

Wireless Reading of Sensirion Sensors

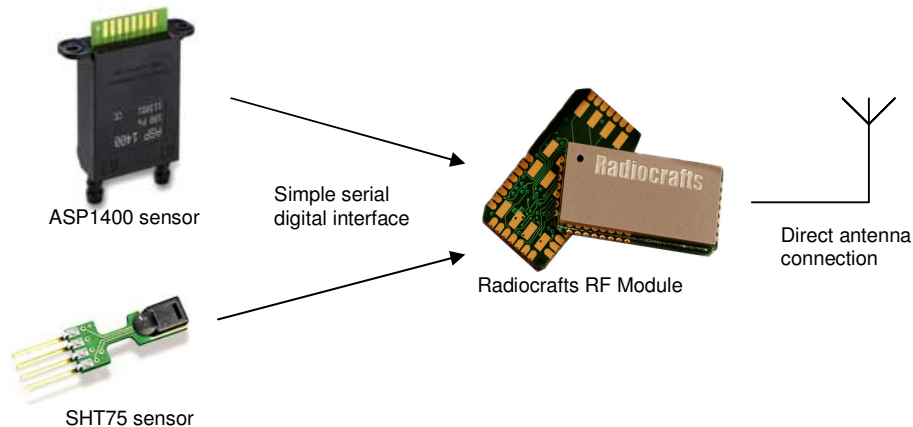
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Abstract

By using an off-the-shelf RF module, wireless reading of pressure-, humidity- and temperature can be achieved with a very limited design effort. Sensirion AG, Switzerland, provide calibrated sensors for measuring various parameters, and by combining their simple-to-use digital interface the sensors can be connected to a Radiocrafts module, either directly via a two-wire (I2C like) serial interface or via a level shifter and an RS232 interface.

Radiocrafts' RC1xx0 and RC2000/2100 modules have a complete embedded protocol for point-to-point or point-to-multipoint (star network) operation. Their small dimensions (12.7*25.4*3.5 mm) and direct digital interface makes it possible to build wireless connection into existing or new designs with limited space.

Sensirion is the technology leader for intelligent and digital sensor solutions. By combining their calibrated sensors with a simple digital interface to the Radiocrafts modules a complete wireless system for monitoring can be built. In this paper Sensirions SHT-series of temperature and humidity sensors and ASP1400 differential pressure sensor are made wireless.



Introduction

Sensors and wireless modules are perfect partners for flexibility and cost savings. While earlier efforts in wireless sensing required rigid development, deep knowledge and a wide competence platform these parameters are now taken care of by calibrated sensors with a simple interface and by ready to go radio modules. To avoid expensive installation cost in new, and not at least in existing buildings, and to maintain flexibility, a wireless network will give significant cost savings compared to wired monitoring.

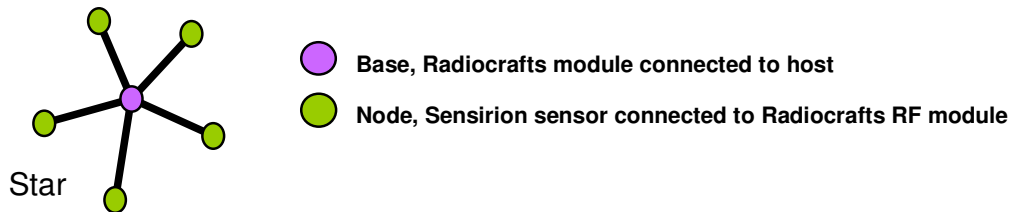
Autonom networks using self-configuration mesh solutions requires huge cost in the development of the software protocol and will also require more processor-power locally in each node. A simple point-to-(multi)point (or "star") solution with longest possible range and most intelligence in the base-controller will give a less expensive and simpler solution to access each and every node in any building or industrial installation. This paper addresses some of the possibilities using simple RF-modules as building blocks in a monitoring system for Sensirion sensors.

Monitoring using ISM frequencies

The ISM (Industrial, Scientific and Medical) bands for license-free use are 433 MHz (EU and US), 868 MHz (EU), 915 MHz (US) and 2.45 GHz (worldwide).

In general, the lower the frequency the longer the range and the less the system is vulnerable to reflections of radio waves. Also, the more narrowband the transmitted RF-signal is, the longer the range and the less the system will be vulnerable to interference from other transmitters transmitting on neighbouring frequencies. Radiocrafts' RC12x0-series of RF-modules are narrowband Frequency Shift Keying (FSK) with less than 25 kHz occupied bandwidth, giving superior range also within buildings. For best coverage an RC1240, operating at 433 MHz, should be the choice, while RC1280 will give slightly less range but can be compliant with narrowband regulations within these higher frequencies. RC1290 fulfil FCC regulations in the US.

