Monitoring of Greenhouse gases with a Sensor Network

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***Abstract*—**This paper introduces a concept the design and implementation of a sensor networks for greenhouse gases monitoring. The sensor networks are deployed and monitored remotely on lifetime systems in a commercial, industrial area and smart cities greenhouse that produces lettuces in a tropical environment. The key issues are low-noise power supply, noise floor of sensor, high sampling rate, and the relationship among displacement, frequency, and acceleration. The sensor nodes were developed with the use of a micro-controller and sensor components . Real time data enabled the operators to monitor the operating parameters of the greenhouse and also to respond immediately to any changes in the controlled parameters.

***Keywords*-** Temperature sensor, CO2 sensor ,ATMEGA16 microcontroller, LCD etc**.**

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I. INTRODUCTION

Many chemical compounds found in earth environments act as green house gases .These gases allow sun light enter earth environment freely ,when sun light strike on the earth's surface some of it is reflected back towards space as infrared radiation. Greenhouse gases absorb this infrared radiation and trap the heat in the earth atmosphere. Over this time temperature of environment increased. Even if carbon dioxide levels stopped today the world would still warm by1.6° above pre industrial level which is more than three-quarters of the way to the 2°C limit the world is supposed to be aiming for. Global average levels of carbon dioxide in atmosphere temporarily broke the 400ppm earlier this year for the first time, the World meteorological organization said. Meanwhile, the UK met office confirmed that the world has now warmed by1°C relative to pre-industrial times. Climate models show

That even if carbon dioxide levels stopped, the world would still warm by around 0.6°C. So the latest figures mean that even if which the world slashed emission by 60 per cent immediately, which is what it would take to stabilize CO_2 levels, we would still hit 1.6°C . It is time to start preparing for a world more than 2° warmer than now. The UN's own analysis of what countries are offering to do to limit greenhouse gas emission shows they fall far short of what's required. In fact, they suggest the world will have emitted enough carbon dioxide to warm the planet 2°C by around 2036.

So it is very important to control the emission of carbon dioxide. Carbon dioxide levels vary from place to place and with seasons which will be monitored by electronic kit and find the location where carbon percentage more.

This paper presents our design and implementation of a microcontroller-based system for monitoring temperature and CO_2. We have used temperature sensor lm35 and CO_2 sensor MQ135 for monitoring the change of temperature in atmosphere with respect change the amount of CO_2 present in earth atmosphere. We use Atmel ATmega16 microcontroller and lm35, MQ135 as the main compound of the system. Lcd is used to display the atmospheric temperature and co_2 in the atmosphere.

II. BACKGROUND

Microcontroller can be define as a RISC(reduced instruction set computer) single-chip special-purpose computer dedicated to execute a specific application. As in general-purpose computer, microcontroller consists of memory on chip program ROM, data RAM, Flash, I/O peripherals, and processor core. This microcontroller, the processor core is not as fast as in general purpose-computer, the memory size is also small. Microcontroller has been mostly used in embedded systems such as, home appliances, vehicles, and toys. There are several microcontroller products available in the market, for example, Intel's MCS-51 (8051 family), Microchip PIC, and Atmel's Advanced RISC Architecture (AVR). We discuss Atmel ATmega16 LM35 temperature and MQ135 CO_2 sensor in this section.

III. IMPLEMENTATION METHODOLOGY

.LM35 TEMPERATURE SENSOR

The LM35 series are integrated-circuit temperature sensors .Their output voltage is linearly Proportional to the Celsius temperature with change the analog voltage of output. The LM35 thus has a benefit over linear temperature sensors calibrated in° K, as there is no need to subtract a large constant voltage from its output to obtain Centigrade reading. It does not require any external calibration or trimming to provide typical accuracies of ±1⁄4°C at room temperature and ±3⁄4°C

over a full −55 to +150°C temperature range. Low cost is due to trimming and calibration at the wafer level. The LM35'slinear output, and precise inherent calibration make interfacing to readout or control circuitry especially easy. LM35 can be used with single power supplies, or with plus and minus supplies .It draws only 60 µA from its supply, so it has very low self-heating, less than 0.1°C in still air. It is rated to operate over a −55° to +150°C temperature range, while the LM35C is rated for a −40° to +110°C range (−10°with improved accuracy. In LM35 show a three pin first pin for vcc supply 5 volt, second one for analog output and another one for gnd. Analog output range of lm35 is 0 volt to 1.5 volt. The +Vs can be from 4V to 20V as specified by the pin configuration. To use the sensor Vcc was connected to +5V, GND to ground and the OUT to one of the ADC (analog to digital converter channel). The output varies linearly with temperature. The output is 10 mill volts per degree centigrade.

