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DATA LOGGER SYSTEM: A SURVEY

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Abstract: *This paper describes a brief introduction about data logger system. A data logger is an electronic device that combines analog and digital measurements with programming methodology to sense temperature, relative humidity and other parameters such as voltage and pulse. The data loggers take input from the thermocouple temperature and humidity and other sensors. Knowledge of temperature and relative humidity course during a certain time is needed in scientific, medical and industrial applications. For retrieval of this information from various devices such as manual readings, chart recorders or data loggers can be used.*

Keywords: *Introduction, History of Data logger system, Operation of Data logger, Characteristics of Data logger and its advantage & applications, future Prospectus, References.*

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I. INTRODUCTION

A data logger (also data logger or data recorder) is an electronic device that records data over time or in relation to location either with a built in instrument or sensor or via external instruments and sensors. Increasingly, but not entirely, they are based on a digital processor (or computer). They generally are small, battery powered, portable, and equipped with a microprocessor, internal memory for data storage, and sensors. Some data loggers interface with a personal computer and utilize software to activate the data logger and view and analyze the collected data, while others have a local interface device (keypad, LCD) and can be used as a stand-alone device.

One of primary benefits of using data loggers is the ability to automatically collect data on a 24-hour basis.The logging interval can be set for any period between 10 seconds and 24 hours, depending on the data requirements.

A complete data logging application generally requires most of the elements/components illustrated below.

1) **Sensors**: The inputs from various sources are given to the data logger through various sensors to measure various parameters such as temperature, humidity where electrical signals are converted to temperature and humidity values.

2) **User Interface**: The interface for interaction with the software and sensors is provided and using implemented algorithm analysis is done for storage of data.

3) **Software**: It displays the information stored from sensors for and also maintains data for long time storage.

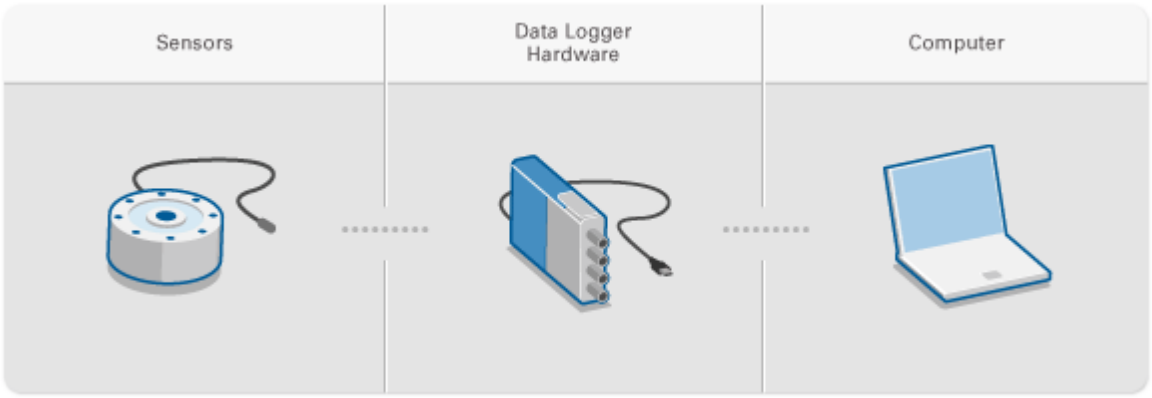

Figure 1. Data Logging System

II. HISTORY OF DATA LOGGER SYSTEM

The earliest form of data logging involved taking manual measurements from analog instruments such as thermometers and manometers. These measurements were recorded into a written log, along with the time of observation. To view trends over time, people manually plotted their measurements on graph paper. In the late 19th century, it became possible to begin automating this process with machines, and strip chart recorders evolved. Strip chart recorders are analog instruments that translate electrical impulses from sensors into mechanical movement of an arm. A pen is attached to the arm, and long rolls of paper are moved at a constant rate under the pen. The result is a paper chart displaying the parameters measured over the course of time. Strip chart recorders were a great leap over manual data logging, but still had drawbacks. For example, translating the traces on the paper into meaningful engineering measurements was tedious at best, and the data recorded took up reams and reams of paper.

With the development of the personal computer in the 1970s and 80s, people began to use computers for analysis of data, data storage, and report generation. The need to bring data into the PC brought about data loggers – a new special-purpose device for data logging. Data loggers are standalone, box instruments that measure signals, convert to digital data, and store the data internally. This data must be transferred to the PC for analysis, permanent storage, and report generation. Data is typically transferred either by manually moving a storage device (such as a floppy disk) from the data logger to the computer or by connecting the data logger to the PC through some communications link such as a serial cable or Ethernet.

