

## Smart phone based Mobile Application to protect human being from hazardous gases present in an environment

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**Abstract**— Automated Gas Monitoring Mobile Application is basically used for measuring and displaying the amount for different types of gases with its level (in ppm) within an environment. Proposed system mainly use various types of gas sensors, temperature sensor, microcontroller, Bluetooth modem and Smartphone. For experimental purpose four types of sensors are tested that are Temperature sensor, Alcohol( $C_2H_5O$ ) sensor,  $H_2$  sensor and Methane( $CH_4$ ) sensor. These different types of gas sensors are communicating with advance microcontroller ATMega328P. Sensors not only detecting the presence of gases, but also measures the amount of gases available in the environment. Afterword it sends corresponding output on microcontroller. The microcontroller read the data from sensors through on-chip ADC (Analog to Digital Converter) and send it serially to Bluetooth modem(HC 05). Now this data is forwarded to the developed android application, it consist a GUI (Graphical User Interface) through which we can get a real time data from sensor to Smartphone through Bluetooth modem i.e. we can see different gas concentration level in ppm and temperature in  $^{\circ}C$  on Smartphone.

**Keywords**— Gas Monitoring Mobile App, Bluetooth Modem, Sensors, Microcontroller, Smart environment, Smart phone, Gas sensors

### I. INTRODUCTION

In an environment there are various types of gases are available. Out of these available gases some gases are might be harmful to human being if they exceeds beyond the certain limit and some are toxic gases which having dangerous effect on human health directly. In case of dangerous toxic gases, they are very much harmful to human health, which leads towards various serious health issues, different types of cancers, breathing as well as respiratory system problems and in worst case result into the death of human being. By considering this; it is most important thing to detect such types of poisonous gases, if they at all present in an environment so that we can protect human being from the adverse effects happens. Here proposed system is successfully implemented and tested on an android platform, which any user can use on his/her smart mobile phone. It is very simple and user friendly mobile app developed for checking various types of gases available within surrounding environment in an automated way.

In the year of 2000, Gas monitoring system was used for vehicle cabin air monitoring system, in that system carbon monoxide (CO) and Oxygen ( $O_2$ ) gas Sensors were used for measuring CO and  $O_2$  gas in vehicle cabin [8]. In 2002, Car cabin air quality monitoring system effectively used to analyze cabin environment using metal oxide semiconducting (MOS) gas sensor. In 2006, GPS and GSM or GPRS services were used in gas monitoring system i.e. sort message sending on to the drivers mobile phone. This message consist of presence of various of gases. In 2008, Focused on wireless monitoring system as the wireless monitoring system has more different types of applications and remote monitoring systems were developed using SMS based communication, some of the systems developed like Intelligent residential burglar alarm, emergency alarm, fire alarm and toxic gas leakage alarm. They all are based on 89c51 single chip computer. The system can give the automatic alarm, which calls the police hotline number automatically, It can also voice alarm which occurred address[7]. In 2012, LPG and combustibile gas sensed by the MQ-2 and MQ-6 sensor respectively and were monitored by the PIC microcontroller and display on the LCD display. If the

gas range exceed than normal level then an alarm was generated and a SMS was sent on the authorized user mobile phone.

Proposed system concentrating on developing the android based application which measures different level of gases in ppm unit and displays it on the users smart phone screen. This system particularly displays current temperature, amount of CO<sub>2</sub>, Alcohol and CH<sub>4</sub> gas level in that respective environment. While implementing proposed system various components are required like Temperature sensor, Alcohol sensor, Methane sensor, CO<sub>2</sub> sensor, Bluetooth modem and microcontroller ATmega328P.

Following figure 1 show diagrammatical arrangement of all the interfaced sensors to the Advance ATmega328P microcontroller. It is a 8 bit microcontroller and also supports to the advance RISK Architecture. It has 32 Kbytes flash memory, 1 Kbytes EEPROM, 2 Kbytes Internal SRAM and 23 Programmable input/output lines. Microcontroller ATmega328P will read sensors data though on chip analog to digital converter and send it to the Bluetooth modem .



