



MINAmI

Micro-Nano integrated platform for
transverse Ambient Intelligence applications

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WP07 – Demonstration, validation & exploitation

Deliverable report

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Section 1 - Executive summary

1.1 Description of the deliverable content and purpose

The main contents of this deliverable are the Installation Guide document and the User Manual document regarding the demonstrator created in Task 7.2 *Health monitoring & Homecare demonstrator*. The purpose of this deliverable is to help users to install and use the Sleep logger and Reader & Charger prototype and the mobile application associated.

More specifically, the Installation Guide section describes the steps needed to install and configure the Sleep logger and Reader & Charger prototype and the *Health monitoring & Homecare* mobile application. On the other hand, the User Manual section explains how the user should make use of the demonstrator: Sleep logger and Reader & Charger prototype and mobile application. Therefore, it describes the Sleep logger and Reader & Charger prototype user interface and the mobile application user interface with the different options available to the user.

Therefore, this deliverable is structured as follows:

Section 2 – Introduction: brief introduction to the whole document.

Section 3 –Installation Guide: contains the steps needed to install the different components regarding the demonstrator.

Section 4 – User Manual: includes the instructions for the user about how to use the different demonstrator components.

Glossary

Acronym

HW
EEG
OS
IMEI
USB
URL
PC
SE
JDK
SSL

Signification

Hardware
Electroencephalography
Operating System
International Mobile Equipment Identity
Universal Serial Bus
Uniform Resource Locator
Personal Computer
Standard Edition
Java Development Kit
Secure Socket Layer

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Section 2 - Introduction

Health monitoring & Homecare demonstrator demonstrates in phase I the feasibility of the ultra-light physiological data logger concept in sleep disorder studies, where EEG and acceleration signal data are acquired from user's forehead over night. The system in phase I consists on a *Logger* device, *Logger Base* device, *Mobile Phone* application for transmitting data and a *Remote Server* application for receiving and archiving the data.

The user initiates data logging in the evening by attaching the *Logger* on his/her forehead using adhesive tape. For data readout from the logger memory in the morning, the user puts the *Logger* on the *Logger Base*, which automatically performs data readout and recharges the flexible batteries. The *Mobile Phone* has not communication with the *Logger Base* in phase I, so it transmits data that it's been stored previously in the mobile phone memory to the *Remote Server*, where the data is archived in a file.

This deliverable contains in two main sections the Installation Guide and the User Manual for this demonstrator.

The Installation Guide describes all the steps needed to install and configure the *Health monitoring & Homecare* demonstrator. This section covers the installation and configuration of the Sleep logger and Reader & Charger prototype and the mobile device application associated.

The User Manual section explains how the user should make use of the demonstrator: Sleep logger and Reader & Charger prototype and mobile application. It describes the Sleep logger and Reader & Charger prototype user interface and the mobile application user interface with the different options available to the user.

The first demonstrator is not intended to be a fully functional system, but rather a test bed for the components. Hence, this document also describes some control procedures not relevant for the final system.

Section 3 - Installation guide

This section provides the Installation Guide document which includes the installation and configuration instructions for the two main components of the *Health monitoring & Homecare* demonstrator: the Sleep logger and Reader & Charger prototype and the mobile device application associated.

3.1 Sleep logger and Reader & Charger prototype

In addition to the system components described below, the following tools are needed:

1. Regulated power supply providing 7 VDC / 200 mA.
2. PC with Windows XP, USB connector and SD card reader.

3.1.1 Description of the system components

Figure 1 depicts the demonstrator system components. The EEG amplifier and the Logger Patch form an integrated entity connected with fixed 'Preamp connector' to each other. Also the batteries are fixed with the Logger Patch.

The communication at this phase is galvanic via Base – Patch –connector. Also galvanic 'Presence –signal' simulates the future optical detector indicating for the base the presence of the Logger patch.

The USB connection is used to connect the Logger Base to a PC for debug and control purposes. Data transfer from Logger Base to PC is performed simply by moving the SD memory card from the Base to the PC.

