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Data Acquisition through Telephone

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Abstract: The purpose of this device is used for acquiring data from remote location using PC .The data to be acquired is collected by micro controller that is installed at industrial location and is connected to various machines. The micro controller continuously records whatever parameters it is programmed to record and display them on display screen. The micro controller is also connected to telephone line. A PC installed in an office at a distance location can connect to this micro controller via telephone line. Whenever the data is to be acquired the PC dials up the number of micro controller line. Once the connection is made PC sends the command to the micro controller giving the details of required. The micro controller then sends the demanded data to the PC .the data acquired by the micro controller is in digital format and is stored in EEPROM .The PC automatically generates the file name and stores data along with the real time.

Keywords: PC,EEPROM,Micro-controller,Telephone Line

1. Introduction

Data acquisition systems have evolved rapidly in the past few decades fueled by the advances in electrical computer engineering and computer science. Standardized input output interfaces have allowed for the development of peripherals such as transducers that connect seamlessly to the computer and make the task of data acquisition a simple one. Data acquisition systems have become faster and relatively inexpensive. They have also experienced a reduction in size and are more reliable. Their high accuracy has made them an essential tool in a wide range of research areas where quantitative methods of analysis are required. DAS plays important role in engineering experiments.

Data acquisition system is the process by which events in the real world are sampled and translated into machine-readable signals [1]. Sometimes abbreviated

DAQ, data acquisition typically involves sensors, transmitters and other instruments to collect signals, waveforms etc. to be processed and with a computer. A typical data acquisition system in common use is the data acquisition card, which can be inserted in the PC main board and make a PC- based data acquisition system. The first step in data acquisition is to detect and convert physical characteristics, such as pressure, temperature, and flow rate, and position into an electrical signal. This is done using a transducer is a device that converts a physical quantity into an electrical signal. Transducers have several important properties. One such property is linearity.

Data acquisition systems, as the name implies, are products and/or processes used to collect information to document or analyze some phenomenon. In the simplest form, a technician logging the temperature of an oven on a piece of paper is performing data acquisition. As technology has progressed, this type of process has been simplified and made more accurate, versatile, and reliable through electronic equipment. Equipment ranges from simple recorders to sophisticated computer systems [1][2]. Data acquisition products serve as a focal point in a system, tying together a wide variety of products, such as sensors that indicate temperature, flow, level, or pressure.

2. Methodology

Hardware Description

The elaborated data acquisition system includes the following components A/D converters, Micro controller IC 89c51, Voltage follower, current transformer, Voltage transformer, Ring detector, signal conditioner, Relay driver and LCD display.

This device is used for acquiring data from a remote location using a PC. The power and current transformer used in the system. In this even the voltage and current ratings are set at some predefined value. So even if small change in their rating takes place micro controller through telephone line can control it. The frequency input, which is used in the system, is used to control the frequency. Its output is applied to signal

conditioning circuit. It will act as Schmitt trigger means it will give the output in form of binary pulses, which are then applied, to micro controller.

The LM324 series consists of four independent, high gains; internally frequency compensated operational amplifiers, which were designed specifically to operate from a single power supply over a wide range of voltages. Operation from split power supplies is also possible and the low power supply current drained is independent of the magnitude of power supply voltage.

The output of power and current transformer is normally applied to voltage follower. So whatever the input applied from current and power transformer can be directly applied to ADC. Thus it will result in no leakage of voltage and current rating. The voltage follower used here is LM324. Application areas include transducer amplifiers, DC gain blocks and all the conventional op amp circuits, which now can be more easily implemented in single power supply systems. For example, the LM124 series can be directly operated off of the standard +5V power supply voltage, which is used in digital systems and will easily provide the required interface electronics without requiring the additional ±15V power supplies.

The ADC converter is used to convert analog signal into digital one, which is easily accessible to micro controller. The ADC used here is IC0809. It implements on a single chip most the elements of the standard data acquisition system. They contain an 8-bit A/D converter, 8 channel multiplexes with an address input latch, and associated control logic. This device provides most of the logic to interface to variety of microprocessor with the addition of minimum number of parts. These circuits are implemented using a standard metal-gate CMOS process. This process is particularly suitable to applications where both analog and digital functions must be implemented on the same chip. These two converters, the ADC0808 and ADC0809, are functionally identical except that the ADC0808 has a total unadjusted error of g (/2 LSB and the ADC0809 has an unadjusted error of g1 LSB. They are also related to their big brothers, the ADC0816 and ADC0817 expandable 16 channel converters. All four converters will typically do a conversion in E100 ms when using a 640 kHz clock, but can convert a single input in as little as E50 ms.

The relay driver, which is used here, is ULN2003. It is used to drive the relay. Across the relay driver load is connected. Relay driver is also used in circuit, which is normally used to drive the relay. Across that relay load is connected. When the system is over loaded the load, which is connected, across relay is switched off. When the system is not loaded the relay is switched on.

