

# Real Time Data Acquisition and Home Parameters Monitoring using LabVIEW

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**Abstract**— Home automation refers to a system that is used to control devices around the home. These devices can include doors, lights, surveillance systems, and consumer electronics. A smart home automation system has been developed to automatically achieve some activities performed frequently in daily life to obtain more comfortable and easier life environment. A sample house environment monitor and control system that is one branch of the Smart home is addressed in this paper. The system is based on the LabVIEW software and can act as a security guard of the home. The approach combines hardware and software technologies.

**Keywords** - ATmega16, Data Acquisition, LabVIEW, Smart House,

## I. INTRODUCTION

With advances in processor and wireless communication technologies, sensor networks will be used everywhere in the future life. Home automation networks are one of the good environments that sensor networks and consumer electronics technologies will be merged. In the home automation networks, many sensors distributed in the house collect various physical data such as temperature, humidity, motion, and light to provide information to the HVAC (Heating, Ventilating, and Air Conditioning) control system. At the simplest level, data acquisition can be accomplished manually using paper and pencil, recording readings from a multimeter or any other instrument. For some applications this form of data acquisition may be adequate. However, data recording applications that require large number of data readings where very frequent recordings are necessary must include instruments or microcontrollers to acquire and record data precisely (Rigby and Dalby, 1995). Laboratory Virtual Instrument Engineering Workbench (LabView™) is a powerful and flexible instrumentation and analysis software application tool which was developed in 1986 by the National Instruments (National Instruments, 2012). LabView™ has become a vital tool in today's emerging technologies and widely adopted throughout academia, industry, and government laboratories as the standard for data acquisition, instrument control and analysis software.

## II. SYSTEM CONFIGURATION

Design of data acquisition system is demonstrated for measurement of parameters like temperature, light, humidity etc. by acquiring data using different sensors at different locations and communicating with the user using ATmega16

AVR microcontroller. System description is divided into two parts, consisting of hardware and software description.

### A. Software Implementation

LabVIEW is being used to design program codes to read, monitor and display process parameters for real time data acquisition system. LabVIEW provides a perfect scope to accomplish computer based research. The wired together icons to perform simple-to-understand tasks which makes operation given below possible.

Building an array

Parsing a string

Digitalizing an analog voltage

A LabVIEW program includes two windows, called the **Front Panel** and the **Block Diagram**.

#### The Front Panel

Once a program is developed, the front panel acts as the face of a laboratory instrument. Front panel includes controls and indicators, which are the interactive input and output terminals of the VI, respectively. Controls are knobs, push buttons, dials, and other input mechanisms. Indicators are graphs, LEDs, and other output displays. Hence the **front panel** is the program's user-interface, which facilitates the interaction of: 1. Providing inputs to the program, 2. Monitoring outputs from the program as it runs.

#### The Block Diagram

The actual LabVIEW programming code is exposed in the block diagram. It contains Lab View's well-stocked libraries of icons that we have selected during the program development. Each icon stands for a block of underlying executable code that does a particular useful function. The programming is done by wiring these icons properly, so that data flows amongst graphical images to achieve a desired function. LabVIEW enables us to carry out state of the art research including:

1. Instrument Control
2. Data Acquisition
3. Data Analysis
4. Data Presentation and Data Storage

#### Virtual Instruments (VI)

LabVIEW programs are called Virtual Instruments (VI) because their appearance and operation imitate physical instruments, such as oscilloscopes and multi meters. Every VI uses functions that manipulate input from the user interface or other sources and display that information or more it to other files or other computers.

## B. Hardware Implementation

In the design of real time data acquisition system, we used several sensors like LDR, temperature sensor, and humidity sensors that will observe the different parameters.

### Microcontroller

Microcontrollers are small and cost effective but self-contained computer chips used for embedded applications in industrial and consumer electronics products. In this system, we are using *ATmega16* microcontroller. The controllers are receiving the data from different sensors, placed at specific locations and sending the data to LabVIEW that communicating with the user. Outputs of the sensors can be provided to processor directly but in this case, distance is the constraint, means sensors cannot be placed at far distance from the processor. It is very important to keep a track of the working of almost all the automated and semi-automated devices, be it a washing machine, an autonomous robot or anything else. This is achieved by displaying their status on a small display module. LCD (Liquid Crystal Display) screen is such a display module and a 16x2 LCD module is very commonly used. These modules are replacing seven segments and other multi segment LEDs for these purposes. The reasons being: LCDs are economical, easily programmable, have no limitation of displaying special & even custom characters (unlike in seven segments), and so on. LCD can be easily interfaced with a microcontroller to display a message or status of a device.

