Sborník vědeckých prací Vysoké školy báňské - Technické univerzity Ostrava
číslo 2, rok 2007, ročník LIII, řada strojní
článek č. 1573

Petr WOJCIASZYK*

ZIGBEE WIRELESS MODULES WITH SMART SENSORS

ZIGBEE MODULY SE SMART SENZORY

Abstract

This paper deals with intelligent instrumentation in wireless networks. The significant parts are created tasks with the wireless technology. These tasks are formed with the Freescale ZigBee modules 13192-EVB or Microchip modules PICDEM Z. The 13192-EVB module includes RS232 and USB (FTDI chip) interface to connect with the PC, ZigBee chip MC13192 for wireless communication, 8-bit microcontroller MC9S08GT60 with A/D converters, switches and LEDs. Programmed additional subroutines are realized on evolutionary board Axiom AXM-0308 mounted with the Freescale MC9S08GB60 (HCS08). The PICDEM Z module includes RS232 interface to connect with the PC, the additional card with the wireless ZigBee chip CC2420, 8-bit microcontroller PIC18LF4620 with A/D converters, switches and LEDs.

Abstrakt

Příspěvek se zabývá inteligentní instrumentací v bezdrátových sítích. Důležitou částí jsou úlohy s bezdrátovou technologií. Úlohy jsou vytvořeny se ZigBee moduly Freescale 13192-EVB nebo moduly Microchip PICDEM Z. Modul 13192-EVB obsahuje komunikační rozhraní RS232 a USB (obvod FTDI) pro připojení k PC, ZigBee obvod MC13192 pro bezdrátovou komunikaci, 8-bit mikrokontrolér MC9S08GT60 s A/D převodníky, tlačítka a LED diody. Naprogramování přídavných podprogramů je realizováno na vývojové desce Axiom AXM-0308 osazené mikrokontrolérem Freescale MC9S08GB60 (HCS08) nebo na vytvořené s M9S08QG8. Modul PICDEM Z obsahuje komunikační rozhraní RS232 pro připojení k PC, přídavnou kartu se ZigBee obvodem CC2420, 8-bit mikrokontrolér PIC18LF4620 s A/D převodníky, tlačítka a LED diody.

1 INTRODUCTION

Presently is very expressive trend using wireless technology for the network communication. There are some wireless standards. They are mostly under control of Institute of Electrical and Electronics Engineers. Very popular are Wi-Fi (standard 802.11b/g – Wireless Local Area Network) for bigger data transfers, Bluetooth (802.15.1 – Wireless Personal Area Network) for smaller. One of perspective category is ZigBee (802.15.4), determinated for sensor's networks (mostly meshed networks) with many sensors, when they do transmit send only small amounts of data.

Demonstrational tasks contain ZigBee modules Freescale 13192-EVB or Microchip modules PICDEM Z. The module 13192-EVB (fig. 1) include RS232 a USB (FTDI chip) interface to connect to PC, the ZigBee chip MC13192 for wireless communication, 8-bit microcontroller MC9S08GT60 with A/D converters, buttons and LEDs.

* Ing., Department of Control Systems and Instrumentation, Faculty of Mechanical Engineering, VSB-Technical University of Ostrava, 17. listopadu 15, Ostrava, tel. (+420) 59 732 3511, e-mail: petr.wojciaszyk@vsb.cz

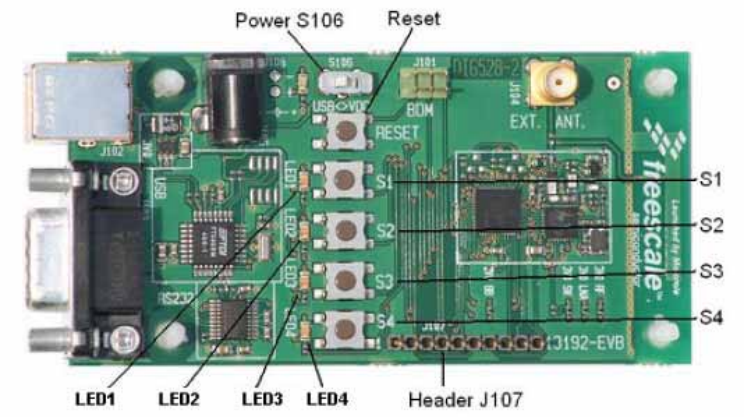


Fig. 1 13192-EVB module

For programming HCS08 microcontroller's applications is the development board Axiom AXM-0308 (fig. 2), which has different communications interfaces, buttons, LEDs or LCD display.

