Precision Data Logger Using LabView GUI

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Abstract- Data logger system is a advanced data acquisition system. By simplifying the settings of the suitable program, specific requirements are met. The output measured in electrical quantity from transducer is logged automatically. These sensors usually communicate over single wire protocol (and ground) that means it requires only one data line for communication with central microprocessor. Lab VIEW GUI is used to display the logged data automatically.

Keywords: Data logging, Lab VIEW, One wire protocol.

I. INTRODUCTION

Fields where temperature and humidity measurement are considerable factors, it is the priority that temperature and humidity must be maintained within their specified ranges. A data logger is a system which generally consists of various sensors that are used to convert physical quantities into appropriate electronic signals such as voltage or current. Binary information can be obtained from these electronic outputs, which can be further examined by software and can be used for further process.

Data loggers uses latest microprocessors, advanced sensors and fully featured software, which improvises its accuracy. The Logging system is dependent on digital processor. The data is stored over a particular time period using an electronic device related to its location either with the instrument within or through the sensors which are connected externally. Data can be collected on a 24-hour basis automatically, which thus fulfills the motive of using the data loggers.

II. SYSTEM MODEL

For precise sensing one wire digital thermometer DS18B20 has the ability to provide 9bit-12bit temperature measurement including the alarm. Every DS18B20 has a unique serial code of 64-bit, thus allowing multiple DS18B20s to function on the selfsame single protocol bus. Hence it makes easy for one to employ one microcontroller that controls many DS18B20s that are geographically placed over an area.

Humidity measurement is done using sensor DHT11 whose output is given to the high performance 8 bit microcontroller. It can measure relative humidity in percentage (20 to 90%RH) and temperature in degree Celsius in the range of 0 to 50°.

PIC18F4520 Microcontroller is used to process the data which is obtained via sensors. It has 10 bit with channels ADC inbuilt. Important information like Transmitter and receiver codes and frequencies can be permanently stored due to the EEPROM inbuilt in microcontroller.

The precisely measured data i.e. temperature and humidity values are displayed at the field using LCD. For specific application areas which are not accessible by humans, the data can be processed via means of Wi-Fi module and further displayed on the User Interface.

Wi-Fi Module ESP8266 has TCP/IP protocol which permits the microcontroller to access its Wi-Fi network.

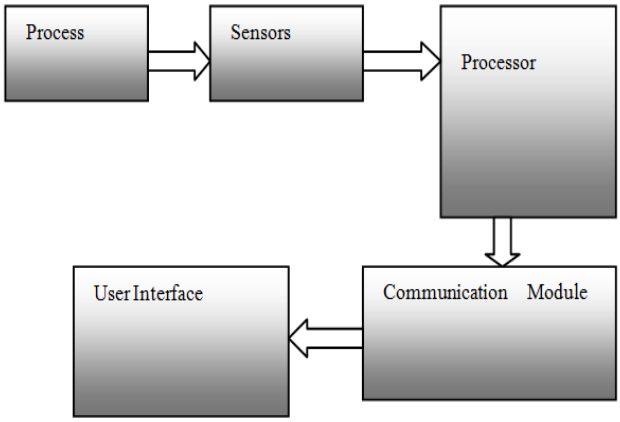

Fig. 2.1 Data logging process

The graphical user interface used is Lab VIEW which is a system, designed that makes us envision every aspect of our application using the graphical programming. The graphical programming language, 'G' of Lab VIEW is modular which its distinctive attribute is. Lab VIEW is mostly preferred due to its benefit of previewing the historical data anytime.

III. PREVIOUS WORK

The detailed concept of logging is described by Dr. Saul Greenburg [8]. Events are recorded using data loggers in the data logging process. The major advantage of using logging system is that they do not interfere with other usability methods when they perform their respective tasks.

Judy Ritchie [6] has compared various data loggers. A data logger is an electronic instrument that continuously records the input quantities (temperature, voltage, relative humidity, pressure, light intensity, and events) over a period. Usually, the data loggers are small, and are powered by battery that are consists of a microcontroller, data storage and a suitable sensor.

IV. PROPOSED METHODOLOGY

Data Logger is an electronic device that automatically records, scans and retrieves the data with high speed and greater efficiency during a test or measurement, at any part of the plant with time[9].

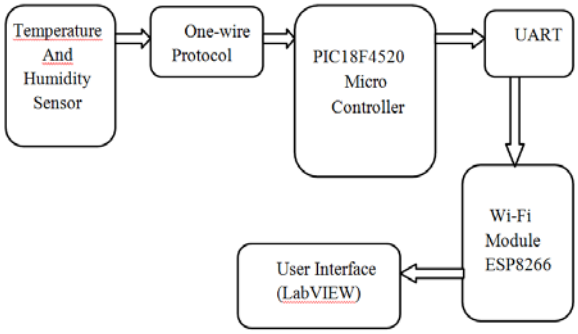

Fig. 4.1 Conceptual Diagram of Precision Data Logging System using Lab VIEW

1. *Sensors:*

Temperature and Relative humidity data is collected from the respective sensors. For temperature sensing, we will be using DS18B20 which implies simplified single-bus communication has four pins, VCC, Ground, data pin, NC pin which has no use. For communication only the data pin is used. For sensing relative humidity, DHT11 sensor is employed. It uses resistive component for measuring relative humidity. Ton, Toff pulses are decoded as start pulse or end of a frame. These sensors transfer data using one wire protocol. The intruder detection alert is also implied here so as to know the presence of anybody in that area if that area is restricted for access. This is done by using PIR sensor that is used to sense motion, and to detect whether a human has moved in or out of the sensors range. It consists of two slots, each slot is made up of a special material that is sensitive to IR. When the sensor is idle, both slots detect the same ambient amount radiated from the room or walls or outdoors. The first interception of one half of the PIR sensor is caused when a warm body like a human or animal passes by, which causes a positive differential change between the two halves. And the opposite happens when the body moves away from the sensing area, causing the sensor to generate negative differential change. These changes of pulse are what are detected as intrusion. The lens that condenses light is Fresnel lens, providing a larger range of IR to the sensor.