In the 1990s, a further evolution in data logging took place as people begin to create PC-based data logging systems. These systems combine the acquisition and storage capabilities of stand-alone data loggers with the archiving, analysis, reporting, and display capabilities of modern PCs. PC-based logging systems finally brought about full automation of the data logging process. The move to PC-based data logging systems was enabled by three technological enhancements:

1. Increasing reliability of PCs.
2. Steadily decreasing cost of hard drive space on PCs.

3. PC-based measurement hardware that could meet or exceed measurement capabilities of stand-alone data loggers.

Today, PC-based logging systems provide the widest range of measurement types, analysis capabilities, and reporting tools. The remainder of this paper will focus on the functionality necessary to implement a PC-based data logging system 1- Wire Weather.

III. OPERATION OF DATA LOGGER SYSTEM

The ability to take sensor measurements and store the data for future use is, by definition, a characteristic of a data logger. However, a data logging application rarely requires only data acquisition and storage. Inevitably, the ability to analyze and present the data to determine results and make decisions based on the logged data is needed. A complete data-logging application typically requires most of the elements illustrated below

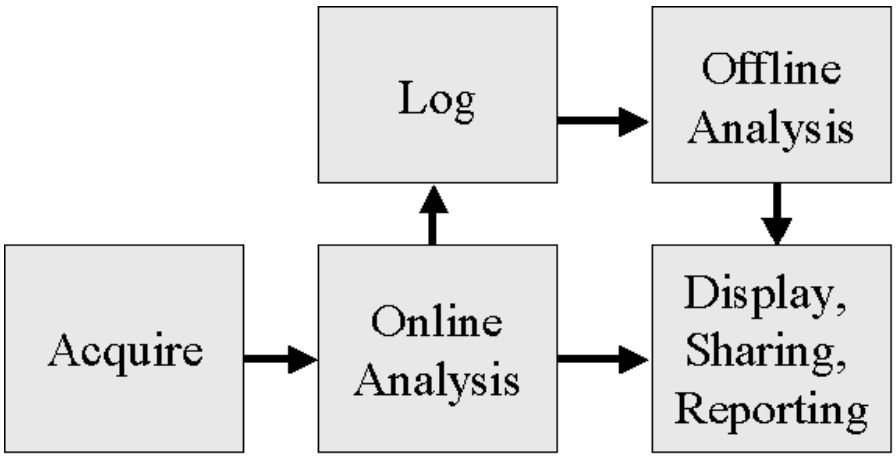

Figure 2. Basic Elements of a Data Logging System

The five major blocks of PC based data logging system are:

1. Data Acquisition
2. Online Analysis
3. Logging & storage
4. Offline Analysis
5. Display, Sharing & Report generation.

1) **Acquire** – The acquisition is accomplished by the measurement hardware, which can be further broken down into sensors, signal connectivity, signal conditioning, and Analog-to-digital conversion and also as well as conversion the physical phenomenon into digital signals.

2) **Online analysis** – In PC based systems special software are used to accomplish online analysis. This step includes any analysis that is likely to be done before storing the data. A common example of this is converting the voltage measurement to meaningful scientific units, such as degree celcius. These complex calculations and data compression are completed before logging the data. Every data logging software application should complete this conversion from binary value to voltage and the conversion from voltage to scientific units.

3) **Log** – The logging or storage block in essential in every data-logging system. Software is of critical importance in PC-based data logging systems, because well-written logging software determines how data is stored, how quickly data can be written to disk, and how efficiently disk space is used. Logging software also gives you data management Capabilities, such as changing data formats, archiving data, and access to databases. There are three general formats commonly used for storage in data logging systems

- ASCII text files
- Binary files.

4) **Offline Analysis** -This step includes any analysis that is to be done after storing the data and it is performing mathematical functions on data after it has been acquired in order to extract important information. A common example is looking for trends in historical data or data reduction.

5) **Display, share & report generation**- This step includes the creation of any reports that are needed to make to present data and displaying the data. However, this can also present data straight from online analysis. The data-logging application requires a display to view the measurements that are being recorded. The display can be of two types,

- Historical Data- Data that has been previously acquired
- Live Data- Data that are currently being acquired

Data viewing utility should provide a user interface with general customization features. Also the data logging application requires some capability for reporting the data. Report generation can be integrated into PC-based data logging applications for increased efficiency. The logging application can be set up to periodically generate specified reports and distribute them. For data that has been logged to be useful, it must be available to the

right people. Logging application should have the capability to publish data over a network in order to propagate the information to the concerned people.

In widely distributed data logging applications, each logging node can publish its measurements to the network, and a main computer can serve as the central collection facility. The central computer retrieves the measurements from each node, combines them for further analysis, logs the results for permanent archiving, and periodically generates reports analyzing the data.

IV. CHARACTERISTICS OF DATA LOGGER

1) **Modularity**: Data loggers can be expanded simply and efficiently whenever required, without any interruption to the working system.

2) **Reliability and Ruggedness**: They are designed to operate continuously without interruption even in the worst industrial environments.

