

Arm7 Based Data Acquisition System

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Abstract—

In this paper, we concern with designing and implementing multichannel data acquisition system which can be utilized effectively to reduce the human effort and accuracy of measurement of data. The data acquisition system is the base of automation technologies. The traditional signal acquisition systems are mostly by wire, i.e., the sensor connected acquisition system by cable, when measuring point is dispersed and hidden, especially when we control and monitor large complex equipment, it needs a large number of cabling work, and each measurement can only be concentrated in one area, otherwise, it has a very long connection cable, and a long connection cable will introduce a large number of noise and interference. The main aim behind this work is to make the instrumentation stream more power full by enabling it modern communication technologies. Here we are designing Portable Embedded solution which can be fixed to any real time running machines blast furnace, Heater containments etc. The temperature and the time will be formed as a packet and will be transmitted using a RF module.

Keywords: Digitizer, Sensor network, Wireless, Multichannel networking, Acquisition and control, Web attachment.

I. INTRODUCTION

DAQ is defined as the process of taking a real-world signal as input, such as a voltage or current any electrical input, into the computer, for processing, analysis, storage or other data manipulation or conditioning. A physical phenomena represent the real-world signal we are trying to measure. A data acquisition system converts a signal derived from a sensor into a sequence of digital values. The sensor is connected to an amplifier, which converts the signal into a potential. The amplifier is in turn connected to a digitizer, which contains an A/D converter. The digitizer produces a sequence of values representing the signal.

Physical system: In physical system the parameters like temperature, pressure, gas, light plays very crucial role but this parameter are detected by sense only.

Transducer: Transducer is the electronics device which converts one form of energy into another form.

Sensors: Sensors are the primary input element involved in reading physical quantities (such as temperature, force or position) into a DAQ system. They are generally used to measure analogue signals although the term 'sensor' does in fact encompass some digital devices such as proximity switches. In this section we will deal only with sensing analogue signals. Analogue signals can be measured with sensors that generate either analogue or digital representation of the quantity to be measured. The field of data acquisition have a very wide range of activities. At its simplest level, it involves reading electrical signals into a computer from some form of sensor. These signals may represent the state of a physical process, such as the position and orientation of machine tools, the temperature of a furnace or the size and shape of a manufactured component. The acquired data may have to be stored, printed or displayed. Often the data have to be analysed or processed in some way in order to generate further signals for controlling external equipment or for interfacing to other computers. This may involve manipulating only static readings, but it is also frequently necessary to deal with time-varying signals as well. Some systems may involve data to be gathered slowly, over time spans of many days or weeks.

Signal Conditioning:

Many sensors deliver signals that must be transformed before they can be digitized. For example, a microelectrode pipette may be used to measure current, while the digitizer measures potential (voltage). The patch clamp amplifier provides a current-to-voltage amplification, usually measured in mV of output per pA of input. This transformation of the sensor signal is called signal conditioning. Signal conditioning may be more complex. An input signal from a non-linear sensor may be converted to a voltage that is linear in the quantity being measured, compensation may be made for second-order effects such as temperature, or an indirect effect such as a frequency shift may be converted to a voltage.

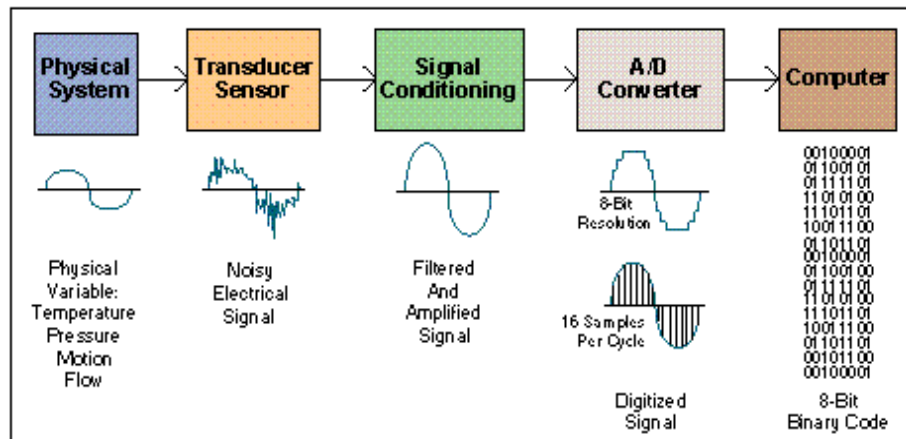


Fig1) Basic block diagram of Data acquisition system

Digitizer:

A digitizer converts one or more channels of analog signal to a sequence of corresponding digital values. The heart of a digitizer is an A/D converter, a device that samples an analog signal and converts the sample to a digital value. For example, for recording from a single ion channel, the digitizer might determine the output of the patch clamp amplifier once every 50ms and provide the resulting value to the computer

II. BLOCK DIAGRAM

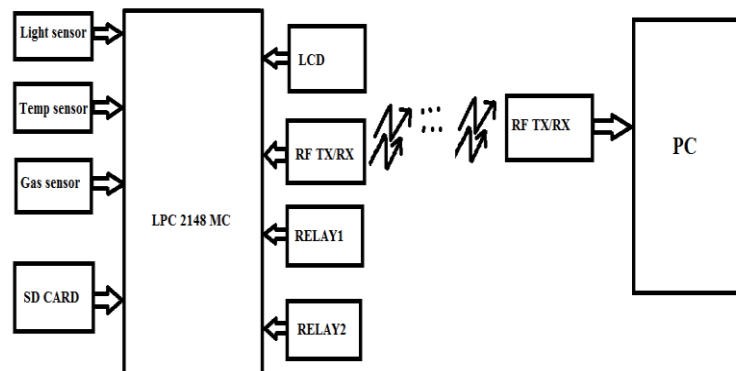


Fig2) Block diagram of Data acquisition system

RF is the wireless transmission of data by digital radio signals at a particular frequency. RF communication works by creating electromagnetic waves at a source and being able to send the electromagnetic waves at a particular destination. These electromagnetic waves travel through the air at near the speed of light. The advantages of a RF communication is it is wireless, you don't have to use cable. Cable is expensive, less flexible than RF coverage and is prone to damage. It provides extensive hardware support for packet handling, data buffering, burst transmissions, clear channel assessment, and link quality.

The three sensor Temperature, gas, light sensors are interfaced to microcontroller LPC 2148 along with LCD and two relay for controlling operation. Also a SD card is interfaced to microcontroller to save data when network is disconnect and transferred later when problem solved. The second RF module is connected to a pc using DB9 connector.

III. HARDWARE IMPLEMENTATION

The basic block diagram of the ARM based data acquisition system is shown in Figure 1. This project implements a Data Acquisition System with RF Networking capability using ARM microcontroller. It implements an interface to a gas sensor, and a 2.4 GHz RF Transceiver. The Gas level in the area will be continuously monitored via the gas sensor. The gas levels will be logged at predefined intervals and will be transferred to the main station via the wireless link. As long as the gas level is within set limits no action signal would be raised. As soon as the level increases beyond the set limits, an signal would be raised, optionally a valve can be operated which will cut off the gas supply for the specific area.

Also the temperature from surrounding monitored via temperature sensor. The temperature level will be logged at predefined intervals and will be transferred to the main station via the wireless link. If the temperature level

cross the limit, relay controls the accessories device. Also light sensor is used to sense light intensity, if intensity is less than the limit the light will automatically on.

GAS sensor (MQ-6): MQ- series are available for various gas sensing. But MQ-6 is a sensor designed for the sensing of LPG, propane, butane.

Temperature Sensor: The temperature sensor which could give a proper linear output of sensed temperature of the location for monitoring and controlling.

Light sensor: Also light sensor is used to sense light intensity.

The three sensor Temperature, gas, light sensors are interfaced to microcontroller LPC 2148 along with LCD and two relay for controlling operation. Also a SD card is interfaced to microcontroller to save data when network is disconnect and transferred later when problem solved. The second RF module is connected to a pc using DB9 connector.

IV. SOFTWARE IMPLEMENTATION

The software section is composed of four software involved namely PROTEUS 7.6, KEIL μ VISION, FLASH MAGIC, MICROSOFT VISUAL STUDIO 2008.