Figure 1: Block Diagram of proposed System

The develop android application will consist the GUI to display the amount of gases in ppm range and temperature in °C unit.

## II. EXISTING SYSTEM

As the discussed in research paper of Esuabom Dijemeni and Danielle Roberts Desktop Based Real Time Oxygen Auto Ventilation and Gas Monitoring System is developed for Homecare and respiratory applications, which calculated the real time oxygen IPM of patient. It is measured and displays on desktop via Bluetooth. It is useful in home and hospitals use [1].

In gas monitoring based Multi-Sensor Information system, multiple information fusion is used by using many types of sensors such as Temperature sensor, wind speed sensor, gas sensor, CO sensor and H<sub>2</sub>S sensor. In this developed system multiple gas sensors are used to sense the real time data to improve the security field in Cole mining area. If the gas concentration is increased then light and sound alarm will be started. Here they used the keyboard to provide input and display device to display the amount of gas present[2].

The indoor environment Gas Monitoring System Based on the Digital Signal Processor developed for monitoring indoor gases, in that system they measure the CO<sub>2</sub> and CO gases with the help of DSP (TMS320C6455) board. Its support to measure the pollution in environment due to the different types of gases [3]. This Real-Time Gas Monitoring System is based on Wireless Sensor Network and also used for measuring some parameters of volcanic mount. It measures real time temperature and different types of gases present in that environment. They use the wireless sensor network with Zig-Bee devices [4].

In an Intelligent Monitoring System Natural Gases are identified. With the help of intelligent software, it identifies odorants gases from environment. In that system optical-based sensor array

was used[5]. The Multi-sensor Wireless Monitoring System was developed for natural gas purification plant for safety purpose . In that system GPS/GPRS modules are used.[6]

### **A. Kitchen Monitoring System**

A Kitchen Monitoring system is developed by Mrutyunjaya Sahani, Avinash Nayak, Rishabh Agrawal and Debadutta Sahu. It mainly consist of application used on smart phone to monitor the gases in kitchen. The system principally monitors environment parameters such CO<sub>2</sub>, CH<sub>3</sub>, C<sub>2</sub>H<sub>6</sub>O, and temperature. In existing system they are detecting environmental parameters such as light intensity, room temperature, fire detection, motion detection LPG gas level and controlling the Kitchen environment. This system can controls the status of kitchen environment and send an email or an alert SMS via GSM network automatically to the user. The ZigBee device and ARM1176JZF-S microcontroller are used in this system. This software system is developed in Python language and this system server was implemented on a Raspberry pi development board in Linux environment when any parameters exceed beyond the threshold values, the WIU sends the warning notification email or SMS to the registered users [7].

### **B. Drip Irrigation Control**

Remote Drip Irrigation Control system Using Internet developed by Nazmeen Tamboli, Pragati Tate and Abhilasha Lokhande. In this developed system using internet was Humidity & soil moisture sensors are used to control drip irrigation system from anywhere via android based mobile application. According to values given by the sensors, continuous graph is display on computer as well as on smart phone with the help of internet. After getting sensor values to microcontroller there is level that MAX232 which convert TTL to RS232 for personal computer and mobile display [8].

### **C. Mine Gases Monitoring System**

Coal Mine Gas Wireless Monitoring System using wireless sensor networks is developed by Qin Xianli, Fu Mingchao and ShenBin. In this developed system WSNs like zigbee nodes are used in coal mine to detect underground gases from mine. All the information collected by sensors is transfer through Controlled Area Network (CAN) towards substation collected information is analyzed to calculate the gas concentration in that respective environment. As software development platform CC2430 system-on-chip based on zigbee technology is used [9].

