# Development of an Automated Rescue System

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*Abstract*— **In order to effectively provide efficient rescue system for the ships in any position if they catch fire or any other fire accidents in the ships, a kind of An Automated Rescue System is designed with ARM as its core controller, collects the fire pollutant indexes consisting of exhaust particulates, sulphur oxides, carbon oxides, as well as nitrogen oxides through different gas sensors and takes advantage of Global Position System(GPS) to obtain the Ships exact position, after that, the information collected is sent as a SMS to the Centre control computer via GSM. Moreover, in order to provide Rescue Departments convenience in supervising the Lost Ships or Fire caught ships, the system also uses Global System for Mobile Communications wireless transmission in which it alarms when the ships are caught up with fire and about sink. Practical run shows that the system is well realized with the function of GPS positioning, remote data transmission, Sensing the fire emitted gasses and the precision of the system is not more the 2,5 percentage.**

*Keywords*— **Fire emitted gasses, GPS, GSM and Gas Sensor.**

## I. INTRODUCTION

We are keep on hearing the news as the fire attacks on a Ship or ships sinking into sea because of floods in the middle of the lot many ocean and people losing their families but no precautions are taken to overcome this problem even we have got so many advanced technologies and so sophisticated improvement in electronics. Even though lifeboats save some of the people from that accident but if those people lose their contact with each and other, then they have to remain in the boat itself until they reach some island or other ships. If they don't find any person or any island in time they have to lose their lives in the boat itself.

Aimed at the above circumstance, Automated Rescue system is developed in this paper; Remote Rescue Department will be operating and will get the information about any ship getting into any kind of accidents especially Fire accidents.

This paper will be structured as follows. In section II we will expose diagram of the system hardware sensor measurement circuit; in Section III we will describe the diagram of the system control and Section IV we will show the results

## II. HARDWARE DESIGN

A. *Diagram of the system Hardware*

Diagram of the system hardware is illustrated in figure.1, The Hardware of An Automated Rescue System includes MCU control Module, Sensor and Signal Processing module, GPS module, GSM communication Module

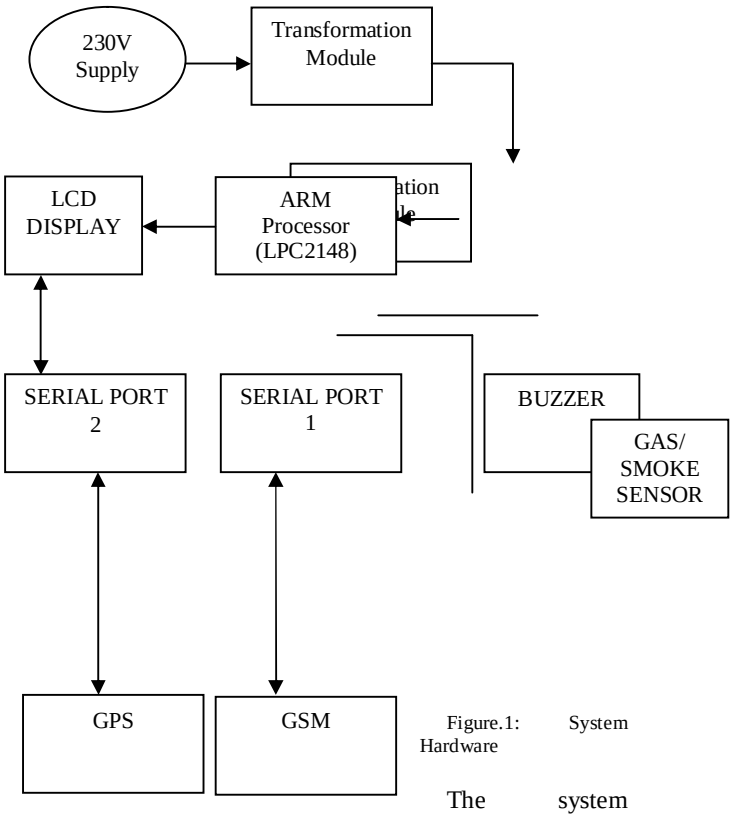


Figure.1: System Hardware

The system automatically takes an advantage of Global Positioning System (GPS) to obtain the ship position, then the information it collects is transmitted to the Rescue department through the GSM network by using AT command. When any unwanted gas or any harmful gasses or any smoke detected in the ship then, alarm messages including the latitude and longitude of

the ship will be sent to the Rescue department mobile telephone.