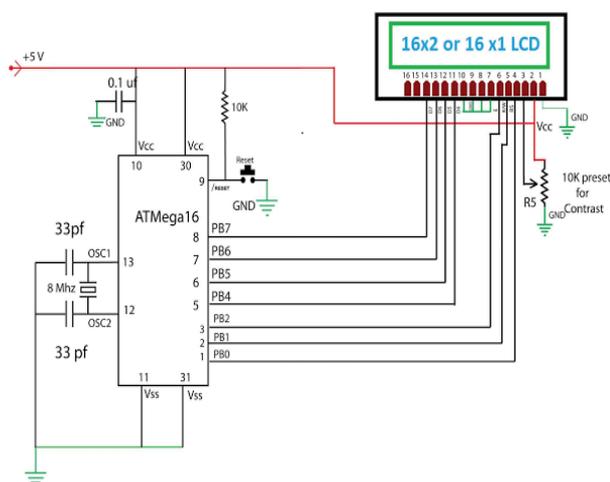


Fig. 1: Schematic of ATmega16(L) with LCD display

### Temperature Measurement

The LM35 series are precision integrated-circuit temperature sensors, whose output voltage linearly calibrated directly in ° Celsius (Centigrade) i.e. Linear + 10.0 mV/°C scale factor with 0.5°C accuracy guarantee able (at +25°C) and rated for full -55° to +150°C range. It operates from 4 to 30 volts and draws less than 60 µA.

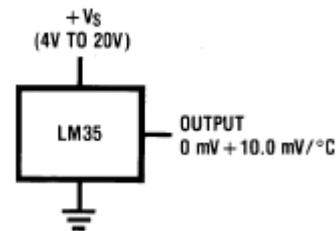


Fig. 2: Temperature sensing and measurement

### Light intensity measurement

A simple light intensity sensor can be constructed using light depended resistance (LDR) to measure the light, it will show different status of light based on the intensity of the light. When light intensity is very low it will show the status darkness or night, when intensity is dim it will show dim, when intensity is medium it will show normal status and for the high intensity it will show day or brightness on LCD.

### Humidity sensor module-SY-HS-220

This module convert the relative humidity to the output voltage and can be used in weather monitoring application. The board consist of humidity sensor along with signal conditioning stages. It is capacitive type, comprising on-chip signal conditioner. The PCB consist of CMOS timers to pulse the sensor to provide output voltage. It is also consist of oscillator, AC amplifier, frequency to voltage converter, and precision rectifiers.

The humidity sensor used in this system is highly precise and reliable. It provides DC voltage depending upon humidity of the surrounding in RH%. This work with +5 Volt power supply and the typical current consumption is less than 3 mA. The operating humidity range is 30% RH to 90% RH. The standard DC output voltage provided at 250C is 1980 mV . The accuracy is ± 5% RH at 250C. As shown in the fig 3, it provides three pins recognized as B, W and R. The pin labeled W provides the DC output voltage, where as the pin labeled B is ground. The VCC of +5V is applied at the pin R. The humidity dependent voltage is obtained and subjected for further processing.



Fig. 3: Humidity Sensor Module

## III. DATA ACQUISITION USING SERIAL PORT

The goal of this application is to demonstrate the usefulness of multifunction data acquisition boards for monitoring and control. This is achieved by using the LabVIEW environment to acquire and process signals, generating commands and displaying the progress of the process variables to the user.

Serial communication needs specification of four parameters: the baud rate of the transmission, the number of

data bits encoding a character, the sense of the optional parity bit, and the number of stop bits. Each transmitted character is packaged in a character frame that consists of a single start bit followed by the data bits, the optional parity bit, and the stop bit or bits. Baud rate is a measure of how fast data is moving between instruments that use serial communication. RS-232 uses only two voltage states, called MARK and SPACE. In such a two state coding scheme, the baud rate is identical to the maximum number of bits of information, including "control" bits, which are transmitted per second. The start bit signifies the beginning of each character frame. It is a transition from negative (MARK) to positive (SPACE) voltage. In transmission of data bits, inverted logic is used and the order of transmission is from least significant bit (LSB) to most significant bit (MSB). An optional parity bit follows the data bits in character frame. The last part of the character frame is a stop bit. These bits are always represented by a negative voltage. If no characters are transmitted further, the line stays in negative voltage state. The transmission of next character frame is followed by a start bit of positive (SPACE) voltage.

LCD display.

In front panel we have an actual code for communication between microcontroller and LabVIEW. First step is the configuration of serial port after that a string is generated for Write operation then for Read operation as shown in Fig. 6. Within this system implementation, we almost tried to replace high cost DAQ (Data Acquisition) card with microcontroller. Without DAQ card the system cost is effectively reduced. By writing easy LabVIEW code using VISA resource, the communication through external hardware is very easy. Serial communication uses a transmitter to send data, one bit at a time, over a single communication line to a receiver. We can use this method when data transfer rates are low.

We can use LabVIEW to inspect the status of serial port. It is explained as follows.

