Low Power Multichannel Data Acquisition System

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Abstract: In this research a low power multichannel data acquisition system has been used for the measurement of temperature and light intensity. ATMEL's ATmega8 AVR series microcontroller is the heart of system, which is used as central processing unit of the system. LM 335 and LDR are used as sensors for temperature and light intensity measurement respectively. Two potentiometers are connected for the future extension of the system.

Keywords: ATmega8 AVR, Data Acquisition System, Temperature Sensor LM335, the Light Sensor LDR.

1. DAS

Data acquisition systems, as the name implies, are products and/or processes used to collect information to document or analyze some phenomenon. Data acquisition is the sampling of the real world to generate data that can be manipulated by a computer. Sometimes abbreviated DAQ or DAS, data acquisition typically involves acquisition of signals and waveforms and processing the signals to obtain desired information. The components of data acquisition system include appropriate sensors that convert any measurement parameter to an electrical signal, which is acquired by data acquisition hardware.Data acquisition begins with the physical phenomenon or physical property of an object (under investigation) to be measured. This physical property or phenomenon could be the temperature or temperature change of a room, the intensity or intensity change of a light source, the pressure inside a chamber, the force applied to an object, or many other things. An effective data acquisition system can measure all of these different properties or phenomenas.
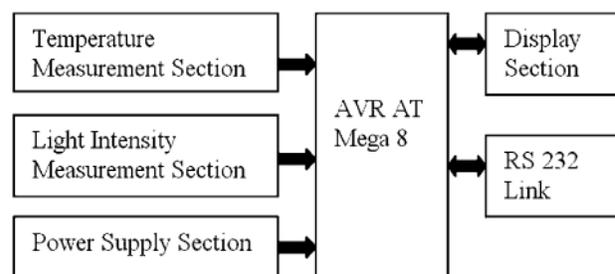
2. LOW POWER MULTICHANNEL DATA ACQUISITION SYSTEM

2.1. Introduction

It's a data acquisition system with provision of Analog input, Digital Display on LCD, Graphical display on the computer using Serial RS232 link. The power supply for the system is drawn from the USB port of the computer. The provision of on-board supply is also provided in case if the computer is not to be used. The central processing of the system is accomplished by ATMEL's AVR series microcontroller ATmega8.The ATmega8 is a low-power CMOS 8-bit microcontroller based on the AVR enhanced RISC

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architecture. By executing instructions in a single clock cycle, the ATmega8 achieves throughputs approaching 1 MIPS per MHz allowing the system designer to optimize power consumption versus processing speed. The ATmega8 features a 10-bit successive approximation ADC. The various sensing sections of the system are interfaced with the microcontroller through this inbuilt ADC of the microcontroller. The interfaced sections of the system include Light intensity measurement and Temperature measurement section. Hence the project can be considered as the combination of the digital thermometer and digital light intensity measurement meter. Two potentiometers are included and their variable signals are also given to the ADC channels of the AVR, indicating the scope for the future expansion of the project. The output of each sensor is displayed digitally on the LCD as well as graphically on the computer.

2.3. Block Diagram

2.4. Working

The data for the Low Power Multichannel Data Acquisition System is acquired from the temperature sensor LM335 and the light sensor LDR. Whenever there is any variation in the temperature, the temperature sensor sense the change and corresponding to the change produces an analog signal. As the controller only understands the digital signals, this analog

output from the temperature sensor should be converted into digital signal so as to feed the AVR and this is done by the means of the ADC. Similarly when there is any variation in the intensity of the light falling on the LDR, the resistance of LDR changes corresponding to the light intesity. The resistance is maximum when LDR is placed in dark. Now with the variation in the internal resistance, the output of the LDR i.e. the analog voltage signal also changes. This analog output from the light sensor is converted into the digital signal by using the ADC. The AVR Atmega8 consists of 6-channel inbuilt ADC. The analog signals from the various sensors are fed to the different channels of the ADC. The ADC converts these analog inputs to the digital voltages which are further used for displaying the measured data of the sensors on the display.

The analog output from the light sensor is given as input to the channel 0 of the AVR's analog to digital converter i.e. Pin no. 23 of the microcontroller. The analog output from the temperature sensor is given to the Pin no. 24 (ADC1) of the Atmega8. Channel 2 and channel 3, Pin no. 25 and Pin no. 26 respectively of the inbuilt analog to digital converter of the controller takes the input signal from the output of the potentiometers which are reserved for the future use. The last two ADC channels are left unused in the project. The 16*2 LCD has been interfaced with the microcontroller to display the data digitally. The control signals RS(register select), R/W (read- write) and E (enable) of the LCD are connected to port B pins – PB.0 (Pin no.14), PB.1 (Pin no.15) and PB.2 (Pin no.16) of the microcontroller respectively. The upper nibble of the data pins of the LCD i.e. DB7 –DB4 are connected to upper nibble of port D i.e. controller pin no. 6, pin no. 11, pin no. 12 and pin no. 13 respectively. The serial communication of the system is done with the computer through RS232 interface. MAX 232 is used as the line driver for making the RS232 signals compatible with the TTL levels. The Pin no.11 (T1in) and Pin no.12 (R1out) of MAX232 are connected to TXD (Pin no. 3) and RXD (Pin no. 2) respectively of the microcontroller. The T1 out and R1 in pins of the line driver are connected to the DB9 connector.The temperature is displayed in terms of degree centigrade and light is displayed in terms of milicandela on the LCD. Also if we vary the resistance of the potentiometers which are connected to the adc channels, the varied signal is displayed on LCD in milivolt scale.The display on the computer shows the variation in the two sensor outputs and the two four screen in measuring components are displayed simultaneously on the the milivolt potentiometers graphically.

2.5. Flowchart
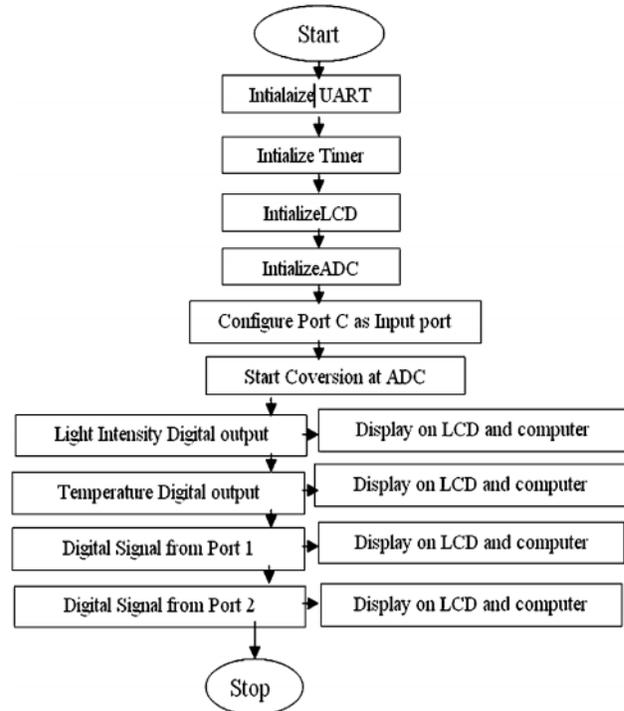
3. CONCLUSION

AVR ATmega8L provides all the usual benefits of RISC: faster clock rates, better performance, and more efficient compiler optimization. The big register set reduces dependence on memory, which improves speed and shrinks data-storage requirements. The system is reliable with the use of Atmel's ATmega8L controller and high precision sensors. The system can be used as commercial product for temperature measurements and light intensity measurements. A total of six sensors can be interfaced with the controller to have a better and extended Data Acquisition System.

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