B. *Design of sensor measurement circuit*

Sensor measurement circuit is core part in this system, and mainly consists of carbon dioxide measurement circuit and sulfur dioxide measurement circuit.

1) *Carbon dioxide measurement circuit*

(1). Base Structure and Working Principle:

Sensor Structure (MG811) as shown in Figure.2, it is composed by Solid electrolyte layer(1), Gold electrodes(2), Platinum Lead (3), Heater(4), Porcelain Tube(5), Double-layer steel less net(6), Nickel and copper plated ring(7), Bakelite (8), Nickel and copper plated pin(9).

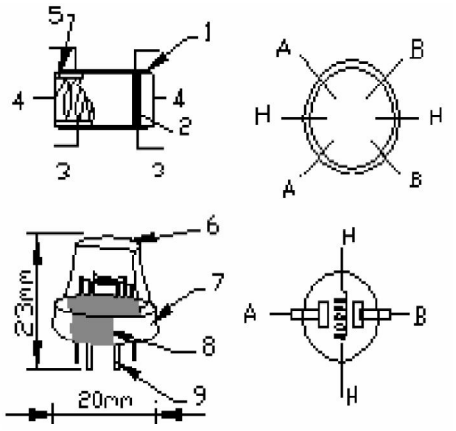


Figure.2 Smoke Sensor

The Sensor adopts solid electrolyte cell principle; it is composed by the following solid cells: Air, Au|NASICON|Carbonate, and CO2. When the sensor is exposed to CO2, the following electrodes reactions occur:

*Cathodic reaction:* $2Li^+ + CO_2 + \frac{1}{2}O_2 + 2e^- = Li_2CO_3$

*Anodic Reaction:* $2Na^+ + \frac{1}{2}O_2 + 2e^- = Na_2O$

*Overall chemical reaction:*

$$Li_2CO_3 + 2Na^+ = Na_2 + 2Li^+ + CO_2$$

The Electromotive force(EMF) results from the above electrode reaction, the relationship between EMF and CO2 concentration can be described by the following equation(1):

$$EMF = Ec - (R \times T)/(2F) \ln (P(CO2)) \quad (1)$$

Where P(CO2)-CO2 partial Pressure, Ec-Constant Volume, R-Gas Constant volume, T-Absolute Temperature(K), F-Faraday constant.

Sensor heating voltage supplied from other circuit, when its surface temperature is high enough, the sensor equals to a cell, its two sides would output voltage signal, and its result accords with Nernst's equation.

(2). Temperature compensate and measurement circuit CO2 concentration and temperature are two factors impacting on MG811 (carbon dioxide sensor) output. A kind of temperature compensation and measuring circuit is designed on purpose of reducing the temperature impacts on carbon dioxide output, and as illustrated in Figure.3, it is mainly composed by the filtering amplifying circuit and temperature compensation circuit with a negative temperature coefficient thermistor labelled RT. Under the condition of the carbon dioxide concentration remains unchanged, assume the temperature rises _T, as a result of that, the voltage ADC2 and ADC3 output will rise _V1, _V2 respectively, if _V1 equals _V2, it implies that temperature compensation will be realized automatically when the relationship between temperature and resistance of Thermistor RT accords with Figure.4.

