RaZberry User and Developers Documentation

z-wave.me

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1   The RaZberry architecture

RaZberry consists of a hardware portion - the RaZberry daughter board including some firmware - and a portion of software that runs on the Raspberry Pi operating system. This portion of the software is refered to as **Z-Way**. Z-Way implements the whole Z-Wave protocol stack and offers an Application Programming Interface to implement third party user interfaces. Z-Way also offers some demo user interfaces to explain and prototype the solution.

2   The RaZberry hardware

A RaZberry hardware solution is a combination of the Raspberry PI motherboard and the RaZberry Z-Wave transceiver daughter board. The daughter board is connected to the motherboard using the General IO Pin header connector of Raspberry PI. This GPIO interface offers Serial TX and RX signals, ground and 3.3 V VCC to power the Z-Wave transceiver board. Figure 1 shows the details of the hardware.

The daughter board consists of several components:

- The ZM3102 Z-Wave transceiver from Sigma Designs. This module combines a "System on Chip" (SOC) with a 8051 micro controller, the Z-Wave transceiver and some IO interfaces the systems crystal and the SAW antenna filter to comply to the national regulations for the frequency band used:

    - EU: 868.4 MHz (EN 300 220)
    - RU: 869.0 MHz (GKRCh/EN 300 200)
    - US: 908.4 MHz (FCC CFR47 P 15.249)

- The 32KB Serial EERPOM that stores the network data
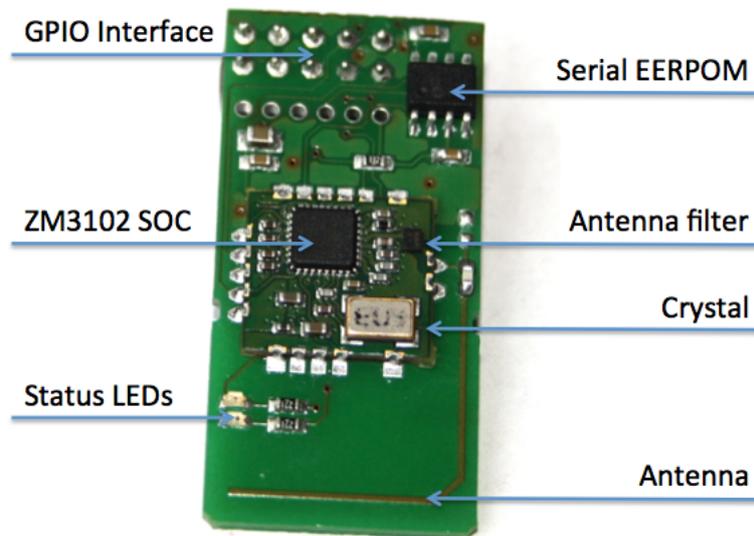
- PCBA-Antenna

Figure 1: RaZberry hardware

- two status LEDs: The red LED shines during inclusion and exclusion mode, the green LED is blinking on successful wireless data transmission

The micro controller of the SOC contains control code that operates the wireless transceiver and handles certain network level operations of Z-Wave. The communication with this code runs over the serial interface. There is a protocol specification for this interface that is issued by the manufacturer of the Z-Wave chip Sigma Designs that most of the Z-Wave transceivers on the market (e.g. USB Sticks) use. This interface specification - called Sigma Designs Serial API - is not a public document but available under Non Disclosure Agreement only as part of the Sigma Designs Systems Development Kit (SDK). The firmware of RaZberry is based on the SDK Version 4.54 but has enhanced the Sigma Designs Serial API in several ways:

- Backup and recovery function including network topology

- Extended Node Information Frame (up to 20 Command Classes possible)

- Optimized transmitting queue handling to speed up transmitting process

- Firmware update from the Raspberry PI OS level in the field

- Extended Wakeup Notification Handling to extend battery life time of battery operated devices in the network

