

Design and Implementation of a Multi-Channel Data Acquisition System Using LabVIEW and NI MAX

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Abstract: *This paper presents the design and implementation of a multi-channel Data Acquisition (DAQ) system using LabVIEW and NI MAX. The system utilizes an LM35 temperature sensor and a sound sensor to monitor environmental parameters in real time. The sensors generate analog signals, which are collected by a DAQ device and converted into digital form. NI MAX is used for hardware configuration, while LabVIEW is used for data processing and visualization. Basic filtering techniques are applied to reduce noise and improve signal stability. Experimental results show that the temperature measurements are accurate within $\pm 0.5^{\circ}\text{C}$, and the sound sensor provides consistent output across varying sound levels. The system is simple, cost-effective, and suitable for laboratory and small-scale monitoring applications.*

Keywords: Data Acquisition System, LabVIEW, NI MAX, LM35 Sensor, Sound Sensor, Real-Time Monitoring

I. INTRODUCTION

A Data Acquisition (DAQ) system is used to collect and analyze physical parameters such as temperature, sound, pressure, and light. Sensors convert these parameters into analog signals, which are then converted into digital form for processing, display, and storage.

Real-time monitoring is essential in modern engineering systems as it improves safety, efficiency, and reliability. Traditional manual measurements are time-consuming and prone to errors, whereas DAQ systems provide faster and more accurate results.

With technological advancements, there is a growing demand for low-cost and efficient monitoring systems. LabVIEW simplifies system development through graphical programming, reducing coding complexity.

The objective of this work is to design and implement a multi-channel DAQ system using LabVIEW and NI MAX for monitoring temperature and sound signals in real time.

II. LITERATURE REVIEW

Various researchers have developed sensor-based monitoring systems using microcontrollers and software tools.

Arduino and LabVIEW-based systems offer cost-effective solutions but lack advanced data analysis capabilities.

LabVIEW is widely used for real-time monitoring due to its graphical interface. Multi-sensor systems improve data reliability but increase complexity. Optical fiber-based systems provide high accuracy but are expensive.

These studies highlight the need for a simple, low-cost, and efficient DAQ system, which is addressed in this work.

III. OVERVIEW OF LABVIEW AND NI MAX

LabVIEW is a graphical programming platform used for data acquisition, control, and automation. It uses a block diagram approach, making it easier to design and understand systems.

NI MAX (Measurement and Automation Explorer) is used to configure and manage DAQ hardware. It helps detect devices, configure input/output channels, and test signals.



Together, LabVIEW and NI MAX ensure reliable communication between hardware and software.

IV. SYSTEM ARCHITECTURE

The system architecture consists of:

Sensors → DAQ Device → Computer (LabVIEW)

The LM35 sensor measures temperature, and the sound sensor detects sound intensity. Both sensors produce analog signals, which are converted into digital form by the DAQ device. LabVIEW processes and displays the data in real time.

V. COMPONENTS

5.1 Sound Sensor

The sound sensor converts sound waves into analog voltage signals. It is used for noise monitoring and sound analysis.

5.2 LM35 Temperature Sensor

The LM35 sensor provides an output voltage proportional to temperature (10 mV/°C). It is simple, accurate, and widely used.

5.3 DAQ Device

The DAQ device converts analog signals into digital form using an Analog-to-Digital Converter (ADC).

5.4 Computer System

The computer runs LabVIEW software for data processing, visualisation, and monitoring.

VI. WORKING PRINCIPLE

Sensors detect environmental conditions and generate analog signals. The DAQ device converts these signals into digital form. LabVIEW processes the data, applies filtering techniques, and displays it using graphs and indicators.

Working cycle:

Sensing → Conversion → Processing → Display

VII. HARDWARE SETUP

LM35 connected to analog input channel AI0

Sound sensor connected to AI1

Both sensors powered using 5V supply

Common grounding maintained

Proper wiring ensures accurate and stable readings.

VIII. EXPERIMENTAL SETUP AND RESULTS

8.1 Sound Sensor

The sound sensor output voltage increases with sound intensity. Minor fluctuations occur due to environmental noise, which are reduced using filtering techniques.

8.2 Temperature Sensor

The LM35 sensor shows a linear relationship between voltage and temperature. Accurate readings are obtained under different conditions.

IX. OBSERVATION TABLES

Condition	Voltage (V)	Temperature (°C)
Normal Room	0.25	25
Slightly Warm	0.30	30
Warm	0.35	35



High	0.40	40
Very High	0.45	45

X. RESULTS AND ANALYSIS

Condition	Voltage (V)	Sound Level
Silent	0.5	Low
Low Noise	1.2	Low-Medium
Moderate	2.0	Medium
Loud	3.5	High
Very Loud	4.2	Very High

Accuracy:

Temperature accuracy is within $\pm 0.5^{\circ}\text{C}$. Sound sensor readings are consistent.

Noise Reduction:

Moving average filtering is used to reduce noise.

Latency:

The system response time is approximately 35 ms.

XI. SYSTEM PERFORMANCE

The system provides stable and accurate readings with low latency. Filtering improves signal quality, making it suitable for real-time monitoring.

XII. ADVANTAGES

- Real-time monitoring
- Low-cost implementation
- Easy to use and modify
- Scalable system

XIII. APPLICATIONS

- Industrial monitoring
- Environmental monitoring
- Smart home systems
- Educational laboratories

XIV. FUTURE SCOPE

The system can be enhanced by integrating IoT for remote monitoring, wireless communication, cloud storage, and machine learning for data analysis.

XV. LIMITATIONS

Sound sensor affected by external noise

Wired connections reduce flexibility

Not suitable for high-precision industrial applications



XVI. CONCLUSION

A multi-channel DAQ system using LabVIEW and NI MAX has been successfully developed. The system provides accurate, stable, and real-time monitoring of temperature and sound using low-cost sensors. It is simple, reliable, and suitable for laboratory and small-scale applications.

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