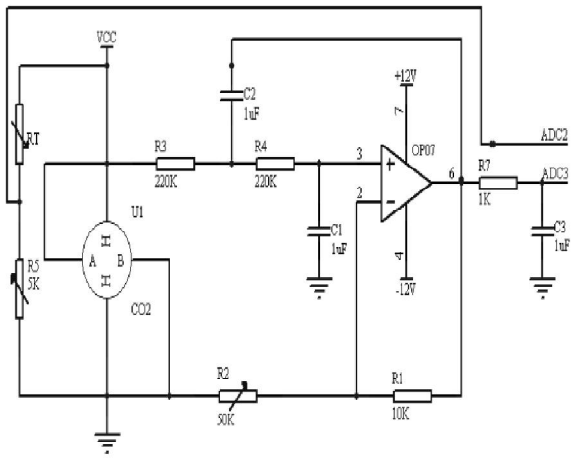


Figure.3 Temperature Compensation Measuring Circuit

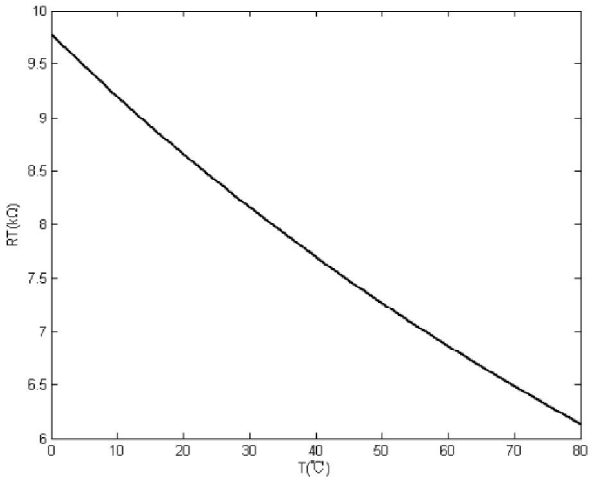


Figure.4 The relation between temperature and RT Resistance

2) *Sulfur oxides measurement circuit*

(1) Basic Structure and Working Principle

The system uses SO2-AF as its Sulfur dioxide sensor, and the sensor is composed by Working electrode WE and Corresponding electrode CE. When the two internal electrodes exposed to voltage, and SO2 enters the selection- permeation-membrane by diffusion, then the following REDOX reaction occurs:

*Working electrode:*

$$SO_2 + 2H_2O \rightarrow H_2SO_4 + 2H^+ + 2e^-$$

*Corresponding Electrode:*

$$\frac{1}{2}O_2 + 2H^+ + 2e^- \rightarrow 2H_2O$$

At this time there is a current flow in electrolyser, and the, the current value is proportional to the Moore number of SO2, and then volume concentration as well as mass concentration of SO2 in waste gas can be calculated.

(2)Temperature compensate and measurement circuit

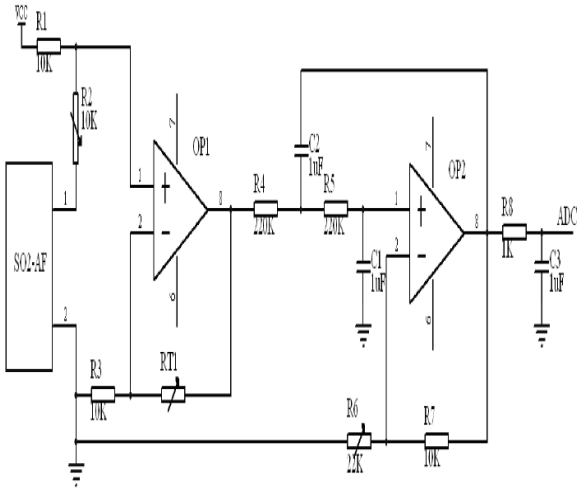


*Figure.5 Temperature compensation circuit*

Because the variation in sensitivity of SO2 Sensor caused by changes in temperature which varies from 0 to 100_, so SO2 sensors need temperature compensation because voltage output from ADC will increase when temperature rises under the condition of that SO2 concentration is invariable. Figure.5 shows the SO2 temperature compensation and measurement circuit which contains the temperature compensation circuit and the low-pass filter circuit. It is verified through theoretical calculation and experiment that, temperature compensation will be realized as long as the change trend of RT conforms to Figure.6.

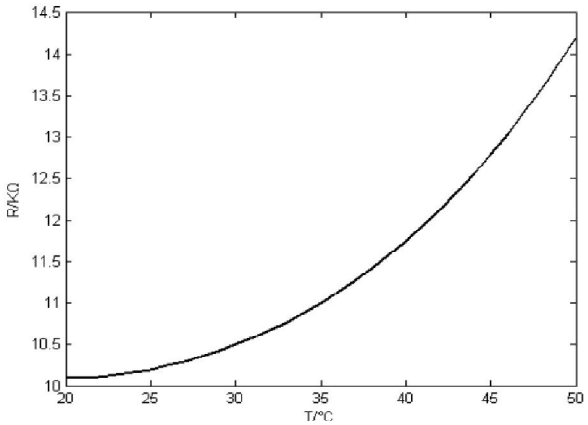


Figure.6 The variation in Thermistor caused by changes in Temperature

## III. CONTROL SYSTEM DESIGN

The diagram of system control centre software is explained in figure.7. Software consists of continuous

monitoring for Gas/Smoke/Fire in the ship, Modem Detection, real-time data reception and analysis module, longitude and latitude update module.

