

Distributed Industrial Process Control Using AT90CAN64

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Abstract : Process control is an engineering discipline that deals with different types of mechanism for the output of a specific process with in a desired range. The CAN bus facilitate to provide new ways of safety and how to make use of that in industry machines, which will minimize the differences in temperature, moisture and pressure. So it will give flexibility and convertibility. This work presents the application of CAN bus (AT90CAN64) in automatic process control.

IndexTerms - CAN, AT90CAN64, AT30TS74, MS8607, Microcontroller, RISC, CISC.

I. INTRODUCTION

Automation process control in Industries greatly reduces the need of human activities and brain requirements. In industry there is a lot of reflections, to be avoided to that we are connecting sensor devices to CAN BUS for detecting the errors and automatically correct the error without manual work. In industrial sector a major advantage of Automation process control is the increased prominence on flexibility and to provide convertibility in the manufacturing process.

The Controller Area Network (CAN) protocol is a widely used serial communication protocol mostly used in various applications like in automotive and industrial platforms. CAN network use a shared bus to connect all nodes in that network. CAN protocol don't employ Master-Slave function in the application. Instead, all nodes have access to the same bus, and bit-wise arbitration of each message is used to determine the priority and avoid bus-collisions. Every message has an exclusive identifier laterally having a priority level. Consider two nodes are trying to access the bus instantaneously, then the message with higher priority will "win" bus access while the message having lower priority will abort. CAN communication protocol widely used in networks which operates on relatively low data rates (1Mbps or less), but very high immunity to EMI and temperature effects. [6,8]

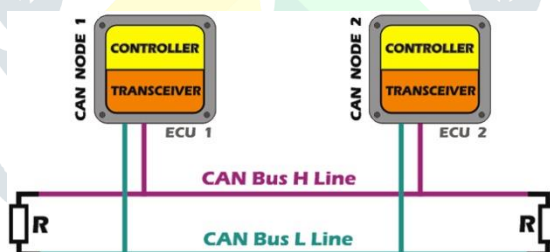


Fig-1-CAN Bus Components

A Microcontroller is usually a silicon chip that contains millions of transistors and other components that process millions of instructions per second integrated with built-in memory and other special purpose chips, and functioned by software. Microcontroller may be classified by their hardware architecture. The most common two basic types of architectures are used based upon instruction set are complex instruction set computer (CISC), and reduced instruction set computer (RISC). CISC based processors can perform complex functions with single instruction while RISC chips usually need multiple instructions. The MCS-family are based on the CISC architecture, while Atmel and PCI family chips are RISC systems. [7,11]

II. APPLICATION OF AT90CAN64 IN AUTOMATION INDUSTRY

The AT90CAN64 is a low-power CMOS 8-bit microcontroller, and its architecture is based on the AVR enhanced RISC architecture. AT90CAN64 executes powerful instructions in a single clock cycle, to achieve high throughputs approximately 1 MIPS per MHz which allows the system designer to optimize power consumption versus processing speed. [5,9]

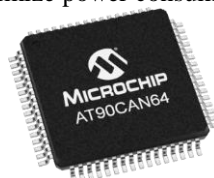


Fig-2- An 8-bit low Power microcontroller AT90CAN64

The AT90CAN64 provides the following features: 64K bytes of In-System Programmable Flash with Read-While-Write capabilities, EEPROM having memory of 2K bytes, SRAM of 4K bytes, 53 general purpose I/O lines, CAN controller, 32 general purpose working registers, four flexible Timer/Counters with compare modes and PWM, Real Time Counter (RTC), a programmable Watchdog Timer with Internal Oscillator, 2 USARTs, a byte oriented Two-wire Serial Interface, an 10-bit ADC having 8-channels with optional differential input stage with programmable gain, an SPI serial port, JTAG test interface of IEEE std. 1149.1 compliant, which can be used for accessing the On-chip Debug system and featured with programming having five software selectable power saving modes.[3,5,7]

The AT90CAN64 AVR is supported with a full suite of program and system development tools which includes C compilers, program debugger/simulators, in-circuit emulators, macro assemblers and evaluation kits.

A. Digital Temperature Sensor using AT90CAN64

The AT30TS74 temperature sensor converts temperatures from -55°C to +125°C to a digital word and provides a typical accuracy of ±1.0°C over the operating temperature range of -20°C to +100°C. The device provides a cost-effective solution with industry level calibration with minimal hardware. In order to reduce the power consumption, the AT30TS74 featured with shutdown mode which switches off all internal circuits excluding internal power on, reset circuit and serial interface circuits. In addition, the device is featured with a power saving one-shot mode which allows the device to make a temperature measurement which will be updated in the temperature register and then system will be directed to shutdown mode. [1,4,13]

