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Atmega8 Based Multichannel Data Acquisition System

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***Abstract*— In this paper we aim to develop a multichannel data acquisition system based on ATMEGA8 microcontroller. The system will acquire real time data using three different types of sensors naming temperature sensor, humidity sensor and a light sensor. The system is connected to PC through serial port. Data obtained from sensors are displayed in computer using MATLAB software.**

***Keywords*— Microcontroller, Humidity sensor, Temparature sensor, LDR(Light Dependent Resistor) .**

I. INTRODUCTION

Data acquisition system [1]-[9], 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.

The data acquisition system [1]-[2] enables us to record the parameter data with respect to time. So a graph can be plotted or a database can be maintained on a computer for future calculation purposes. This data can also be used for detection and record of failure time and failure conditions and causes.

Our system consists of an ATMEGA8 [3] microcontroller and three different types of sensor namely thermistor, humidity sensor [4] and LDR. The system will acquire real time data from the sensors through 10 bit internal ADC [5] of ATMEGA8. Acquired sensor data will be then send to computer through rs232 protocol using internal usart module. The system is connected to PC through serial port. Data obtained from sensors are displayed in computer using MATLAB [6] software.

II. WORKING METHODOLOGY

Assuming the control unit is powered and functioning properly, the process of system will proceed through following steps:-

1. Sensors sense respective measuring parameters.
2. Then it is sent to ADC (Analog to Digital converter) of Atmega8 through processing circuit.
3. Converted data is then sent to computer via Max232 Protocol.

4. Data is analyzed by some coding [7] as mentioned in appendix-I.

The block diagram of the proposed system is shown in the Fig.1.

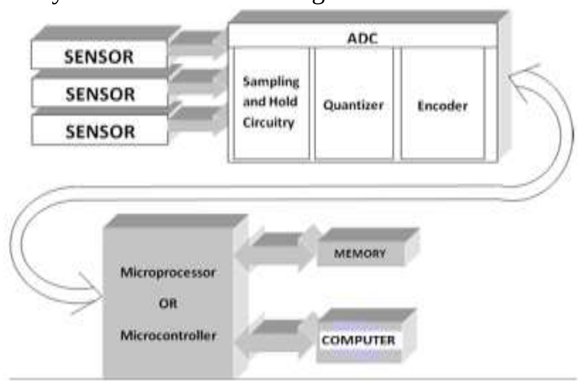

Fig. 1. Block diagram of system.

III. SYSTEM DESCRIPTION

System hardware comprises of ATMEGA 8 IC which is an 8 bit microcontroller having internal 10 bit 6 channel ADC,1 MAX32 IC, DC connector, serial port, sensor connecting port.

The entire system as shown in the Fig. 7 is divided into subsequent parts:-

A. Microcontroller

Microcontroller is the key element in all Embedded Systems, Control and Automation processes. It behaves like a single chip microcomputer and is coupled with a processing unit, memory, input output devices, timers, data convertors, serial port etc. In our project Atmega8 is used with the pin configuration as shown in the Fig. 2.

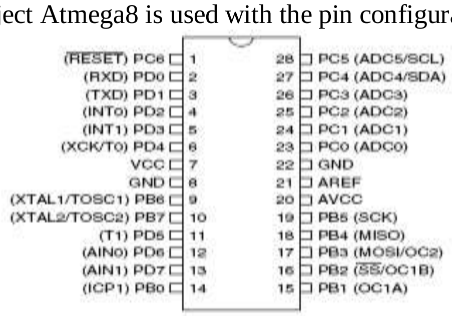

Fig. 2. Pin configuration of Atmega8.

The ATmega8 features a 10-bit successive approximation ADC. The ADC is connected to an 8-channel Analog Multiplexer which allows eight single-ended voltage inputs constructed from the pins of Port C. The single-ended voltage inputs refer to 0V (GND).

B. Light Dependent Resistor

light-dependent resistor, alternatively called an **LDR**, **photo resistor**, **photoconductor**, or *photocell*, is a variable resistor whose value decreases with increasing incident light intensity. An LDR [8] as shown in the Fig. 3 is made of a high-resistance semiconductor. If light falling on the device is of high enough frequency, photons absorbed by the semiconductor give bound electrons enough energy to jump into the conduction band. The resulting free electron (and its hole partner) conduct electricity, thereby lowering resistance.

