts out a route request to all of its neighbors. The neighbors then broadcast the request to their neighbors, etc. until the destination is reached. Once the destination is reached, it sends its route reply via unicast transmission following the lowest cost path back to the source. Once the source receives the reply, it will update its routing table for the destination address with the next hop in the path and the path cost.

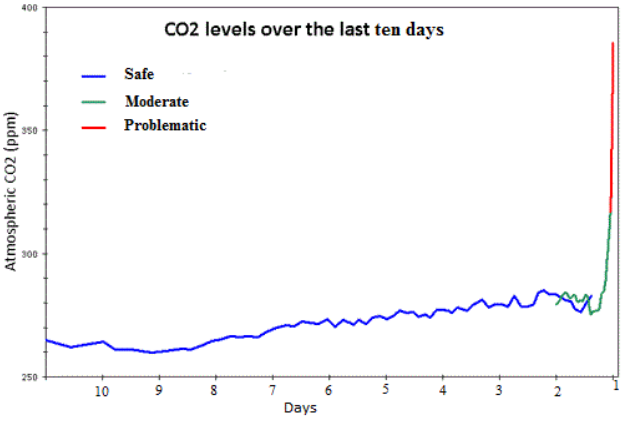


B. *Application Layer*

The application layer is the highest-level layer defined by the specification, and is the effective interface of the ZigBee system to its end users. It comprises the majority of components added by the ZigBee specification: both ZDO and its management procedures, together with application objects defined by the manufacturer, are considered part of this layer.

C. *Main Components*

The ZDO is responsible for defining the role of a device as either coordinator or end device, as mentioned above, but also for the discovery of new



(one-hop) devices on the network and the identification of their offered services. It may then go on to establish secure links with external devices and reply to binding requests accordingly.

The application support sublayer (APS) is the other main standard component of the layer, and as such it offers a well-defined interface and control services. It works as a bridge between the network layer and the other components of the application layer: it keeps up-to-date binding tables in the form of a database, which can be used to find appropriate devices depending on the services that are needed and those the different devices offer. As the union between both specified layers, it also routes messages across the layers of the protocol stack. Communication models.

VI. WORKING PRINCIPLE

The general objective of this project is to design the monitoring and control system of industrial parameters using wireless communication. This project is used to reduce the high manpower requirement in industries by monitoring the overall parameters through a zigbeee. And also controls the parameters without any manual operation. Basically,

this project is designed with microcontrollers and various sensors the control process will automatically take place, only if the parameter exceeds the fixed value. For an instance, the co2 is sensed by the sensor,. The sensed data is then sent to the controller. Likewise the methane level is also sensed. Here, the atmega 8a microcontroller performs various operations like converting the received analog signals into digital values with the help of in-built adc converter, storing the data with the help of flash memory, etc. To monitor the sensed values through a lcd display connected with the microcontroller

Thus the waste affluence gases from the industry came out which can be sensed by the Methane sensor and CO_2 sensor. Then the Sensor sends a signal to the microcontroller. The controller tends to know the concentration of the affluence and it predicts its value. Then the controller converts the predicted value into an electrical signal and sends the data to Zigbee Transistor. The receiver receives signal and the actual process can be monitored in the SCADA.

VII. CONCLUSION

This paper demonstrates Design and Implementation of industrial parameter Monitoring & Controlling System used for controlling the devices as well as monitoring the environmental parameters. Embedded controlled sensor networks have proven themselves to be a reliable solution in providing remote control and sensing for environmental monitoring systems. The sensors have been integrated with the system to monitor and compute the level of existence of CO2 AND METHANE GASES in atmosphere using information and communication technologies

VIII. REFERENCES

[1] S. Palanisamy, S. Senthil Kumar J. Lakshmi Narayanan, "Secured WirelessCommunication for Industrial Automation and Control" ,978-1-4244-86793/11/$26.00 ©2011 IEEE.

[2] Mohit Kumar, Mohnish Sharma, Rishabh Narayan, Sumit Joshi1, Sanjay Kumar2, "Zigbee based Parameter Monitoring and Controlling System for Induction Machine", Conference on Advances in Communication and Control Systems 2013 (CAC2S 2013).

[3] Arun Kumar, "A Zigbee Based Wireless Data logging System", International Journal of Scientific & Engineering Research Volume 3, Issue 9, September-2012 1 ISSN 2229-5518.

[4] Jin-Shyan Lee, Yu-Wei Su, and Chung-Chou Shen, " A Comparative Study of Wireless Protocols: Bluetooth, UWB, ZigBee, and Wi-Fi " ,Information & Communications Research Labs, Industrial Technology Research Institute (ITRI).

[5] Christo Ananth, I.Uma Sankari, A.Vidhya, M.Vickneshwari, P.Karthiga, "Efficient Sensor Network for Vehicle Security", International Journal of Advanced Scientific and Technical Research (IJST), Volume 2, Issue 4, March-April 2014,pp – 871-877

[6] Philipp Gorski, Frank Golatowski, Ralf Behnke, Christian Fabian, Kerstin Thurow,Dirk Timmermann:"Wireless Sensor Networks in Life Science Applications" 3rd International Conference on Human System Interaction (HSI 2010), pp. 594-598, Rzeszow, Poland, 2010