Template to write a contribution for IWES6

Nathalie Maes/ Kari Keskikastari/Andreas Schwaner/Raimund Stampa
RENESAS TECHNOLOGY EUROPE
Millboard Road
Bourne End, UK
Tel.: +44 / (0) – 1268.585.100
Fax: +44 / (0) – 1268.585.180
E-Mail:
maes.nathalie@gmail.com
kari.keskikastari@renesas.com
andreas.schwaner@renesas.com
raimund.stampa@renesas.com

URL:
http://www.renesas.com

Acknowledgements

Thanks to: Luc Friant, Francesco Anwander, Daniel Smolinski, Nathalie's parents

Keywords

Wireless sensors, Semiconductor Device, Education methodology.

Abstract

Renesas Technology is the worldwide number #1 microcontroller supplier and devoted to the ambient intelligence age by its slogan "Everywhere you imagine".
End of 2006 Renesas started a European university program. By this program which includes special offers and support for the participants, the co-operation and technology know-how exchange between Renesas and the universities shall be strengthened in Europe.
One of the key components of this program is the Renesas Starter Kit (RSK) concept, which offers a flexible and easy-to-use software and hardware platform for the complete product roadmap from low pin count 8bit devices for sensor applications up to high performance 32bit devices for industrial PC and Web applications.
This platform is ideally suited for students. One thesis based on an RSKH8S38347 and an Ember ZigBee module was already conducted successfully and shows how such a co-operation could look like in concrete detail.

Introduction

This paper is divided into three parts. It first starts with an introduction to Renesas technology, its education programs and especially its university program. Then it introduces the Renesas Starter Kit as an education tool to teach and learn embedded systems design. In the third paragraph this paper deals with a concrete example of a student thesis dealing with the wireless sensor network standard ZigBee, which was already conducted at Renesas.

Renesas Technology

Renesas was founded in April 2003 but its history is much bigger, as it was created out of a spin-off and merger of the Hitachi semiconductor branch and the Mitsubishi Electric semiconductor branch.

Needless to say that it belongs now to the biggest semiconductor companies worldwide and holds the number 1 position for microcontroller share. With its headquarter in Tokyo, all over the world about 26.000 employees are working for Renesas. Headquarter of the European operation is in Bourne End, UK. Other European offices are in 12 different countries. Renesas microcontrollers can be found "everywhere you imagine", which is by the way the slogan of the company and shows its addiction to the coming area of ambient intelligence. "Everywhere you imagine" means for example in cars (airbag, motor control, body control, navigation systems, etc.), mobile phones, washing machines, refrigerators, laptops, industrial control, etc.
With the focus on microcontrollers Renesas offers the full range from very low cost 4-bit and 8-bit microcontrollers up to high performance 32-bit multi core solutions operating at clock frequencies in the GHz range. Renesas can offer a uniquely embedded Flash technology for its microcontrollers, which is extremely reliable in the field: of more than one billion Flash microcontrollers shipped to customer, no quality failure occurred.

As educational tools Renesas has already offered the Renesas Interactive online learning program on internet.
In order to strengthen the co-operation with scientific organizations like research laboratories and universities, Renesas has established an alliance partner program (for design houses, system integrators and research laboratories) and a university program (for universities).
Similar programs are also running in other areas of the world, e.g. in Singapore and in the United States.