### **D. Embedded Control System for Factory Environment**

Embedded Control System for Factory Environment developed by Kuang-Yow Lian , Sung-Jung Hsiao and Wen-Tsai Sung. In this system temperature, humidity and air quality parameters are maintained using smart phones at the same time, this system detects the vibration of operating machinery, possible flames and analyzes it and monitors electrical load. This real time sensing data send message to integrated embedded system via Zig Bee protocol. For displaying data Android application is used in smart phone. To analyze the power loads in the factory area Fast Fourier Transform (FFT) method is used [10].

### **E. Air Pollution Monitoring Using Smartphone**

Air Pollution Monitoring Using Smartphone's David Hasenfratz, Olga Saukh, Silvan Sturzenegger, and Lothar Thiele. As air pollution has direct impact on human health, by collecting sensor readings near governmental measurement stations to keep sensors calibration up to date and display these reading on gas mobile. To sense the ozone concentration in the atmosphere MiCS-OZ-47 sensor is used.RS232-TTL interface is used for digital communication, this board is directly connected with gas mobile. User can take measurement, calibrate sensor, access the settings and upload the measurement to server using android application. sensor calibration and measurement is display on smart phone using android application [11].

### **F. Mine Safety helmet Based on WSN**

Mine Safety helmet Based on WSN developed by Chunlong Ma, Jinming Huo and Xiaohui Yang. This system monitors underground gases also monitoring to secure helmate which used in gas

environment .wireless sensor node gather sensor data and send this real time data to underground computer center. It stores and analyzes the data if the gas concentration level increases then helpmate in wireless sensor network gives buzzer. Computer converges gas information of each node using Fussy fusion Algorithm [10],[12].

### G. Embedded system for Hazardous Gas detection and Alerting

Embedded system for Hazardous Gas detection and Alerting is developed by V.Ramya and B. Palaniappan. LPG and Propane gases are hazardous to human health these gases can be detected using MQ-2 and MQ-6 sensors. This sensor gathers real time gas value in environment and sends it to the microcontroller. Microcontroller sends this data to authorized user using SMS [13].

### III. Proposed work Technology used

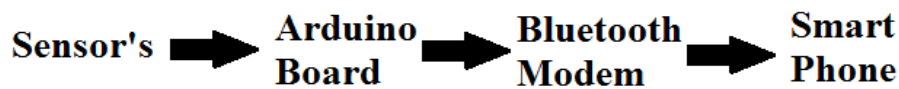


Figure 2: Flow of Proposed System.

Above figure 2 shows control flow of system which is used for smart phone based gas monitoring system. In this proposed system different types of sensors are used to detect temperature, Alcohol, Methane, Hydrogen gases. All this sensors are connected to Arduino board ATmega328 microcontroller. Sensors detect gas changes in the environment which is in analog type signal and send real time analog gas values to microcontroller through ADC (Analog to Digital Converter). ADC converts analog signal in to a digital signal, then microcontroller send this value to smart phone using Bluetooth modem. To send serial data from arduino board to smart phone HC-05 Bluetooth modem is used. According to real time values detected by sensors data will be display on smart phone using Bluetooth communication. To see real time data on smart phone user need to install gas detector application on his smart phone, so that User can see real time gas values from anywhere which is advantage of this system.

### IV. Proposed work Technology used

As hazardous gases are dangerous to human body so to detect gas molecules gas sensor are used.

These sensors measure the concentration of gases in the environment.



Figure 3: Data Flow with available setup.

Above figure 3 shows Data Flow in system, In proposed system gas sensor is transducer which detect the gases and produces an electrical signal. These signal send to Arduino board ATmega328 microcontroller which has Analog to Digital Converter(ADC). It convert the analog sensor value send by sensors to digital signal, then microcontroller send this value to smart phone using Bluetooth modem HC-05.Using Bluetooth communication real time gas values detected by sensors will be display on smart phone. To see the real time gas values like temperature, methane, alcohol and carbon dioxide.

### V. Technology Used

In this system architecture to detect temperature, CH<sub>4</sub>, alcohol and CO<sub>2</sub> gases sensors such as LM-35, MQ-8, MQ-4, MQ-3 sensors are used respectively. These sensor collect real time gas values and send to microcontroller which convert analog data send by gas sensors into digital data and send to android smart phone using Bluetooth modem HC-05.

