USE MANUAL
Stand-alone application

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USE MANUAL – Stand-alone application

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1 INTRODUCTION

As part of Task 6.2. “Develop the Cloud architecture” from Work Package 6 (WP6) “Development of Cloud Computing based Monitoring & Management Central”, the ENTOMATIC stand-alone application has been developed to check locally (i.e., in the area covered by a single gateway) the proper operation of the system as well as to download the data gathered in the gateway even in conditions of internet access failure. Unlike the web-access application, this data is only accessible by the SME-AG which holds the infrastructure deployed in the area.

The current document describes the main functionalities of this application, its requirements to be executed in a computer and also includes an installation manual. Lastly, a complete description of all its menus is also provided.

2 MAIN FEATURES

2.1 REQUIREMENTS

The stand-alone application may be installed in a PC or notebook with the requirements described in Table 2.1 and the additional requirement of having a micro-SD reader, as all the logs regarding the operation of the system are stored in a micro-SD card embedded in the gateway.

Table 2.1: System requirements of the ENTOMATIC stand-alone application

Supported operating systems		Windows, Linux, Mac OS
Hardware requirements	CPU Speed	2.2 GHz minimum or higher; Hyper-threading (HHT) or Multi-core recommended
	Processor	Intel Pentium 4, Intel Core Duo, or Xeon Processors
	Disk Space	500 MB of available disk space
	Memory / RAM	1 GB or higher
	Display Properties	24-bit color depth
	Screen Resolution	1024 x 768 recommended or higher at normal size (96 dpi)
	Video / Graphics Adapter	64 MB RAM minimum
	I/O	Micro-SD reader
Software requirements		*Java Runtime Environment* installed and updated

As for the gateway unit employed to gather data from the field, its detailed description can be found in Deliverables D4.2 “Development and performance evaluation of the ENTOMATIC network” [1] and D7.1 “Design of the fully integrated prototype and performance evaluation of the complete ENTOMATIC system” [2].

2.2 FUNCTIONALITIES

The ENTOMATIC stand-alone application is a software layer defined to receive, even in conditions of local internet access failure, the data obtained by the ENTOMATIC gateway unit via a micro-SD card. This module is able to read the data received from the field and store it, after pre-processing it, in the file system of the micro-SD card and the user computer.

This module also incorporates the ability for the software to perform system checks and detect possible failures in nodes and sensors. A user friendly graphical interface has been developed for the user to interact with all the above described modules. The whole application has been developed in Java[1], because of its ability to run the same program on many different systems and OS.

For being really useful to the user who wants to know the behaviour of the local network and to have a better understanding of the data obtained by sensors, the ENTOMATIC stand-alone application consists of two big elements: a network status dashboard and a log monitor. In the following lines, the main functionalities of the ENTOMATIC network status dashboard and the log monitor are detailed.

2.2.1 NETWORK STATUS DASHBOARD

The status dashboard shows in a simple and intuitive GUI as much information as possible of the elements of the ENTOMATIC system in a passive way, without asking the gateway to send any additional message to the network and just from its own information gathered:

[1] Java is a functional computer programming language that is concurrent, class-based, object-oriented, and specifically designed to have as few implementation dependencies as possible. It is intended to let application developers "write once, run anywhere" (WORA), meaning that code that runs on one platform does not need to be recompiled to run on another. Java applications are typically compiled to byte code that can run on any Java Runtime Environment (JRE) regardless of computer architecture.

- **The traps**
  The network status dashboard shows the following characteristics of each sensor node embedded in a trap:
  - Identifier
  - Relative position within the network
  - Status (active, inactive, no information) via a colour code
  - Date of its first deployment
  - Battery level
  - Summary containing the main metrics of its operation within the network: delays when transmitting data, sleeping periods, and power consumption

- **The gateway**
  As for the gateway, the dashboard also shows the following features:
  - Identifier
  - Relative position within the network
  - Status (active, inactive) via a colour code
  - Date of first deployment
  - Battery level
  - Reliability level of the received transmissions

- **Communication**
  Lastly, the state of the communications is also shown:
  - Evaluation of the link state between each node and the gateway

2.2.2 LOG MONITOR

The log monitor of the stand-alone application, apart from displaying operational data and offering drill-down functionality (i.e., allowing the user to explore more of the data and get different insights), uses the log generated by the gateway during its operation time to perform the following tasks:

- Generation and visualization of graphics generated from the data log
  - Time distribution of olive flies detected by each trap
  - Time distribution of other weather parameters sensed by each trap (temperature, humidity, and luminance)
- Comparison of parameters obtained by different traps
- Data filtering, analysis and generation of statistics

3 INSTALLATION AND USE

3.1 MICRO-SD

The ENTOMATIC stand-alone application allows to visualize the data gathered in the micro-SD card of the ENTOMATIC gateway unit. As it can be seen in Figure 3.1, the micro-SD card is placed in the little gap between the two USB connectors of the ENTOMATIC gateway unit. To run the ENTOMATIC stand-alone application the first step will be to remove the micro-SD card from the ENTOMATIC gateway unit and put it into the PC where the ENTOMATIC stand-alone application will be installed.

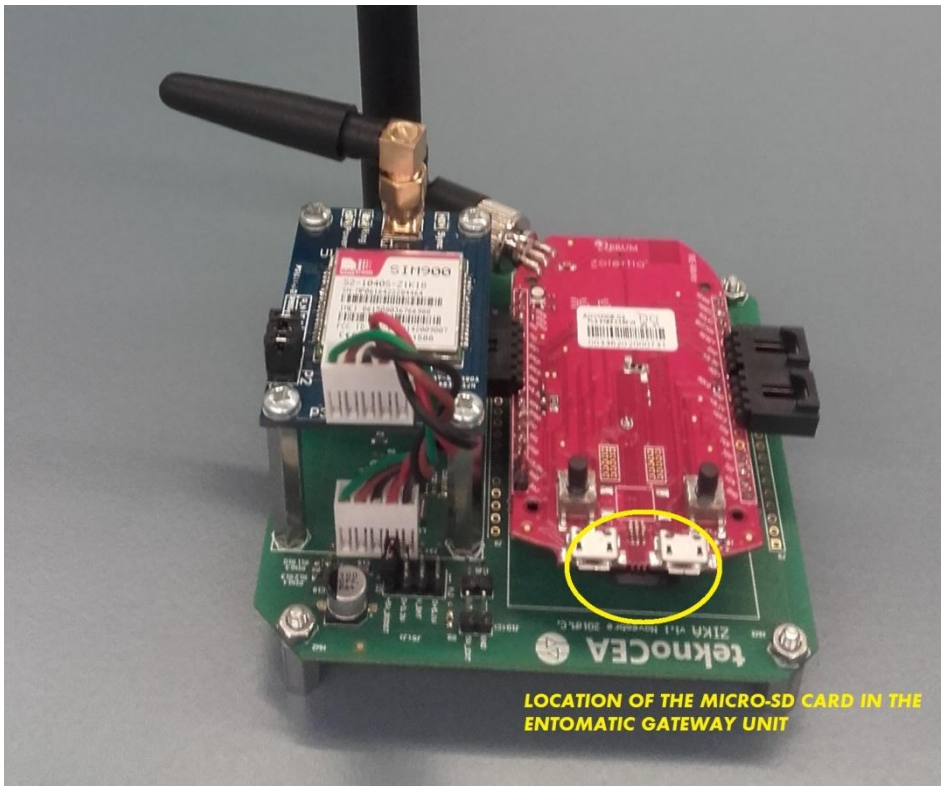

Figure 3.1: Location of the micro-SD card in the ENTOMATIC gateway unit

Two different files should appear in the folder corresponding to the micro-SD card (see Figure 3.2): ***routes.csv*** and ***log.csv***. While the first file stores the information regarding the network topology and the transmission routes, the second file includes all the gathered information from flies and environmental sensors as well as statistics from stations' performance.

At this point, it is highly advisable to copy these two files into a folder from the internal memory of the computer, so that the micro-SD card can be placed again in the ENTOMATIC gateway unit in order to keep controlling the whole system and storing new data from the field.

