IOSR Journal of Computer Engineering (IOSR-JCE)
e-ISSN: 2278-0661,p-ISSN: 2278-8727, Volume 22, Issue 2, Ser. II (Mar - Apr 2020), PP 56-59
www.iosrjournals.org

Smart Calibrator of Auto

A. Pandian[1], Ajit Kumar Satapathy[2]
[1](Department of Electrical Engineering, Gandhi Engineering College, India)
[2](Department of Electrical Engineering, Gandhi Institute For Technology, India)

Abstract: *Smart Auto calibrator is a microcontroller based digital device intended to perform calibration of sensor. Arduino micro controller along with LabVIEW software allows on-site calibration of sensors in automatic manner .This not only save the money and time but makes the system very effective by minimizing the sensing error. This paper discusses the implementation of software technique on comparing the output from the master sensor with the test sensor. Controller compares the value and performs the calibration in a periodic manner with the duration set by the user.*
Key Word*: Auto calibrator, calibration factor, Lab VIEW, Arduino.*

I. Introduction

Calibration is the process of finding a relationship between two quantities that are unknown. When one of quantity is known, this is considered as a standard. The second device is the unit under test.

In Industry calibration in an important factor. The sensor due to environmental effect or due to ageing effect sensitivity reduces and gives some faulty value after a period of time. Therefore it is very important to calibrate this sensor in a regular interval. Every industry has instrumentation departments which regularly check the sensor and makes necessary calibration from time to time. In this process each sensor has to un-mount from its platform and must be calibrated with the standards. This is a monotonous work. Moreover this calibration has to perform in a periodic manner. To minimize the works of inspection department, in this project a concept of Auto calibration is implanted.

II. Working

Before understanding about auto calibration we need to understand about the signal processing and the programming concept of the sensor data. The sensor got used here are operated in 5V dc and gives a maximum voltage output of 5 volt. In the system we used a microcontroller which samples the data into 10 bit value. i.e. 2^{10}=1024 (from 0-1023). Hence the controller when the controller get a voltage in the analog pin it maps the data into 0-1023 value. The value generated by the controller for every sensor input is given by-Sensor value

$$(SV) = \frac{\qquad\qquad}{\qquad\qquad} 1023$$

Thus 5 volt means 1023, zero volt means 0, 2.5 Volt means 512 in the controller and so on. The data from the sensor passes through the microcontroller in the form of a string and is converted to a numeric value using a string to numeric convertor (a block in case of Lab VIEW a and a class in processing language). The system give a resolution of 0.00488 volt.

Now let us take an example. Let us take an example. In coal mines methane is a very poisonous gas and some gas sensors are used to sense the gas in the side. Let us consider gas concentration is sensed by a methane sensor and give and output of 2.5 volt. The sensor value is obtained as 512 in the controller. Now due to aging effect , screening effect etc the sensitivity is decreased and after some month the same sensor in the same input condition gives a output of 1.25 volt i.e. 256 sensor value. The value got decreased by ½. This factor is termed as calibrating factor and is divided by the sensor value to get the original value (i.e.512) again. The system is calibrated against a standard sensor which is implanted inside each node of coal mining area. These sensors are kept isolated from the environmental effects using proper shield and the only get contact with the environmental condition just for a few second during each calibration. A sealed chamber with a relay connected opening, deactivate the sensor isolation during the calibration. The flow chart for whole system is given below. All this program includes under initialization of the system in the main program.

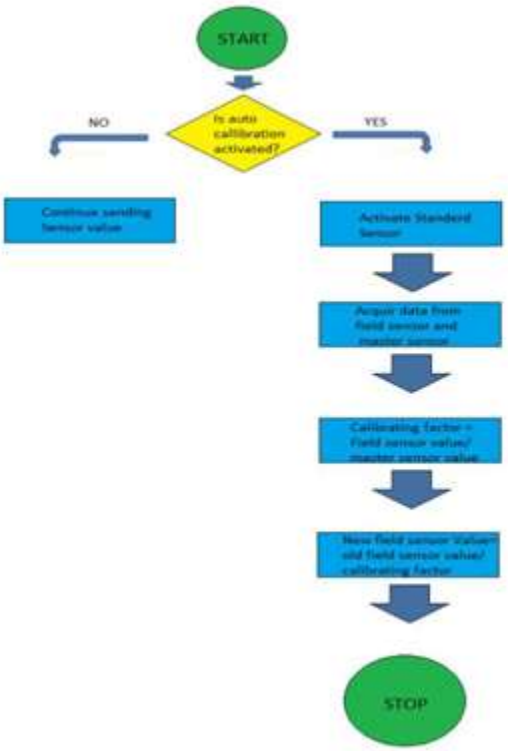

Figure 1 flow chart for auto calibration programming

III. Lab View Design Of The System

Figure below shows the lab VIEW design of the system.