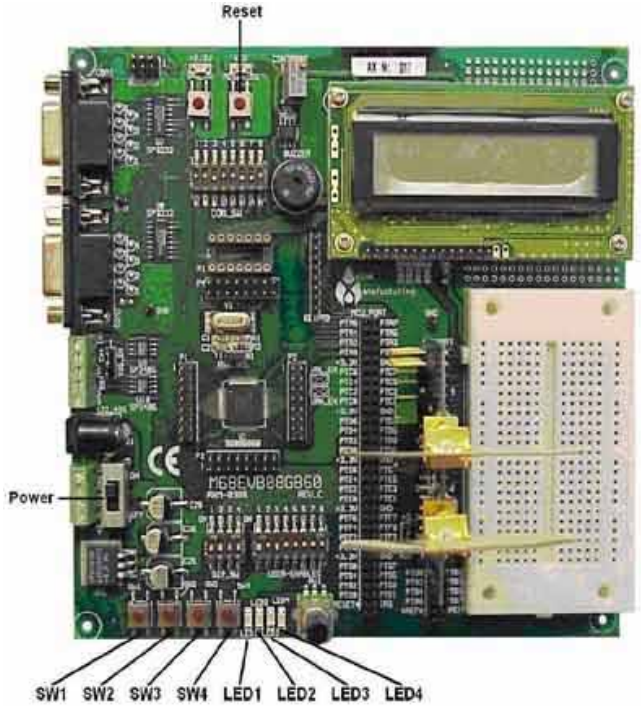


Fig. 2 Evolution board Axiom AXM-0308

The PICDEM Z module (fig. 3) includes RS232 interface to connect to PC, the additional board with the ZigBee chip CC2420 for wireless communication, 8-bit microcontroller PIC18LF4620 with A/D converters and the thermometer TC77.

Fig. 3 PICDEM Z module

2 PROGRAMMING

Preprogrammed tasks for 13192-EVB modules are possible download in the application Test Tool with basic configuration (fig. 4), but only to the MCU with loaded bootloader.

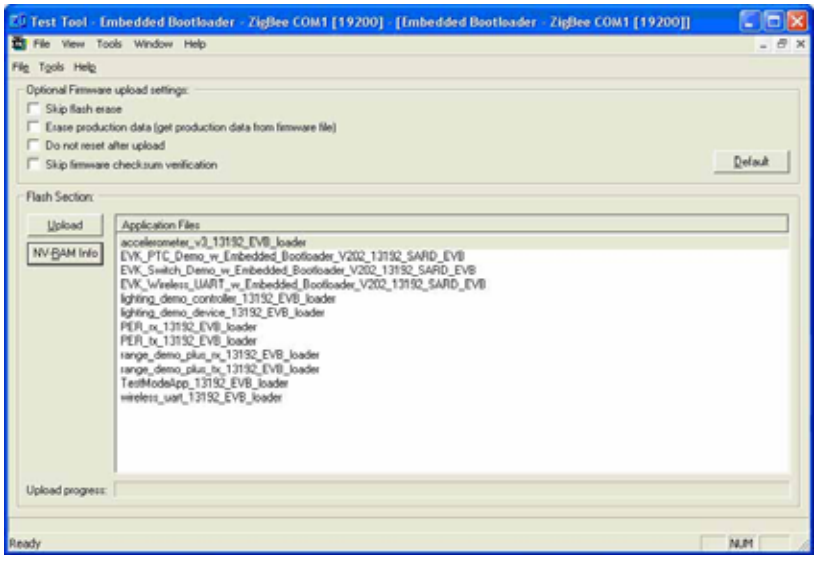


Fig. 4 Programming the microcontroller with bootloader

HCS08 microcontrollers can be programmed in development environment with debugger and then download to the MCU with BDM programmer.

PIC microcontrollers can be programmed in development environment MPLAB and then download to the MCU with application ASIX UP and PRESTO programmer.

For wireless networks and other communications interfaces it is used configuration tools: BeeKit (fig. 5) for Freescale modules and ZENA Software (fig. 6) for Microchip modules.