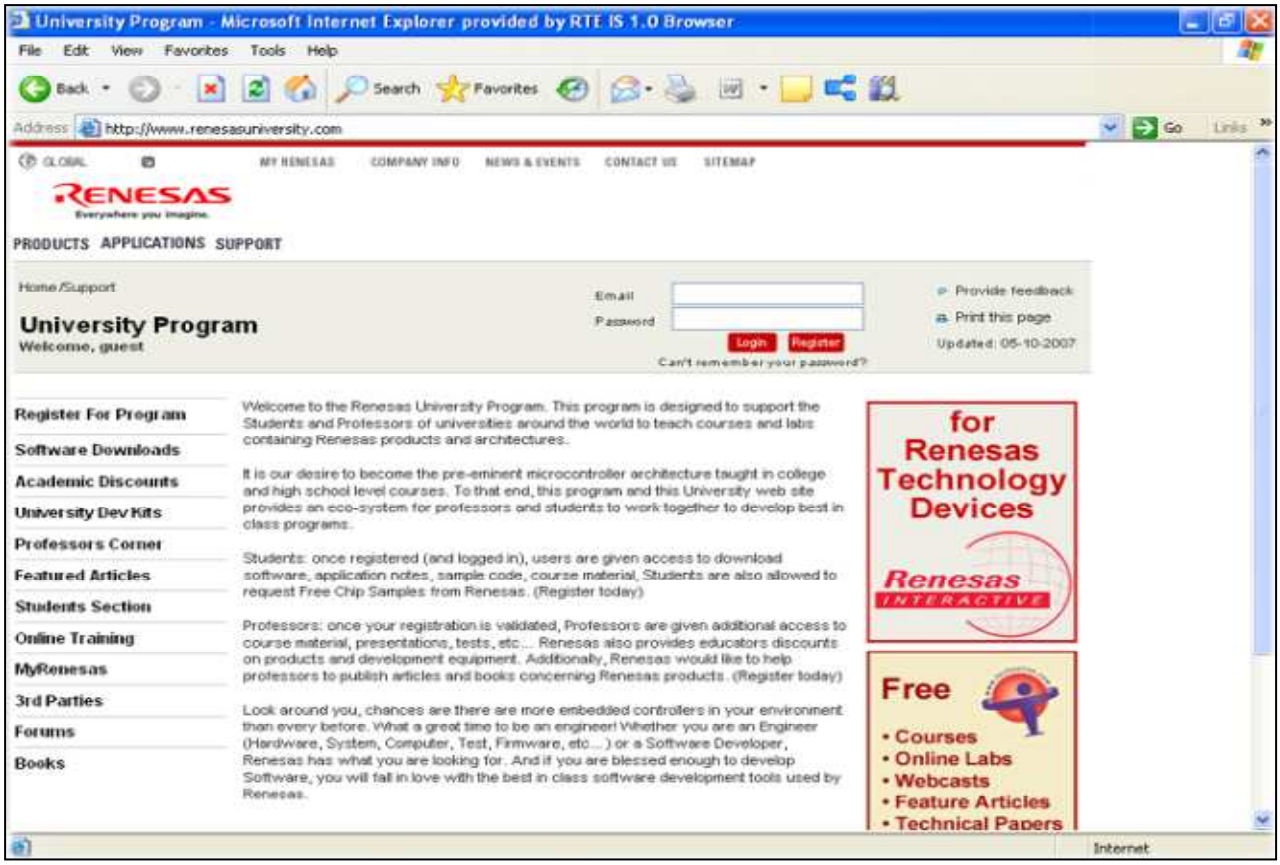

Fig. 1: Webpage of university program with link to Renesas Interactive

The official website link is http://www.renesasuniversity.com.

Currently there 38.000 people (4.000 students) have subscribed to the university program. It shall bring benefits to all participants:

The program shall serve as an information network stimulating know-how exchange and co-operation projects between Renesas and universities as well as among universities.

Renesas offers following services to the partner universities:

- Sophisticated Web access with Renesas Interactive online labs and tools
- Discounted and free of charge Renesas Starter Kits (RSKs) which enable hands on course/project work based on MCUs/ high level programming language
- Supply of literature: Renesas will provide hardware manuals, brochures and application notes for the chosen MCU.
- Technical support: Renesas will provide direct technical support to up to two nominated members of university staff on tools provided
- Technology trends
  Renesas newsletters inform students and professors on latest technology trends and technical updates on Renesas products.
- Joint press releases

26 European universities and polytechnic universities have already entered the program including universities from Istanbul, L'Aquila, Ancona, Bologna, Padova, Milano, Clermont, Madrid, Munich, Prague, Leipzig, Leuven, Kiel, Warszawa, Exeter, Glamohgah, Warwick, Hull, Birmingham, Strathclyde, Göteborg, Helsinki, Tampere, Vaasa aud Lulea.
The focus is not necessarily on big universities with high public reputation but more on universities which are specialized on embedded system activities.

The tool supply is organized through the Renesas distributor Glyn in Idstein, Germany (sales@glyn.de). The main hardware and software educational platform is the Renesas Starter Kit, which is provided free of charge within the university program. But also other tools like ZigBee Development Kits can be provided. The Renesas Starter Kit is explained more in detail in the next paragraph of this paper.

The program can already show some success stories. One success story is the ZigBee thesis by a student from the KHK Leuven, Belgium, which will be shortly presented in the third paragraph of this abstract. Other success stories are a 3rd place in a Eurobot contest (200 participants) for the INSA/Lyon in France using M32C/83 or the Polytech Clermont France working with several companies on motor control algorithms using SH Tiny and M16C devices.
Further partners of the IWES6 participating in the university program are the university of applied sciences of Kiel and the polytechnic university of Vaasa itself. More than 40 M16C starter kits have been already shipped to Vaasa to support the students.

