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Design And Simulation Of Temperature Data Logger

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ABSTRACT: *Logging is a phenomenon that occurs every day. This happens when human being beholds a thing or an event and keeps the memory of such in his brain for later use. In the same way, data logging can be defined as the process of collecting, analyzing and storing data for later use. This paper presents the design and simulation of a Temperature data logger.Temperature is the ever-changing parameter because of exposition to huge array of stimuli from their environment. It can be measured via a diverse array of sensors. All of them infer temperature by sensing some change in a physical characteristic. The methodology is presented and the circuit was simulated in Proteus simulation software. The circuits and the result were presented.*
Keywords:*Temperature, Stand-Alone, Data-logger, Sensor*

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I. INTRODUCTION

Logging is the processes to collect, analyze and store data for later use. It is a process to record events during a test or measurement with the use of a system or a product. The human brain and its memory, the nature's creation, without doubt is the best data logging mechanism. Where there is the need to collect information faster than a human brain, data loggers can possibly collect the information and in cases where accuracy is essential.Data logging implies the control of how sensor collects and analyzes the data. It is commonly used in scientific experiments and in monitoring systems. Data loggers automatically make a record of the readings of the instruments located at different parts of plant. The type of information recorded is determined by the use. By definition, data logger is defined as an electronic device that automatically records, scans and retrieves the data with high speed and greater efficiency during a test or measurement, at any part of the plant with time [1]. The type of information recorded is determined by the user, i.e. whether temperature, relative humidity, light intensity, voltage, pressure or shock is to be recorded, therefore it can automatically measure electrical output from any type of transducer and log the value.

One of the primary benefits of using data loggers is the ability to automatically collect data on a 24-hour basis. Upon activation, data loggers are typically deployed and left unattended to measure and record information for the duration of the monitoring period. This allows for a comprehensive, accurate picture of the environmental conditions being monitored, such as air temperature and relative humidity [2].

In environmental monitoring applications, parameters such as temperature, humidity, water levels or pollution need to be monitored continuously over long periods. A conventional personal computer based data acquisition system can be used, but such a system involves a computer and a Data logger, making it expensive. Secondly, the physical size is large. Thirdly, power assumption will be high, and this implies that a powerful battery pack is required in the application where there is no mains supply. A Stand-Alone Data logger is a useful device for such an application. Firstly, it is dedicated. Its only task is to acquire data and save the data into its memory. It can be connected to a computer at any time to allow its collected data to be transferred and analyzed. In this research, a standaloneTemperature data logger will be designed using Proetus simulation software.Temperature is the ever-changing parameter because of the exposition to a huge array of stimuli from their environment. It can be measured via a diverse array of sensors. All of them infer temperature by sensing some change in a physical characteristic.

II. LITERATURE REVIEW

The data logger is an invaluable tool to collect and analyze experimental data, having the ability to clearly present real time analysis with sensors and probes able to respond to parameters that are beyond the normal range available from the most traditional equipment [3]. The differences between various data loggers are based on the way that data is recorded and stored.

A. Characteristics of Data Loggers

Data loggers possess the following characteristics [4]:

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.

B. Operation of Data Logger

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 steps described below [4].

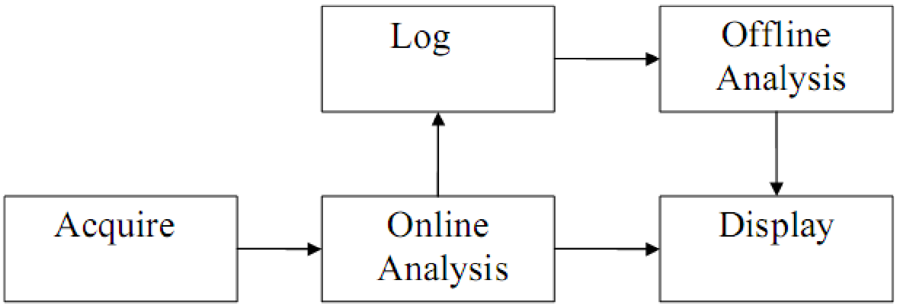

Fig. 1: Block Diagram of Data Logger.

1.) Acquire – This step includes your sensors and data logger hardware as well as conversion of physical phenomena into digital signals [5].

2.) 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 Celsius. 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 – This step refers to the storage of analyzed data including any formatting required for the data files [6,7].

4.) Offline Analysis - This step includes any analysis that is to be done after storing the data. A common example is looking for trends in historical data or data reduction [6,7].

5.) Displaying, reporting - 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. This represents the ability to monitor and view the data as acquired and analyzed in addition to simply viewing historical data.It should have the following components:

i. Hardware to digitize what is to be logged including sensors, signal conditioning, and analog-to-digital conversion hardware.
ii. Long-term data storage.
iii. Data-logging software for data acquisition, analysis, and presentation.