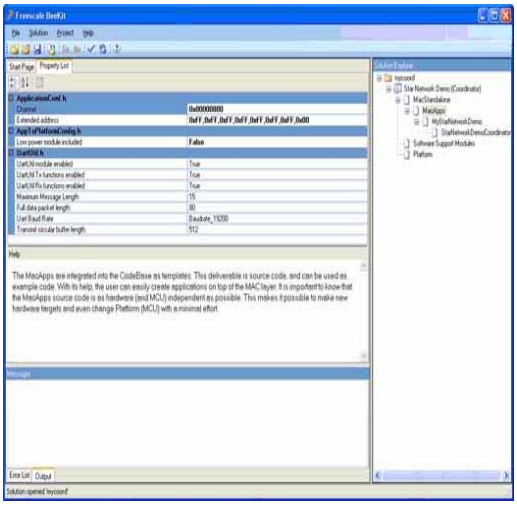


Fig. 5 Configuration tool BeeKit

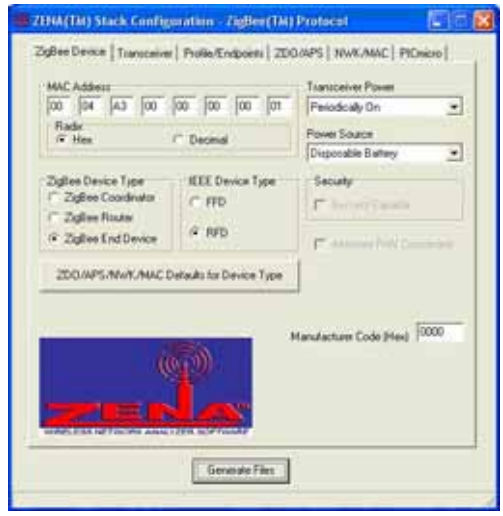


Fig. 6 Configuration tool ZENA Software

In one of tasks the MCU senses sensor's voltage on the A/D converter. Captured data are sent through the SPI interface to the ZigBee chip. This chip provides wireless connection and the communication with the second node (block diagram on fig. 7). The second node transfers data to PC over the RS232 interface (or RS232 to USB converter too).

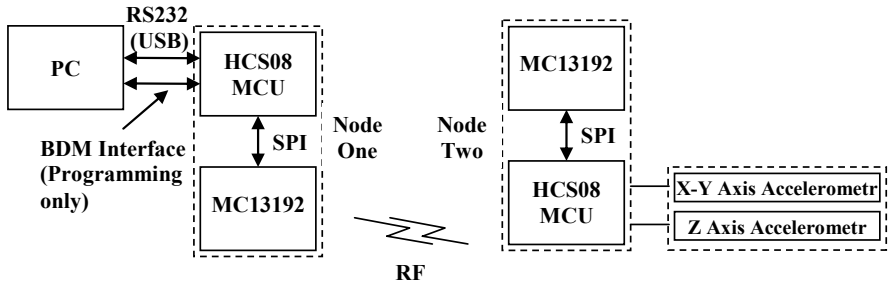


Fig. 7 ZigBee demo task block diagram

3 1-WIRE INTERFACE

As complement to microcontrollers a communication interface for the 1-Wire net was created. It is possible to use this for communication with various elements (e.g . digital thermometer, timer, A/D converter or inputs/outputs). There are used 1-Wire components: digital thermometer DS18B20 and digital inputs/outputs (8 pins) DS2408 (for the serial communication with the LCD display MC1602E-SYL).