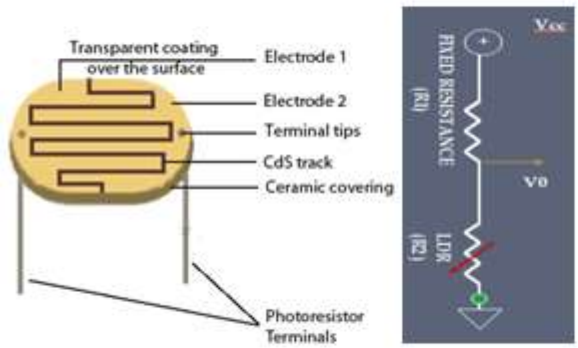

Fig. 3. LDR.

We have placed the LDR in one arm of a potential divider. Now, if the resistance of the LDR varies, the output voltage of the potential divider also changes.
V0= (Vcc * R2)/(R1+R2).

C. Temperature Sensor

Here we used thermistor shown in the Fig.4 as a temperature sensor. The term "Thermistor" is used to describe a range of electronic components whose principle characteristic is that their electrical resistance changes in response to changes in their temperature. Thermistors are further classified as "Positive Temperature Coefficient" devices (PTC devices) or"Negative Temperature Coefficient" devices (NTC devices).

Fig. 4. Thermistor.

D. Humidity Sensor

Humidity is the presence of water in air. The amount of water vapor in air can affect human comfort as well as many manufacturing processes in industries. In resistive humidity sensors as shown in Fig. 5, the change in electrical resistance of a material due to humidity is measured. Typical materials are salts and conductive polymers. The accuracy and robustness against condensation vary depending on the chosen resistive material. Robust, condensation-resistant sensors exist with an accuracy of up to ±3% RH.

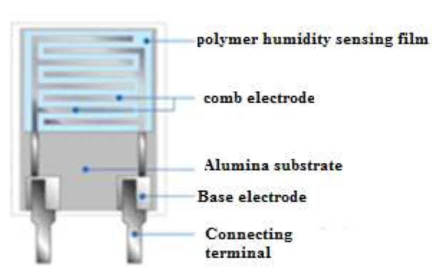

Fig. 5. Humidity sensor.

F. Communication protocol

RS-232 (recommended standard 232) is an asynchronous standard for serial binary data communication. In RS232 standard the logic 0 or space is given by any voltage [9] ranging from +3V to +25V and logic 1 or mark is given by any voltage from -3V to -25V as shown in Fig. 6.

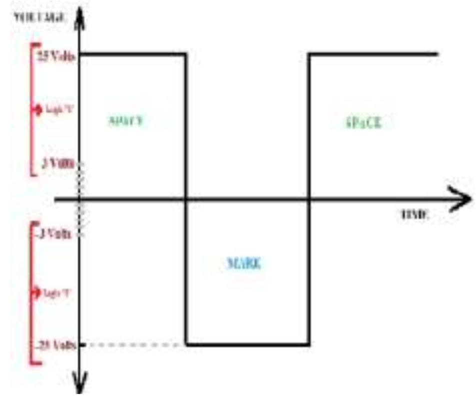

Fig. 6. RS232 voltage levels.

Fig. 7. Multichannel data acquisition system.

IV. RESULT

1.Initial graph plot when the sensors are not subjected to any variations shown in Fig. 8.

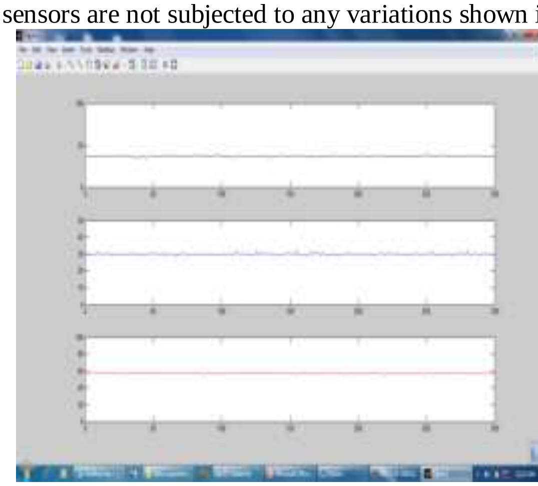

Fig. 8. No variation. Humidity (red line), temp (blue line) and light (black line) Vs real time(seconds).