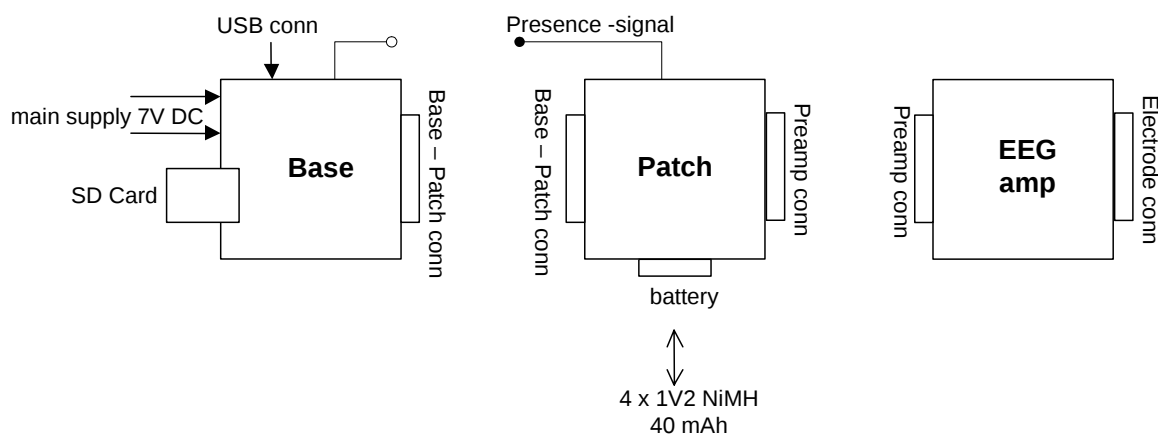


Figure 1 - Logger base, Logger patch and EEG amplifier external connections

Figure 2 shows a photograph of the logger system with labels of key components. This picture is will be referenced in several places both in the installation manual section and in the user manual section.

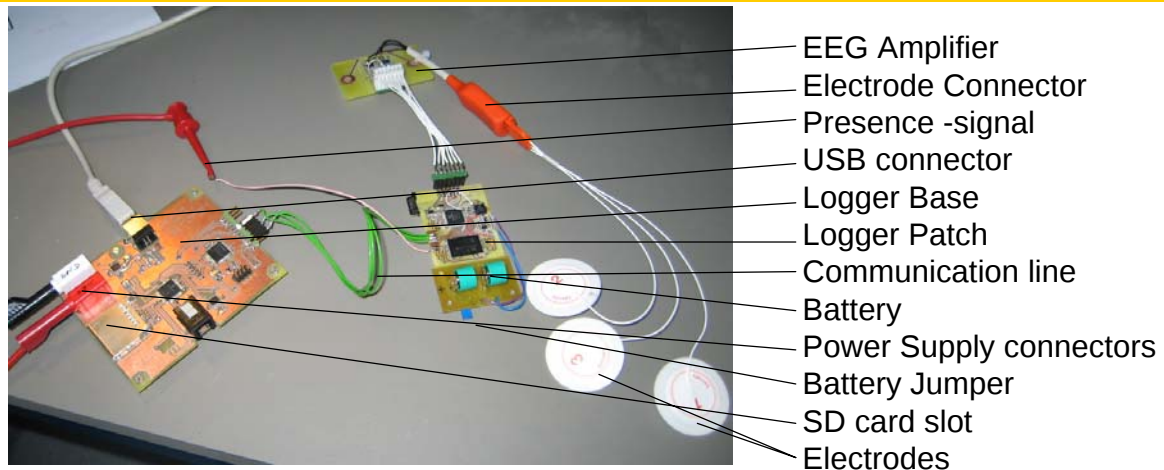


Figure 2 - Photograph of Logger system

3.1.2 Installation

3.1.2.1 Serial port Drivers

Serial port drivers for USB are needed for the PC to communicate with Logger Base.

