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Information Fusion Performance Monitoring System with Zigbee Communication

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Abstract: The system has the higher degree of electrical automation of electric equipment, and puts forward higher request for monitoring the intelligent control and parameter measurement precision, and puts forward new requirements for man-machine interface, data processing, network communication and the logical aspects. In electrical automatic on-line monitoring field of embedded system, the ARM has great advantage in multi-parameter acquisition multi-level monitoring and networking. But the only fly in the ointment was that part of the ARM couldn't directly connected with the Internet system, and it causes the inconvenience of remote monitoring system, aiming at the actual needs of the electrical equipment monitoring process control, and displaying results in chart format. This paper uses the ARM embedded technology and information fusion technology, designing a kind of high cost performance of electrical equipment monitoring system.

Keywords: ARM, Monitoring System, Cost Performance.

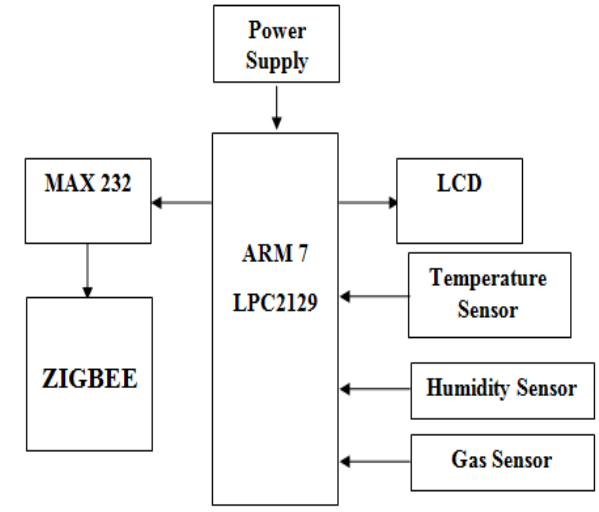
I. INTRODUCTION

In the existing system, the automation system is based on low speed processors and there is no remote monitoring and it is based on wired communication. Low speed is not useful always. There are many places where speedy acquisition becomes vital. In the proposed system, a Microcontroller based on ARM7 architecture is used. The Microcontroller is LPC2129. The sensors such as temperature, Gas and humidity are interfaced to the Microcontroller. These values are measured and the measured values are transmitted to the monitoring section through Zigbee protocol. The received values in PC are uploaded in the internet. Since ARM processors are high speed processors the speed of operation is very faster that it becomes very helpful in real time.

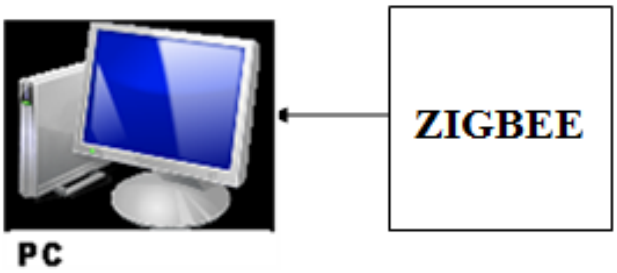
II. LIST OF MODULES

Module1: Power Supply and ARM Processor.
Module2: Temperature Sensor.
Module3: Humidity Sensor.
Module4: Gas Sensor.
Module5: Liquid Crystal Display.
Module6: Max232.
Module7: Zigbee.

Block Diagram



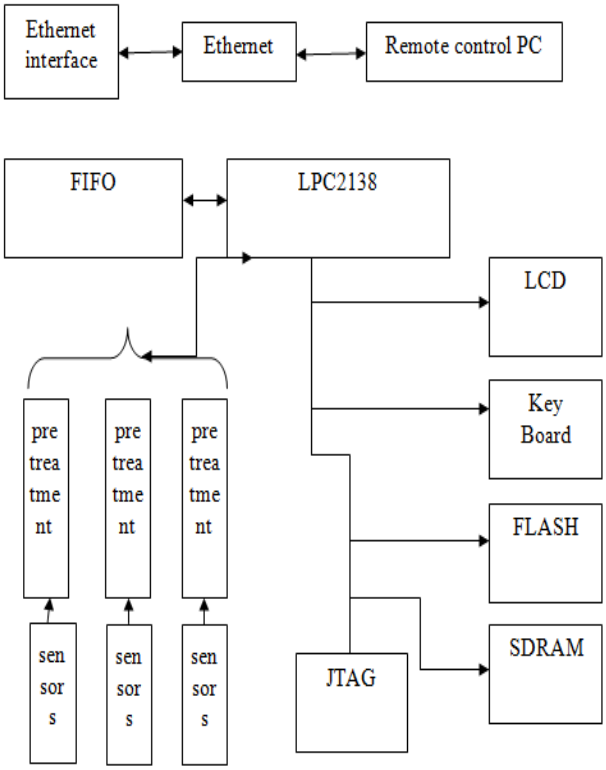
Monitoring section



Figur1. Block Diagram.