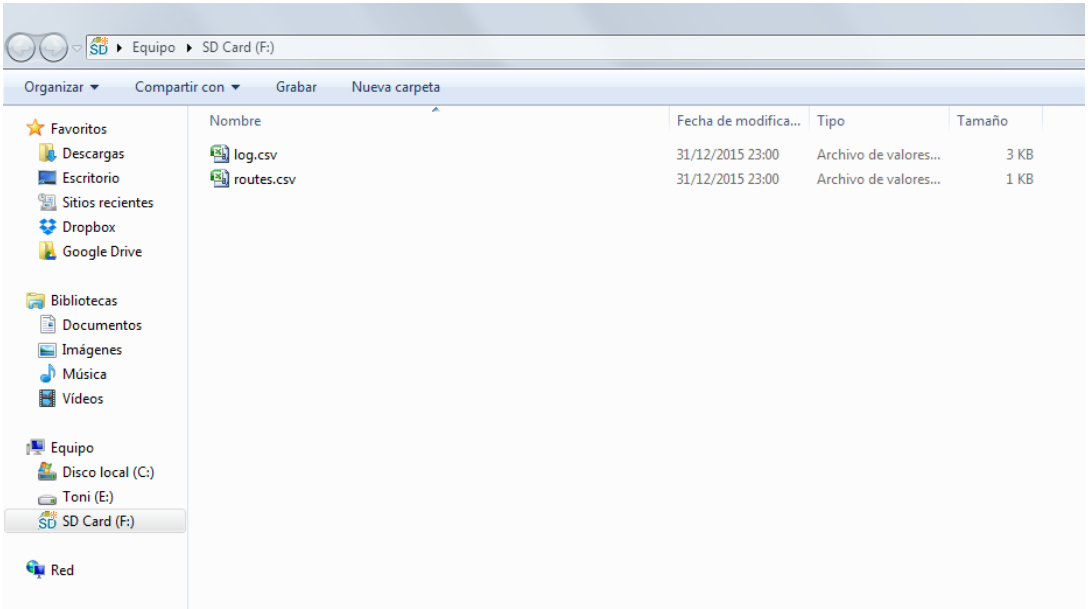

Figure 3.2: Contents of the micro-SD card running the ENTOMATIC system

3.2 JAVA EXECUTABLE

The ENTOMATIC stand-alone application is freely available through the following link by clicking on the ***Clone or download*** button:

https://github.com/wn-upf/ENT_StandAlone

Once downloaded the .zip package, the Java application executable is located in the following path:

\ENT_StandAlone-master\ENT_StandAlone-master\dist\ENT_standalone_Net.jar

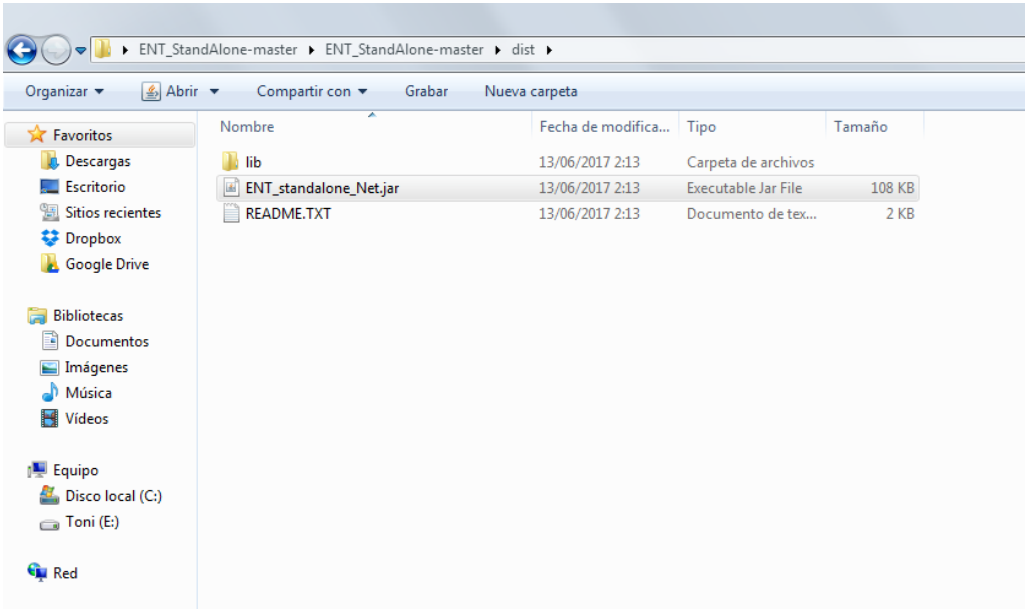

Figure 3.3: Location of the application executable

To execute the ENTOMATIC stand-alone application is necessary to have previously installed in the PC the Java Runtime Environment (JRE); that is, the software package that contains what is required to run a Java program. It includes a Java Virtual Machine implementation together with an implementation of the Java Class Library. The JRE can be freely downloaded from the following link:

https://www.java.com/en/download/

The first menu when launching the ENTOMATIC stand-alone application is the one from Figure 3.4. No network topologies are shown as no files have been loaded in the system. To do so, it is necessary to click on the *File* button, select the *Open topology* option and load the file with name ***routes.csv*** [2]. The outcome of this operation should be the drawing of the current network topology, like the one from Figure 3.5.