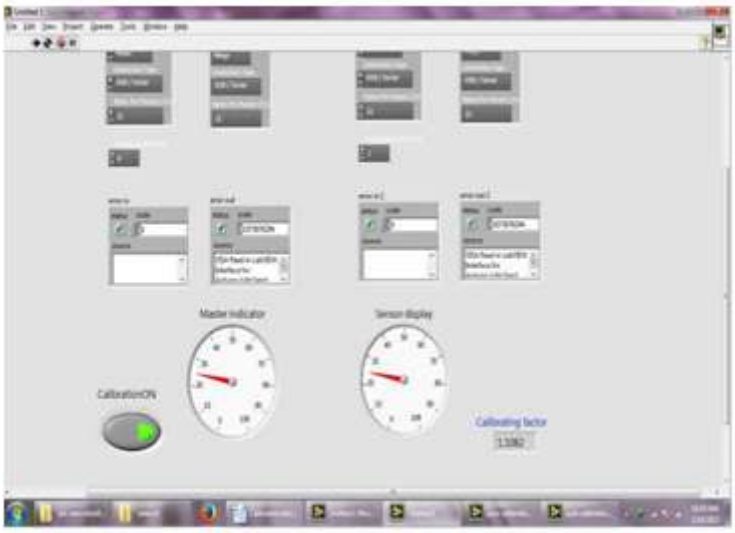

Figure 2 Front Panel view of Lab VIEW

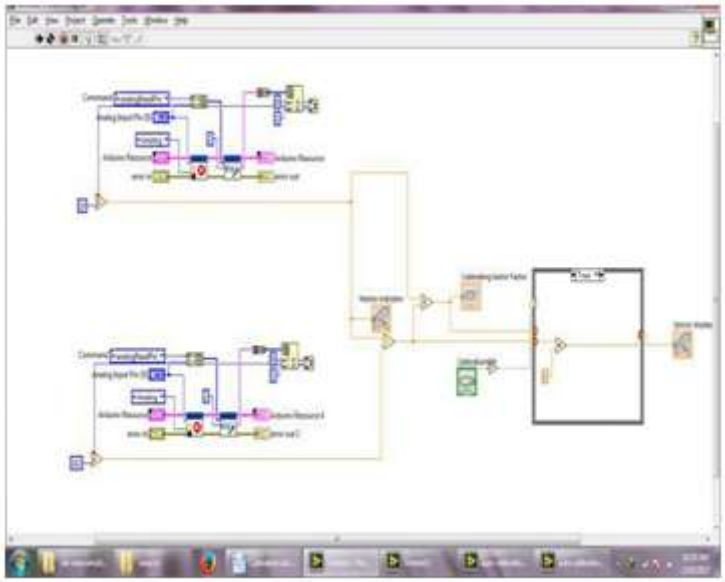

Figure 3 Block diagram panel view of Lab VIEW

Gas concentration is varied and check against both Master indicator and sensor display and. A disturbance (atmospheric, ageing etc) is created and checks the value against both the display again. Initially as the disturbance increases the difference between both display increases. No correction can be made when the auto calibrator is in off position. But as soon as we activate the auto calibrator (in actual case it is a timed program) calibrated factor is displayed and is changing with the disturbance.

IV. Design Of Hardware

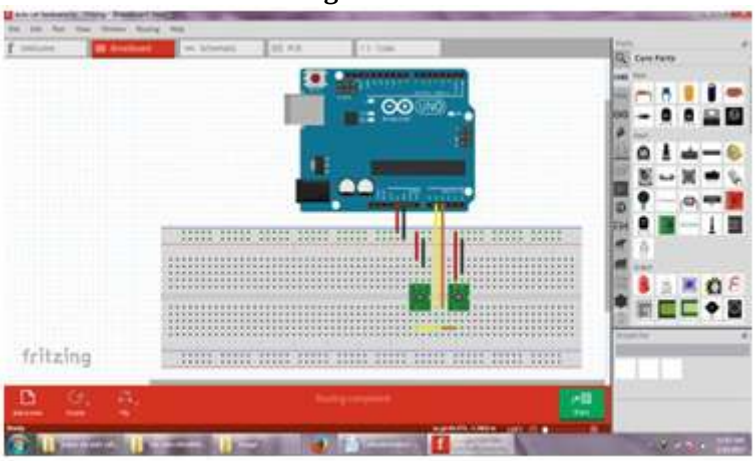

Figure 4 The Design of Circuit in Fritzing

The circuit is designed in software called Fritzing can be use for fabrication of electronics circuit. Two potentiometer is simply connected at the analog pin of Arduino. One as a sensor value and the other is the disturbance Actual hardware