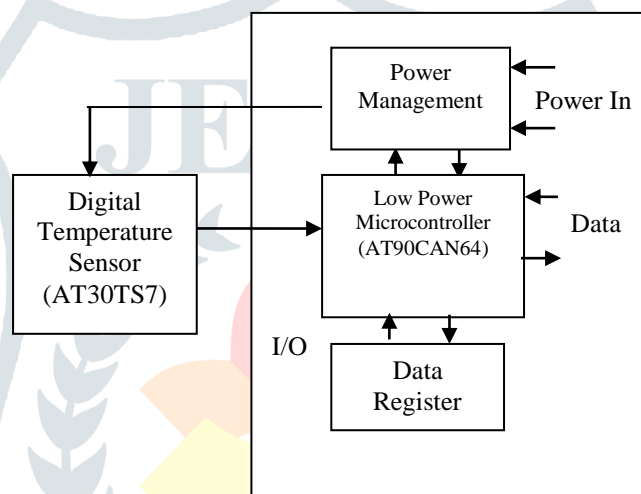


Fig-3 - Digital Temperature Sensor using AT90CAN64 in Automation Industry

In the Fig-3 the digital temperature sensor sense the temperature and after that the microcontroller (AT90CAN64) takes the digital input and it checks either the temperature is equal to the reference temperature or not.[1,2] If the reference temperature is not equal to the measuring temperature then microcontroller send the signal to the user. Then user can change it as per requirement. The data registers are used to store the data. Power management is maintaining the power supply as per the requirement by the devices.

B. Humidity Sensor using AT90CAN64 in Automation Industry

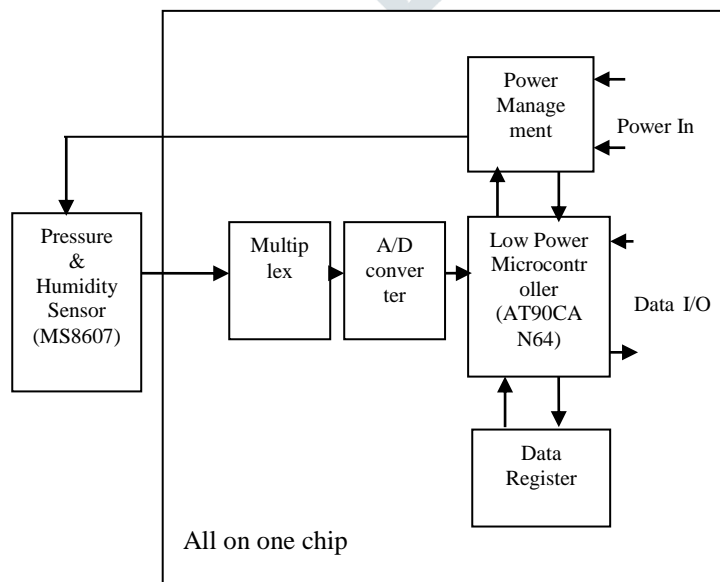


Fig-4-Pressure - Humidity Sensor using AT90CAN64 in Automation Industry

The MS8607 is the world's first combination sensor module that contains a high- performance humidity, temperature, and barometric pressure sensors in a single package. The MS8607 utilizes a patented humidity sensor design, a temperature sensor, a MEMS pressure sensor, and an A/D ASIC to provide very high accuracy and resolution. It is available with a small footprint of 5.0 x 3.0 x 1.0mm³. The I2C interface provides a simple universally acceptable connection scheme. In the Fig-4 the humidity-pressure sensor sense the humidity and pressure and after that any one of the signals can be selected by the multiplexer as per the priority and it is converted to digital by A/D converter. Then the microcontroller (AT90CAN64) takes the digital input and it checks either the humidity or pressure is equal to the set point or not. If not it sends the signal to maintain the set point. The data registers are used to store the data. Power management is maintaining the power supply as per the requirement by the devices. [2, 4, 10, 13]

System Architecture

It is consisting of two parts as transmitter and receiver.

Transmitter side: This side is consisting of three types of sensors such as temperature sensor, Pressure and Humidity sensor. These sensors will collect the response from surrounding machinery and to measure require parameters. The sensor responses are in form of analog signals. On completion of measurement, these analog signals are converted into digital signals and compared with the actual signals. If any difference occurs between the measured and actual signals, then it is considered as emergency. The AT90CAN64 processor plays an important role in controlling all the devices. Optimized for cost and power sensitive applications, the AT90CAN64 provides the low power consumption, small size, and high performance needed in portable, embedded applications. CAN transmitter and receivers connected to ARM these will collect the signals and transfer to the receiver side. [9, 12, 14]

Receiver Side: It is consisting of CAN transmitter and receiver that are used to transfer the error to AT90CAN64. Those values are displayed on the LCD and those values are compared with the actual values and set correct value.

Software Design

This includes the coding of AT90CAN64 processor using embedded c using keil software version and flash magic version for dumping.

Advantages

It provides high level of safety for industries. Easy retrieval of data for the cause of incidents, low cost, reliable because of its error checking mechanism with less time consumption and also less complex system for installing and application. [8]

Conclusion

The microcontroller AT90CAN64 program can be easily modified to different needs of a product line, allowing upgrade in performance with normal redesign. From the above we know that in all the industries there are lot of issues that can be rectify the error with some sensors and AT90CAN64 processor. AT90CAN64 has lot of advantages and even work for all types of industries with less cost and more accuracy. It provides technology platform to the industry for better experiences.

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