Currently Renesas Europe is preparing the first official contest for their university partners.

The Renesas Starter Kit

The RSK (Renesas Starter Kit) is a generic hardware and software platform for Renesas general purpose microcontrollers. It is used as a generic format for all devices and standardized worldwide. Additionally to the device specific IO pin headers on the board, there are also function specific generic headers, which are the same on any RSK type. By this it is easy to connect an application board (General applications boards, motor control application boards and USB/Ethernet communication boards are already existing.) to the platform and to upgrade or downgrade from one device to another in order to optimize and tailor the device resources and costs to the specific requirements.

Until now 24 different devices are supported by the RSK platform and more than 12.000 boards have been shipped so far.

Fig. 2: Outline of the RSK package

By a quick start guide the RSK is quite easy to use. It comes with a CD , which includes a lot of sample source code, especially sample drivers for the peripherals like ADC, DAC, Timer, UART, LCD, USB and so on. The E8 debugger included in the box can be used for any other platform as well.

Besides of the standard low end and mid end class RSKs there is also a high end class for higher performance microcontrollers like e.g. the SH7203 with SH2A core.
The RSK for the RSKSH7203 has got USB and Ethernet interfaces as well as a TFT display on board and comes with a ucLinux based Web-Server software.

More Renesas Linux and ucLinux staff can be found under the alliance partner webpage http://www.shlinux.com.

Example of a Student Work at Renesas

This paragraph shows an example of a typical final year project at Renesas in co-operation with the KHK Leuven, Campus Geel.

The project was focused on the wireless sensor network technology ZigBee (http://www.zigbee.org) and its target was to evaluate the status of ZigBee and its opportunities for home control applications. By developing a simple embedded hardware and software application on existing ZigBee development kits and by analysis of the standard, the real maturity of this technology could be analyzed.

A gateway hardware and a software driver have been developed to connect a standard RSK (H8/38347) to a ZigBee module provided by Ember (http://www.ember.com). This solution has been compared to an existing Renesas Zigbee development kit based on the M16C/28 host controller for the network and MAC layer connected to a 2,4GHz/900MHz ZigBee RF.

An application has been developed on top of the network layer to send an alarm to the ZigBee coordinator triggered by a configurable light sensor.

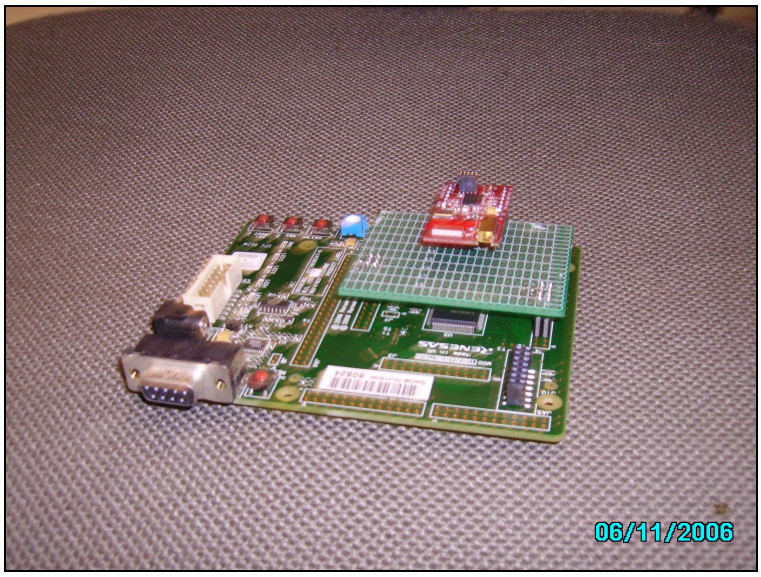

Fig. 3: First manually soldered prototype of the ZigBee gateway

The thesis could be finalized successfully. It proves that easy to use tool environments can reduce the development time for embedded systems significantly.
ZigBee tools have to be selected carefully based on supported components and versions of the ZigBee standard, supported network topologies and supported higher layer frameworks.

Conclusion

Renesas Technology can offer interesting opportunities for universities and students including educational online tools, hardware and software platforms for standard devices as well as new technologies (like ZigBee). Furthermore Renesas Technology can offer opportunities for students to write the final year thesis in one of the Renesas engineering locations in co-operation with the university or to participate at research contests.

References

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