

DEVELOPMENT OF INTERLOCKING AND ALERT SYSTEM FOR N₂ GAS CYLINDERS

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Abstract: Industries consist of several procedures where the raw materials have been designed and processed in a desired product form. For the completion of certain procedures nitrogen gas is used for its several properties. Nitrogen being in gaseous state, it is stored in cylinders and can only be measured in the form of pressure and it is to be ensured that the pressure level should be maintained and be filled upto its capacity level. For this, the recent system is still preferring the analog meters for the measurement and its calibration. Due to some of its difficulties and errors which can lead to accidents, this paper is dealing with the solution of analog system errors which can be replaced by digital system which would also perform alarming and interlocking system simultaneously in the abnormal condition or exceeding the limitation. This device is capable of 0-175 psi pressure reading and it can be operated from any remote place for controlling. As the problems are eliminated and more features have been added this device is well suited for industrial application.

Keywords: Pressure measurement, alert system, interlocking

I. INTRODUCTION

In this new culture of modernizing the lifestyle of industries, the reach is to provide more efficient with faster response for taking quick action on a particular process with which it is being dealing with. The equipment's and apparatus is required to get more and more smart and reliable which is moving towards the self-automation of the system with its protection. As the technology is updating gradually, the accidents are getting more severe and worse. Hence, the system should be designed with its full safety and it is needed to ensure that the system should be updated while looking forward to its benefits from the out dated system to the upcoming recent system.

The Nitrogen cylinders used in the industries having multiple applications due to its special features of its annealing property which is used in steel industries for the completion of annealing process of steel or iron bars, it is also used as refrigerant in food, biomedical and pharmaceutical industries and even it is also used as a perseverant for packaging in food factories. The nitrogen cylinders are limited to specific pressure according to its capacity and it is needed to check its pressure range so that it would not cause any accident or severe explosion if it is filled more than its capability.

Looking towards the automation in digital system for industrial purpose, this project deals with the digital representation of nitrogen gas pressure numerically as well as graphically gives the details about the incoming and outgoing gas also having the multipurpose features like alarming and also interlocking system. With the set range of boundaries the device will alarm the circuit when it crosses the boundary range and gives signal to interlocking system for performing the particular operation of opening and closing the inlet or outlet of gas pipe

to the cylinder. Having multiple advantages over the outdated analog system it is reliable and well suited for industrial application in nitrogen cylinders which reduces errors and gives accuracy in output.

II. PROBLEM STATEMENT

- The analog meters are unpredictable when the calibration is below 10 psi hence it is a main drawback of analog system.
- Pointer and scale meters can only indicate and measure the value so it is not capable for implementation of alarming and detection instantaneously.
- It is difficult to determine the fault if it is occurred in an analog meter hence a faulty meter may give improper reading.

III. OBJECTIVES

- To detect and process the pressure and convert it into desired data form in means of pressure indication and level indication.
- To provide high accuracy and continuous operation.
- To observe the behavior of gas pressure according to its determined level.
- To protect the respective gas cylinder by alarming system for the excess of gas pressure in a cylinder.

IV. BLOCK DIAGRAM

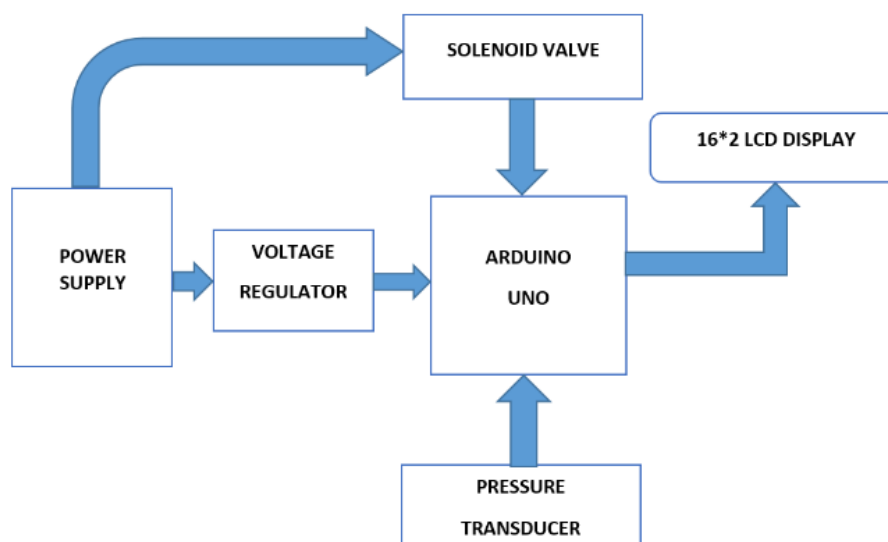


Fig.1: Proposed System

V. METHODOLOGY

For solve these problems statement, we develop a simple, reliable and low cost efficient system. The working