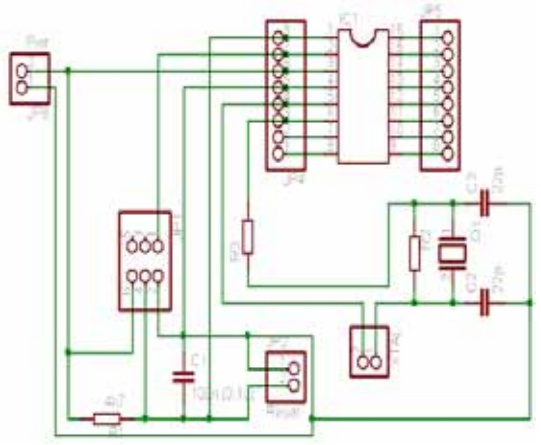


Fig. 8 Board scheme M9S08QG8

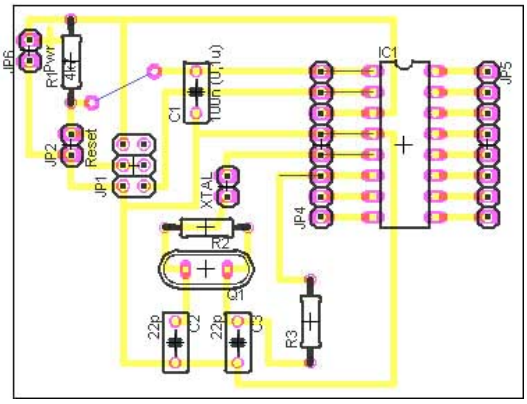


Fig. 9 PCB with M9S08QG8

As complement was created and connected board with DS2408 chip for the LCD display (fig. 10). Application display the temperature obtained from the digital thermometer over serial 1-Wire interface on the display MC1602E-SYL.

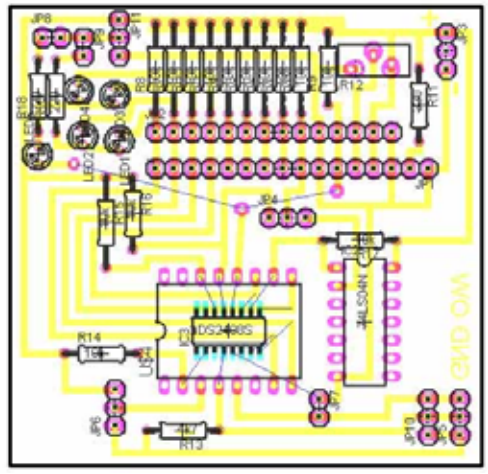
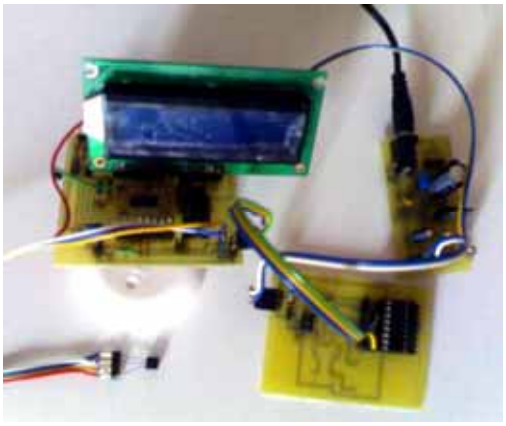


Fig. 10 PCB for LCD display



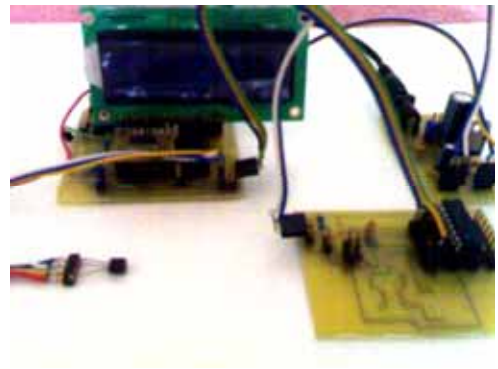


Fig. 11 Evaluation boards with M9S08QG8 and MC1602E-SYL

4 CONCLUSIONS

In the paper are described ZigBee communication modules and application creation. The significant parts are created tasks with the wireless technology. These tasks are formed with the Freescale ZigBee modules 13192-EVB or Microchip modules PICDEM Z. Modules include RS232 or USB (FTDI chip) interface to connect with the PC, ZigBee chip for wireless communication, 8-bit microcontroller with A/D converters, switches and LEDs. As complement to modules was created a communication interface for the 1-Wire net, which is used to a temperature measuring with the digital thermometer and display on LCD. To development purposes were created next auxiliary modules. Programmed additional subroutines are realized on evolutionary board Axiom AXM-0308 mounted with the Freescale MC9S08GB60 (HCS08).

The research work was performed to financial support of grant reg. No. G1/3086/2006 of FRVŠ MŠMT CZ.

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Reviewer: prof. Dr. RNDr. Lubomír Smutný, VŠB - Technical University of Ostrava