III. THE DESIGN OF HARDWARE SYSTEM

This system based on the ARM high-performance processor realizes data pressing function, it can reduce the operation pressure of data reduction, through the use of high-speed embedded, processors, it improve the real-time monitoring and optimize the performance of system. Figure is the overall structure. This system mainly consists of ARM processor LPC2138module, storage module FIFO. Ethernet interface module DM9000A, information pretreatment module and keyboard and display module system adopts ARM processor with A/D converter and timer cycle to cycling collect signal, in data processing part, processor ARM will be part of data input, real-time displaying sensor state information and doing corresponding processing, and then conducting data fusion analysis, and transferring fusion results to remote monitoring PC through the Ethernet interface.



Figur2. System Hardware Design.

A. ARM7 Processor (LPC2138)

The ARM7TDMI-S is a general purpose 32-bit microprocessor, which offers high performance and very low power consumption. The ARM¤ architecture is based on Reduced Instruction Set Computer (RISC) principles, and the instruction set and related decode mechanism are much simpler than those of micro programmed Complex Instruction Set Computers. This simplicity results in a high instruction throughput and impressive real-time interrupt response from a small and cost-effective processor core. Pipeline techniques are employed so that all parts of the processing and memory systems can operate continuously. Typically, while one instruction is being executed, its successor is being decoded, and a third instruction is being fetched from memory. The ARM7TDMI-S processor also employs a unique architectural strategy known as Thumb, which makes it ideally suited to high-volume applications with memory restrictions, or applications where code density is an issue. The key idea behind Thumb is that of a super-reduced instruction set. Essentially, the ARM7TDMI-S processor has two instruction sets:

- The standard 32-bit ARM set.
- A 16-bit Thumb set.

The Thumb set os 16-bit instruction length allows it to approach twice the density of standard ARM code while retaining most of the ARMÕs performance advantage over a traditional 16-bit processor using 16-bit registers. This is possible because Thumb code operates on the same 32-bit register set as ARM code. Thumb code is able to provide up to 65 % of the code size of ARM, and 160 % of the Performance of an equivalent ARM processor connected to a 16-bit memory system.

B. Max232

The MAX232 is an IC, first created by Maxim Integrated Products, that converts signals from an RS-232 serial port to signals suitable for use in TTL compatible digital logic circuits. The MAX232 is a dual driver/receiver and typically converts the RX, TX, CTS and RTS signals. The drivers provide RS-232 voltage level outputs (approx. ± 7.5 V) from a single + 5 V supply via on-chip charge pumps and external capacitors. This makes it useful for implementing RS-232 in devices that otherwise do not need any voltages outside the 0 V to + 5 V range, as power supply design does not need to be made more complicated just for driving the RS-232 in this case. The receivers reduce RS-232 inputs (which may be as high as ± 25 V), to standard 5 VTTL levels. These receivers have a typical threshold of 1.3 V, and a typical hysteresis of 0.5 V.

C. Zigbee

ZigBee is a wireless technology developed as an open global standard to address the unique needs of low-cost, low-power, wireless sensor networks. The standard takes full advantage of the IEEE 802.15.4 physical radio specification and operates in unlicensed bands worldwide at the following frequencies: 2.400–2.484 GHz, 902-928 MHz and 868.0–868.6 MHz.

1. The power levels (down from 5v to 3.3v) to power the zigbee module.
2. The communication lines (TX, RX, DIN and DOUT) to the appropriate voltages.

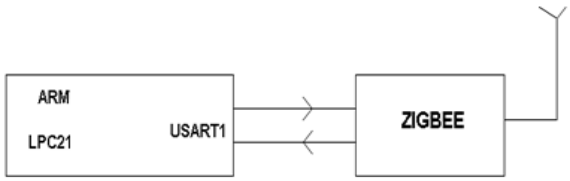


Figure3.