Install USB virtual COM port driver on the PC: <http://www.ftdichip.com/Drivers/VCP.htm>

3.1.2.2 Terminal program

Windows HyperTerminal is used to communicate with Logger Base for control and debug purposes.

Configure Windows HyperTerminal with the following values to use the installed COM port:

- 115200 bauds
- no parity
- 8 bits
- 1 stop bit

Connect the Logger Base and PC with USB-cable and power up the Logger Base. Press Space Bar. The dialog in Figure 3 appears. Store the HyperTerminal configuration on computer's Desktop.

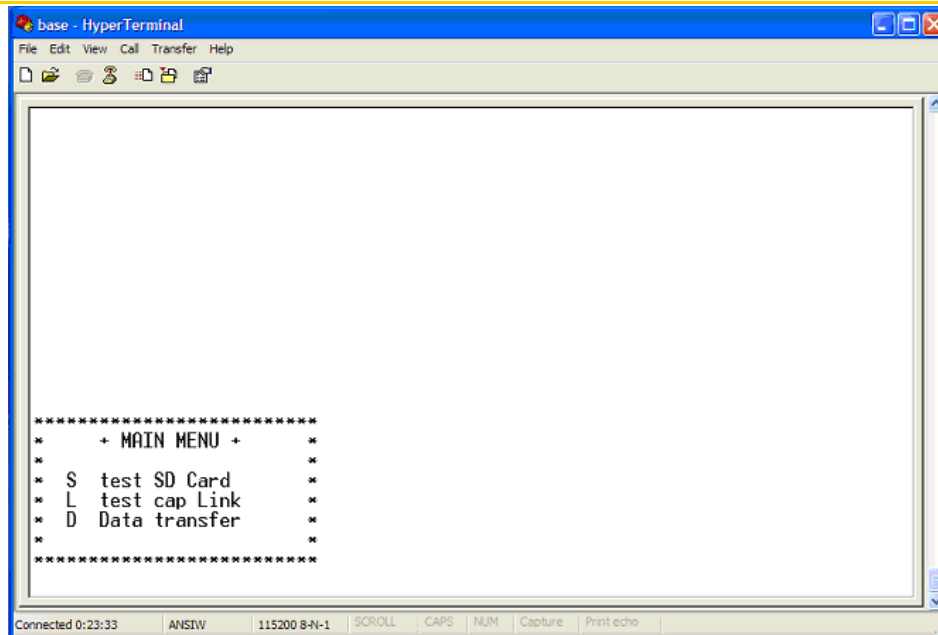


Figure 3 - Logger Base control window

3.1.2.3 Conversion program

Program ledf.exe (GE Healthcare) converts the Logger –specific data format in to widely used EDF-format (<http://www.edfplus.info/>) for visualization and post processing.

Copy the ledf.exe program file into a suitable folder, e.g. D:\Ledf. The program has only a Command Line user interface. If you plan to use the Command Line interface extensively, it is convenient to store the executable in such a folder, which is included in the operating system's search Path.

To access it conveniently from Windows, create a shortcut on desktop with settings show in Figure 4. 'Start in' folder is the destination folder of the converted data.

Name the shortcut 'Logger2EDF'. For other command line options, create new shortcuts with different command line parameters chosen from the following list:

- | | |
|-------------|---|
| -h | print this usage summary |
| -d DESTFILE | destination file name for EDF-formatted data |
| -s SRCFILE | source file name for logger data (without drive letter) |
| -p | write the output as an EDF+ file |
| -v | select verbose mode |
| -l DRV | drive letter for source data (e.g. F:) (Drive letter of the SD card reader) |