PROTEUS 7.6: Many CAD users dismiss schematic capture as a necessary evil in the process of creating PCB layout but we have always disputed this point of view. With PCB layout now offering automation of both component placement and track routing, getting the design into the computer can often be the most time consuming element of the exercise. And if you use circuit simulation to develop your ideas, you are going to spend even more time working on the schematic. ISIS has been created with this in mind. It has evolved over twelve year research and development and has been proven by thousands of users worldwide. The strength of its architecture has allowed us to integrate first conventional graph based simulation and now - with PROTEUS VSM - interactive circuit simulation into the design environment. For the first time ever it is possible to draw a complete circuit for a micro-controller based system and then test it interactively, all from within the same piece of software. Meanwhile, ISIS retains a host of features aimed at the PCB designer, so that the same design can be exported for production with ARES or other PCB layout software. For the educational user and engineering author, ISIS also excels at producing attractive schematics like you see in the magazines. It provides total control of drawing appearance in terms of line widths, fill styles, color and fonts. In addition, a system of templates allows you to define a 'house style' and to copy the appearance of one drawing to another.

KEIL μ VISION: μ Vision3 is an IDE (Integrated Development Environment) that helps you write, compile, and debug embedded programs. It encapsulates the following components:

- A project manager.
- A make facility.
- Tool configuration.
- Editor.
- A powerful debugger.

μ Vision3 adds many new features to the Editor like Text Templates, Quick Function Navigation, Syntax Coloring with brace highlighting, Configuration Wizard for dialog based startup and debugger setup.

FLASH MAGIC: NXP Semiconductors produce a range of Microcontrollers that feature both on-chip Flash memory and the ability to be reprogrammed using In-System Programming technology. Flash Magic is Windows software from the Embedded Systems Academy that allows easy access to all the ISP features provided by the devices.

These features include:

- Erasing the Flash memory (individual blocks or the whole device)
- Programming the Flash memory
- Reading Flash memory
- Performing a blank check on a section of Flash memory
- Reading the signature bytes
- Reading and writing the security bits
- Direct load of a new baud rate (high speed communications)
- Sending commands to place device in Boot loader mode

Flash Magic provides a clear and simple user interface to these features and more as described in the following sections. Under Windows, only one application may have access the COM Port at any one time, preventing other applications from using the COM Port. Flash Magic only obtains access to the selected COM Port when ISP operations are being performed. This means that other applications that need to use the COM Port, such as debugging tools, may be used while Flash Magic is loaded.

MICROSOFT VISUAL STUDIO 2008: It is a VB .NET which helps in programming and generating the required GUIs for enhancing results.