The ring detector used in the circuit has single opt coupler when the resistance is in dark the output increases than the transistor turns on and energizes the relay and the relay terminal switches from NO to NC [2]. As the light gets brighter the output increases and transistor turns off and thus the relay de energizes and the relay terminal, which is connected across it, switches from NC to NO.

This will indicate that telephone line is busy. In this system the PC dials up the telephone number of the micro controller line. Once the connection is made the PC sends the command to the micro controller giving the details of the data acquired. The micro controller then sends the demanded data to the PC. This is done through telephone line. During all this process if any customer will try to access the telephone line will appear busy to the customer.

b. Specification OF The Device

1. Current transformer – 5:1Ampere
2. Power transformer – 6V, 500mA
3. Frequency input – 50 Hz
4. Voltage follower – LM324
5. ADC – 0809
6. Signal conditioning – 40106 Schmitt trigger
7. Rely driver – ULN2003
8. DTMF decoder – M-8870
9. DTMF generator – UM91214B

3. System Description

This device is used for acquiring data from a remote location using a PC. The voltage and current rating can be set in micro controller and whenever the reading crosses its set value that is when it results in over voltage or over current or changes its set value. At that time PC which is installed at office distance location can connect the micro controller to telephone line can be used to control the over voltage and over current rating. The frequency input, which is used in the system, is used to control the frequency. Its output is applied to signal conditioning circuit. It will act as Schmitt trigger means it will give the output in form of binary pulses, which are then applied, to micro controller.

In this system data recorded continuously in EEPROM that is known as electrically erasable programmable read only memory [1]. Then the system is checked continuously for whatever the parameters it is programmed and display those parameters on the display screen. The output of voltage and current transformer is applied to voltage follower so that whatever output comes from voltage and current transformer is directly applied to ADC. Voltage follower is used here so that no leakage of current takes place in the circuit. ADC is connected also connected to micro controller line. Whenever micro controller wants to read data it will send signal to ADC that is it will give signal to ADC, which is known as SOC. After getting the command from micro controller line ADC will read signal from power and current transformer. After completing it's reading it will convert the data in binary format and give the signal EOC to the micro controller line.

Whenever the system is over loaded or changes its set value it will be displayed on display screen. If the system is over rated at that time PC automatically dials up the number of the micro controller line. At that time telephone line will be busy. It will act as off hook relay.

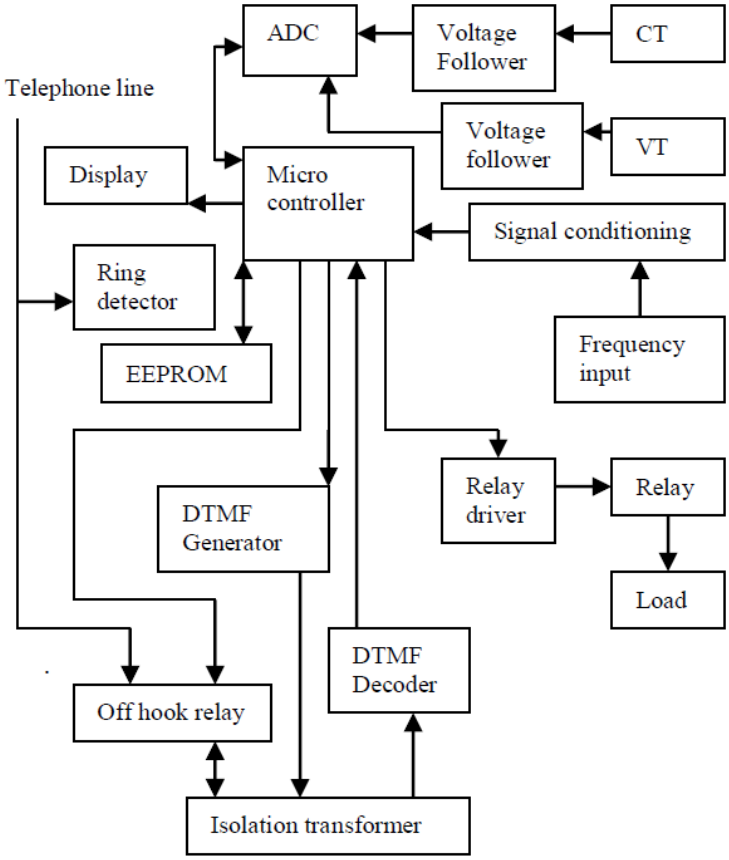

Figure 3.1 Block diagram for data acquisition through telephone (Transmitter)

