Design And Implementation of A Unit for Industrial Air Analysis

Supriya P Joshi
Dept Of Electronics and Communication
Vidya Vikas Institute Of Engineering and Technology
Mysuru, Karnataka, India

Syeda Sadiya
Dept Of Electronics and Communication
Vidya Vikas Institute Of Engineering and Technology
Mysuru, Karnataka, India

Santhosh R
Dept Of Electronics and Communication
Vidya Vikas Institute Of Engineering and Technology
Mysuru, Karnataka, India

Vijay C
Dept Of Electronics and Communication
Vidya Vikas Institute Of Engineering and Technology
Mysuru, Karnataka, India

Lalitha N
Dept Of Electronics and Communication
Mysuru, India

***Abstract*— Now a day's air quality is affected by various economic and industrial activities which alter the composition of air and affect the environment locally, regionally and globally. Both natural and/or anthropogenic activities introduce air pollutants into the atmosphere that pose problem to human health and other life forms on earth. Hence to overcome this problem an unit is designed to study the level of pollutants being discharged by the industries. Smoke sensor, temperature sensor and pressure sensor are used to know the values of smoke, temperature and pressure of the exhaled air. In real time a solenoid valve will be used to draw in samples of air for analysis from pipes/chimneys. The values are uploaded to a data base for any action to be taken by the government if the recorded values exceed the permitted levels. The necessity of treatment of gas/air before its release from industries needs to be recognized.**

Keywords—LCD, GSM, Solenoid, Renesas.

I. INTRODUCTION

Air pollution is a major urban environmental problem leading to serious impacts globally. Air pollution is leading to increase in the atmospheric temperature and making the conditions for sustainability of life getting worse over decades. There is an immediate need to develop a device that can characterize the air exhaled out of industries suitable to be discharged or to be treated before doing so based on various properties like the level of smoke, temperature and pressure. This unit makes use of a smoke sensor, temperature sensor and an air pressure sensor to detect the values of smoke, temperature and pressure of the air samples. A LCD is also incorporated in order to give alert messages. The alert messages are the indication of high smoke, high temperature and high pressure when the marginal or permitted levels are exceeded. In real time a solenoid valve will be used to collect samples of air/gas going out into the atmosphere from the pipes or chimneys. A solenoid valve is an electromechanical actuated valve used to control the flow of gases. All the recorded values are uploaded to a data base for further analysis and for any action to be taken. Depending upon the permissible levels of the recorded values an action can be taken by the government. The emission source such as the industry which has crossed the nominal values may be asked to treat the air before liberating it into the atmosphere. Another solution would be to impose a fine on the industry for not marinating the allowable levels and polluting the air. Depending on these reference values, the exhaled air can be categorized as suitable to be discharged into the atmosphere or not.

II. IMPLEMENTATION OF THE SYSTEM

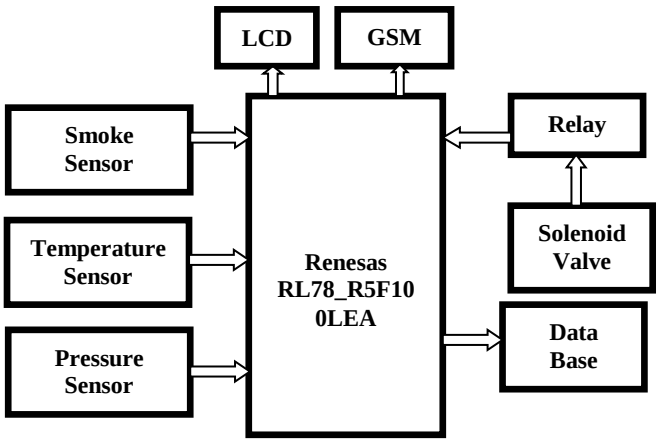

Fig. 1. Design of System hardware

The unit used to collect in the air/gas samples from the pipes or chimneys in the industries is a solenoid valve. Solenoid valve is a device used to control the flow of gases. Solenoid valves can be controlled electrically. In order to control the valve a relay is used in this set up. The collected samples are then passed across the various sensors. The smoke sensor detects the amount of smoke, temperature sensor

measures the temperature and similarly the pressure sensor provides an output proportional to the pressure applied to it. All the measured values are displayed on a display panel that is a LCD. A marginal value for the amount of smoke, temperature and pressure is previously defined. When the measured values exceed these thresholds, High smoke/High temperature/High pressure values are respectively displayed on to the LCD. Also the recorded values are uploaded to a data base for any further procedure to be carried or for comparisons to be done when same tests are carried out in future.