1. Android Programming
2. Adriano Programming
3. Bluetooth Modem

### 1. Android Programming:

To develop android application, android software development kit (android IDE). Android code is easier to write and it runs on different operating system such as windows and linux. Android programming uses java language to develop the application.

### 2. Adriano Programming

Arduino programming is an open source so it is easier to write arduino code and upload this code on hardware. Set of instructions are given to arduino board for reading sensor data and to send it on smart phone. To give instruction to arduino board arduino programming is used.

## VI. EXPERIMENTAL SETUP

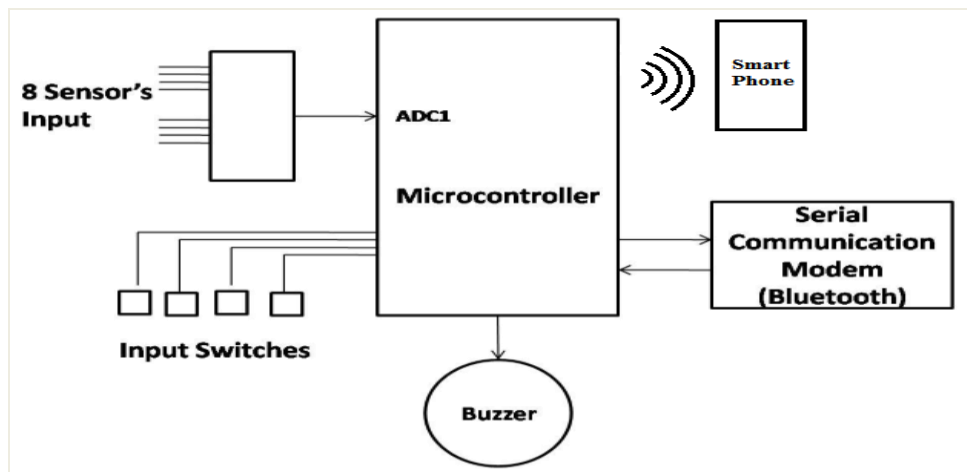


Figure 4: Design Module

Above figure 4 shows the design module of smart phone based gas monitoring system, In this system LM-35, MQ-8, MQ-4, MQ-3 sensors are used for sensing temperature, H<sub>2</sub>, CH<sub>4</sub>, C<sub>2</sub>H<sub>6</sub>O gases respectively. These sensors detect the amount of gases in environment and send to microcontroller which is in analog form. ADC convert these values in to digital voltage, microcontroller send this data to smart phone using HC-05 Bluetooth modem. This Bluetooth modem is used to transfer data serial between microcontroller and smart phone. So, real time value which is sense by sensors will be displayed on smart phone. Sensors send data to microcontroller using parallel communication and microcontroller send data to smart phone via Bluetooth modem using serial communication.

## VI. CONCLUSION

This paper represents design and implementation of Smart Phone Based Gas Monitoring System which is developing for monitor gases in environment using Bluetooth serial communication. Installing android application on smart phone will display real time gases values in the environment via Bluetooth modem; Bluetooth is excellent modem for sending data due to its low cost. Many industries, chemical area produces dangerous gases which is harmful to human. This proposed system is used in such areas for human safety.

