Four-Channel Universal Wireless Data Logger For Hazardous Processes

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Abstract—A PIC Microcontroller based Wireless data logger has been designed through which we can measure & monitor different parameter like temperature, pressure, voltage etc in different hazardous processes. The main aim of this research work is to prevent major industrial accident & to prevent unwanted releases of hazardous chemical, in order to avoid different tragedies taking place.

Keywords: Universal wireless data logger, PIC24F128GA010, hazardous process.

I. INTRODUCTION

India has witnessed several devastating fires, explosions of toxic releases which not only claimed life of 100's of employees worker but also huge property of capital loss. Two most destructing & breath-taking examples of hazardous processes & gas leakages are one happen in Nagothane (Maharashtra) on 6th November 1990, due to improper handling & sealing of tanks, leakage of Ethane & Propane gas occurred which took life of more than 30 employees & the other was Bhopal gas Tragedy (3rd, December 1984) that happen due to toxic release of Methyl Isocyanate, about 500 people were charred to death.

Hence by developing a data logger we have taken sincere efforts to prevent the hazardous processes taking place in several industries & chemical laboratories. The data logger is generally portable, and has internal memory for data storage purpose and equipped with different sensors. One of the primary benefit of using data logger is its ability to automatically collect data on a continuous basis.

The rest of this paper is organized as follows. Section II presents literature survey. Section III will give an overview of methodology inculcated along with block diagram.. Section IV will be the implementation part. Section V emphasizes on results of our implementations. Section VI provides conclusions and future scope.

II. LITERATURE SURVEY OF DATA LOGGER SYSTEM

Thompson, et al. [1] have described the development of low cost , very low power consumption, self-contained digital data logger capable of independent operation for long period of time. In **[2]** the authors have designed a data acquisition system that transferred logged data by the DAQ system to personal computer, which is responsible for data storage and signal analysis. The concept of logging and how logging is done is described in **[3] by Greenburg**. **Kalsi [4]** has detailed the concept of data loggers and its basic operation is described. A data logger is a comprehensive and highly advanced data acquisition system. **Roberson [5]** has reviewed the use of data loggers. . The data logger can be of enormous benefit to allow for improvements in time efficiency, clear presentation of data to allow easier analysis and interpretation, difficult data rapidly displayed to allow clear visual

interpretation of relationship between variables. **Mazidi, et al. [6]** discussed the overview of PIC microcontroller. Microcontrollers and microprocessors are widely used in embedded system products. **Castaneda, et al. [7]** described a microcontroller-based data logging system to record temperature and relative humidity for acoustic measurement applications. **Badhiye, et al. [8]** have discussed that data loggers are based on digital processor. **Krishnamurty, et al. [9]** have discussed a microcontroller-based portable GSR data logger for physiological sensing.

III. METHODOLOGY

A. Block Diagram
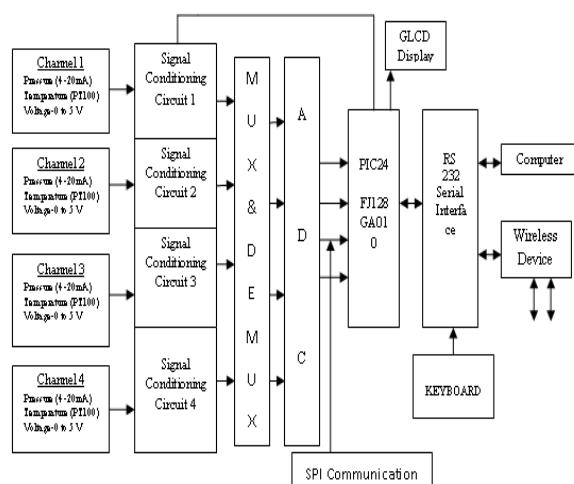
Data Loggers are based on digital processor. It is an electronic device that record data over the time in relation to location either with a built in instrument or sensor or via external instruments and sensors. Data Logger can automatically collect data on a 24-hour basis, this is the primary and the most important benefit of using the data loggers.