The concept of logging and how logging was presented in detail [8]. Logging is a process to record events with the use of data loggers during a test or field use of a system or a product. Logging is one of the usability methods that can and should be used to gather more supplementary information as an integral part of the iterative design of the usability engineering cycle. Logging has the major advantage compared with other usability methods of not interfering with the users in performing their tasks. Users can basically ignore the log and use the system in exactly the way they would anyway.

A very low cost and power consumption digital data-logger was presented in [9]. This digital data-logger was said to be self-contained. This means that it has storage for keeping the logged samples. Its primary purpose was for temperature measurement (0.1^{o}C resolution), but any voltage in the range 0-5V can be measured. The logger can record up to 8 channels of 10-bit data simultaneously and stores data in 512Kbyte of on-board memory. [10] described the basic operation and concepts of data-logger. A data logger is a comprehensive and highly advanced data acquisition system. It is made versatile and flexible, to render it suitable for widely varying applications, specific requirements being met simply by setting up a suitable program. It can measure electrical output from any type of transducer and log the value automatically. Microcontrollers and microprocessors are widely used in embedded system products [11]. An embedded product uses a microcontroller to do one task and one task only. In addition to the description of criteria for choosing a microcontroller, the interfacing with the real world devices such as LCDs, ADCs, sensors and keyboard is described in detail. Finally; they discussed the issue of interfacing external memories, both RAM and ROM.

Comparism of different data-logger was presented in [8] A data logger is an electronic instrument that records measurements (temperature, relative humidity, light intensity, on/off, open/closed, voltage, pressure and events) over time. Typically, data loggers are small, battery-powered devices that are equipped with a microprocessor, data storage and sensor. A microcontroller-based data logging system to record temperature and relative humidity for acoustic measurement applications was presented by [5]. The system is simple to use, requires no additional hardware and allows the selection of amount of data and the time intervals between them. The collected data can easily be exported to a PC computer via a serial port.

III. METHODOLOGY

Basically there are two methods of designing data logger:

- Hardware
- Software

A. Software Method.

Software design includes developing algorithm for the system, allocating memory blocks as per functionality, writing the separate routines for different interfacing devices and testing them on the designed hardware. Interfacing of microcontroller with ADC, LCD, MEMORY, etc. has been carried out using various software modules. The control program is written in assembly language. The software is able to show the real time values from the analog channels for immediate analysis. For designing the software for this work; the flow of software between the hardware components is to be understood first.

The Proetus simulation is shown below;

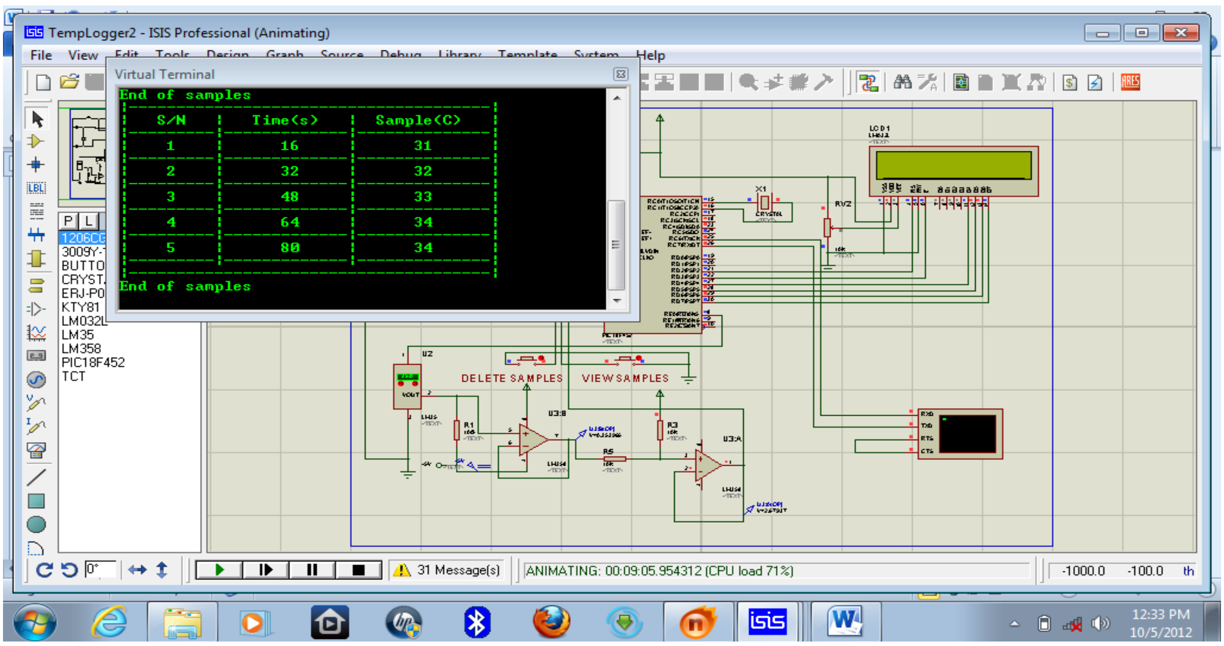

Fig. 2 Proteus Simulation

B. Description of materials.
The temperature sensor used is LM35. This sensor is chosen because of its cost effectiveness. The output from thesensor is then amplified by the two stage amplifier connected to its output.

