Int. j. adv. multidisc. res. stud. 2023; 3(6):616-619

Received: 06-10-2023
Accepted: 16-11-2023

International Journal of Advanced Multidisciplinary Research and Studies

ISSN: 2583-049X

Using Atmega 16 for Pressure Measuring Instrumentation for Differents Gaseous Enviroments

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Abstract
Gageous pressure measurement plays an extremely important role in the industrial domain such as pneumatics or steam pressure, in compressors system. Measurement and monitoring need to be continuous and in time in order to adjust and control that will avoid excess permissive pressure, damage to pipes, tanks and equipment, and even cause explosion and damage to equipment, facilities and the environment. Pressure measurement is also used for high temperature such as steam will be done.
A pressure gauges using Atmega 16 sensor will be used in order to observe and store the whole process for satisfying the demands. This instrumentation can be designed and integrated completely. It also helps measure the actual pressure created by the compressor, helping to increase or decrease the air compressor's capacity. This increases the safety of the air compressor as well as helps the air compressor reach the required pressure when operating.

Keywords: Atmega 16, Eectronic Instrumentation, Pressure Gauges, Gaseous Enviroment

1. Introduction

The sensors for measuring gas pressure are a type of industrial equipment used to measure pressure in high pressure applications such as pneumatics, gas, steam, etc. They have the common characteristics of having a range of measure. The measurement is quite wide and near high because the working environments of this device all have quite high-pressure levels. Moreover, pressure sensors will have many different measuring ranges for us to choose.
In addition to measuring pressure in the air compressor, the pressure sensor can also measure steam pressure and boiler pressure. However, the maximum operating temperature range of the sensor is high will be discussed in the paper.

2. Theoretical Basis of the instrumentation

Fig 1: Mechanical pressure measuring instrumentation

In fact, most of the pressure gauges used today are mechanical, so the measurement results must go to the installation site for monitoring. Therefore, it is very difficult and it is not possible to look up the history of the measuring device or improve ability to measure of instrumentation (Fig 1).

Writing embedded programs for microcontrollers and creating a webserver as a database to store as well as transmit information, monitor measured pressure parameters.

3. General design theory

There are many different types of sensors as well as components using for measured pressure parameters. The schematic diagram of the system for measuring pressure will be designed and make printed circuit board, then manufacturing the hardware related to the product.

The system will include 2 different electronic circuit parts, transmitting and receiving information with each other by RF waves. It consists of one central circuit and another sensor circuits. The sensor circuit has the function of measuring pressure, processing the pressure signal and transmitting it to the central circuit.

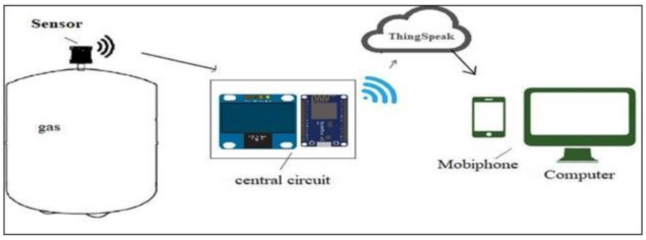

Fig 2: Diagram of pressure measuring system

The central circuit (Fig 3) is the circuit that has the function of receiving the sent information of the sensor circuit and then displaying it directly on the OLED screen, web interface and phone, warning if the limit is exceeded.

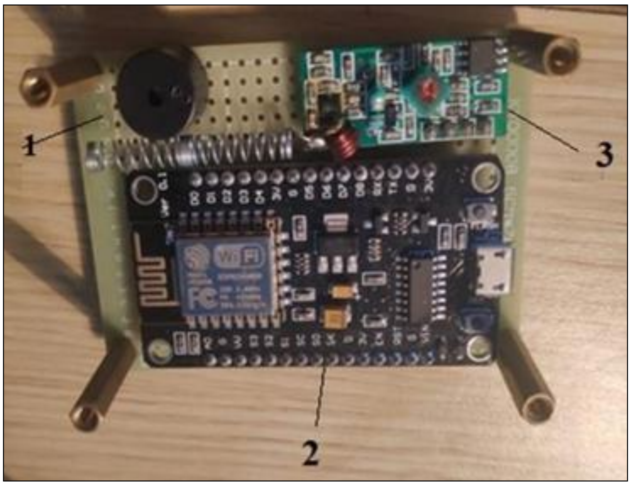

Fig 3: The central circuit blocks 1. Horne 2. Board Node MCU ESP8266 3. RF Receiver Module

The central circuit does not require too much compactness and size, so the board is assembled in a modular way, so that, it will be easy to choose for connecting components, easy to replace and upgrade.

The schematic diagram of the pressure measurement circuit using Atmega 328p is described in the Fig 4 as bellow:

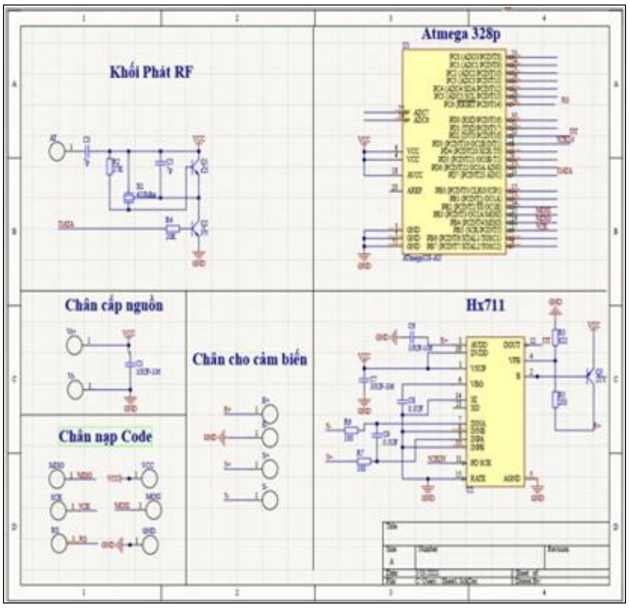

Fig 4: Schematic diagram of the pressure measurement circuit using Atmega 328p

In order for the Printed Circuit Board to be optimized in terms of size, each block will be placed as close to each other as possible and separately into each cluster.