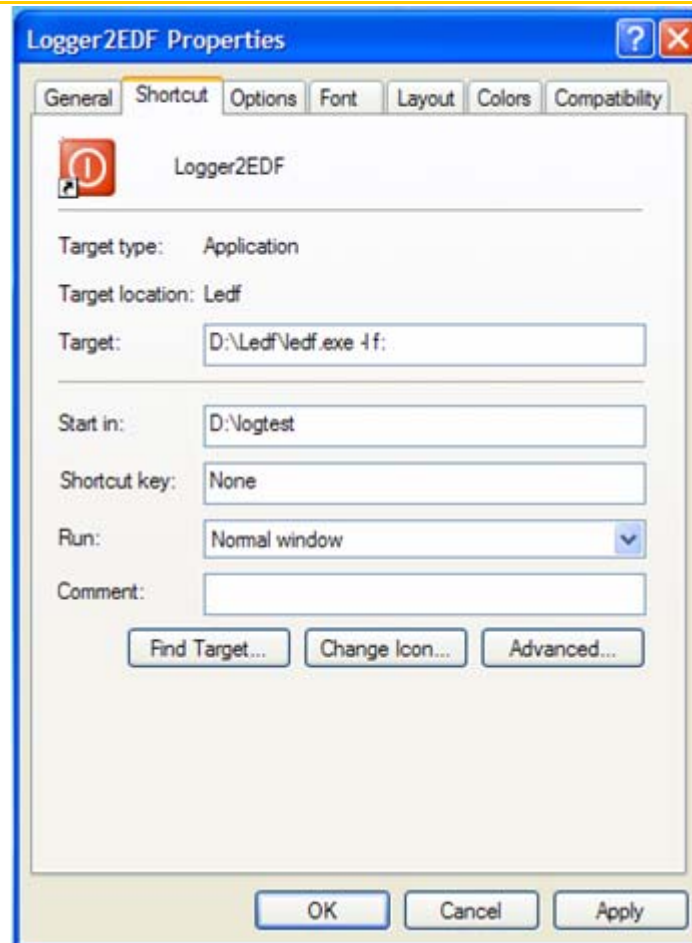


Figure 4 - LEDF.EXE shortcut

3.2 Mobile device application

The mobile device application associated to *Health monitoring & Homecare demonstrator* runs on terminals with Symbian OS version S60 3rd edition.

MINAmI's mobile device applications are Symbian's 3rd party external applications (.sis files) that must be signed (.sisx files) so the device can confirm its authenticity and it came from the intended developer and is not a virus of some sort¹.

Environmental needs:

- Desktop computer or laptop with USB port or Bluetooth connection.
- MINAmI-enabled mobile device (Symbian OS version S60 3rd edition).
- MINAmI *Health monitoring & Homecare demonstrator* (T7.2 hereafter) mobile application signed.

There are two options for installing the MINAmI's mobile device application. For both of them Nokia PC Suite² software must be installed and configured:

¹ Nokia provides free digital certificates to sign any application for each terminal. To generate those certificates is needed the IMEI number of each device. The IMEI number is usually printed on the compliance plate under the battery or in the mobile device's box. It can also be get in most mobile devices typing the code **#06#* so it appears directly in the display. When the product is finished the certificate must be bought to Nokia to sign the application with it so it can be distributed for every terminal. In order to install the application, the provider must supply a valid signed application for the mobile device that is going to be used.

- Option 1: Nokia PC Suite's install applications option.
- Option 2: Windows Explorer's Nokia Phone Browser option.

3.2.1 Option 1: Nokia PC Suite's install applications

- ❑ Step 1
Plug the mobile device in the USB port of the personal computer. In a few seconds a menu is visible in the mobile device, then select that it's going to be used the PC Suite (See Figure 5).

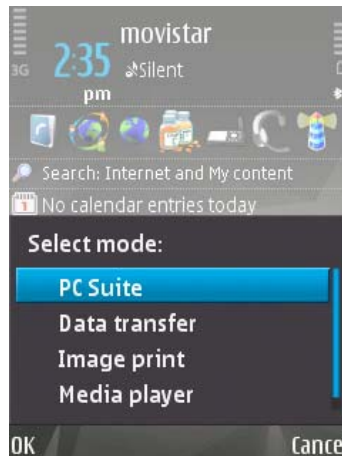


Figure 5 - Mobile phone's select mode

- ❑ Step 2
Open the Nokia PC Suite installed in the personal computer. Then select the option *Install applications* (See Figure 6).