RaZberry uses the serial interface /dev/AMA0 that is physically connected to the GPIO pin header. On default this serial interface is used for terminal processes of the Linux operating system. The installation script is turning off these terminal and console functions to free up the port for use by Z-Way.
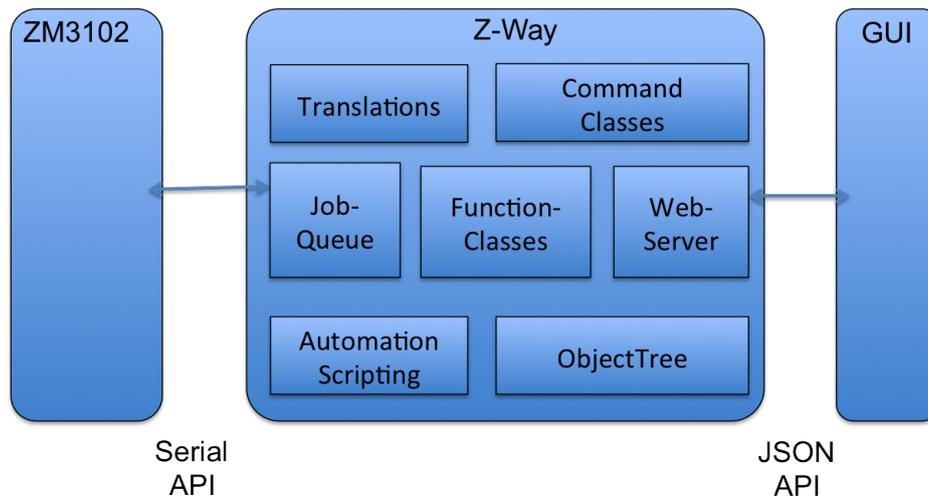
Figure 2: Z-Way Software Structure

3   The Z-Way software architecture

Z-Way is the portion of RaZberry that runs on the Rasberry Pi operating system level. The code comes as Linux executable with libraries and is using certain configuration and translation files that are described later.

Z-Way is a fully featured home automation controller supporting Z-Wave as communication technology. It allows to

- Include and exclude devices and configure these devices, manage the network configuration and stability by visualizing the configuration and routing within the network

- Switch actuators such as electrical switches, dimmers, motor controls for sun blind, garage doors or venetian blind, door looks, heating thermostats and many more

- Access sensor data such as motion detection, temperature, CO2, smoke etc.

- Visualization of all functions of the Z-Wave network mapped to the floor plan or as tables simple to read

- Create logical connection between events created by sensors and actions performed by actuators

Z-Way communicates (south bound) to the Z-Wave transceiver firmware (using the Serial Interface) and offers a northbound interface that complies to the JSON specification (for details about JSON see explanation in the chapters below). This north bound Interface - referred to as JSON Interface - is used by applications or web pages (with Javascript) to operate and use the Z-Wave network. It is possible that multiple user interfaces or applications run in parallel and use the JSON API. However in case they send contradicting messages (one is turning off a device while one is turning on) the resulting state of the network is unpredictable.

Z-Way consists of several function blocks:

- The Job Queue: This is the core of Z-Way

- Function Classes: The implementation of all the commands to control the Z-Wave transceiver chip and the Z-Wave network

- Command Classes: The application level commands used to control Z-Wave devices in the network

- The JSON web server: It implements the application programmers interface

- Translation Functions: They help to translate machine readable tokens into human-readable strings

- The automation and scripting engine: This is the way to get the intelligence into the system.

For more information about Z-Way such as the user interface, the JSON API structure etc please refer to the Z-Way User and Developers Documentation available online at http://razberry.z-wave.me/docs/zway.pdf

4 Installation and Start

Attention: You must unpower the Raspberry PI board before installing the RaZberry hardware. For the installation of the Rasperian OS please refer to the online resources of the Raspberry Pi project. Once the OS is installed and you are ready to have access to the command line interface of the pertain system, log into the Raspberry Pi with the RaZberry hardware attached.

Execute the following command on the command line:

```
wget -q -O - http://razberry.z-wave.me/install | sudo bash
```

This script checks if the system is ready to run RaZberry, frees up the serial interface /dev/AMA0 and installs all needed modules. After the installation is complete you can edit the file /opt/Z-Way/config.xml in case you want to change the TCP port the JSON web server is running on. After rebooting (unplug/replug power) of the Raspberry Pi open the following page on your web browser of choice:

```
http://IPADDRESSOFRASPBERRY:8083/
```

or whatever port you have chosen to run the device. If you are already familiar with Z-Wave you may want to skip the next section about Z-Wave basics.