

Effluent Monitoring System Using LabVIEW And GSM

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Abstract—Pollution monitoring systems are nowadays used widely in the industries for real time applications. The majority applications of pollution monitoring systems are in the industries where the control of parameters which causes pollution and deteriorates the industrial and natural environment pattern is a great challenge. The main objective of our project is to design an efficient and robust system which will assess and monitor the effluent like smoke, CO, CO₂ from the industries and provide the information to the pollution control authorities via GSM when any of the parameters exceeds the industrial standards. The monitoring of these factors can be done through the internet using LabVIEW software.

Keywords— GSM, LabVIEW, Smoke, CO, CO₂

I. INTRODUCTION

The terms monitoring and assessment are quite often confused and used synonymously. The process of air quality check in the industries is an evaluation of the industrial quality in relation to standard quality set by pollution control board. More significance is allotted to the factors which may affect human health and the health of the natural system itself. Over the past few decades, there has been a massive change of industrialization and urbanization experienced, and these industries have caused complex and serious problems to the environment. The first is the severe environmental pollution which has caused deterioration of atmosphere, climate change, stratospheric ozone depletion, loss of biodiversity. Industrial effluent monitoring system is the collection of information at particular locations of industries and at regular intervals in order to provide the data which may be used to define current conditions, establish trends etc.

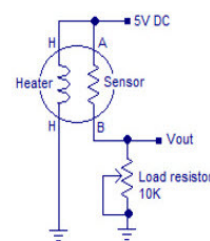
II. SYSTEM DESIGN

The system design is consisting of two parameter analyzing sensors along with a temperature sensor for monitoring the

temperature of the exhaust containing the effluents. All the sensors are synchronized with microcontroller. There are indicators provided for depicting the rise of the sensor output above the set point. The GSM periodically sends message to the pollution control board regarding the output of the sensor.

A. Air Quality sensor

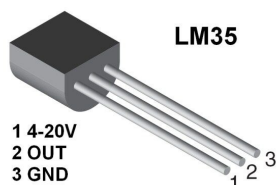
It is a hazardous gas sensor (MQ135) used for monitoring the air quality. It is ideally suitable for detecting alcohol, NH₃ (ammonia), smoke and CO₂. The sensitive element whose electrical conductivity varies with respect to the gas concentration is tin oxide (SnO₂). Its high sensitivity to smoke is one of the merits. The load resistor value can be varied to obtain better performance. The range of the sensor is between 10-10000ppm. Heater resistance varies from $31\Omega \pm 3\Omega$.



B. Temperature sensor

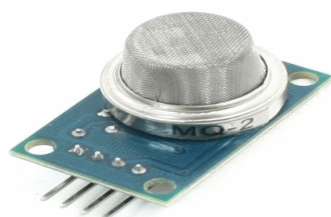
The circuit consists of an LM35 whose terminals are connected to an input voltage of 5V and a series connection of 100k Ω resistance and 100MF capacitance is connected in order to avoid any voltage drop across the circuit. The series connection is grounded and output is taken from terminal 2. It has an output voltage that is proportional to the Celsius temperature. The scale factor is .01V/ $^{\circ}$ C. The LM35 does not require any external calibration or trimming and maintains an

accuracy of $\pm 0.4^{\circ}\text{C}$ at room temperature and $\pm 0.8^{\circ}\text{C}$ over a range of 0°C to $+100^{\circ}\text{C}$.



C. Gas sensor

Gas Sensor (MQ2) module is useful for gas leakage detection in industries. It is suitable for detecting H_2 , LPG, CH_4 , CO (Carbon monoxide). Due to its high sensitivity and fast response time, measurements can be taken as soon as possible. The sensitivity of the sensor can be adjusted by using the potentiometer.



| Model No. | MQ-2 | MQ-5 | MQ-135 |
|---------------------------|---------------|------------------|---------------------------|
| Sensor Type | Semiconductor | | |
| Standard Encapsulation | Bakelite | | |
| Highest Sensitivity Gases | Smoke | LPG, Natural Gas | Ammonia, Sulfide, Benzene |
| Detection Range | 300-10000ppm | 200-10000ppm | 10-10000ppm |

D. ARDUINO MICROCONTROLLER

The Arduino Uno is a microcontroller board based on the ATmega328. It has 14 digital input/output pins (of which 6 can be used as PWM outputs), 6 analog inputs, a 16 MHz crystal oscillator, a USB connection, a power jack, an ICSP header, and a reset button. It contains everything needed to support the microcontroller; simply connect it to a computer with a USB cable or power it with a AC-to-DC adapter or battery to get started. The Uno differs from all preceding boards in that it does not use the FTDI USB-to-serial driver chip. Instead, it features the Atmega8U2

programmed as a USB-to-serial converter.