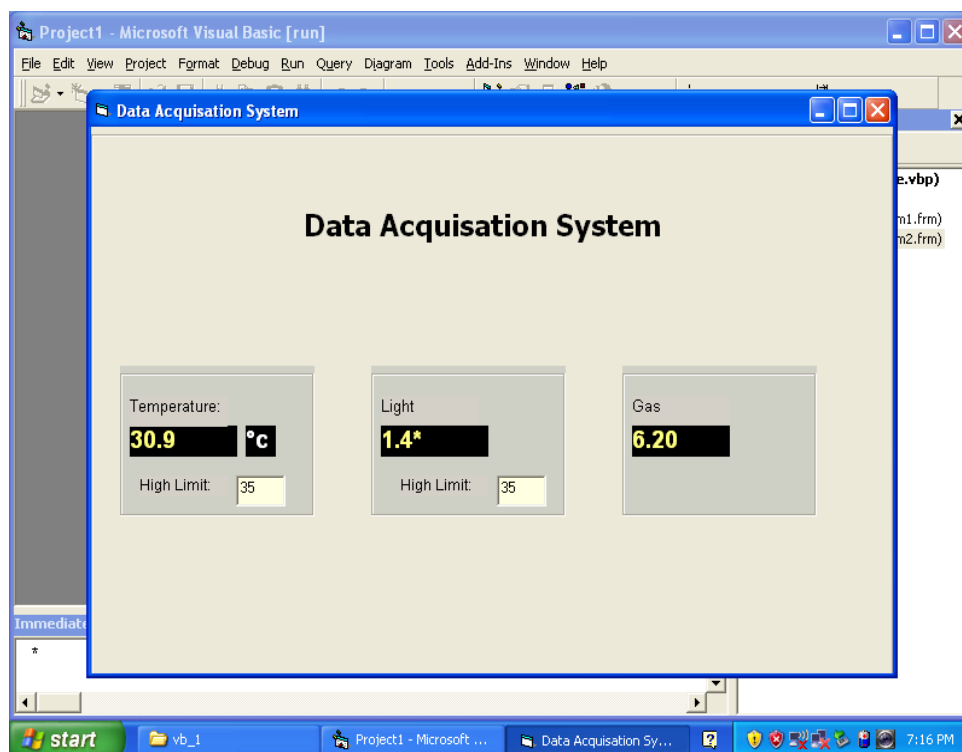
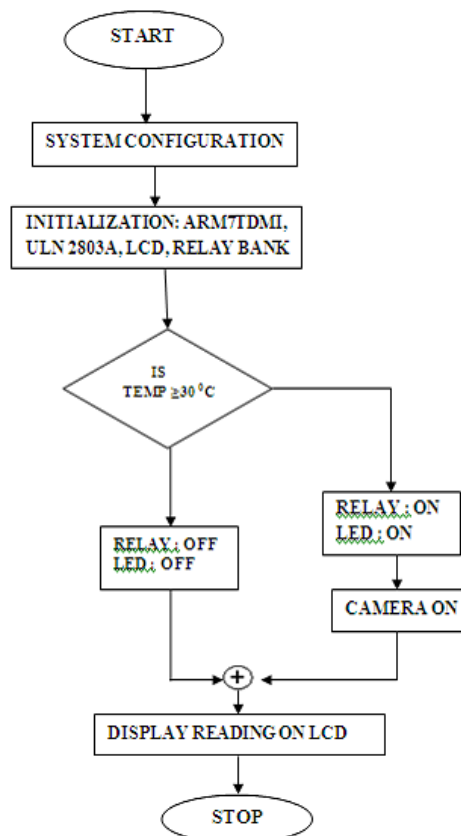


Fig) Window of VB software

PC acquires the data from transmitter and display it on visual basic software, the higher and lower limit can be changed through VB software and controlling and monitoring action can be taken by PC via RF module.

V. FLOWCHART



VI. ADVANTAGES

1. Can use hazardous/remote areas where life is at risk.
2. High data reliability.
3. Support for multiple network topology
4. Transmission range available upto 1.6 km
5. Lower power consumption with battery life ranging from months to year
6. Highly reliable cost effective ,and compact in size
7. Independent of line of sight communication
8. Simple to install and easy to maintain. It helps to monitor and control the parameters in a place where human inference is difficult.
9. No need of any technical person for control or monitoring.
10. Number of parameters can be added in the system as we have used ARM7.

VII. APPLICATION

1. DAS generally used in Automation control system
2. Temperature monitoring and pressure measurement.
3. Water level management in liquid tanks.
4. Weather forecasting.
5. Light controlling system.
6. The system helps the user to get the efficient and cost effective system for monitoring and controlling hazardous gas like LPG

VIII. RESULT AND CONCLUSION

Here in our project we have designed a wireless data acquisition system using LPC2148 microcontroller and RF module. Data Acquisition is a portable acquisition system of humidity and temperature data. The system can be connected with host by RF module interface and process humidity, temperature and other data. The DAS is an invaluable tool to collect and analyse experimental data, having the ability to clearly present real time results, with sensors and probes able to respond to parameters that are beyond the normal range available from most traditional equipment. The system helps the user to get the efficient and cost effective system for monitoring and controlling hazardous gas like LPG. It helps to monitor and control the parameters in a place where human inference is difficult. No need of any technical person for control or monitoring. Number of parameters can be added in the system as we have used ARM7.

There exists a scope for further improvement in its speed, number of channels, power consumption, and PC interface software for post data analysis.

Also for any illegal action and in natural calamity the data or message can be send to each and every worker for their safety.

GSM communication performed almost data transfer from sensor at remote area was executed without incidents. Since all communication between DAS and user are wireless based, this translates into lowest cost compared to all others system. In this project all the database is stored in a central database in the DAS; user has global access to consolidate data from many system or locations.

Wireless based solutions have universally accepted, familiar and user friendly system. Real-time logging would allow warnings to be flagged to the relevant personnel (e.g. an SMS warning message to the supervisors) and allow corrective action to be taken before the quality and value of the catch is degraded

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