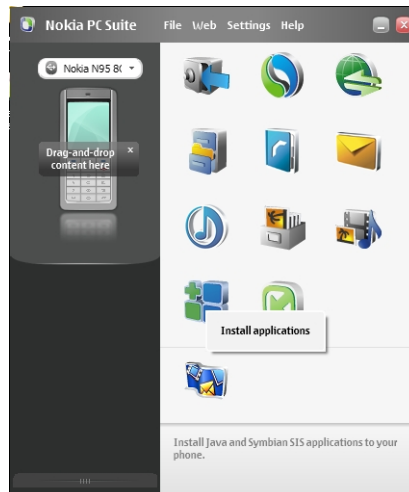


Figure 6 - Nokia PC Suite main window

² Nokia PC Suite is a free software package for connecting your Nokia device to a compatible PC. The following address offers a complete tutorial with animated demonstrations that can give you an overview of what your Nokia device can do in tandem with your PC:
http://nds1.nokia.com/tutorials/support/global/phones/pc_suite/english/index.html

□ Step 3

The Application Installer is shown, on the left side of the window it appears the personal computer's browser and on the right side it appears the mobile phone's browser. On the left side search and select the T7.2 MINAmI application's .sisx file and on the right side select Phone memory in order to install the Symbian application there. With the corresponding .sisx file selected, click on the install arrow in order to start the installation on the phone's memory (See Figure 7).

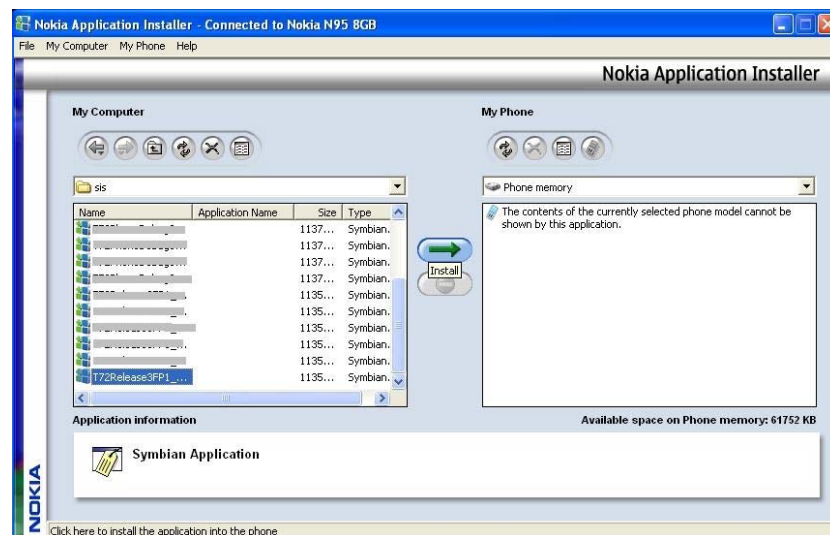


Figure 7 - Nokia Application Installer

3.2.2 Option 2: Windows Explorer's Nokia Phone Browser

□ Step 1

Plug the mobile device in the USB port of the personal computer. In a few seconds a menu is visible in the mobile device, then select that it's going to be used the PC Suite (See Figure 8).

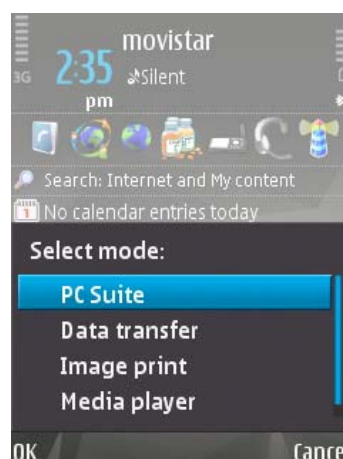


Figure 8 - Mobile phone's select mode

- ❑ Step 2
Open a Windows Explorer. On the left side it appears the personal computer's browser. When selecting on the left side the Nokia Phone Browser directory, on the right side of the explorer it appears the mobile phone's browser (See Figure 9).

