

Introduction

This Application Note describes how to create a wireless UART link using two sensor boards from the JN5121 Evaluation Kit. The software required to implement the system was developed using the JN5121 802.15.4 protocol stack and Hardware API, both provided free-of-charge by Jennic.

The benefits of using this solution include:

- Replacement of serial cables with wireless connectivity via the JN5121
- Quick addition of low-cost wireless connectivity to products using a UART link for communications

Application Overview

This application allows two devices (such as PCs) containing UARTs to communicate via a wireless (radio) link. Each device connects to a sensor board from the JN5121 Evaluation Kit – the device's UART connects to the JN5121's on-chip UART on the sensor board. The two sensor boards then provide the radio communication link.

This is illustrated in the figure below.

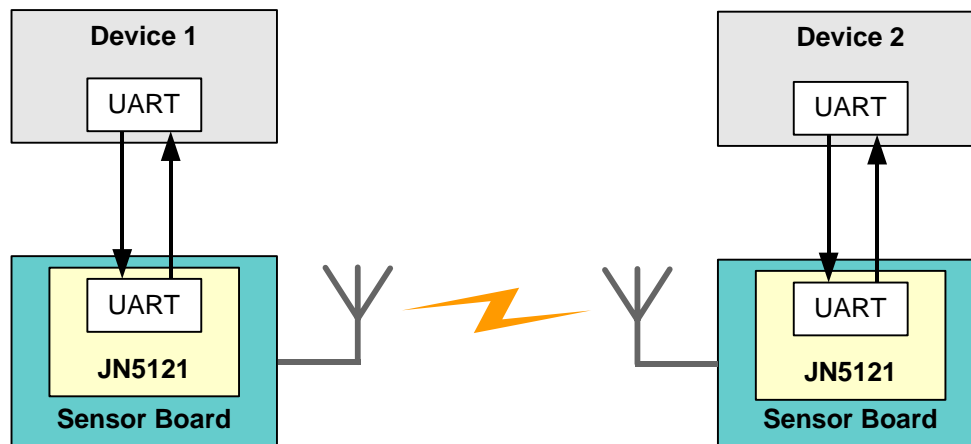


Figure 1: Wireless UART Link

This configuration has been tested by connecting each of the sensor boards to a PC using the programming cable supplied with the evaluation kit.

System Architecture

When the JN5121 is used in an application such as this, it is assumed that a permanent power source will be available at both ends of the wireless link. This means the on-chip radio can always be active, eliminating the need to synchronise the transmission/reception of data. The link is designed to operate at up to 19200 baud.

One of the sensor boards must act as a PAN Co-ordinator. The PAN Co-ordinator is responsible for starting the network and allocating an address to the other sensor board, which acts as an End Device.

Software Design

Apart from the network management performed by the PAN Co-ordinator, the software contained within each sensor board is identical. Data received via the radio is output to the connected device using the on-chip UART, and data received by the on-chip UART from the device is transmitted over the radio. This process is repeated every 10ms.

The board LEDs are used as follows:

- LED2 on each board indicates the network status and is illuminated once the network has been successfully created, i.e. once the End Device has associated with the PAN Co-ordinator.
- LED1 flashes approximately once per second to indicate that the software is running.

The source files required to build the application are described below:

uart_c.c

This is an application for the PAN Co-ordinator. It performs the following tasks:

- Selects the quietest channel
- Starts the network
- Allows an End Device to associate with the Co-ordinator
- Transfers data from the radio to the on-chip UART and vice-versa:
 - Data arriving from the connected device via the on-chip UART is buffered and transmitted via the radio every 10ms
 - Data received via the radio is buffered and transferred to the connected device via the on-chip UART as soon as it is available

uart_e.c

This is an application for the End Device. It performs the following tasks:

- Scans the radio channels, looking for the PAN Co-ordinator
- Once it has found the Co-ordinator, it associates with it

Data transfer between radio and the on-chip UART is identical to that described above.

uart.c, serialq.c, serial.c

These files are common to both applications, and are used to support serial communications using the on-chip UART.

config.h

This file contains configuration information that is common to both applications, e.g. baud rate, PAN ID etc.

The following flowchart illustrates the transmit/receive processes for both the Co-ordinator and End Device. Note that the flowchart refers only to the on-chip UART – the UART input buffer accepts data coming from the connected device.