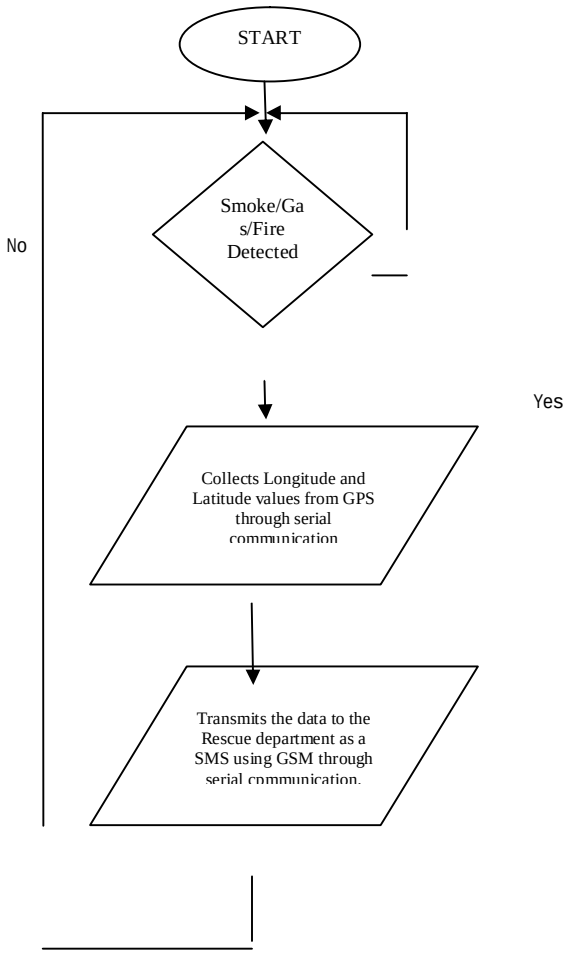


Figure.7 Flow Chart of the complete control system Design

## IV. CONCLUSION

Development of an Automated Rescue System is out of the pollution enterprise's control and it has two features. Firstly, all the data collected by the system will be directly transmitted to the Rescue supervision and management department. Secondly, the system can automatically alarm and send the special information to the supervision staffs by the GSM network. Two characteristics can effectively control the terrible phenomenon that the large losses for the families who travel in the ships for long days and even send the rescue system in time and save everyone from the danger using air transportation also if required. At the same time, with the advantages of small size, real-time communication, inexpensive and easy to maintain, the system also has tremendous superiorities when compared with the expensive monitor system used by the Rescue supervision and management departments imported from foreign country. All the rescue systems developed before only gives alarm in the ship itself but our system clearly gives information to the rescue department with an SMS using GSM AT commands with accurate ship location using GPS.

## V. REFERENCES

**[1].** SIM300 AT Command Set Designed by SIMCOM

[2]. WANG F, LIN J H. "Design of SMS platform based on GSM network". China Measurement Technology, No.3 , pp101-102, Mar.2008.

[3]. PAN Z Y, LI L. "Data acquisition information system based on GSM". Chinese Journal of Scientific Instrument, Vol. 25, No. 4, pp512-514, Apr. 2007.

[4]. Stelios P. Mertikas,Kosmas I. Damianidis. Monitoring the quality of GPS station coordinates in real time [J]. GPS Solutions, Vol11, No.2, pp119-128, Mar.2007.

[5]. F. H. Ramírez Leyva, J. P. Acevedo Cuellar, R.G.Maldonado Basilio, E. Espinosa Justo, Proceedings of the 14th Internationa Conference on Electronics, communications and Computers ,2004.

[6]. www.parallax.com CO2 Gas Sensor Module (#27929) v1.0 2/25/2010.

[7]. Zhao Xiaoqiang , Zhang Zuhou Xi'an. University of Posts and Telecommunications Xian, Shaanxi 710021, China "Development of Remote Waste Gas Monitor System" 2010 International Conference on Measuring Technology and Mechatronics Automation.

[8]. Chwan-Lu Tseng a, Joe-Air Jiang b,, Ren-Guey Lee c,Fu-Ming Lub, Cheng-Shiou Ouyangb, Yih-Shaing Chenb Chih-Hsiang Changb a National Taipei University of Technology, Taiwanb National Taiwan University, Taiwan c National Taipei University of Technology, Taiwan Feasibility study on application of GSM–SMS technology to field data acquisition Received 29 October 2005; received in revised form 28 March 2006; accepted 29 March 2006.

[9]. A. Somov, D. Spirjakin, M. Ivanov, I. Khromushin, R. Passerone, A. Baranov, A. Savkin, Combustible gases and early fire detection: an autonomous system for wireless sensor networks, in: Proceedings of the First International Conference on Energy-Efficient Computing and Networking (e-Energy 2010), Passau, Germany, April 13–15, 2010, pp. 85–93.

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