Measurement and Monitoring System With Real Time Data Logging Based on Microcontroller

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ABSTRACT

This article presents a microcontroller-based system for measurement and monitoring voltage of a three-phase electrical system with real-time data logging abilities. The proposed system uses voltage signals and time data as input. The output is an LCD and data files. The system accurately records abnormal voltage variations which have occurred on the system. A PC software is developed to receive and save data in two spreadsheet files through a serial port. The log file contains the measured voltage, which is recorded periodically with a predefined time interval, and the second file contains the type of the fault. The proposed system is first simulated by ISIS-Proteus and then realized and implemented on an electronic board. It is beneficial to make detailed, scientific judgments and analysis for the voltage system to be supplied to a load. Because of the very simple circuit, it finds applications in industrial facilities. It is also useful in applying final circuits for both investigation and monitoring purposes.

KEYWORDS

Data Logging, Microcontroller, Monitoring, Real Time Clock, Voltage

INTRODUCTION

Nowadays, microcontrollers are considered the main parts in modern electronics because of the simplicity and flexibility of handling by the software; they are employed in the most of electronic systems that need inputs and outputs. Performance improvement at low price makes microcontrollers highly adequate for vast applications (Jaanus, Udal, Kukk, & Umbleja1, 2013). Generally, large series of microcontrollers have built-in analog to digital converters, these converters are employed and used for analog data acquisition (Krejcar, Spicka, & Frischer, 2011). Most of built-in converters have ten bit resolution which is enough for simple purposes, while in some applications in which the accuracy is very important, analog to digital converters with higher resolution is needed (Jaanus, Udal, Kukk, & Umbleja1, 2013). Among the applications that use microcontroller and introduce analog to digital converters is voltage measurement, it is considered the most main parameters in electrical systems and engineering. However, to measure voltage that is the difference of electrical potential between two points in electric circuits, voltmeter is the instrument commonly used for this purpose (Imran & Moshiur, 2014; Abraham, Thekkekara, Sajana, Sandeep, & Sandeep, 2014).

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Another application that employs microcontroller is data logger, it is used to record or capture by time and date measurements by means of peripheral sensors over a period of time (Al Mamun et al., 2013), there are times when it may need to analyze a complex situation, process large amounts of data, diagnose an error, or perhaps need an automated way to run an experiment or just record data for storage or for future analysis. These devices are normally connected to a personal computer. Such data can either be analyzed online or offline.

In other side, simulation can improve design efficiency and reduce considerably the cost of product development. Actually there are many software of simulation such as Matlab which have strong and efficient functions of simulation in many kinds of systems, but design in electronic applications needs to analyze relationship of variety output signals and understanding real time signal behaviors in the designed circuits (Liping & Weiguo, 2012), for this purpose, Proteus ISIS as simulation platform has been chosen to design and develop voltage measurement and monitoring system with real time data logging based on low cost microcontroller. In addition, Proteus ISIS is widely used (Heribertus, Catur, Samiul, & Adrin, 2015) and provides vast functions such as graphical display, showing signal changes in graphic form and, the designers can observe the results of simulation directly.

The present paper takes Proteus ISIS software as simulation platform to design a combination of the two systems in one, voltage measurement system and real time data logging based on microcontroller PIC 18F4550, it will be ideally suited to local monitoring of voltage electrical installations in industrial facilities, commercial buildings, particular loads, utility networks or critical power environments. Voltage measurement and monitoring system with real time data logging based on microcontroller and its typical application has been shown in Figure 1.

**SYSTEM OVERVIEW**

The entire system was designed to sense voltage from three phase electrical power system using voltage sensors, by using of an rms-to-dc converter chip with high accuracy even with distorted or non-sinusoidal voltage wave form to get measurable dc signal, the sensed values witch are analog values then sent to the built-in analog to digital converter (ADC) of PIC 18F4550 microcontroller and converted to digital values, at the same time the PIC microcontroller receives data from a real

![Figure 1. Typical application of the proposed system](image-url)
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