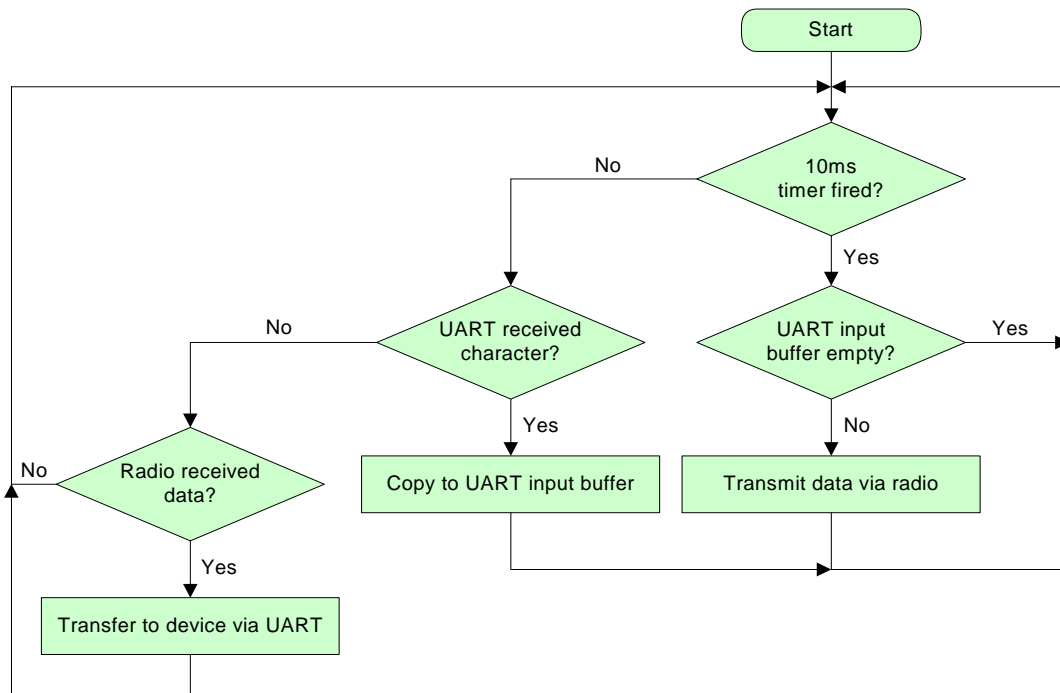


Figure 2: Software Flowchart

UART Selection

The JN5121 contains two UARTs (UART0 and UART1). This Application Note uses UART0 by default, but UART1 can be used simply by making the following change in the file **config.h**:

The line

```
#define UART                E_AHI_UART_0
```

should be changed to

```
#define UART                E_AHI_UART_1
```

Demonstration

The functionality of this application software can be demonstrated by forming a wireless connection between the serial ports of two PCs.

This is illustrated in the figure below.

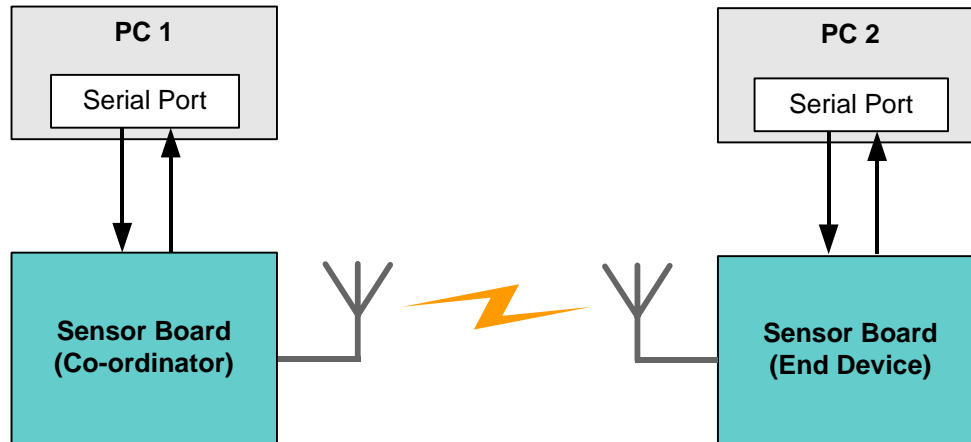


Figure 3: Wireless Serial Link

To perform this demonstration, follow the steps below:

1. Load the binary files **wuart_c.bin** and **wuart_e.bin** into the two sensor boards.
2. Connect each board to the serial port of a PC, using the serial cable and programming adaptor provided with the evaluation kit.
3. Power-on both of the boards
4. Test the wireless serial link by transferring data using a terminal emulator such as HyperTerminal (configure the serial connection as follows: 19200 bps, 8 data bits, no parity, 1 stop bit, no handshaking).

Caution: Some terminal emulation programs, including HyperTerminal, hold RTS asserted when handshaking is set to 'none'. This forces the Jennic module into 'programming mode' in which it checks the PGM pin at power-up and finds it held LOW. If LED1 does not start flashing at power-up, you should disconnect the serial cable and power cycle the board. Alternatively, ensure that HyperTerminal is started **after** powering up the evaluation kit boards.

Version Control

Version	Notes
0.1	Initial version.
1.0	Released to website.
1.1	Updated document style.
1.2	Updated to include ROM and library based source code.
1.3	Updated document template and corrected minor bugs in ROM MAC version of source code.
1.4	Added paragraph on Hyperterminal usage
1.5	Title of Application Note changed (from Wireless UART). Co-ordinator now selects best channel (based on energy scan). Improvements made to UART configuration, now easy to change baud rate and UART (0 or 1). Note : Above changes only available in ROM MAC version of source code.
1.6	Improvements made to UART selection code, and added text to Application Note regarding this feature. Note: Change only available in ROM MAC version of source code.
1.7	Corrected rounding error in baud rate calculation. Removed v2 version of source code.



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