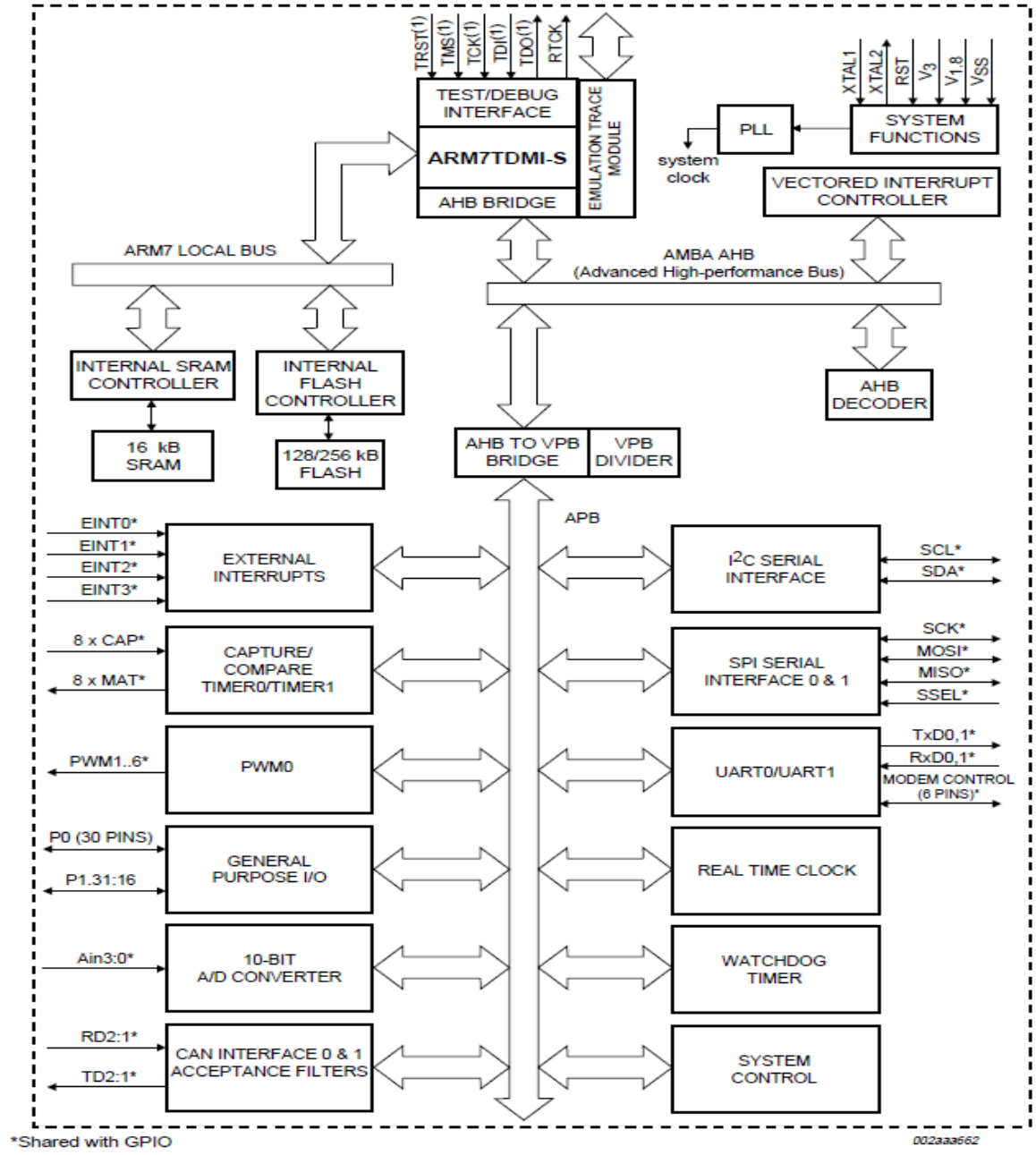
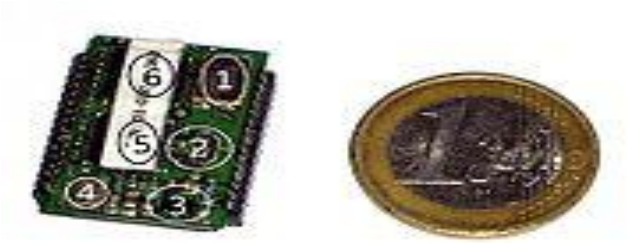


Figure4.

The Zigbee module acts as both transmitter and receiver. The Rx and Tx pins of ZIGBEE are connected to Tx and Rx of 8051 microcontroller respectively. The data's from microcontroller is serially transmitted to

Zigbee module via UART port. Then Zigbee transmits the data to another Zigbee. The data's from Zigbee transmitted from Dout pin. The Zigbee from other side receives the data via Din pin.