ALGORITHM
SCANE MODE

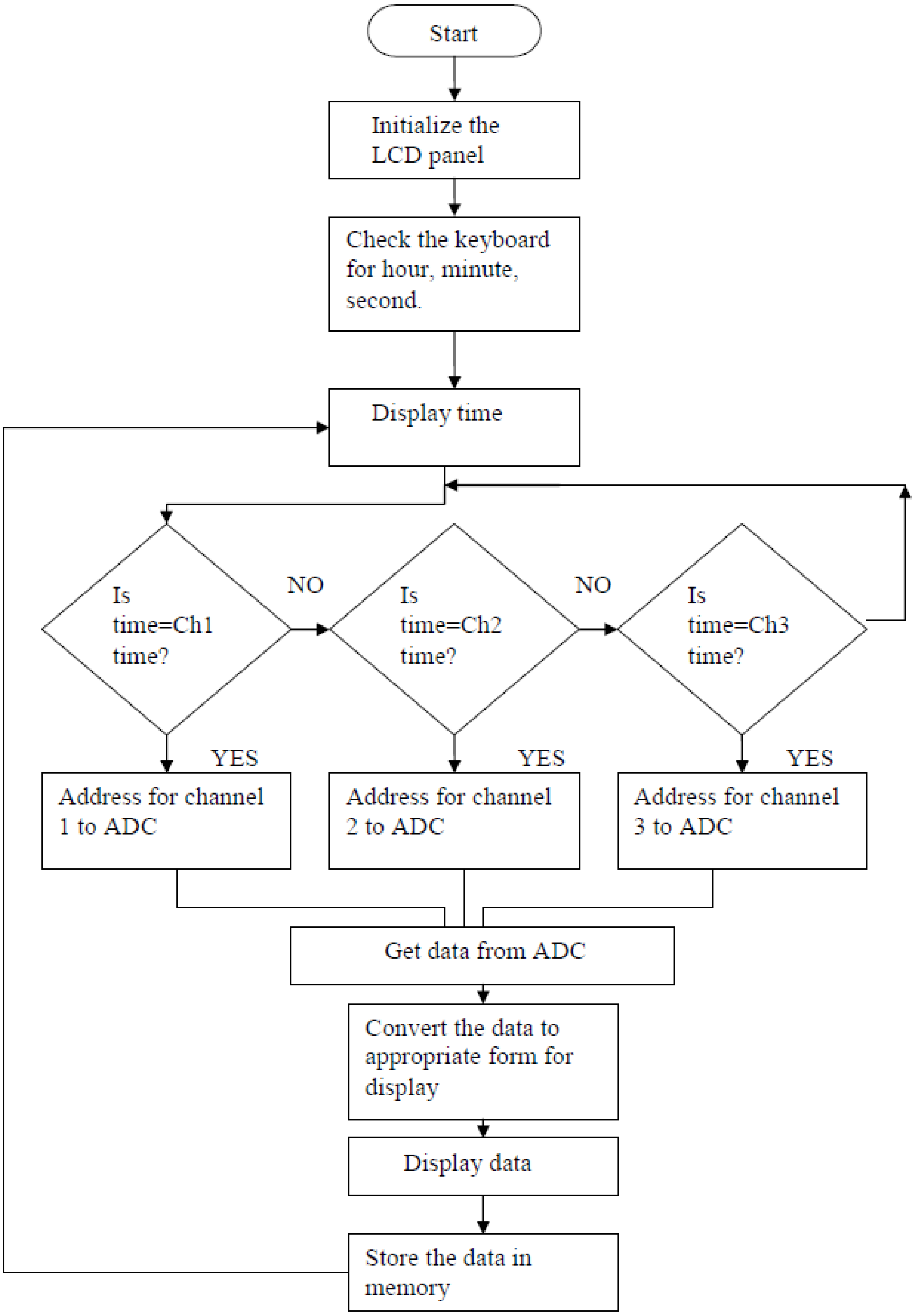

Fig. 3 Flow Chart of the Scan Mode of the Logger.

