MIMOS Smart Platform for Wireless Mesh Sensor Network (Mi-SPARK)

Mi-SPARK is a mesh-capable wireless communication platform for connecting things to the Internet i.e. Internet-of-Things, and is specially designed for various low bandwidth, low data rate and low power applications.

Overview

Mi-SPARK is a low bandwidth, low data rate and low power wireless communication platform that can be used to connect sensors and transducers to the Internet to facilitate implementation of various IoT uses cases and applications. The platform comprises of 3 components, namely node, gateway and backend server. The node is wired to device to be sensed or controlled, essentially acting as its wireless modem, while the gateway connects a network of nodes to the backend server over the Internet. Users can interface with each Mi-SPARK node via a web-based dashboard.

Wireless communication between Mi-SPARK node and gateway complies with 802.15.4 specifications on sub-GHz ISM radio band (919-923MHz), allowing for longer communication range with less RF interference compared to 2.4GHz band. Meanwhile, its networking layer uses 6LowPAN, which is a low-power wireless network technology where each node has its own IP address. This allows the node to easily exchange data with remote hosts over the Internet or wireless local area network through the gateway. The 6LowPAN network stack also supports mesh capability, allowing each Mi-SPARK node to route data from and to other nodes, effectively extending the network communication range even further while also making the network more robust to any node failure. Mi-SPARK uses MQTT protocol for data transfer between node and backend server, as well as CoAP protocol for over-the-air (OTA) firmware update.

Features

Mi-SPARK node comprises the following features:

- **Multiple On-board Sensors**
  On-board sensors include temperature/humidity, accelerometer/gyroscope, light level and pressure to cater for various use cases.

- **Extendable Headers**
  Node functionality can be extended to support additional sensors and transducers using daughterboard via extension headers.

- **Bluetooth Low Energy Integration**
  On-board BLE transceiver for ease of integration with external device, such as smartphone and BLE beacons.

- **Multiple Power Options**
  Can be powered using 5VDC micro USB adapter or using batteries (AA or LiPo). Mains powered is also supported via suitable AC/DC step down converter

- **Ethernet & 3G Gateway**
  Choice of Ethernet or 3G based gateway

- **IP65-Rated**
  Gateway enclosure is rated IP65 for outdoor deployment

Technology Summary

Mi-SPARK
Wireless mesh sensor platform to ease implementation of low bandwidth, low data rate and low power IoT applications.

Applications: Smart homes/buildings/factories, smart cities, smart agriculture/farming, environment monitoring, structural monitoring

Features
- Multiple on-board sensors and power options
- Extendable header
- Bluetooth Low Energy Integration
- IP65-rated Ethernet or 3G Gateway

Technology Benefits
- Long range communication
- Less RF Interference
- IP-based Low Power Wireless Mesh Network

Technology Benefits

The benefits of Mi-SPARK are:

- **Long Range Communication**
  Mi-SPARK operates at sub-GHz frequency where signal absorption by the environment is less compared to its higher frequency counterpart. Thus, long range communication over difficult terrain and non-LoS condition is possible.

- **Less RF Interference**
  Compared to the 2.4GHz ISM band, the sub-GHz band is less crowded and relatively interference-free.

- **IP-based Low Power Wireless Mesh Network**
  Mi-SPARK is a low power embedded device that can form an ad-hoc wireless mesh network and able to communicate over the Internet via the gateway. This allows the device to send and receive data with remote hosts using standard IP networking, as well as eases OTA firmware update.

Specifications

Mi-SPARK	
Specifications	
Supply Voltage	5VDC (node), 5VDC, 2A (gateway)
Frequency Band (MHz)	919-923
Bandwidth (kHz)	200
Data Rate (kbps)	50
Receive Sensitivity (dBm)	-110 @ 50kbps
Selectivity ±100kHz (dB)	56
Blocking Performance ±10MHz (dB)	90
Max TX Power (dBm)	26
TX Current (mA)	13.4 @ 10dBm
RX Current (mA)	5.4
Operating Temperature (℃)	0 to 55
Compliant Standard	802.15.4, 6LowPAN
Multicast	✓
Mesh Networking	✓
OTA Firmware Update	✓

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