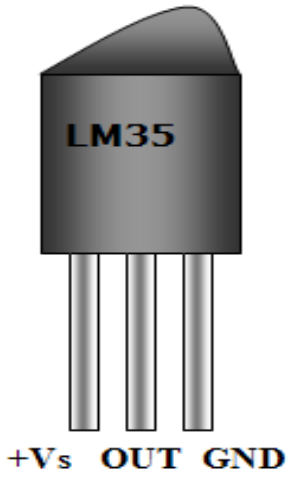


Figure A: LM35 SENSOR

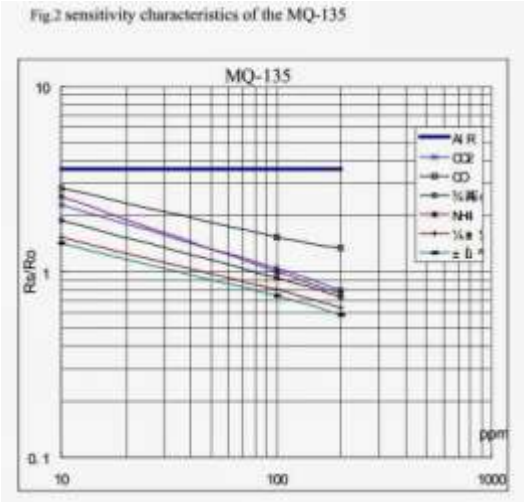
B) ATMEGA16

ATmega16 is an 8-bit high performance microcontroller. It is a less power consuming device. The Atmel's ATmega series of microcontrollers are very popular due to the large number of peripherals built in them. They have features such as 10-bit A/D converters, UART/USART, and much more and due to that reason they become useful for a large number of applications and external hardware is reduced as these are built-in.

C) MQ135 TEMPERATURE SENSOR

MQ135 is an Air Quality Sensor suitable for detecting of NH3, Alcohol, Benzene,CO_2 and other gases. It is used to convert the output of the sensor to the related ppm physical physical characteristic for the gas under test.

Figure C:1)MQ135 CO_2 Sensor 2) Characteristic of the gas Sensor



the co_2 curve can be described by the equation in the form $Y=a * x^b$

Where y corresponds to ppm and x corresponds to Rs/Ro. Since the characteristic is defined graphically, we determine two points that can be described with the minimum deviation. Substituting these points and then solving the set of two equations.

$$200 = a \cdot 0,8^b$$

$$10 = a \cdot 2,1^b,$$

We obtain coefficients a, b which represent scaling factor and exponent respectively. To obtain the calibration constant Ro, known current average

value of CO_2 in the atmosphere and the equation 3 is used, where Rs is the measured value, a = 100.0482, b = -3.1041 and current ppm = 401.52.

$$R_O = R_S \sqrt[b]{(a/ppm)}$$

On this basis, we can conclude that the ppm value can be determined by the equation

ppm = 100.0482*(Rs/Ro)^−3.1041.

 ISSN: 2321-8169
6408 - 6411

Using the above calculation, it is possible to obtain values of CO2 levels in the air of monitored environment.

D) 16X2 Liquid Crystal Display (LCD)

Liquid crystal display is very important device in

embedded system. Now days it is very common for screen

industry to use LCD replacing Cathode Ray Tubes (CRT).

IV. DESIGN AND IMPLEMENTATION

We define our system to have specification as follows. 1) Temperature sensor used to measure temperature in degree centigrade.2) CO_2 sensor is used to sense the CO_2 in earth atmosphere in ppm.

The system consists of hardware software parts. to poartA of ATmega16 and the lcd to portB ,same as MQ135 CO_2 sensor

is connected to portA of ATmega16 and the lcd to portB.We used software in this project AVR studio4 and proteus. AVR studio4 is the development platform .AVR studio is required to write the c code and it is used to compile the program generated hex code .

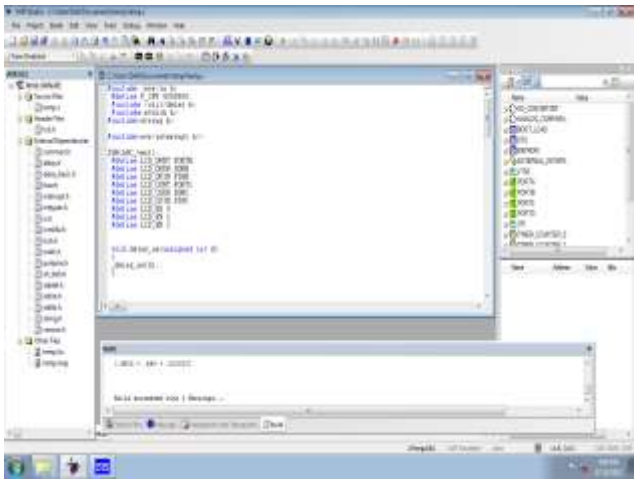


Figure IV:b) AVR Studio 4 Software

Proteus 7.0 is a Virtual System Modelling grew by Labcenter Electronics this was basically developed to cosimulate the microcontroller based designs which integrate animated components, circuit simulation and microprocessor proteus is a simulation software ,it is used to simulated the programs and hardware design

