Home Alarm System with Arduino and LabVIEW

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Abstract

The purpose of this paper is to create a functional system in terms of hardware and software, to create a home alarm system. The system can monitor the following parameters: temperature, possible gas emissions, the presence of smoke as a result of a fire, as well as the audible warning of exceeding normal values and also the ventilation of the house. This system will be built using the Arduino Mega 2560 development platform, and programming will be done using the LabVIEW graphical programming. Hardware resources that will be used in the paper are: Arduino Mega 2560, two LM35 Precision Centigrade Temperature Sensors, the MQ-2 smoke sensor that is sensitive to smoke and to the flammable gases, the MQ-135 Air Quality Sensor, the MQ-5 Gas Sensor sensitive for LPG, natural gas, coal gas,the DC 12V Brushless Cooling Fan, a breadboard, a buzzer, 2 LEDS with 2 x suitable resistors for to limit the current through LEDs (220 Ohms is fine) and connecting wires. The results will be displayed through the serial interface on the computer, in the LabVIEW program.

Keywords: Temperature Sensors, Smoke Sensor, Air Quality Sensor, Gas Sensor, Arduino, LabVIEW, LINX.

1 Introduction

With the development of new electronic technologies and their integration with older, traditional building technologies, smart house is at last becoming a real possibility. Smart House is not a new term for science society but is still far more away from people's vision and audition. This is because although recent various works has been done in designing the general overview of the possible remote access approaches for controlling devices (Hamed, 2012).

Data Acquisition (DAQ) is the principle of conversion using I/O signal interface from one device into another (e.g. Analog to Digital) using the appropriate channel of conversion. Data acquisition systems have evolved over time from electromechanical recorders containing typically from one to four channels to all-electronic systems capable of measuring hundreds of variables simultaneously (Data Acquisition Handbook, 2012)

LabView VI uses USB cable to connect the port for data acquisition board (Arduino), while another side of the cable connects to the port of PC which shows the COM Port communication number when tested to the LabVIEW connection port block.

The components required for this technical project are: LM35 temperature sensor, MQ-2, MQ-135 and MQ-5 gas sensors, a fan commanded by 5VDC Relay Module, 5V piezoelectric buzzer, 2 LEDs with 2 suitable resistors for to limit the current through LEDs, and an Arduino MEGA2560 development board.
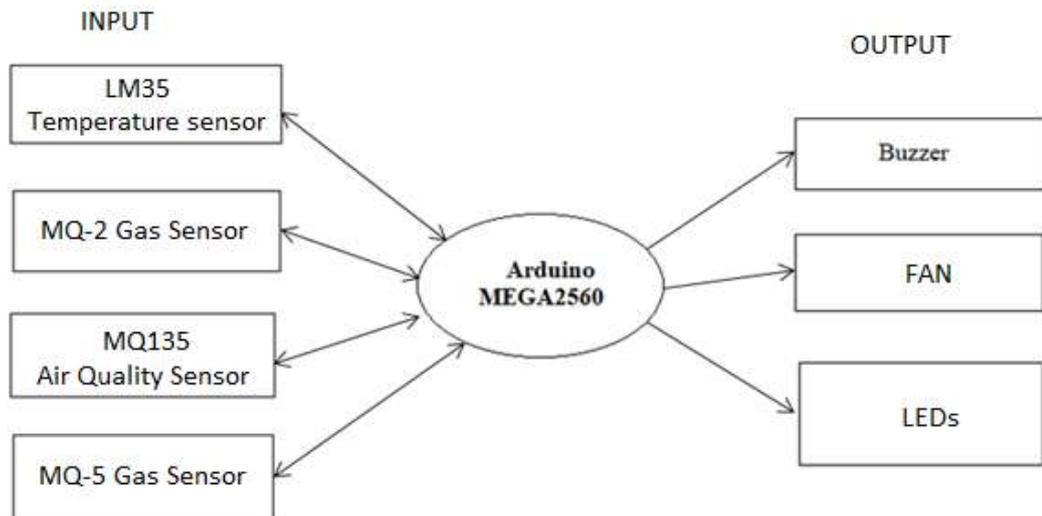
Figure 1.The components necessary for the elaboration of the technical project