The top of the Printed Circuit Board is the Radio frequency blocks, the microcontroller, the feed and power pins. Includes components as shown in Fig 5.

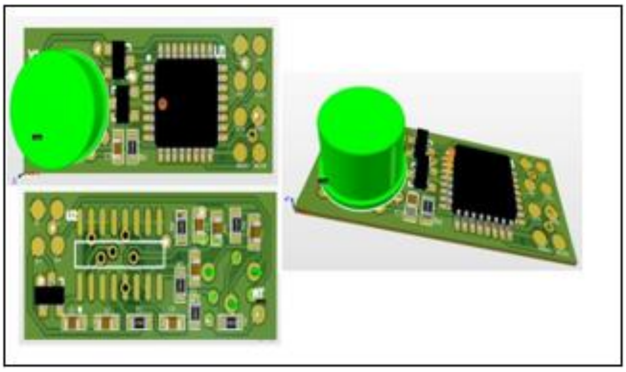

Fig 5: The 3D image of the pressure sensor circuit

The Fig 6 is the pressure measuring instrumentation product. It has 2 main parts, the main part (figure 6a) includes an antenna, a screen, a button and a knob. Here the knob and push button will be used to set the alarm level for the device. The sensor's exterior (figure 6b) includes an antenna, a switch to select battery mode, a power jack and a high-pressure intake.

Write embedded programs for microcontrollers and create a webserver as a database to store as well as transmit information, monitor measured pressure parameters. The final step is testing, evaluating the accuracy of the system and recalibrating the software and hardware so that the results obtained are as exactly as possible.

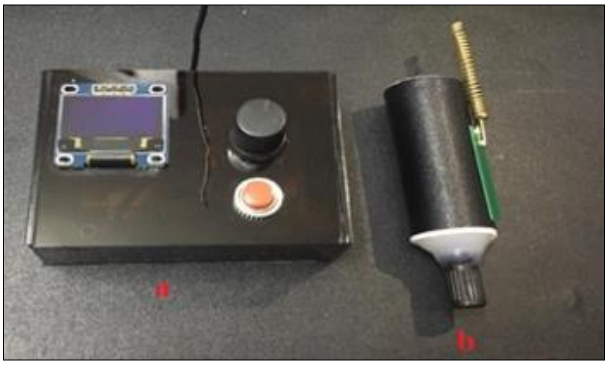

Fig 6: Pressure measuring instrumentation; a. Main part b. Sensor's exterior part

4. Creating Thing Speak Web sever

ThingSpeak is an open-source Internet of Things (IoT) application for storing and retrieving data using HTTP protocols over the Internet or over a Local Area Network. ThingSpeak allows creating sensor applications, logging, location tracking applications and sensor networks with status updates to the server, we will get the result as shown in Fig 7.

Fig 7: Measured pressure data has been sent to Thing speak

Furthermore, the measurement results can be displayed on the mobile phone. The mobile interface is very friendly and full of necessary values we want to use. On the interface, we can also set alarms for the cases of maximum pressure (for example 2,83 Bar) or minimum pressure (for example 1,25 Bar) values as in the Fig 8. This will help users easily recognize and make early decisions even though they are far from the measuring device.

Fig 8: The interface displayed on the phone

5. Experimental results

We do an experiment with the newly built device and compare it with 2 control devices, a mechanical measuring device and an electronic device (Fig 9). From there know the error of the measurement and correct it. We adjust the measuring range of the device we have just built in the range of 1-7 Bar and perform experiments in this range when compared with the 2 reciprocating devices.

Fig 9: Mechanical and Electronic pressure measuring instrumentation

Here we use two different gas environments to do experiments. There are specifically in the ambiant air environment and in the water vapor (steam) environment. The measurement results from the newly designed pressure measuring instrumentation and the pressure gauges currently in use give us the results as shown in the following table.

Table 1: Table of test results

S. No	Ambiant air			Water vapor		
	Pressure measured by new device (Bar)	Pressure measured by gauges (Bar)	Error (%)	Pressure measured by new device (Bar)	Pressure measured by gauges (Bar)	Error (%)
1	3.25	3.3	1.5	3	3.3	9.09
2	2.17	2.2	1.3	2.5	2.2	13.6
3	1.5	1.5	0	1.3	1.5	13.3
4	1.06	1.1	3.6	1.13	1.23	8.13
5	0.67	0.75	1.06	1.1	1.01	8.9

6. Conclusion

The measurement results show that the value of pressure measured in the air environment has very small errors compared to the case of measurement with traditional measuring equipment. The error of the devices is not much and less than 3.6%. So, we can temporarily accept this result and will have more detailed and accurate studies by comparing with standard measuring instruments to properly calibrate the designed pressure measuring instrumentation.

However, in the case of measuring with steam, this error is the lowest at 8.13% and the highest at 13.6%, showing that using newly manufactured equipment cannot measure the pressure of steam.

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