ZigBee module. The €1 coin, shown for size reference, is about 23 mm in diameter. ZigBee is a specification for a suite of high level communication protocols using small, low-power digital radios based on the IEEE 802.15.4-2003 standard for wireless personal area networks (WPANs), such as wireless headphones connecting with cell phones via short-range radio. The technology defined by the ZigBee specification is intended to be simpler and less expensive than other WPANs, such as Bluetooth. ZigBee is targeted at radio-frequency (RF) applications that require a low data rate, long battery life, and secure networking.

Figure5.

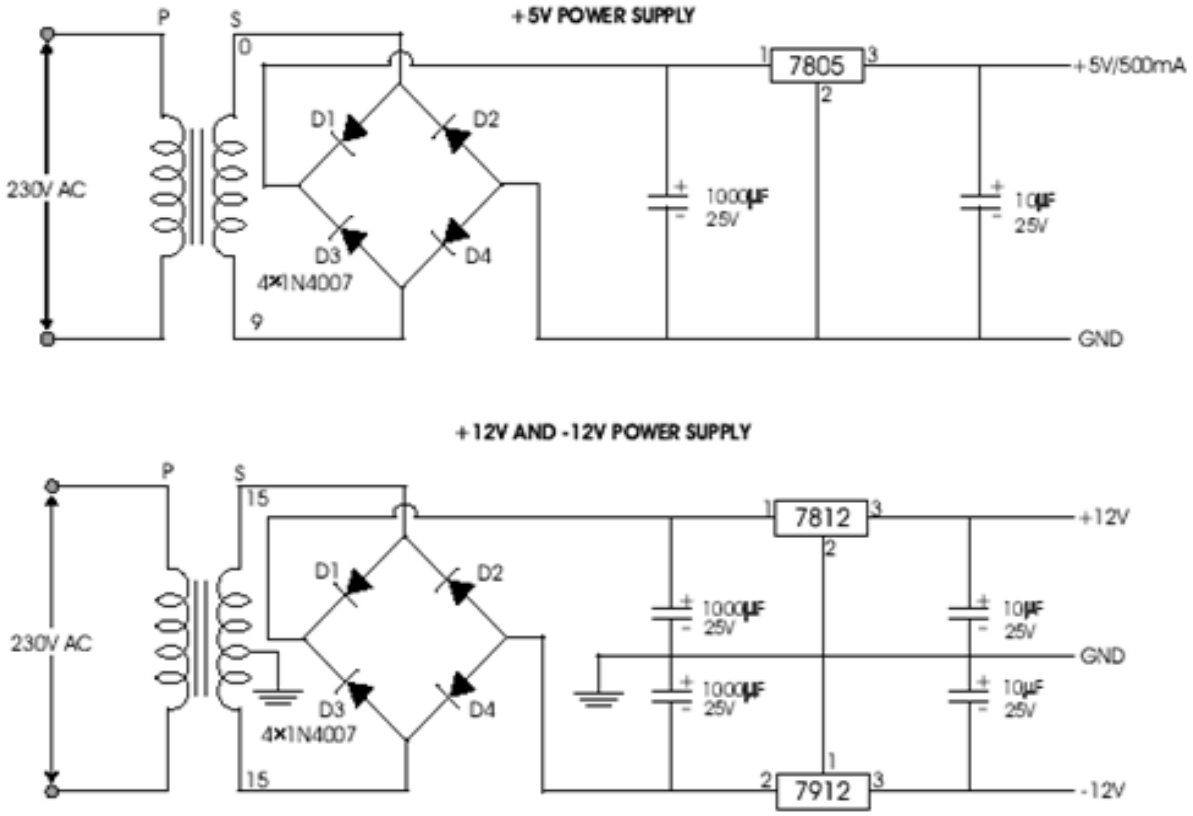


Figure6.

D. IC voltage regulators

Voltage regulators comprise a class of widely used ICs. Regulator IC units contain the circuitry for reference source, comparator amplifier, control device, and overload protection all in a single IC. IC units provide regulation of either a fixed positive voltage, a fixed negative voltage, or an adjustably set voltage. The regulators can be selected for operation with load currents from hundreds of milli amperes to tens of amperes, corresponding to power ratings from milli watts to tens of watts.

The series 78 regulators provide fixed positive regulated voltages from 5 to 24 volts. Similarly, the series 79 regulators provide fixed negative regulated voltages from 5 to 24 volts.

- For ICs, microcontroller, LCD --------- 5 volts.
- For alarm circuit, op-amp, relay circuits ------ 12 volts.