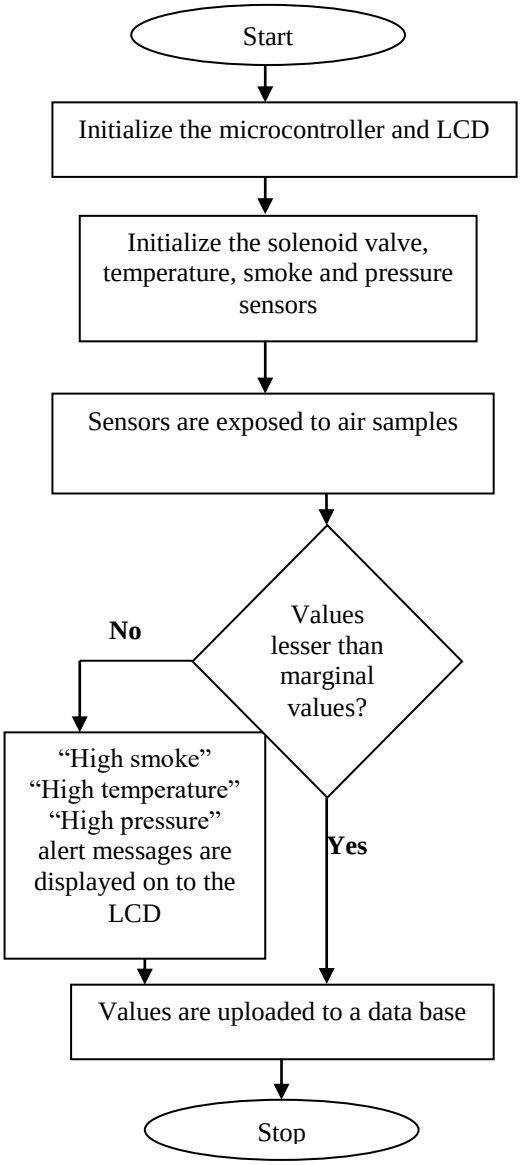

Fig. 2. Implementation of Flow chart

III. COMPONENTS

The main components required for the functioning of the above proposed solution are elucidated below.

A. Microcontroller

The Renesas RL78_R5F100LEA is a 16 bit microcontroller. This microcontroller operates at low voltage, low active current and has high efficiency. It also has high temperature support, different low power modes and also high accuracy on- chip oscillator. RL78 can be used for wide range of applications.

B. GSM SIM 800

SIM 800 is a quad band GSM solution in a SMT type which can be embedded in customer application. It supports quad band 850/900/1800/1900MHz and can transmit voice, data, SMS and data information with low power consumption. Its size is 24*24*3mm and weighs about 3.14gm.

C. LCD

We are using a high quality 16 characters by 2 line display module, with back lighting.

- 16 Characters x 2 Lines
- Chip On Board (COB) type
- Positive transflective display type
- 8 bit parallel data lines

D. LM35 temperature sensor

The LM35 series consists of two independent, high gain, internally frequency compensated operational amplifiers which were designed specifically to operate from a single power supply over a wide range of voltages. Other characteristics include very low supply current drain, low input offset voltage and large output voltage swing.

E. MQ 2 Sensor

The MQ-2 is smoke sensor that detects the concentrations of smoke in the air and outputs its readings as analog voltage.

F. MPX5100DP

The MPX5100DP is a piezo resistive transducer designed for a wide range of applications but particularly those employing a microcontroller or microprocessor with A/D inputs. This sensor gives linear output with the varying pressure.

G. SPDT Relay

The SPDT relay is a single pole double throw relay. This coil's relay is rated up to 5V and the contact is rated up to 30A. The working voltage is 4.7~5.0v and the operating ambient temperature is -25 to 70oC.