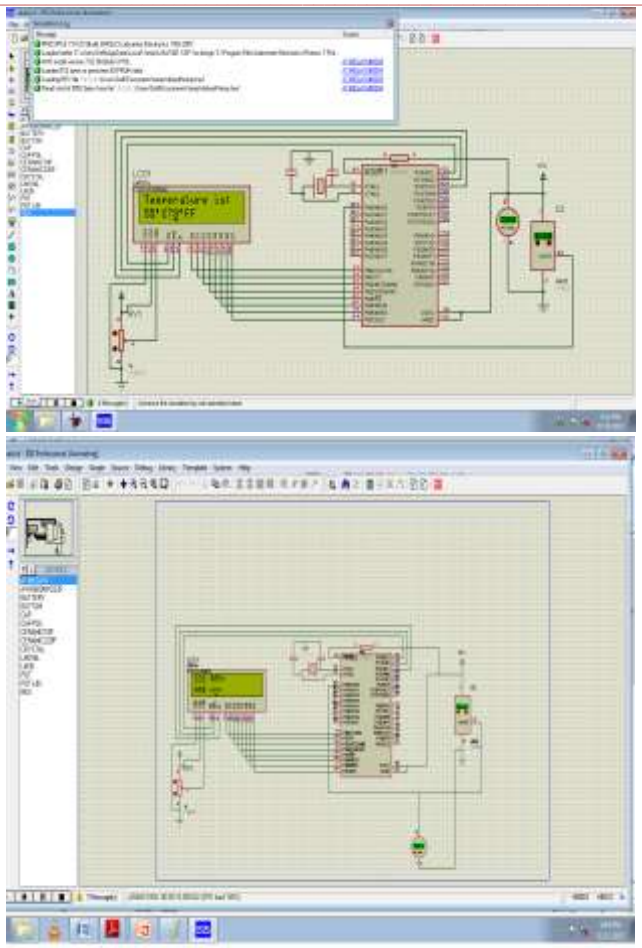


Figure IV:c) Circuit Simulation with use of Proteus

Here we used ATmega16 40 pins microcontroller four port device, in this microcontrollers portA contain ADC pins features of the ADC is 8 channels 10 bit resolution. The voltage value is read from portA(0)/ADC(0) then stored in Adc V_{in} variable. This value then, after some computations, is assigned to V_{in} variable. The value of V_{in} variable is the value to be send to the predefined lcd.

```
'... other code...
Data_adc = Getadc(0)
Adc_vlt = Data_adc / 1024
Adc_vlt = Adc_vlt * 500
Vlt = Fusing(Adc_vlt , "##.#")
```

Figure IV:a) ADC Code

V. HARDWARE BLOCK DIAGRAM

The output pin of LM35 temperature sensor was connected to one of the ADC input pin of ATmega16 microcontroller, same as MQ135 sensor connected to one of the ADC pin of

ATmega16. LCD was connected to Port C of the microcontroller ADC was activated for interfacing the temperature and carbon dioxide sensor and a program wait written so that whatever temperature the sensor sense it can be displayed on LCD screen.

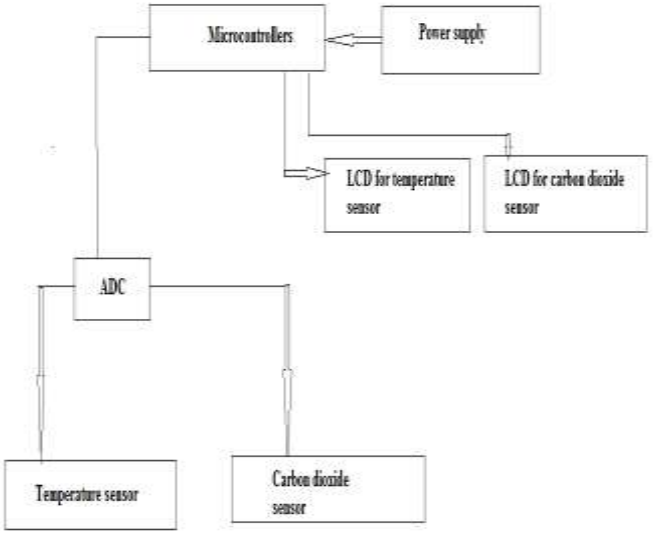


Figure V: Proposed Block diagram

VI. RESULTS

FigureVI: Designed system as with reference to block diagram proposed has shown in FigureV

The Designed system is as shown in the FigureVI ,we have used two hardware circuit one circuit for measure temperature of atmosphere and another one measure presence of carbon dioxide in ppm with the help of this circuit to monitored the greenhouse effect.

CONCLUSION

In this paper, we have designed and implemented a microcontroller-based system for monitoring server room temperature and carbon dioxide. We utilized Atmel AVR ATmega8535 microcontroller and LM35 temperature sensor and MQ135 carbon dioxide sensor. Based on the testing results, the system works according to our predefined specification. This system can be used to help the administrator to monitor atmosphere temperature and CO_2 control the emission of carbon dioxide.

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