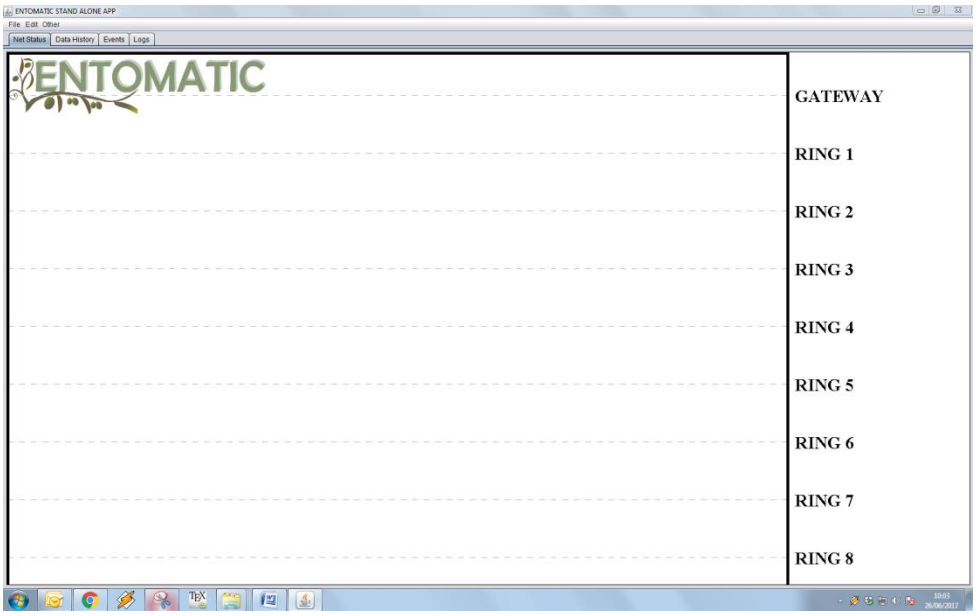

Figure 3.4: Main menu of the ENTOMATIC stand-alone application

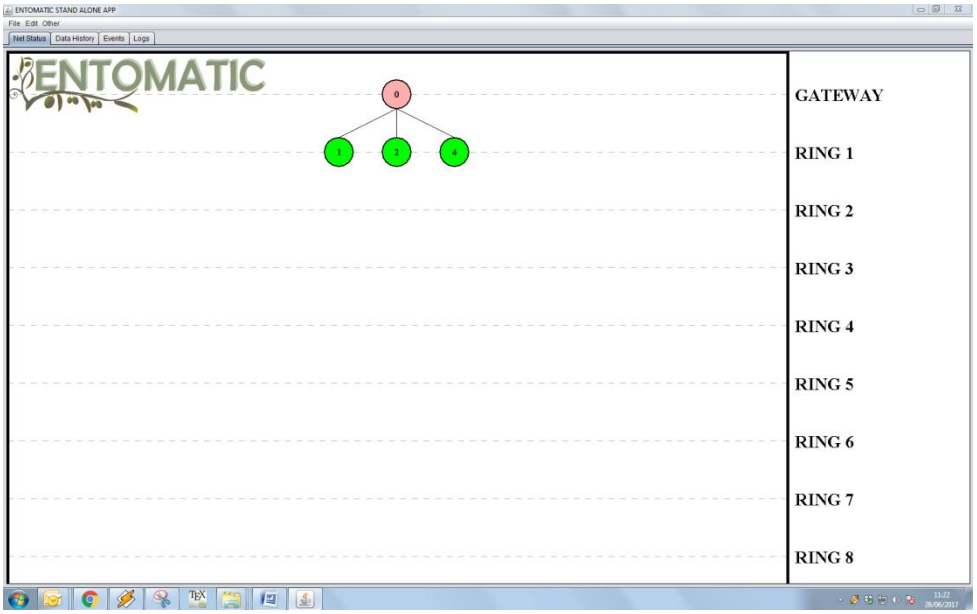

Figure 3.5: Example of network topology

Next, the data log should be also loaded in the application. To do so, it is necessary to click on the *File* button, select the *Open history* option and load the file with name ***log.csv*** [3]. To check if the operation has been successfully completed, it is advisable to have a look at any of the data tabs (*Data History*, *Events*, or *Logs*).