The Base – Node concept

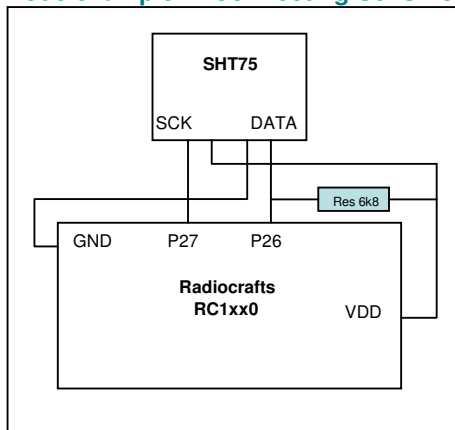


In a typical star network one central Base communicates to one or more peripheral Nodes. The Base needs a host or controller, being the processor which records the polled data and performs the polling at regular (or irregular) intervals.

Base: All Radiocrafts modules have an UART, which easily can communicate with a PC or PDA via a level shifter and RS232. There are also available simple USB-RS232 dongles, making an easy USB access to the RF module in the base. Also, Ethernet-UART controllers are coming more and more available. All in all, there are numerous possibilities to connect a module-UART to the host in the base.

For system simplicity a polling routine is implemented in a PC or PDA which is connected to the Base. In the Node the sensor is surveilled by a two-way transceiver module which responds status to a polling request. The embedded protocol in the modules makes unique addressing of nodes, broadcasting, error check etc easily available and configurable.

Node example 1: Connecting Sensirion SHT11/15/71/75 to Radiocrafts modules



All these sensors have a two-wire serial interface consisting of a SCK and DATA line and this is all that is needed for reading back calibrated temperature and humidity. The Radiocrafts modules operate at 2.8-5.5 V and provides regulated supply to the sensor from its VDD pin. See connection sketch below. An I2C serial interface is available in the RC12x0-Sensirion. By adapting internal firmware to this special application a variety of polling systems can be built.

Possible measurement system: For instance, the host (PC/PDA) transmits the sequence Tnnn?, where nnn is three addressing bytes, programmed unique into each module in the node. By receiving a call for T (temperature) the module with Unique ID nnn responds by reading the temperature sensor via the I2C bus and transmit back to host the needed bytes for a complete measurement.

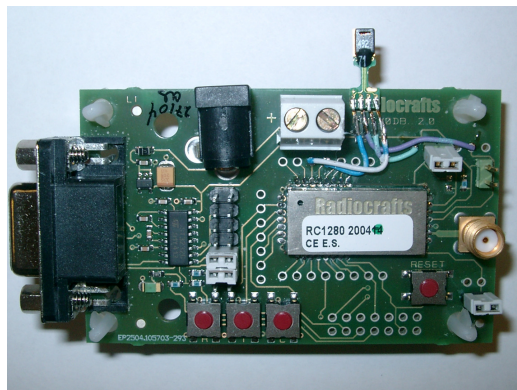


Figure 1: SHT75-sensor connected directly to a Radiocrafts module mounted on a Demo Board from Radiocrafts

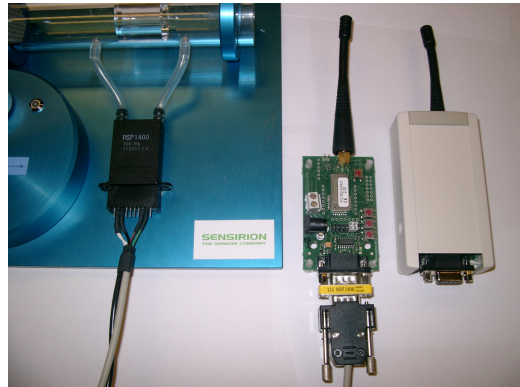
Node example 2: Connecting Sensirion ASP1400 to Radiocrafts modules

This differential pressure sensor has an internal RS232 level shifter/Line driver suitable for direct connection to any host with RS232 interface. The Radiocrafts modules all have an UART interface, which by adding a simple level shifter IC can be directly connected to the ASP1400. See also Radiocrafts Application Note AN001 for how to connect the module to a level shifter.

To match the regular transmissions from ASP1400 the module must be configured for 9600kbps and packet timeout of 32ms, see RC232 User Manual for reference. The RC1xx0 Demo Board available from Radiocrafts can directly be connected to the ASP1400 as shown in figure 2. Remember to connect the TXD-line of the sensor to the RXD-line of the Demo Board (requiring a null-modem cable), or the R1IN line of the level shifter.

Possible measurement system:

As the ASP1400 on regular intervals sends a measurement (with configurable resolution and intervals) any terminal window like HyperTerminal connected to the base will continuously receive pressure (and temperature if configured for this). A graphical presentation can be achieved by using the SensiView software from Sensirion.



**Figure 2: ASP1400-sensor connected directly to a Radiocrafts Demo Board (DB).
To the right a DB in plastic enclosure**

Document Revision History

Document Revision	Changes
1.0	First release

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