LM35 temperature sensor, which are precision integrated-circuit temperature devices with an output voltage linearly proportional to the Centigrade temperature. It can measure temperature from -55 degree Celsius to +150 degree Celsius. The voltage output of the LM35 increases 10mV per degree Celsius rise in temperature. Thus, at 0°C it will have an output voltage of 0V and increases by 10mV when raising the temperature by 1°C.

LM35 can be operated from a 5V supply and the standby current is less than 60uA (http://www.ti.com/product/LM35).

The gas sensors of the MQ series are analog sensors, designed to detect the presence of different chemical components in the air. We can connect these devices with any microcontroller, like Arduino. There is a wide variety of MQ sensors. Each model is designed to detect one or more substances, designed for a specific use, such as flammable gas detection, air quality or detection of alcohol in breathed air (Bogdan M., 2018).

The MQ sensors use small heater inside with an electro-chemical sensor that changes resistance in contact with the various substances. They are sensitive to a range of gasses and are used indoors at room temperature. The output is an analog signal and can be read with an analog input of the Arduino (https://playground.arduino.cc/Main/MQGas Sensors).

2 Hardware Description

The following figure shows the block diagram of the alarm system to better express how the components communicate with the microcontroller. All sensors send data to the microcontroller, which in turn will send instructions to the sensors, and then the output will be controlled.

Figure 2.Block diagram of the alarm system

The following figure shows the wiring diagram of the alarm system to better express how the components communicate with the microcontroller.
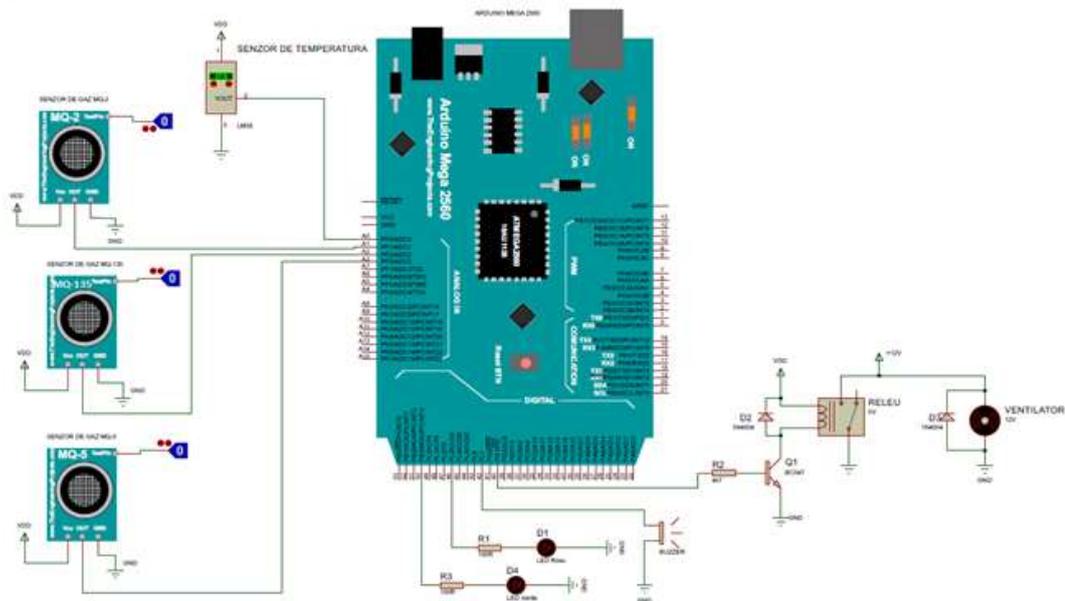