## REFERENCES

- [1] Esuabom Dijemeni, Danielle Roberts, "Desktop Based Real Time Oxygen Auto Ventilation and Gas Monitoring System For Homecare Respiratory Application" published in IEEE International Conference on circuit, Power and Computing Technologies: DOI :10.1109/AE.2014.7011670 Date of Conference: 9-10 Sept. 2014.
- [2] Hua Fu Tao Wang Cui Yang , " Gas Monitoring System Based on the Multi-Sensor Information Fusion" , Published in: Electronic Measurement & Instruments, 2009. ICEMI '09. 9th International Conference , DOI: 10.1109/ICEMI.2009.5274421 Date Of Conference: 16-19 Aug. 2009



- [3] Anuj Kumar, I. P. Singh, and S. K. Sud , “Indoor Environment Gas Monitoring System Based on the Digital Signal Processor”,Published in:Multimedia, Signal Processing and Communication Technologies, 2009. IMPACT '09. International ,Date of Conference14-16 March 2009 DOI: 10.1109/MSPCT.2009.5164221
- [4] B. Supriyo, S.S.Hidayat, A. Suharjono, M.Anif , Sorja Koesuma,”Design of real-time gas Monitoring system Based-on Wireless Sensor Networks for Merapi volcano” Published in: Information Technology, Computer and Electrical Engineering (ICITACEE), 2014 1st International Conference ,Date of Conference: 8-8 Nov. 2014 ,DOI: 10.1109/ICITACEE.2014.7065709
- [5] C. Zanchettin,L. M. Almeida ; F. D. de Menezes,”An Intelligent Monitoring System for Natural Gas Odorization ”,Published in:IEEE Sensors Journal ,DOI: 10.1109/JSEN.2014.2345476
- [6] Liang Zhu, Bing Zou, He Zhang, Zhen Wang and MinJiang,”Design of Multi-sensor Wireless Monitoring System and its Application in Natural Gas Purification Plant”,Published in: Mechatronics and Automation (ICMA), 2015 IEEE International Conference on ,Date of Conference: 2-5 Aug. 2015,DOI: 10.1109/ICMA.2015.7237525.
- [7] MrutyunjayaSahani, AvinashNayak, RishabhAgrawal and DebaduttaSahu,"A GSM, WSN and Embedded Web Server Architecture for Internet Based KitchenMonitoring System", Published in IEEE International Conference on Circuit, Power and Computing Technologies, DOI :10.1109/ICCPCT.2015.7159480, Date of Conference: 19-20 March 2015.
- [8] NazmeenTamboli,PragatiTate,AbhilashaLokhande," Remote Drip Irrigation Control Using Internet ",Published in International Journal of Advanced Research inComputer Science and Software Engineering,Date of Conference: December 2013.
- [9] Qin Xianli, Fu Mingchao, ShenBin,"Coal Mine Gas Wireless Monitoring System Based on WSNs",Published in IEEE Second International Conference on Digital Manufacturing & Automation, DOI: 10.1109/ICDMA.2011.82, Date of Conference: 5-7 Aug. 2011.
- [10] Lian KY, Hsiao SJ, Sung WT," Mobile monitoring and embedded control system for factory environment.",DOI: 10.3390/s131217379
- [11] David Hasenfratz, Olga Saukh, Silvan Sturzenegger, and Lothar ThieleComputer Engineering and Networks Laboratory ETH Zurich, Switzerland,"Participatory Air Pollution Monitoring Using Smartphones",Published:2012
- [12] Chunlong Ma Jinming Huo ,Xiaohui Yang Information Engineering Department Guang Hua College, Chang Chun University Chang ChunJiLin,China,"Experimental Design of Gas Monitoring System in Mine Safety helmet Based on Wireless Sensors Networks",2011 International Conference on Mechatronic Science, Electric Engineering and Computer,Published: August 19-22, 2011, Jilin, China
- [13] V.Ramya, B. Palaniappan , " Embedded system for Hazardous Gas detection and Alerting", International Journal of Distributed and Parallel Systems (IJDPS) Vol.3, No.3,Publish: May 2012
- [14] K. Galatsis, W. Wlodarsla, K. Kalantar-Zadeh and A. Trinchi, " INVESTIGATION OF GAS SENSORSFOR VEHICLE CABIN AIR QUALITY MONITORING", Publish: January 4, 2010
- [15] A.A.Vasiliev, N.N. Samotaev, A.V. Ivanova, K.Yu. Oblov, "Wireless Digital Platform for Environmental Gas Monitoring", Publish:2015.