[2] It is highly advisable to keep a record in the PC of the different ***routes.csv*** files retrieved from the micro-SD card. This file is overwritten in the ENTOMATIC gateway unit every time the network changes its topology.
[3] It is highly advisable to keep a record in the PC of the different ***log.csv*** files retrieved from the micro-SD card. Every time the ENTOMATIC gateway unit is reset, new data is appended in the aforementioned file (in this case, no data is removed).

New information from consecutive activations of the system is appended in file ***log.csv***, so that old registers are never removed from memory. However, system administrators and application users should keep a record of these files in PC's memory and establish an own protocol to manage them and control versioning.

3.3 DESCRIPTION OF MENUS

There are four different menus in the ENTOMATIC stand-alone application that will help producers to analyse not only the data gathered by the system (namely; number of captured flies, temperature, humidity, and luminance), but also the behaviour and characteristics of the system.

3.3.1 NET STATUS

The ***net status menu*** provides the producer with the logical topology of the deployed network. On this screen the gateway is represented with a red circle, while traps are represented with green ones[4]. The number inside the circles corresponds to the ID identifier of each station. Traps are categorized into *rings* (i.e., the number of hops to the gateway) and lines between circles represent the dependence relationship between a parent and its child.

In addition, when clicking on any node, a little box appear with the following information:

- ID identifier
- MAC address
- Type of station
- Parent node
- Ring
- Number of children
- Battery level
- PDR (Packet Delivery Ratio) rate[5]

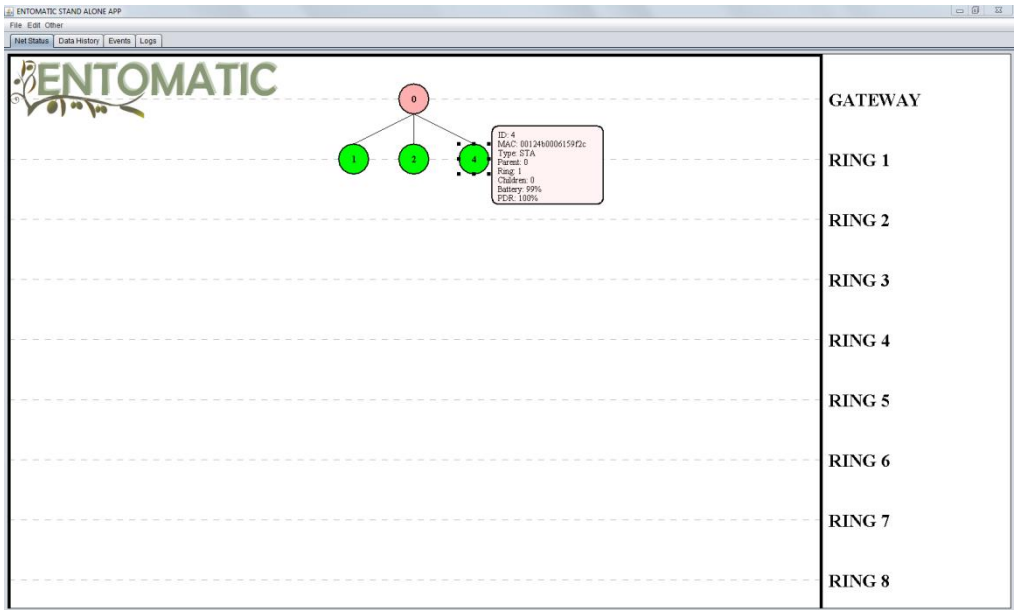

Figure 3.6: Net status menu

[4] Any node with a PDR rate below 92% will be painted in red instead.
[5] The PDR rate is the ratio of packets that are successfully delivered to a destination compared to the number of packets that have been sent out by the sender.

3.3.2 DATA HISTORY

The ***data history menu*** is the part of the application where the gathered data is displayed. It consists, in turn, of 4 different menus: *flies*, *temperature*, *humidity*, and *light*. The active traps of the system are listed on the right part of the screen while the representation of the corresponding variable appears on the left part. The information corresponding to a trap can be shown or hidden by clicking on the box next to the name of the trap.

