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An example of a method to wirelessly transfer measurement data from cows in a free stall barn

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One of the basic ideas of precision livestock farming (PLF) is to gather information of e.g. animals' production, health, and welfare in order to more efficiently manage the production process. Information is gathered from multiple sources such as automated feeding stations, milking solutions and gates, activity monitors and various loggers related to animal welfare. Information may be gathered directly from the animals and/or indirectly from their environment. In many cases huge amount of information is being logged but can be put to use only after the animal comes within the range of a specific data reader or downloader. Here we describe a wireless data measurement and transfer system that operates within a free stall barn. We report also the reliability of the system. This system was designed and built in Very Intelligent Cow Barn project in 2006-2007.

The overall goal was to measure cows' position in the barn via GPS, 3-D acceleration and neck surface temperature. The measurement and data transfer system is composed of two major subsystems. The measurement subsystem included a low power microcontroller (ATmega1281, Atmel, San Jose, USA), a Fastrax GPS module (ITrax 03-02, Fastrax Oy, Vantaa, Finland), accelerometer sensor (ADXL330, Analog Devices Inc., Massachusetts, USA), input for the temperature sensor and a radio (Nanopan 5361, Nanotron Technologies GmbH, Berlin, Germany). The measurement subsystem was placed inside a small watertight casing. The casing was attached to the neck part of the collar of 32 dairy cows.

The data transfer subsystem consisted of a System-on-Chip receiver (SoC) with a Nanonet radio, a PC for data storing, and eight pseudosatellites in a synchronised network mounted high on the walls of the barn. GPS position, 3-D acceleration values, cow surface temperature, and battery status was measured with a 10 Hz frequency and sent wirelessly once a second to SoC. The SoC packed the received data and sent it forward via Ethernet to be stored in the PC database.

A sample from 16 collars revealed that 91 % of all sent data was successfully stored to the PC database. This result is quite promising, considering that data cannot be received when cow is inside a milking robot or an automated feeder. The Nanonet wireless radio network can be used to send multiple measurements from multiple sources at a high rate with a relatively low cost.