The data logger unit consists of:
- Four channels with physical parameters which are to be measured.
- Signal conditioning circuit for respective input parameters
- Multiplexers and de-multiplexers for selecting any one channel out of four
- Analog-to-digital Converter,
- Microcontroller (PIC24),

- Graphical LCD, Keypad & RS232 serial interface module for serial communication with computers or wireless devices.

The main purpose of this project is to measure physical parameters like pressure & temperature, calibrate them with standard specification in order to avoid destructions of any work unit in industries or chemical laboratories.

At very first physical parameters like pressure, temperature, voltage, & current are sensed using different sensors. After sensing these parameters they are fed to the signal conditioning circuit which manipulates the incoming input signal in such a way that meets requirements of the next stage for further processing.

Now a multiplexer is used to select one of parameter from the four channel as per the user's choice. The working of multiplexer & signal conditioning circuit is controlled by the PIC24 controller. For the user to enter his choice, we will be using a touch pannel that will be interfaced to the microcontroller externally. By using touch pannel the user will enter their choice. The user entered data is given to the microcontroller. According to user's entered choice the corresponding parameters selected by multiplexer will be converted into digital form using analog to digital converter.

Now using the concept of SPI serial communication the output of ADC will be stored in the memory of controller for further usage. Since the project deals with wireless communication using RS232 interface the digital values of physical parameters stored in memory will be transmitted to the intended receiver unit or computer using Zigbee or GPRS module.

B. Software Description

MPLab:

MP Lab is a proprietary freeware integrated development environment for the development of embedded applications on PIC and dsPIC microcontrollers, and is developed by Microchip Technology.

MP Lab supports the following compilers:

- MPLAB MPASM Assembler
- MPLAB ASM30 Assembler
- MPLAB C Compiler for PIC18
- MPLAB C Compiler for PIC24

MPLab X:

MPLAB X is the latest version of the MPLAB IDE built by Microchip Technology, and is based on the open-source NetBeans platform.

MPLAB X supports the following compilers:

- MPLAB XC8 — C compiler for 8-bit PIC devices
- MPLAB XC16 — C compiler for 16-bit PIC devices
- MPLAB XC32 — C/C++ compiler for 32-bit PIC devices
- HI-TECH C — C compiler for 8-bit PIC devices
- SDCC — open-source C compiler

OrCAD:

OrCAd is a proprietary software tool suite used primarily for electronic design automation (EDA). The software is used mainly by electronic design engineers and electronic technicians to create electronic schematics and electronic prints for manufacturing printed circuit boards.

Channel No.	Input voltage applied to the channel(in Volts)	Measured output voltage at the channel(in Volts)
Channel 0	3.1	3.10
Channel 1	3.1	3.11

Channel No.	Set Value of pressure using WIKA pressure transmitter (in BAR)	Observed Value of Pressure (in BAR)
Channel 0	9.3	9.33
Channel 1	9.3	9.32

