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Subject Area	Wireless Communications

Self-Meshing Sensor Network

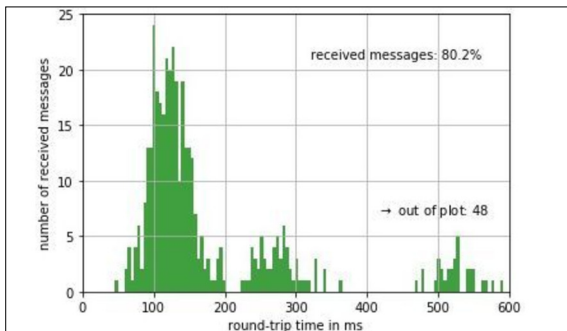


Top: low-power device with integrated battery and chip antenna.
Bottom: relay device with external antenna

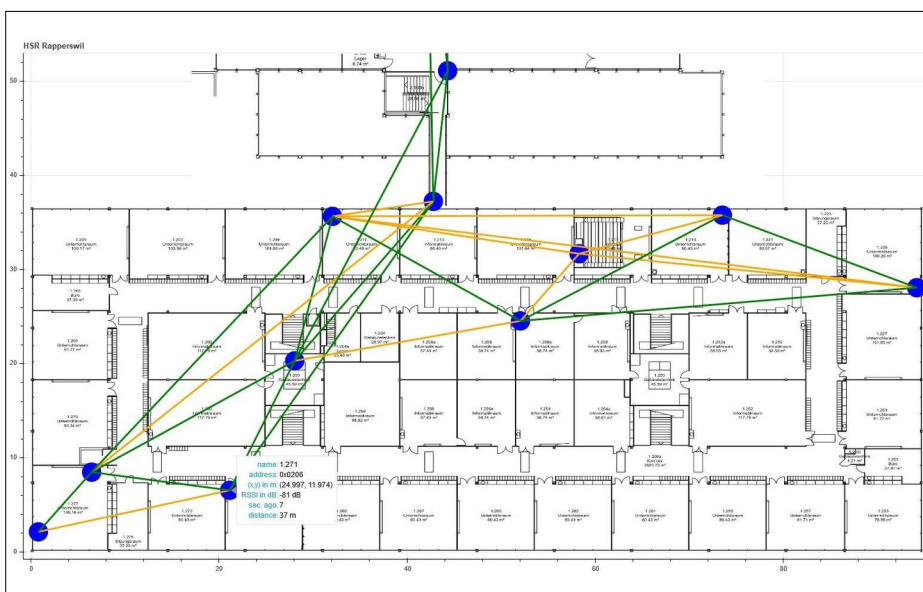
Introduction: The Bluetooth 5 standard was introduced in December 2016. For the first time, it now supports the mesh functionality that enables many-to-many device communications. Smart-Home applications such as lighting, controlling, or sensor-networks can now be realized with the widespread Bluetooth technology.

Objective: The goal is to build a mesh sensor network based on Nordic Semiconductor SoCs and Sensirion sensors. The sensors in the network measure the temperature, humidity and air quality. The network should consist of low-power and non-low-power devices, where the latter can additionally act as relays for messages. The network is accessed via a gateway device to collect the data and visualize it graphically on a computer.

Result: The devices in the network are based on a newly developed hardware. The hardware with the external antenna can act as a relay. As soon as the low-power features in the protocol stack are available, the hardware with the integrated battery and chip antenna can be used as low-power device. A user can access the network via a dedicated graphical user interface that communicates over a gateway. With the aid of dedicated status messages, the connection between two individual devices can be identified and their respective RSSI values measured. Additionally, latency measurements can be done by measuring the round-trip time from the gateway to any device in the network. The reliability of the network highly depends on where the devices are placed. Various tests showed that a mesh can be set up in a large multi-level building with connection distances between two devices of up to 60 meters.



Histogram of the round-trip time recorded over 24 hours



Graphical user interface showing the nodes and connection lines of the mesh network