The different monitored variables are chronologically represented on the graph, from the first data packet received by the gateway to the last one. Daytime axis can be moved forward or backward by using the scroll tool located at the bottom of the screen.

In addition, any specific area of the graph can be also zoomed in by using the left button of the mouse and creating a square target. Lastly, when clicking any area of the graph with the right button of the mouse, several different actions can be performed like resizing the plot, saving the image into a *.png* file or even printing the graph.

Figure 3.7: Data history menu

3.3.3 EVENTS

The list of events offered by the ***events menu*** informs the producer of the main events occurred during the execution of the ENTOMATIC system. There are up to four fields for each event:

- **Time:** Time in which the event occurred.
- **STA:** Trap responsible for the event. In case the GW (or the whole system) is involved in the event, STA value would be 0.
- **Category:** Number to distinguish between different kinds of events.
- **Message:** Short describing text of the event. The following events have been considered in the current version of the application:
    - **GW associated:** The GW has been successfully connected to the ENTOMATIC platform hosted in the corresponding web server.
    - **Reassociation beacon:** The GW has emitted a beacon to reassociate all the active stations of the system.
    - **New STA associated:** A new station has been associated to the ENTOMATIC platform.
    - **STA killed:** Due to its inactivity, a station has been disassociated from the ENTOMATIC platform.
    - **GPRS Error:** The GPRS could not transmit certain data to the ENTOMATIC platform.

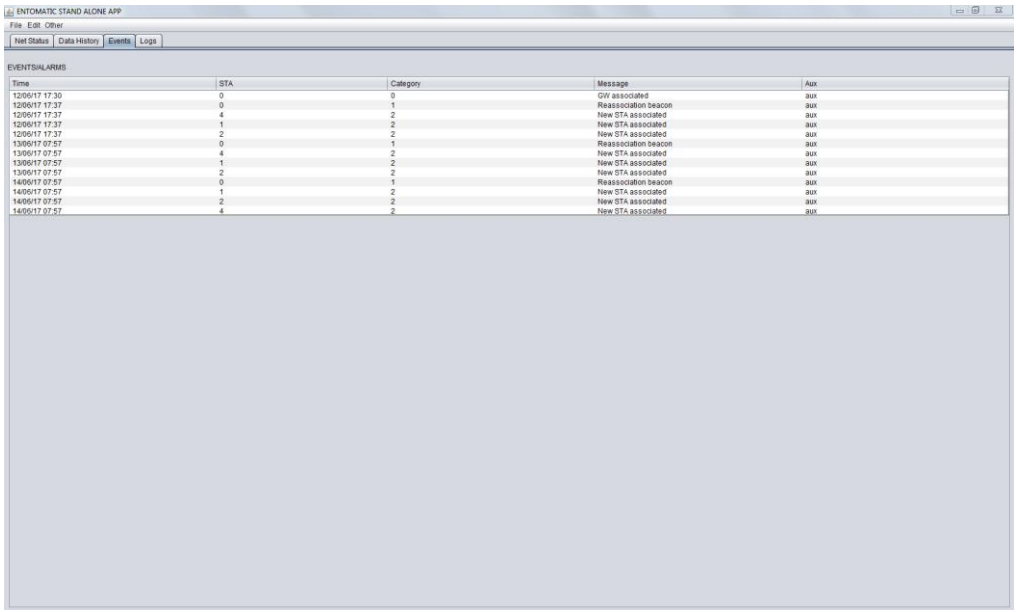

Figure 3.8: Events menu

3.3.4 LOGS

The ***logs menu*** compiles all the useful information regarding the state of the deployed network. This tool shall be used by producers and network administrators to control the behaviour of the network and plan its maintenance. The logs menu consists of two different information panels: the node topology log and the statistics history log.