H. Solenoid Valve HR2

A solenoid valve is an electromechanically operated valve. The valve is controlled by an electric current through the solenoid. As soon as the coil is electrically energized a magnetic field is created which pulls the plunger towards the centre of the col. This opens the orifice so that the medium flows through. We specifically use HR2 solenoid valve in this project.

IV. RESULTS AND DISCUSSIONS

Due to the increasing air pollution the earth's atmosphere is becoming toxic day by day. This is causing serious problems to all life forms on this planet. Industries are one of the major sources that cause air pollution. This paper presents an idea to design a real time unit that can analyze and characterize the amount of pollution caused by an industry. On the basis of the results generated, measures can be taken in order to reduce the excessive amount of air pollution caused by the emission source.

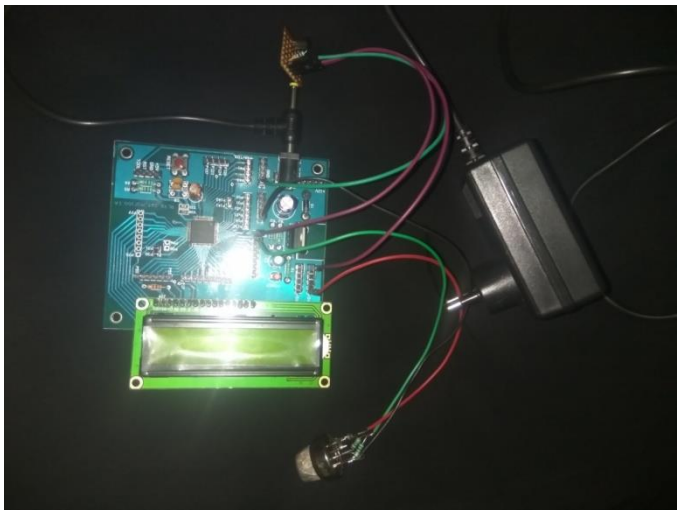

Fig. 3. Experimental setup

V. CONCLUSION

The project presents the prototype model of Renasas based Real Time System for analysis of air exhaled out of industries. The main component in this prototype is the solenoid valve which will be used in real time to draw in samples of air for measurements to be made. The sensors that are involved for the analysis are smoke, temperature and pressure sensors. The output values are also updated to a data base. Depending on the marginal values, the air exhaled can be characterized as fit to be discharged into the atmosphere or not. If it is not then the industrial unit has to treat it before letting it out in the atmosphere. Billing or fine may also be imposed for not maintaining the permissible levels. Since the values are available in the data base, easy comparisons can be made for any further tests carried out in near future.

VI. FUTURE ENHANCEMENT

There are lots of applications in this project mainly in the field of controlling air pollution caused by various emission sources. This model incorporates three different sensor for analysis. In future enhancements we can include more number of sensors and test various other factors such as air density sensors or CO sensors. Inclusion of other sensors increases the accuracy of tests and also contributes to much more efficient characterization of air samples.

ACKNOWLEDGMENT

We would like to thank the management Sri Vasu, Sri KAvish gowda, Dr. M Ravishankar, Principal, Dr. Bindu A Thomas, HOD for their encouragement. Mr. Nitesh K A, Assistant Professor, Department of Electronics and Communication Engineering for the valuable supports in the completion of our project assignment into productive and fruitful one.

REFERENCES

[1] Boyanka Marinova, Marin Berov Marinov, Georgi Todrov Nikolov, "Air quality monitoring system", 2006.

[2] Patel H and Pandey S, "Physico-chemical characterization of textile chemical sludge from various CETPS in India",2008.

[3] Vikram, "Solenoid valve engineering information" ASCO, 2014.

[4] Ateeque Ahmed and Nikhat Bano, "Ambient air quality of Firozabad city", 2015.

[5] Simone Brienza, Andrea Galli, Giuseppe Anatasi and paolo Bruschi,"A low cost sensing system for cooperative air quality monitoring in urban areas", 2015.

[6] Jadhav Aditya S, Pawar Vishwajeet P, Jorwekar Sagar R and Jadhav Vidya P, "Industrial air pollution monitoring and analysis system", 2016.

[7] Brian W. Kernighan and Dennis M. Ritchie, "The C programming Language" 2nd Ed, 2013.

[8] Mullet, "Wireless Telecom systems and networks", Thomson Learning 2006.