IV. IMPLEMENTATION

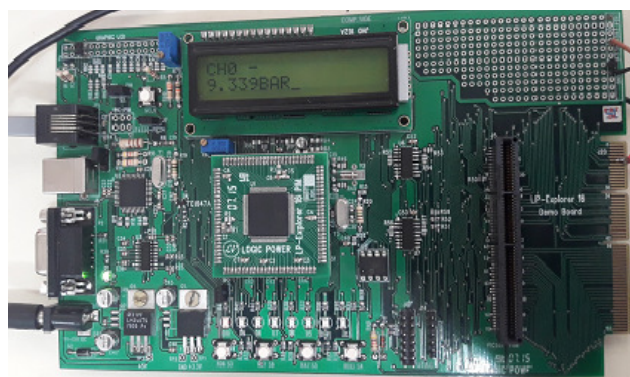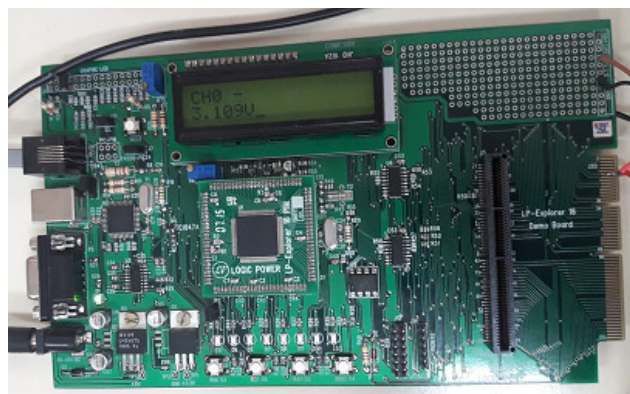We have implemented and simulated the design of data logger system using OrCAD software.
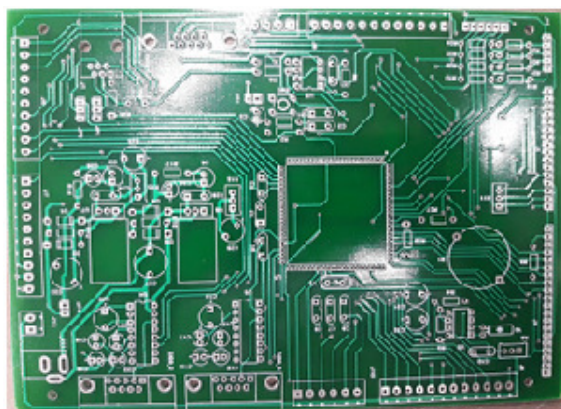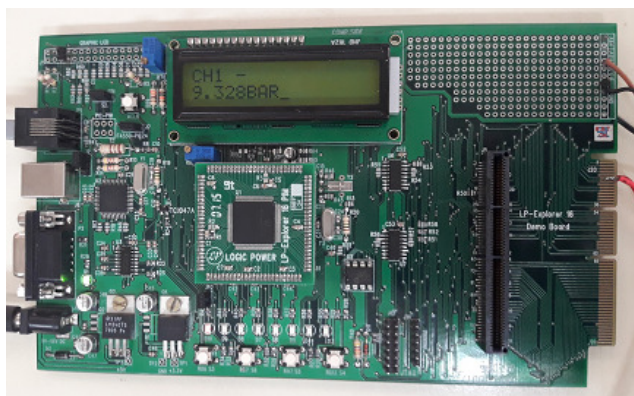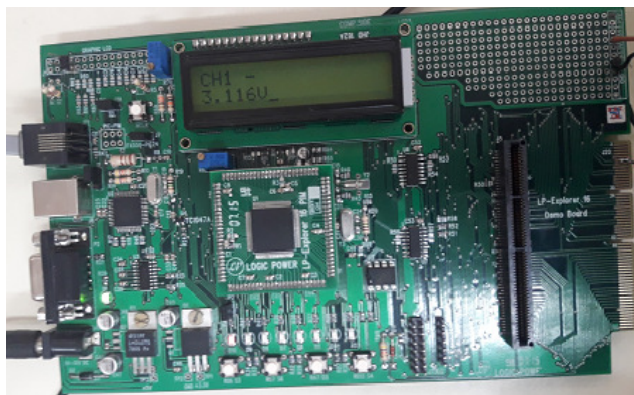

V. RESULTS

On the internal analog to digital converter of microcontroller we have observed the voltage and pressure input applied and the corresponding outputs using logic power Explorer 16 board.

VI. CONCLUSION AND FUTURE SCOPE

A data logger is a portable data acquisition system and an invaluable tool used to collect and analyze experimental data, having the ability to clearly present real time results. We have designed this system to continuously monitor the chemical processes taking place in chemical industries and to store the measured data for future use so as to avoid industrial hazards. This system can also be implemented in ammunition factories and defence applications.

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