and construction of this system is divided into sub-section, which is shown in figure below of section diagram.

The system is operated on 230v AC power supply. The section A consist of power supply section, in which 230v AC is converted into 12v DC by using step-down transformer, full wave bridge rectifier, capacitor filters and 7812 voltage regulator IC. Another section that is section B is known as control section. It consist of Arduino, 4-channel Relay Module and 16*2 LCD display.

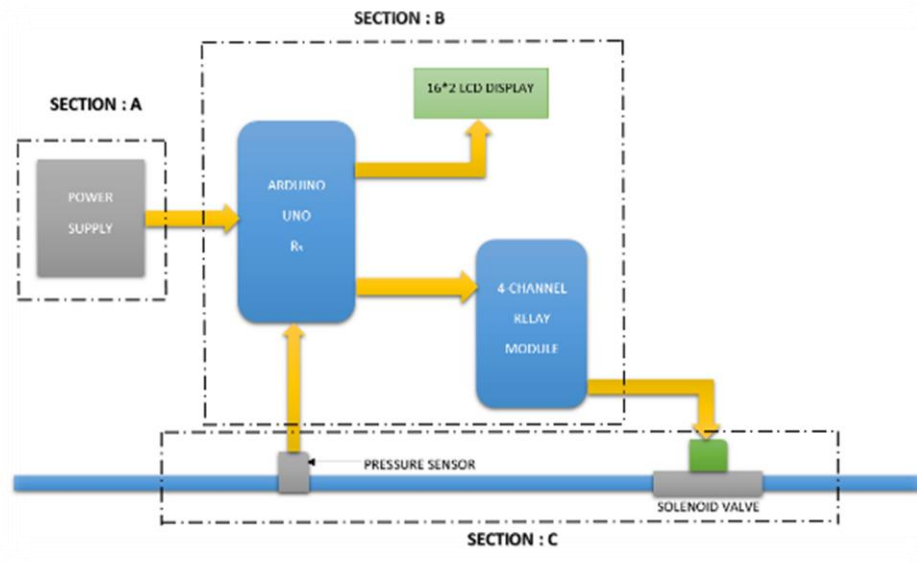


Fig. 2: Section Diagram

This section controls all the function which is carried out during operation like indication, interlocking and alert indication. Arduino helps to convert the transducer voltage into pressure unit which is indicated by display. To operate solenoid valve we use 4-channel relay module which is also controlled by the Arduino. In Arduino program we set the pressure range as per the requirement of the user. At this pressure range the relay is energized and the valve is closed.

Next section is section C which is said to be output section. It consist of pressure sensor and solenoid valve. The pressure sensor is used to sense the pressure and give the input to the section B. solenoid valve will receive command in ON/OFF form, from the control section, then it will start working. Both pressure sensor and solenoid valve is mounted on pressure pipe as shown in fig.

VI. HARDWARE SETUP & TESTING

First and foremost, the pressure is generated in the cylinder through suitable arrangement. Analog meter will depict the pressure generated in the gas cylinder. A solenoid valve is connected in the channel from cylinder to sensor. Eventually, it will sense the pressure of the channel during the operation if the helter-skelter situation occur such as, if the pressure in the cylinder rises either marginally or dramatically than the desired or set value then solenoid valve will give command to Arduino and Arduino will give to relay, therefore relay will tripped and consequently triggered the alarm, which will be indicated by red LED.