OFFLINE ANALYSIS

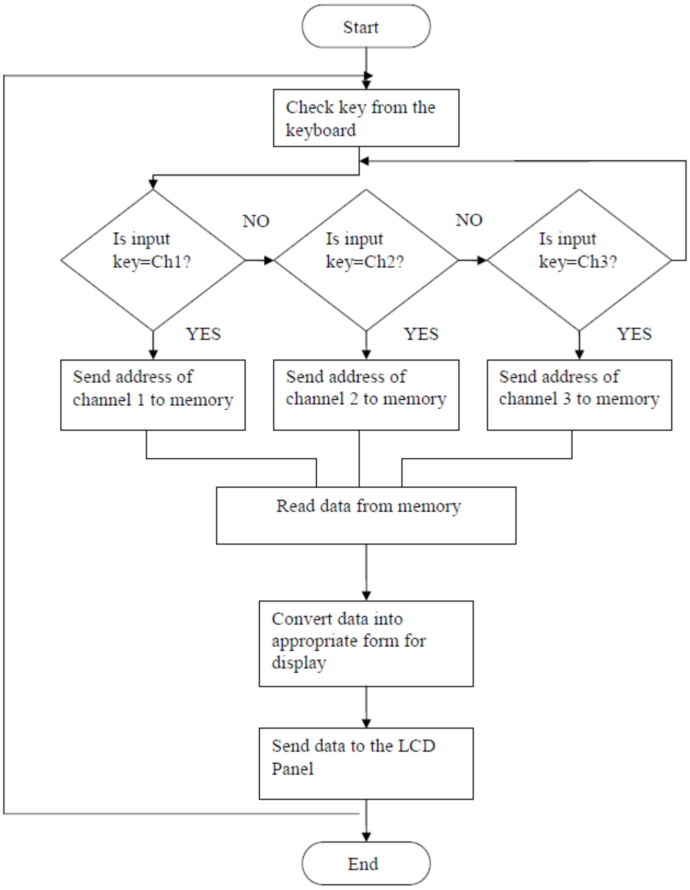

Fig.4 Flow Chart for Offline Analysis.

IV. RESULT AND ANALYSIS

The simulation result obtained from the Proteus environment is shown in figure 5. The unit of the sample is degree Celsius. The result is a continuation of the sample of figure 2.

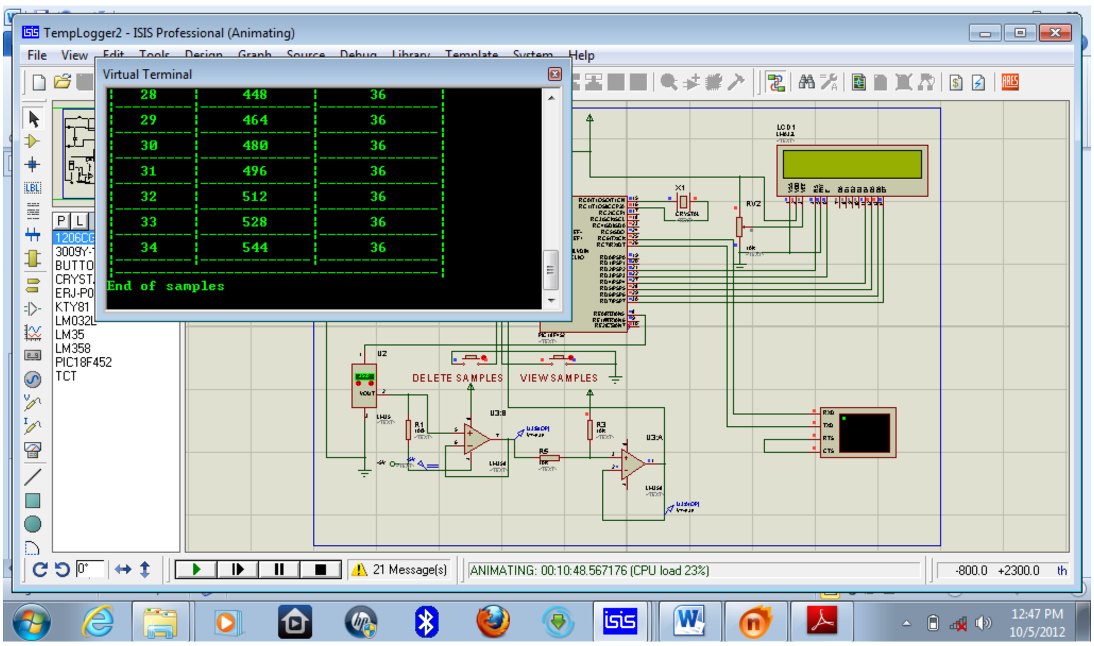

Fig. 5 Simulation Result.

V. CONCLUSION

The data logger was simulated; the result is as presented in figure 5. The advantage of this design is the provision of large storage facility to store bulk data. At different stages, the data can be deleted or viewed at any time.

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