Figure 3.The Wiring diagram of the project, made in Proteus

Arduino plays a key role in the project, being its brain. All sensors transmit data to the Arduino MEGA2560 microcontroller, which is based on the Atmega2560 chip and an oscillator operating at 16 [MHz].
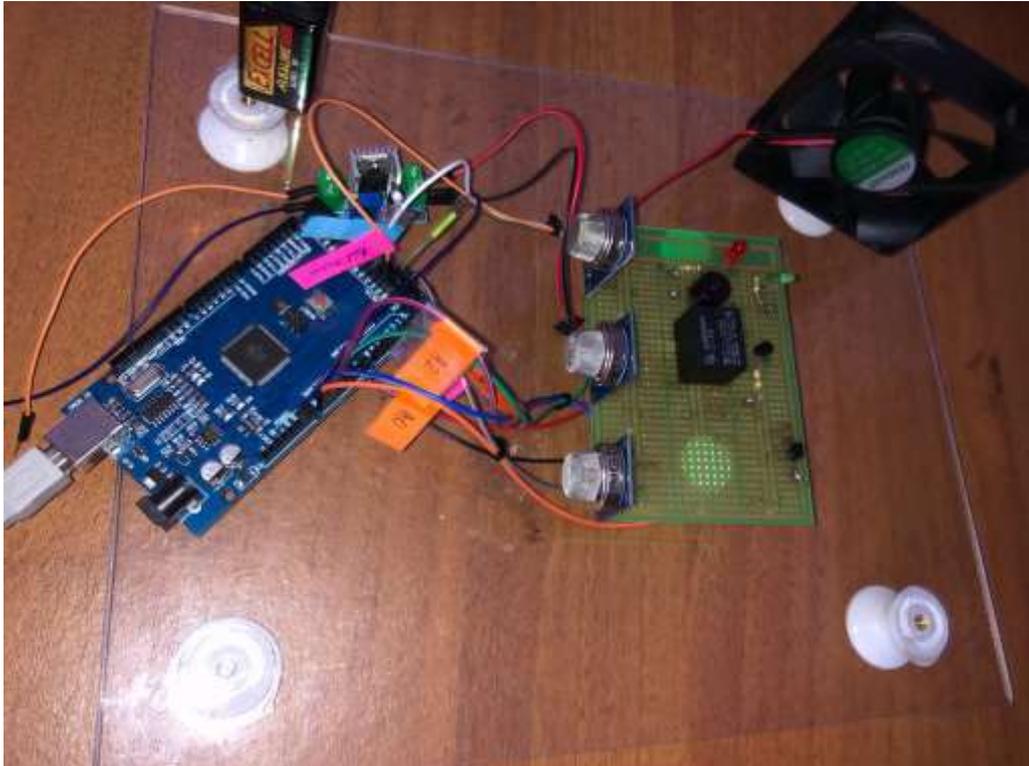
Figure 4.The image of the project

3 Software Description

In the figure 5 you can see which are the steps that the application must follow. Figure 6 shows the front panel of the VI, that contains the controls and indicators, and figure 7 shows the Block Diagram.

Programs developed in LabVIEW are called virtual instruments or VIs and have the extension .vi. These programs have the role of receiving data from the user or from the computer interfaces with the process, processing them and then displaying, storing or transmitting them remotely (Bogdan 2017).

After establishing the elements and the appearance of the front panel (with various decorative elements), I made the Block Diagram of VI.