1. Open All Functions>Instrument I/O>Serial>VISA Configure Serial Port.VI to the block diagram.. To create a new I/O for one of input "COM port number". To create an indicator for output "error code". Next to decide what number should be filled into this parameter of port number. We should go back to find how many communication ports we have.

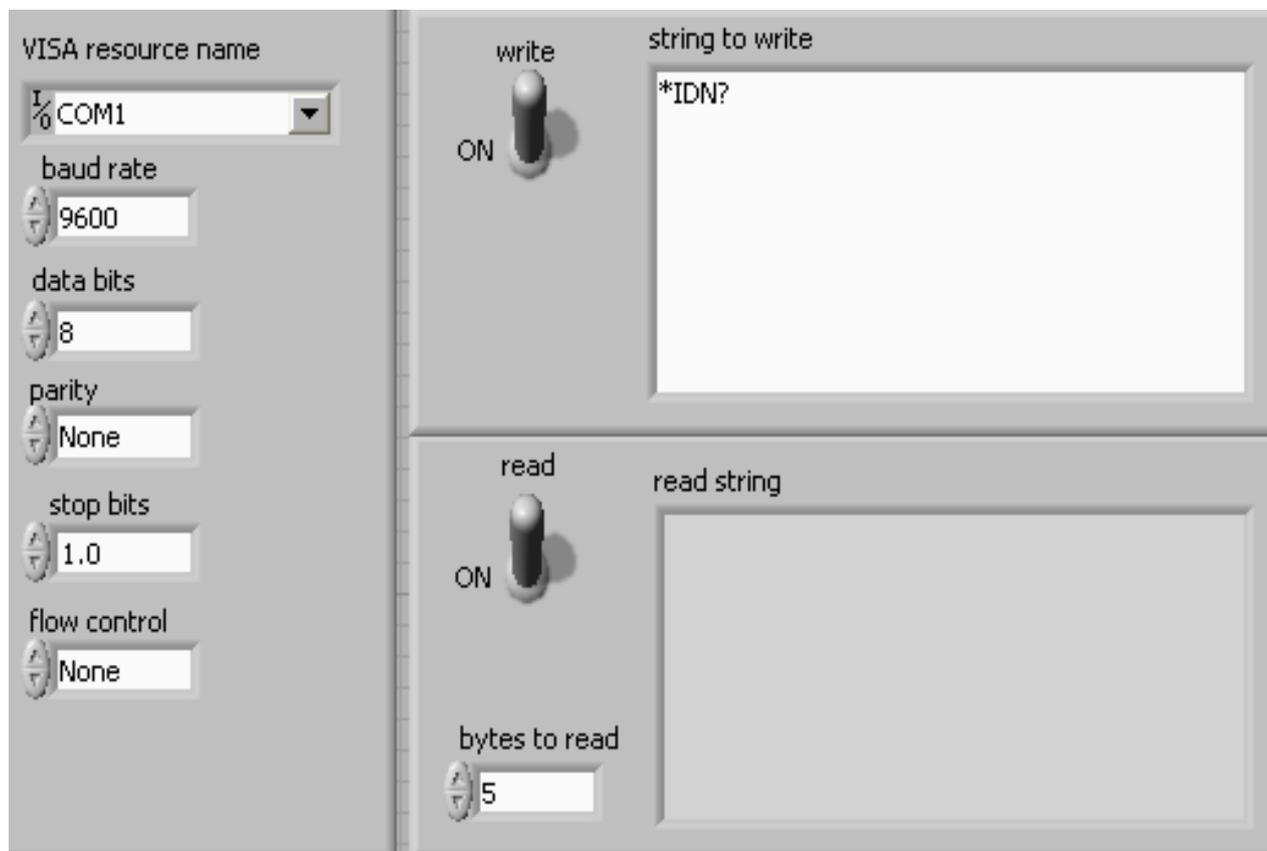


Fig. 4: Read and Write task communication block diagram

The VISA Configure Serial Port VI initializes the port identified by VISA resource name to the specified settings. Timeout sets the timeout value for the serial communication. Baud rate, data bits, parity, and flow control specify those specific serial port parameters. Serial port communication for read and write operation is shown in figure.

The LabVIEW code created to communicate microcontroller with LabVIEW and the data is displayed on

Right now we

use COM1 or COM2 as activated port.

2. It will be generated a number to show the quality of COM1. If we press the execution button and a number '0' is displayed which means everything O.K. , the quality of COM1 is good. If we got the other number which means the communication port (COM1) does not work, it may make a mistake while installation. Please come back to check a system and set-up again.