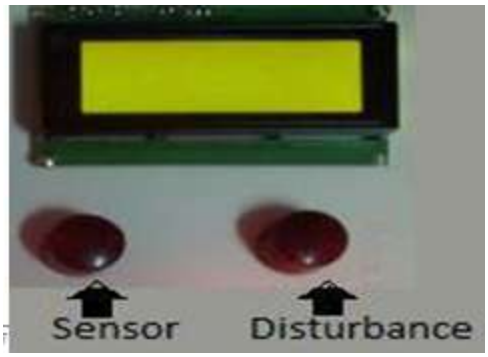

Figure 5 The hardware set up

V. Results And Discussion

After implementing the system on hardware following data are obtained

Table 1 Experiment Data

No of experiments	Disturbance (voltage)	Master sensor output (voltage)	Measuring sensor output (without cal)	Measuring sensor output (with auto cal)
1	0.2	3.17	2.97	3.11
2	0.4	4.85.	4.65	4.75.
3	0.6	1.96	1.36	1.83
4	0.8	2.47	1.67	2.39
5	1	3.29	2.29	3.25
6	1.2	1.59	.39	1.51
7	1.4	3.81	2.41	3.79
8	2.6	1.6	1	1.52
9	1.8	5	3.2	4.93
10	2	3.14	1.14	3.11
11	2.2	3.18	.96	3.12

Data obtained are represented graphically .clearly it is seen that, when there is no calibration the sensor does not follow the master sensor value. But in case of auto calibrated sensor it almost same as the master sensor After observation we finally concluded that auto calibrator is very much accurate and allows the sensor to measure correct reading. Moreover the principle is simple and hardware is of low cost. Thus we believe it is becoming a very useful tool for process industries and instrumentation for accurate calibration without losing its sensitivity.

References

[1]. Xusheng Z and Yunlong Z. 2010. Accident cause analysis and counter measure of coal and gas outburst nearly two years of our country [J]. Mining Safety and Environmental Protection. 37(1):84-87.

[2]. Dawud Y. 1999. "Smoke episodes and assessment of health impacts related to haze from forest fires: Indonesian experience". The Indonesian Association of Pulmonologist, Persahabatan Hospital Jakarta. pp. 313-322.

[3]. Gongbo Zhou, Zhencai Zhu, Guangzhu Chen, Ningning Hu,2009, Energy-Efficient Chain-type Wireless Sensor Network for Gas Monitoring, Second International Conference on Information and Computing Science

[4]. Dani Martínez, Javier Moreno, Marcel Tresanchez, Mercè Teixido, Davinia Font, Antonio Pardo,Santiago, Marco and Jordi Palacín 2011Experimental application of an autonomous mobile robot for gas leak detection in indoor environments

[5]. Jinhao Sun, Jinhao Sun Yezi Li Xiaojin Ya, 2011 The design of automatic detection processing deviceof gas leakage based on the MB95204K, IEEE - 978-1-4244-8165-1/11

[6]. HE Si-yuan, 2008, The Research of Energy Efficient MAC Protocols in Gas Monitoring System of Mine. International Symposium on Information Science and Engieering

[7]. Mohd Erwan Mohd Ussdek, Syed Abdul Mutalib Al Junid, Zulkifli Abd Majid, Fairul Nazmie Osman, Zulkifli Othman,2013, High-Sensitivity Gas Detection and Monitoring System for High-Risk Welding Activity, Conference on Systems, Process & Control (TCSPC2013), 13 - IS December 2013, Kuala Lumpur, Malays

[8]. Ibrahim M. I. Ramadan and Naglaa kamal Rashwan, Calibration of Vehicle Emissions-Speed Relationships for the Greater Cairo Roads, International Journal of Civil Engineering and Technology, 7 (1), 2016, pp. 74-82

[9]. Khichada Bhavin A, K.J. Chudashma, Vyas Darshan M and Shiyal Jignesh D, 3-Phase Induction Motor Parameter Monitoring and Anal ysis Using Labview. International Journal of Electrical Engineering & Technology, 7(6), 2016, pp. 81–91.