E. GSM MODULE

GSM module is used to establish communication between a computer and a GSM-GPRS system. Global System for Mobile communication (GSM) is an architecture used for mobile communication in most of the countries. Global Packet Radio Service (GPRS) is an extension of GSM that enables higher data transmission rate. GSM module consists of a GSM modem assembled together with power supply circuit and communication interfaces (like RS-232, USB, etc) for computer. The MODEM is the soul of such modules.



F. LabVIEW

LabVIEW ties the creation of user interfaces (called front panels) into the development cycle. Lab VIEW programs/subroutines are called virtual instruments (VIs). Each VI has three components: a block diagram, a front panel, and a connector panel. The last is used to represent the VI in the block diagrams of other, calling VI's. Controls and indicators on the front panel allow an operator to input data into or extract data from a running virtual instrument. However, the front panel can also serve as a programmatic interface. Thus a virtual instrument can either be run as a program, with the front panel serving as a user interface, or, when dropped as a node onto the block diagram, the front panel defines the inputs and outputs for the given node through the connector pane. This implies each VI can be easily tested before being embedded as a subroutine into a larger program.



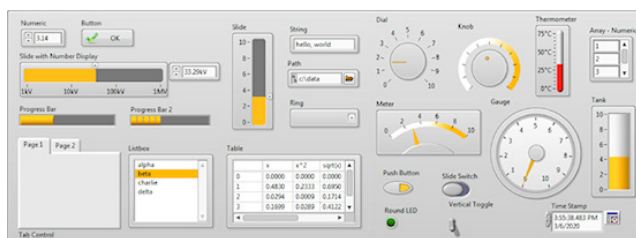
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G. Equation

a) Temperature sensor

$$b = a * 500 / 1023$$

in the above given equation the analog value from the sensor is read into the variable 'a' and after the conversion is done the value is stored into 'b' in degree Celsius.

b) Air quality sensor

$$f = e * (10000 - 100) / 1023$$

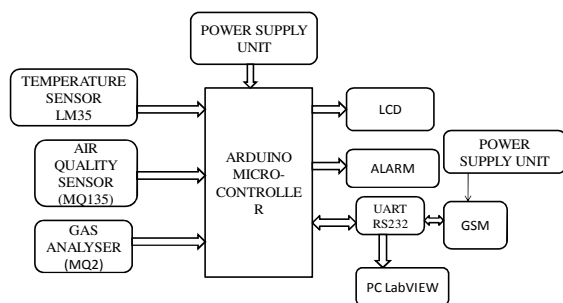
in the above equation the analog value is read into the variable 'e' and after the conversion the final value of concentration in ppm is store in 'f'.

c) Gas sensor

$$d = c * (10000 - 300) / 1023$$

in the above equation the analog value is read into the variable 'c' and after the conversion the final value of concentration in ppm is store in 'd'.

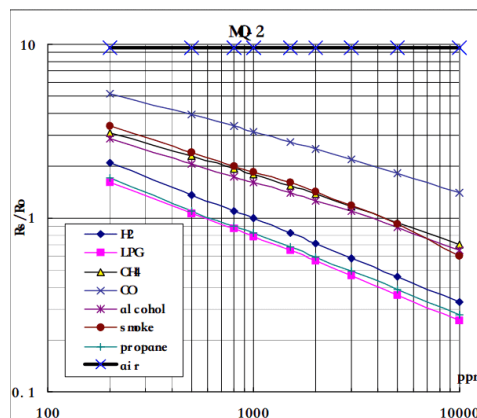
III. BLOCK DIAGRAM



IV. IMPLEMENTATION & RESPONSE

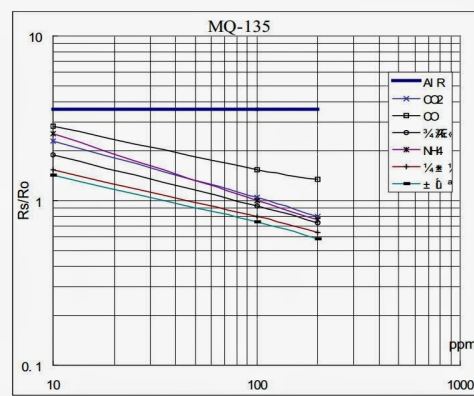
A. SENSITIVITY

a) MQ2



b) MQ135

Fig.2 sensitivity characteristics of the MQ-135



V. CONCLUSION

The field of effluent monitoring is very wide and this project is an attempt to reduce the problem of cost and periodical inspections by the utility of Global System for Mobile communications. For alleviating these problems, advanced GSM system with Lab VIEW is used. The performance and robustness of the pollution monitoring and control system can further be improved by implementing sensors for controlling noise, moisture and various other parameters, thereby improving the industrial and natural environment.

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