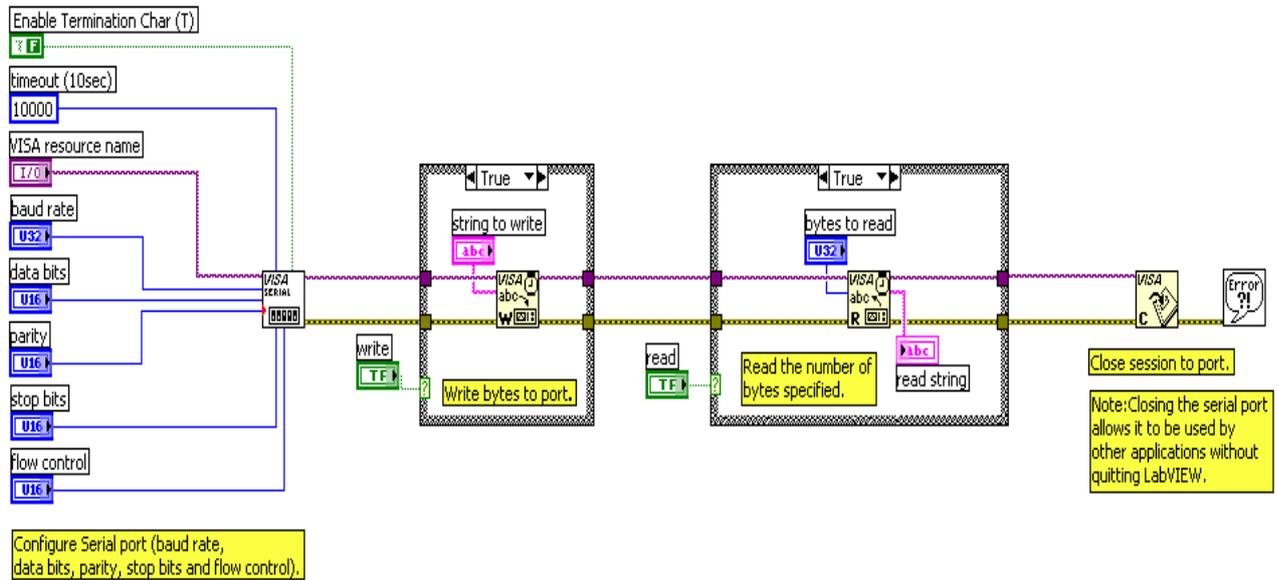


Fig. 5: Data Read and Write Front Panel

**IV. RESULTS AND ANALYSIS**

The status of fire alarm is shown in Fig. 7. The alarm is in OFF state during the experiment. Humidity, temperature and light status is shown in Fig. 8. The burglar alarm status is in ON state as shown in Fig. 9. All the parameters are easily monitored and can be controlled using LabVIEW and microcontroller.

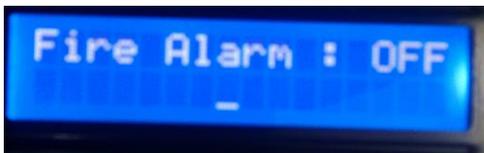


Fig. 6: Fire Alarm Status

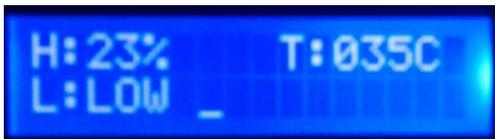


Fig. 7: Humidity, Temperature and Light status



Fig. 8: Burglar Alarm Status

Humidity sensor module is easily interfaced to the microcontroller and it can be monitored in LabVIEW. Fig. 10 shows the variation of humidity with respect to the output voltage of module. Due to the linear characteristics curve and easy signal conditioning, it is very easy to interface the module with microcontroller and PC.

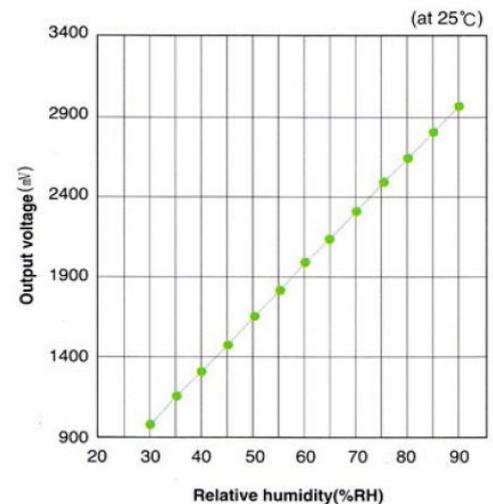


Fig. 9: Humidity and its respective output voltage

**V. CONCLUSION**

This paper represents importance of home parameters monitoring system for home security. Installing home security systems are not status symbols anymore but rather they have become a great necessity in today's environment. Employing embedded technology, based on AVR ATmega 16L microcontroller, the Wireless Sensor Node designed and implemented for development of home monitoring applications. Use of smart sensor module causes to enhance the accuracy and reliability as well. On inspection of the results, it is found that the humidity data given by the sensor node is accurate.

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