APPLICATION NOTE

USING MESH LITE FOR LOW POWER TEMPERATURE MONITORING

ABSTRACT:
This application note gives a typical usage of Mesh Lite functionalities for WSN (Wireless Sensor Network) application. In this example is described the realization of a very low power battery operated temperature monitoring system.
1. INTRODUCTION

One RF Technology is a leading company specialized in the design of high performances radio solutions in the ISM license-free frequency bands. It offers a wide range of wireless products in boards and modems for the European and US markets.

A key advantage of One RF solutions is the availability of powerful embedded firmwares into its products, allowing various communication protocols and functionalities.

One of these embedded firmwares available into the new TinyOne family (TinyOne Pro, Plus & Lite) is called Mesh Lite. It allows mesh networking, which is the ability to use a wireless device as logical repeater to transfer data between two end points without direct radio connection. It is a way to increase reliability and distance of a wireless link.

This document describes a specific Mesh Lite application dedicated to temperature monitoring. The goal of this application is the automatic measurement of temperature value from different points to a central server through a low power wireless network.
2. **SYSTEM DESCRIPTION**

2.1. **System Requirements**

- Automatic temperature monitoring.
- Wireless network between temperature sensors and central server.
- Measurement frequency: minimum once per ½ hour.
- No external power supply for temperature sensors.
- Temperature sensors placed into freezers.
- Central server placed in another room (maximum 30m range with 2 walls)

2.2. **Solution Description**

- Wireless link based on standard TinyOne Lite board @868MHz.
- Temperature sensor made with NTC thermistor.
- Temperature sensor battery operated.
- Mesh Lite embedded firmware to allow low power management and assure communication reliability.
3. TECHNICAL DESCRIPTION

3.1. Hardware Description of Temperature Sensor

**RF platform**
- TinyLITE board @868MHz, sub-band 1f.
- General characteristics:
  - Data rate 38.4kbps
  - Output power 10dBm
  - Power supply between 2.2 and 3.7V
  - Tx/Rx consumption 40/30mA
  - Stand-by consumption 10µA
- Internal antenna λ/4 bended wire.

**Temperature sensor**
- NTC thermistor.
- Analog value measurement directly related to the temperature.

**Battery**
- Lithium +3.6V AA battery.
- Capacity 2450mA.h, peak current allowed 130mA.
- Operating temperature range -60 / +85°C.

**Casing**
- Plastic casing for internal antenna radiation.
- IP65 protection.
- Side flanges for wall mounting, with 2 screwing holes (10cm separated).

**Others**
- Sensor ID manually set up through internal 8-bit DIP switch.
- Internal ON/OFF switch for power on.
3.2. **Functional Description of the system**

- Mesh networking with 1 coordinator, and 1 or more routers (depending on the environment).
- Up to 100 temperature sensors (end points) into the network.
- Coordinator connected to the server through RS232 link.
- Easiness of temperature sensors installation and follow up thanks to:
  - manual set up of ID through DIP switch before power on,
  - automatic acquisition into the network at power on.
- Automatic temperature sending each 10 minutes (value set by configuration).
- Automatic stand-by management for consumption optimization of temperature sensors.
3.3. Performances

Temperature sensing
- ± 1.5°C precision
- Ultra low cost solution
- High reproducibility
- Measurement frequency: once each 10min (per sensor)

Wireless link
- Communication range sufficient thanks to mesh networking
- Communication reliability on sub-band 1f (duty cycle 1%

Life time

<table>
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<tr>
<th>MESH LITE NETWORK LOW POWER, ENDPOINT CONSUMPTION ESTIMATION</th>
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<td>SETTINGS</td>
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<td>Network Parameters</td>
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<td>NW period</td>
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<td>Parent SF duration</td>
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<td>Low Power Parameter</td>
</tr>
<tr>
<td>wake-up once each / NW period</td>
</tr>
<tr>
<td>wake-up secure time</td>
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<tr>
<td>Data exchanged</td>
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<td>Duration of transfer</td>
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<th>SUMMARY TABLE</th>
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<td>Current (mA)</td>
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<td>Std by</td>
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<tr>
<td>RX</td>
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<tr>
<td>TX</td>
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<tr>
<td>Total for 1 wake up NW period:</td>
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<td>Average for n NW periods:</td>
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<tr>
<th>BATTERY LIFE TIME</th>
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<tr>
<td>Average Consumpt.</td>
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<td>Battery capacity</td>
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<table>
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<tr>
<th>Life time</th>
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<tbody>
<tr>
<td>10.9 years</td>
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