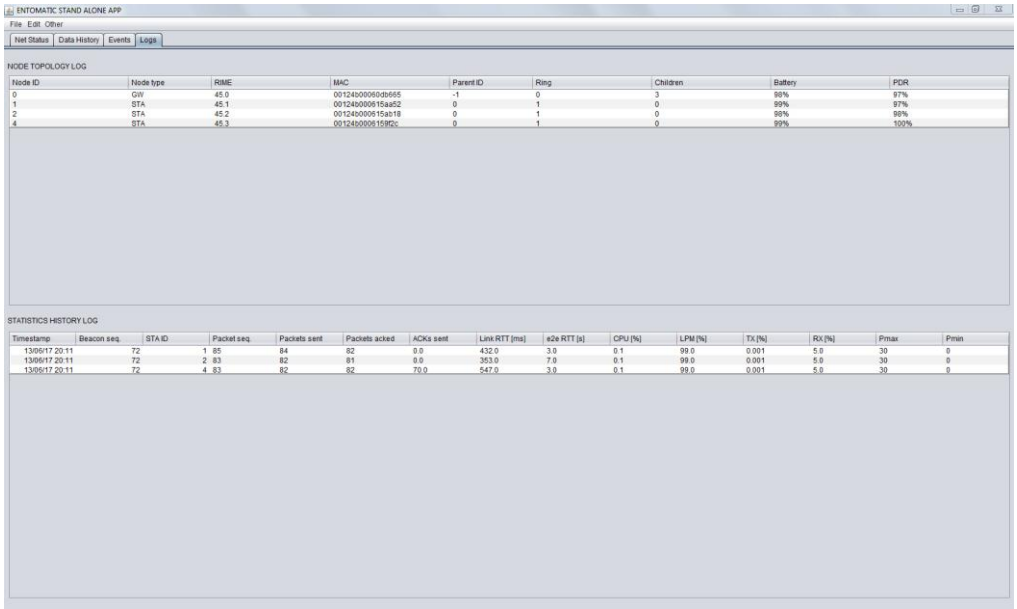

Figure 3.9: Logs menu

3.3.4.1 Node topology log

The ***node topology log*** is the written complement to the net status menu. This part of the log shows all the available information regarding the topology of the deployed network. The information is classified into the following fields:

- **Node ID:** Identifier of the node.

- **Node type:** Type of station (gateway or station).
- **RIME:** RIME[6] address of the node.
- **MAC:** MAC address of the node.
- **Parent ID:** Identifier of the parent node. This value is *-1* for the gateway, as it has no parent.
- **Ring:** Network ring in which the node is located.
- **Children:** Number of children of the corresponding node.
- **Battery:** Battery level (in %) of the corresponding node.
- **PDR:** Packet Delivery Ratio (in %) of the corresponding node.

3.3.4.2 Statistics history log

The ***statistics history log*** gives detailed information of the internal behaviour of each node. The following fields are provided:

- **Timestamp:** Time in which the statistics packet was received.
- **Beacon seq.:** Beacon sequence number.
- **STA ID:** Identifier of the station.
- **Packet seq.:** Statistics packet sequence number.
- **Packets sent:** Number of data packets sent by the corresponding station.
- **Packets acked:** Number of data packets properly acknowledged by the parent of the corresponding station.
- **ACKs sent:** Number of ACK packets sent to the children of the corresponding station.
- **Link RTT:** Average Round Trip Time (RTT) at link level expressed in ms.
- **e2e RTT:** Average Round Trip Time (RTT) at end-to-end level expressed in s.
- **Time states:** Percentage of time spent by the STA in each of the possible transceiver states:
    - **CPU:** Time (in %) in which the station's microprocessor remained in processing state.
    - **LPM:** Time (in %) in which the station's microprocessor remained in sleeping state.
    - **TX:** Time (in %) in which the station's transceiver remained in transmitting state.
    - **RX:** Time (in %) in which the station's transceiver remained in receiving state.
- **Power levels:** Maximum and minimum power level used by the corresponding station during the period from the last statistics packet sent.
    - **Pmax:** Maximum power level (from 0 to 30).
    - **Pmin:** Minimum power level (from 0 to 30).

[6] RIME is the internal addressing system of the wireless sensor network developed for the ENTOMATIC project.

4 REFERENCES

[1] T. Adame, S. Barrachina, A. Bel, B. Bellalta, I. Potamitis, F. Spiller, J. Charlier, J. Mira, G. Laude, N. Stavrakis, E. Ciner, M. Laleli and A. Estévez, “Design of the fully integrated of the complete ENTOMATIC system prototype and performance evaluation,” 2017.

[2] T. Adame, S. Barrachina, A. Bel, B. Bellalta, M. Chamoun, C. Capiscol, I. Potamitis, F. Spiller and W. Bryssinckx, “Development and performance evaluation of the ENTOMATIC network,” 2017.