As per the abnormal pressure, the solenoid valve will close and the flow of pressure will stop. On the other hand, if the pressure in the cylinder is within the set value than the usual condition will be enumerated by green LED. Ensure that whenever the system is disconnected from the cylinder, the supply of system should be turn

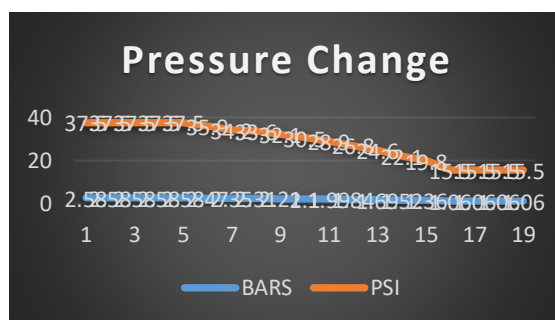
off.

Controller section:-In this section the Arduino UNO R3 is the center heart of this system. It will convert program into functional output. The Arduino is open source microcontroller board. It consist of ATmega 328P microcontroller, which is developed by Arduino manufacturer. The Arduino board has several input as well as output pins. At left side of Arduino board 14 digital pins and at right side 7 analog pins.

Sensor:-We used a pressure gauge transducer as a pressure. It will sense the pressure and give the signal to the control section in the form of voltage. Then the control section convert this into PSI and Bars form, which will indicated.

Interlocking:-Solenoid valve is used for the interlocking system. It required the power supply of 12V DC. It will also controlled by the arduino. It is electrically operated valve, which is work on the principle of solenoid valve.

VII. RESULTS



The rise and fall in pressure in a cylinder is obtained graphical as well as numeric form by the proposed system. The pressure in numeric is displayed on LCD. When the pressure in more or less than predefined value, the LCD will glow according to the condition. As a result it will triggered the alarming, interlocking system and will block the flow of gas.

VIII. CONCLUSION

The proposed system of pressure detection system provides information about the fluctuation in pressure that occurred in the respective cylinder, and will consequently show different ranges of pressure of N₂ gas inside the cylinder. The system will measure the pressure of cylinder continuously with assistance of pressure sensor. And moreover, this will be displayed on LCD as an output. At last, it will operate alarming and interlocking system.

IX. FUTURE SCOPE

Our proposed system used for all types of inert gases which is used in different industries, for the pressure measurement. This system also used in steel industries and petrochemical industries, for the pressure measurement of CO, CO₂, Petrol, Diesel and other chemicals.

REFERENCES

- 1) R.Nareshnaik, s.Nandakishore, k. Tharunkumarreddy, p.SHIVA NAGENDRA REDDY (assistant professor, department of ECE, kuppam engineering college, kuppam, chittoor, a.P, india), (eissn: 2278-2834, p- ISSN: 22788735. Volume 11) “arduino based LPG gas monitoring & automatic cylinder booking with alert system”
- 2) Sushilkumarparidda, sharadkumarpani, ankitpratik, ratiranjansabat (dept. Eee-dept. Gandhi institute of engineering and technology, GUNUPUR), (ISSN: 2347-6982) “innovative design and simulation of gas level detection system in liquefied petroleum gas cylinder for indian household application” year (2016).
- 3) T. Mizuno, K. Morita, Y. Kurata, H. Miyagawa (meidensha corporation), (0-7803-7525-4/02) “the electrical performance of air or nitrogen gas with solid insulation and the application for switchgears “
- 4) V.Ramya, B. Palaniappan, “Embedded system for hazardous gas detection and alerting” International Journal of Distributed and Parallel Systems (IJDPS) Vol.3, No.3, May 2012
- 5) Nihal A Siddiqui, Akula Ramakrishna and P SojanLal (2013). REVIEW ON LIQUEFIED PETROLEUM GAS (LPG) CYLINDER LIFE CYCLE. International Journal of Advanced Engineering Technology. IV Issue III, pp.37-41.
- 6) K. Galatsis, W. Wlodarsla, K. Kalantar-Zadeh and A. Trinchi, “Investigation of gas sensors for vehicle cabin air quality monitoring”, National Conference on Synergetic Trends in engineering and Technology (STET-2014), International Journal of Engineering and Technical Research ISSN: 2321-0869
- 7) “Smart Gas Cylinder Using Embedded System”, Issn (Online) 2321 – 2004 Issn (Print) 2321 – 5526, International Journal Of Innovative Research In Electrical, Electronics, Instrumentation And Control Engineering Vol. 2, Issue 2, February 2014.