3) **Accuracy**: The specified accuracy is maintained throughout the period of use.

4) **Management Tool**: They provide simple data acquisition, and present the results in handy form.

5) **Easy to use**: These communicate with operators in a logical manner, are simple in concept, and therefore easy to understand, operate and expand.

V. ADVANTAGE AND APPLICATIONS

Advantages:

1. Inline Analysis

Data analysis with a traditional stand-alone data logger is typically performed offline only after the data has been transferred to the PC. Using a PCbased data logger, you can take advantage of multicore processors and increasingly available RAM in the PC to perform signal processing and analysis on your data as you acquire it. LabVIEW includes many common math and signal processing functions that use configuration wizards and make it easy to add analysis to your measurements.

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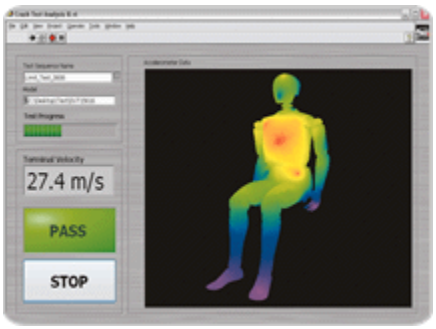
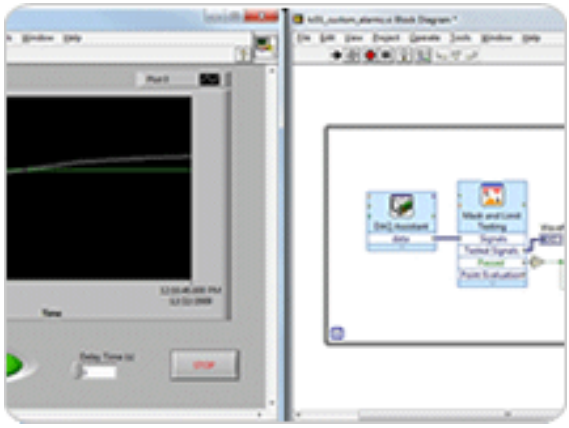


2. User-Defined Functionality

With a traditional stand-alone data logger, you are generally limited to hardware and software functionality defined by the vendor. These functions are good for accomplishing generalpurpose tasks, but they may not help you meet your unique application requirements. For example, you may want to log data only under certain conditions or generate custom alarms that aren't built into the data logger. PC-based data loggers are softwaredefined instruments. This means the functionality of the device is defined by the software, and you can customize the software to meet your specific application needs. Using LabVIEW, you can easily build functionality for custom alarms, logging conditions, report generation, and signal analysis. You can log data to virtually any file format for importing into other tools and sharing data with others.

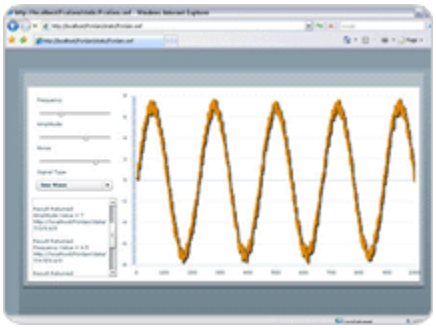


3. Terabytes of Data Storage

Data storage is an important component of a data logger. You can log only as much data as you can store in your data logger. Traditional stand-alone data loggers are limited by the amount of memory built into the device. Because the PC is actually a part of a PC-based data logger, you are limited only by the amount of hard drive space on the PC. Today, it's not uncommon to find a PC hard drive with terabyte capacity that provides ample space for your current measurements as well as permanent storage space.

4. Network Connectivity

For applications that require long-term monitoring over days or weeks, you may have difficulty continually checking results. Remote monitoring is useful because you can see results from a remote location. Using a PC-based data logger, you can take advantage of the PC's network connectivity to transmit results over a network for remote viewing. With LabVIEW, you can create custom alarm conditions that send e-mails or even design a Web service that you can visualize over a Web-based application.



Applications:

1) In unattended recording at weather stations to record parameters like temperature, wind speed / direction, solar radiation and relative humidity.

2) For hydrographic recording of water flow, water pH, water conductivity, water level and water depth.

3) In the recording of soil moisture levels.

4) To record gas pressure and to monitor tank levels.

5) Transportation monitoring, troubleshooting, educational science, quality studies, field studies and general research.

6) Remote collection of recorded data and alarming or unusual parameters are possible with the help of data loggers where these are connected to modems and cellular phones.

VI. FUTURE PROSPECTIVE :

Using data logging, scientists and engineers can evaluate a variety of phenomenon, from weather patterns to factory performance. PC-based data logging systems provide most flexibility, customization, and integration. To define a data logging system, we must evaluate all the requirements for acquisition, analysis, logging, display, and report generation. Based on these requirements, we can customize data logging software and hardware to meet any needs.

VII. REFERENCES:

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