2. Single wire Protocol:

One wire protocol uses single wire interface for data communication between the devices. It uses master and slave configuration in which single slave or multiple slaves are interfaced with single master on the bus. In order to enable the smooth communication between the sensors and the processor, we will need 5k-10k pull up resistor to keep the data line high. All the output pins should be connected to weak pull up resistor which must be open drain. When any one device drives it low, the bus will have low state. The transfer of data occurs between two devices when others are in IDLE state. As the device uses external power, it will be requiring pull up values 10K or higher for minimum data rate with less trace length and requires pull up less than 1K for maximum data rate with long trace length.

3. Microcontroller and UART:

The data is then forwarded to PIC18F4520 Microcontroller which has 10 bit ADC inbuilt with 13 channels consisting one timer of 8-bit and 3 timers of 16-bit.It has processing speed of 100k samples/second. The UART pin Of PIC 18F4520 is used for communication purpose. Some devices works on TTL logic where we have taken out 4 pins for connection-VCC, Ground, Tx, Rx. While some devices work on RS logic, thus we need RS232 for voltage compatibility which is also a 4 pin connector. So we are using UART1 and UART0. But UART0 is used specifically for downloading the code from Flash magic, so it is connected to RS232.

4. Wi-Fi Module:

The Wi-Fi module ESP8266 is used to transfer the respective data to other devices. This modules has a default firmware loaded into it, hence we can program the module using AT commands. These commands are sent through a serial communication channel. This channel is established between

the PIC and the ESP8266 module by using the USART module in the PIC microcontroller**.**

5. User Interface:

The Measured Data is displayed with the help of graphical user interface LabVIEW. This software is able to take measurements, formation of report, alarms, and signal analysis. LabVIEW applications consist of a Front Panel and Block Diagram. By using appropriate time delay functions in a while loop, we can acquire data continuously with an interval and plot it to a chart or graph.

V. SIMULATION RESULTS

The Temperature and relative humidity data are displayed on the LabVIEW software in terms of numeric values and graph. The intruder detection is displayed as 1 for presence detected and 0 for no presence.

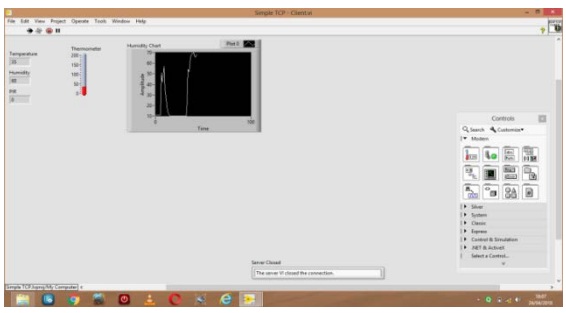

Fig. 5.1 Labview display of Temperature, humidity and intruder alert.

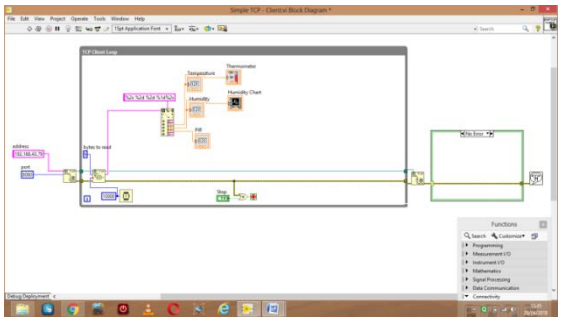

Fig. 5.2 VI for Precision Data logger system.

TABLE 1. MEASURED DATA

Sr. No	Measured Quantities	Event 1	Event 2
1.	Temperature	29 degrees (normal room temperature)	35 degrees (with equipments In ON condition)
2.	Relative humidity	42% (In Normal conditions)	61% (During Monsoon)
3.	Intruder Alert	1 (Intruder detected)	0 (No Intruder detected)

VI. CONCLUSION

We can get a data logger system with low cost and long term stability. Relative humidity and temperature measurement can be done very precisely. The output with excellent quality is achieved. Data logger system having very fast response and reduced time delays can be implemented for industries. System is having strong anti-interference ability. The output signal is transmitted over long distance without loss of any form of information. Digital display of Temperature and relative humidity measurement is done. Precise calibration of the system is achieved.

VII. FUTURE SCOPES

The present system uses 10 bit resolution, but it can be increased by using higher resolution bit ADC's connected externally. Using advanced version of microcontrollers may improve the speed of data transfer with better performance. By modifying software and hardware configurations will facilitate long distance acquisition. Miniaturization of the existing systems can be done by employing surface mount devices i.e. SMD components.

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