III. SYSTEM SOFTWARE DESIGN

The software is designed to be easy to develop on small, inexpensive microprocessors. The radio design used by ZigBee has been carefully optimized for low cost in large scale production. It has few analog stages and uses digital circuits wherever possible. Even though the radios themselves are inexpensive, the ZigBee Qualification Process involves a full validation of the requirements of the physical layer. This amount of concern about the Physical Layer has multiple benefits, since all radios derived from that semiconductor mask set would enjoy the same RF characteristics. On the other hand, an uncertified physical layer that malfunctions could cripple the battery lifespan of other devices on a ZigBee network. Where other protocols can mask poor sensitivity or other esoteric problems in a fade compensation response, ZigBee radios have very tight engineering constraints: they are both power and bandwidth constrained. Thus, radios are tested to the ISO 17025 standard with guidance given by Clause 6 of the 802.15.4-2006 Standard. Most vendors plan to integrate the radio and microcontroller onto a single chip.

A. User application design

This is mainly the multi-sensor information fusion algorithm procedures, it can be written in C downloaded to ARM according to relevant principles. Information fusion is a variety of sources, such as sensors, knowledgebase, database and human itself access relevant information, which are filtered, correlated and integrated, forming a framework, the framework is suitable to obtain relevant decisions, such as information's explanation, achieving the system target (such as identification, tracking or situation assessment), sensor management and control system etc. Mathematical tools function of information fusion is most basically and multiple, it make all input data, which will be described effectively, in a public space, and finally these data's will be properly integrated and be in properly form to output and perform.. In the field of information fusion, the mathematical tools or methods are mainly probability, reasoning network, fuzzy theory and neural network etc.

B. Performance monitoring section

The performance monitoring of the system will be taken with the help of software and monitoring section. The LCD display will display the results time to time. The zigbee module will transfer the data. From the receiving zigbee module we can take the values with the help of heper Terminal of the receiving system. From The hyper terminal we can see the updated results. If we want to store the values we can connect to the front end application (Dot Net) and we store those values in database.

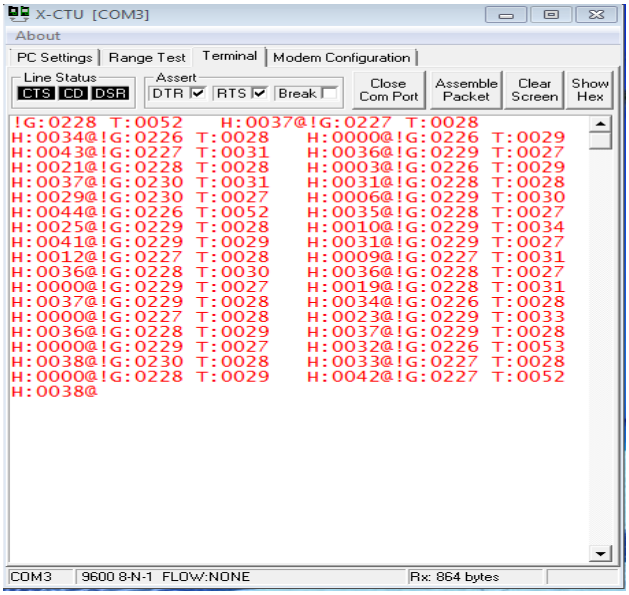


Figure7. Displaying Section: the results will be shown in Figure8.

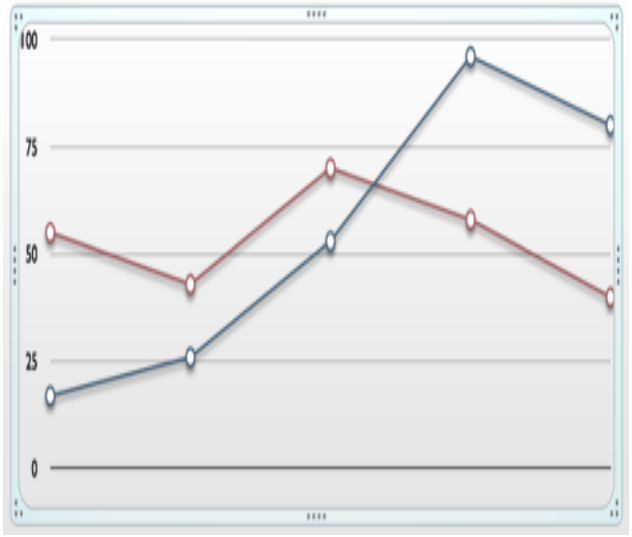


Figure8.

IV. CONCLUSION

The system is designed for monitoring the information fusion. By using this system we can monitor the data remotely. Any obstacles that can occur we can identify easily. The communication using this system is easy.

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