2. Final graph shown in the Fig. 9 when the sensors are subjected to changes in respective parameters.

}

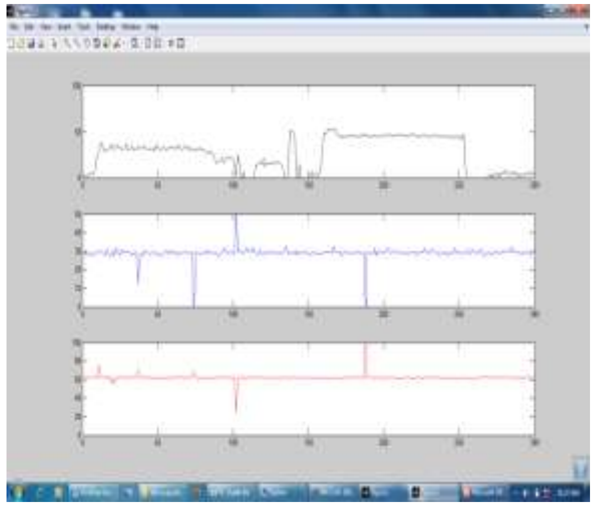

Fig. 9. System subjected to changing parameter.

V. CONCLUSION

This Data Acquisition System implemented here uses very simple concepts to generate highly accurate values given to it by the sensors used. It is simple to use and a low cost device. The microcontroller program has the ability to produce values of high range beyond decimal point thus making the system reliable to precise values. Further developments can be achieved in the near future so as to make it a better and much more user friendly device to check values and outputs of different sensors.

ACKWONLEDGEMENT

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APPENDIX-I

USART programming:

```
#include<avr/io.h>
#include<compat/deprecated.h>
#include<util/delay.h>
int ADC_Read(uint8_t channel)
{
   uint16_t val;
   sbi(ADCSRA,7);
              ADCSRA=0X87;
              DDRC&= ~(1<<(channel-1));

   ADMUX=0X40 | (channel-1);
              ADCSRA |= (1<<ADSC);
   while ( ADCSRA & (1<<ADSC) );

   val=ADC;

return(val);

}
```

Source code:-

```
#define F_CPU 8000000
#include<avr/io.h>
#include<compat/deprecated.h>
#include<util/delay.h>
#include<stdio.h>
#include"uart.h"
#include"adc.h"
int main(void)
{
   int val1,val2,val3;
                USARTInit(8); /// 115200 bps @ 8.000 MHZ

                while(1)
                {

                  val1=ADC_Read(1);
                  val2=ADC_Read(2);
                  val3=ADC_Read(3);
      printf("%d %d %d\n",val1,val2,val3);
                  _delay_ms(50);

                }
                return(0);
}
```

MATLAB programming:-

```
com_name=input('Please enter the Com port name - (eg. COM1) - ');
s=serial(com_name,'BaudRate',115200);
fopen(s);

figure(1);
hold on
H=gcf;
i=1;

while 1

str=fscanf(s,'%s');
k=sscanf(str,'%3d %3d %3d',3);
ch1(i)= 80 - k(1)/10;
ch2(i)= 69 -  k(2)/ 11.42;
ch3(i)= k(3)/6.3 - 16;

%disp([ch1,ch2,ch3]);

 if(i>300)
 clf(H);
 subplot(3,1,1); plot(ch1(i-300:i),'k'); axis([0 300 0 100]);
 subplot(3,1,2); plot(ch2(i-300:i),'b'); axis([0 300 0 50]);
 subplot(3,1,3); plot(ch3(i-300:i),'r'); axis([0 300 0 100]);
 drawnow;
```

```
 end
pause(0.01);

i=i+1;
end.
```

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