The Block Diagram of VI contains the controls and indicators terminals of the Front Panel, the various nodes, constants and the wires. The nodes in LabVIEW are different functions, subVIs and programming structures (Bogdan, 2019).
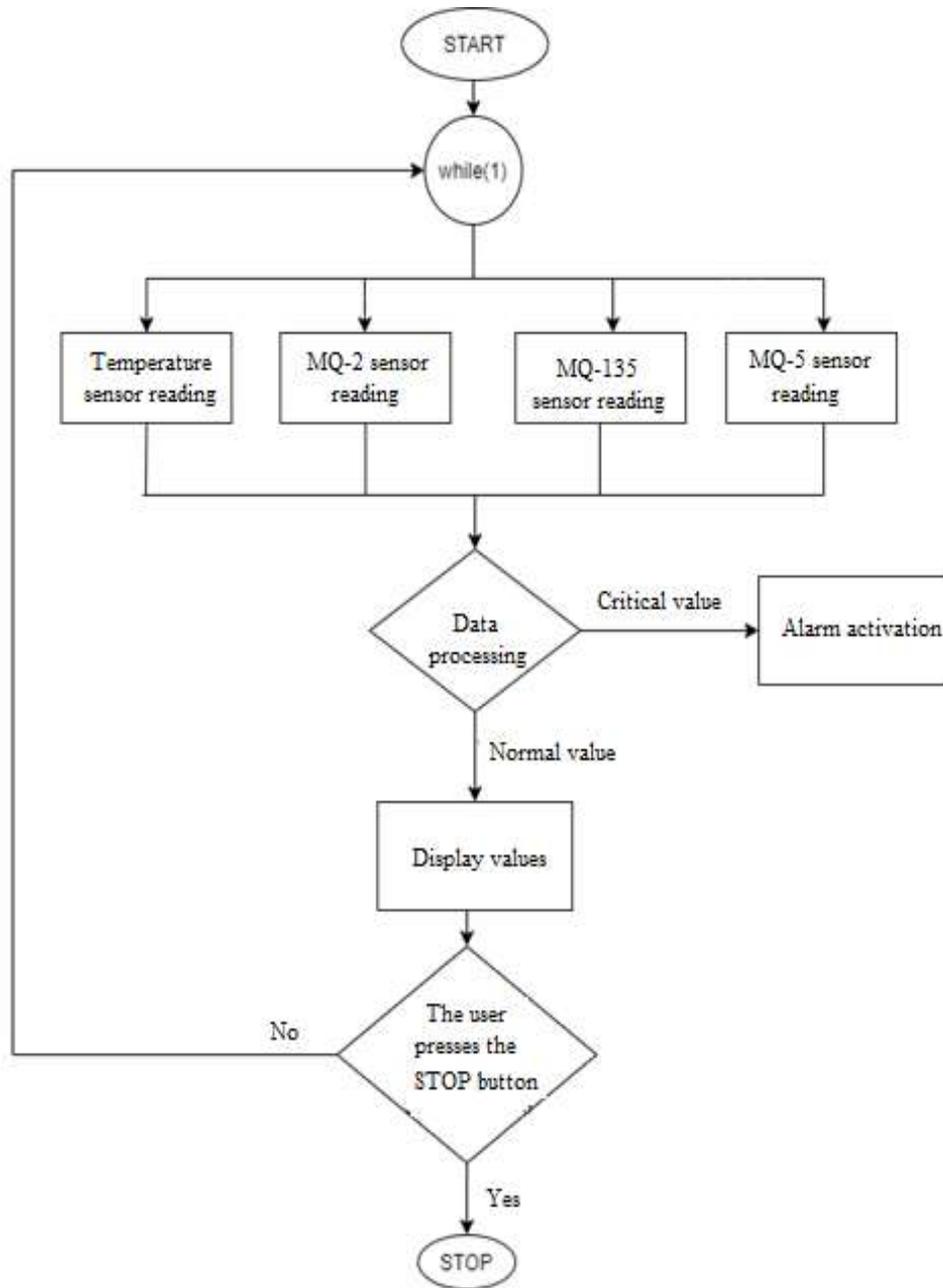
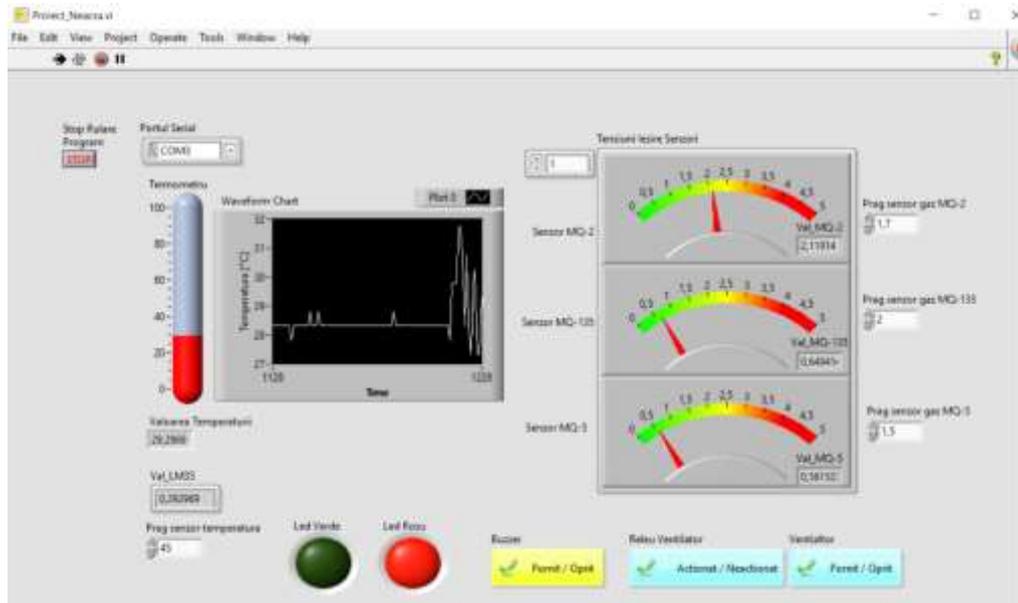*Figure 5.Software architecture of the application*
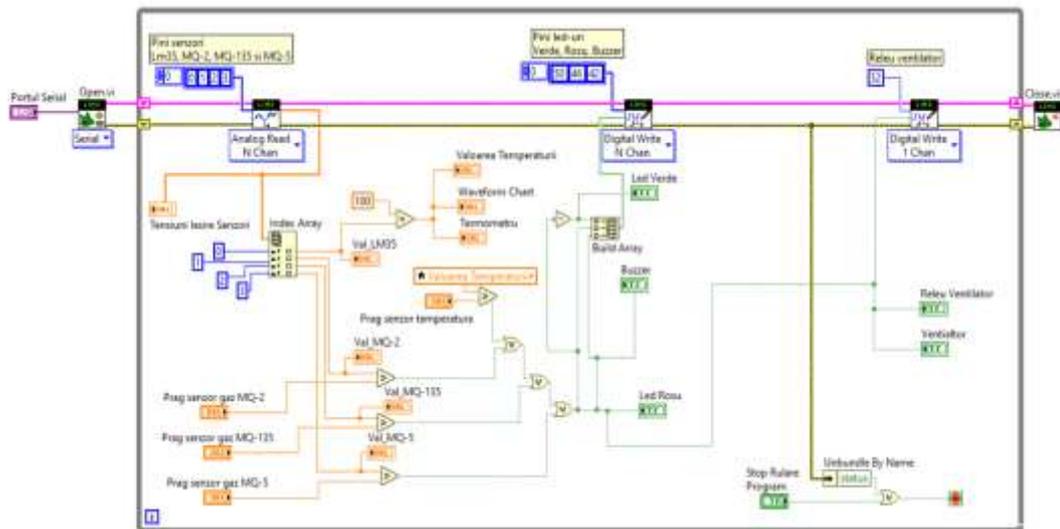
Figure 6. The Front Panel of the VI

Figure 7. The Block Diagram of the VI

3 Conclusion

The purpose of this project is to introduce an electronic alarm system that monitors the temperature and possible gas emissions in a room and the audible warning in case of exceeding normal values. The software was made in the LabVIEW graphical programming environment with the help of the Arduino development board, which has the possibility to both read the data and control the elements. The solution presented has a low cost and can make this system easily integrable into a overall more complex. In addition to these aspects, as further developments I

mention the use of a GSM module to be able to receive messages on the phone when a fire or gas leak is detected.

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