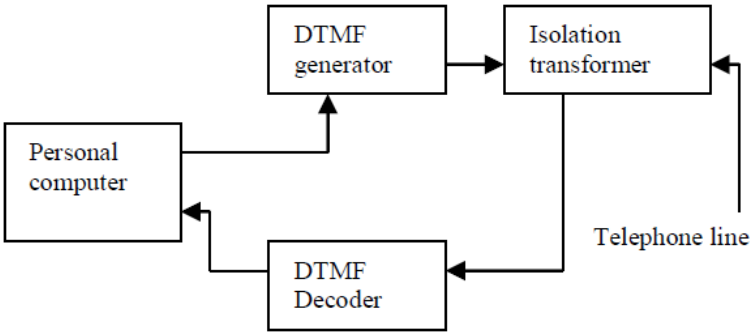

Figure 3.2 Block diagram for data acquisition through telephone (Receiver)

When the PC dials up the telephone line that line is not made available to any other customer until the connection is released. Once the connection is established it will give beep signal to micro controller line. Ring detector, which is connected, in the system is used for indication. This beep signal will act as acknowledgement to the micro controller line.

Then the micro controller line sends command to PC, which give the details of data need to control. DTMF, which is known as dual tone multiple frequency generators, does this. In this system tones have been assigned to the data need to be controlled. Then DTMF generator generates DTMF codes and through telephone line they are passed to PC. DTMF decoder, which is used here, decodes the pulses generated by DTMF generator in the binary format. These binary pulses are then applied to the PC. Then the PC control the rating automatically and generates DTMF pulses at receiver which are then applied to micro controller through telephone line. At the transmitter DTMF decoder is present which converts that pulses in binary format which are then applied to micro controller. Relay driver is also used in circuit, which is normally used to drive the relay. Across that relay load is connected. When the system is over loaded the load, which is connected, across relay is switched off.

When the system is not loaded the relay is switched on. The ring detector used in the circuit has single opt coupler when the resistance is in dark the output increases than the transistor turns on and energizes the relay and the relay terminal switches from NO to NC [4]. As the light gets brighter the output increases and transistor turns off and thus the relay de energizes and the relay terminal, which is connected across it, switches from NC to NO.

The isolation transformer, which is used in the circuit, is used to isolate the voltage. As when the ring is coming that time the voltage of telephone line is about 90V. When the system at on hook relay at that time it is about 40-50V and when the system is operating that is when it is off hook relay at that time voltage is about 9-12V. As the micro controller line operates at 5V only. In order to isolate these voltages the isolation transformer is used in the circuit.

4. Measurements

Data acquisition systems, as the name implies, are products and/or processes used to collect information to document or analyze some phenomenon. In the simplest form, a technician logging the temperature of an oven on a piece of paper is performing data acquisition. As technology has progressed, this type of process has been Ring detector Micro controller ADC Display Voltage Follower CT VT Signal conditioning Frequency input Relay driver Relay Load DTMF Decoder DTMF Generator EEPROM Off hook relay Isolation transformer Personal computer DTMF generator DTMF Decoder Isolation transformer Voltage follower simplified and made more accurate, versatile, and reliable through electronic equipment. Equipment ranges from simple recorders to sophisticated computer systems. Data acquisition products serve as a focal point in a system, tying together a wide variety of products, such as sensors that indicate temperature, flow, level, or pressure [7].

The second step involves signal conditioning. A signal conditioner is usually needed to amplify, attenuate, and/or filter the signal that is produced by the transducer. Typically, the signal produced by the transducer is in the milivolts range and the signal conditioner amplifies it to a predetermined range (normally used values are 0 to 5 volts or 0 to 10 volts) [6].The nature of electrical signal having defined characteristics requires faithful representation of their analog form, which refers to operation to be performed on such electrical signal is called signal conditioning. It gives suitable form of electrical signal compatible for interface with other elements stage of industrial process. the signal conditioning is an intermediate stage after transducer or sensor and before the process controller.

The next step in the data acquisition process is analog-to-digital conversion. A computer's method of handling data is strictly binary, meaning everything is a zero or a one, high or low. Physical phenomena upon which transducers rely to create a signal remain analog. This introduces the need of analog-to-digital (A/D) conversion. A/D converters are devices that interface between the two types of information. Digital events must also be taken to transistor-to-transistor logic (TTL) voltage levels [2]. After the A/D conversion, the information is ready to be input into the computer where it will be stored and/or manipulated using a software package.

In this system the data to be acquired is collected by a micro controller that is installed at the industrial location and is connected to the various machines. The micro controller continuously records whatever parameters it is programmed to record and displays them on its display screen. The micro controller is also connected to a telephone line. A PC installed in a office at a distant location can connect to this micro controller via the telephone line.

5. Conclusion

A data acquisition system is in deed a powerful tool for research. The system is designed in this project here an attempt has been made to control voltage and current parameters. In this system data is recorded continuously in EEPROM so that the required data can be viewed at any time. In the system if voltage and current exceeds its predefined value at that time relay driver is used to drive the over load. Here telephone line has been used to control all these parameters. The micro controller has been connected to the telephone line. The PC installed at office is also connected to micro controller. The micro controller record the continuously and show the data on LCD display.

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