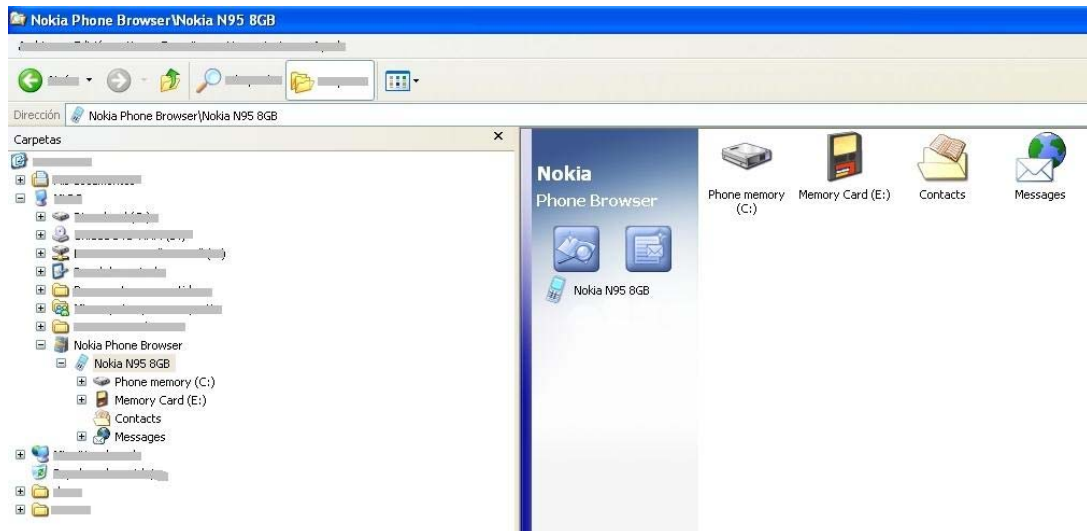


Figure 9 - Nokia Phone Browser

- ❑ Step 3
Search the T7.2 MINAmI application's .sisx file placed in the personal computer and copy it into the Phone memory of the mobile phone.
- ❑ Step 4
Browse into the Phone memory and select the Symbian application copied in the mobile device. Make double click on it; it'll ask for a confirmation, say yes and the installation on the phone's memory will start (See Figure 10).

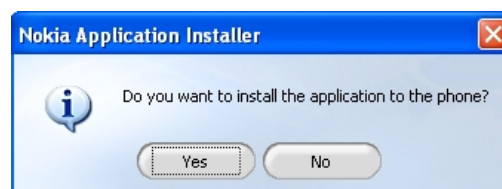


Figure 10 - Install confirmation

3.2.3 Update application

If it's necessary to update the application installed version, just delete the application from the mobile device and follow again the steps specified above.

3.2.4 Installation test

Once the application is installed, it's now available in the Applications folder on the mobile device's menu. Click on MINAmI_T7_2 icon and if the first page of the application appears it means that the application was installed successfully.

3.3 Server

The installation of the Web server is out of project's scope in phase I. It has been used a TID test environment and server.

3.3.1 Environment specifications

The host name is *minami2* and it has the following characteristics:

- Microsoft Windows XP Service Pack 2.
- Java 2 SE Development Kit: JDK 6 Update 2.
- Web Server Apache Tomcat 6.0.14.
- Secure Protocol SSL.
- Logging utility Apache log4j library.
- T7.2 Web application deployed in the server.

3.3.2 Authentication and authorization

The mechanism used to authenticate and authorize users in the server is the *lapache-tomcat-6.0.14\conf\tomcat-users.xml* resource offers by the Web Server Apache Tomcat. The user's roles are specified in that file in the following way (See Figure 11):

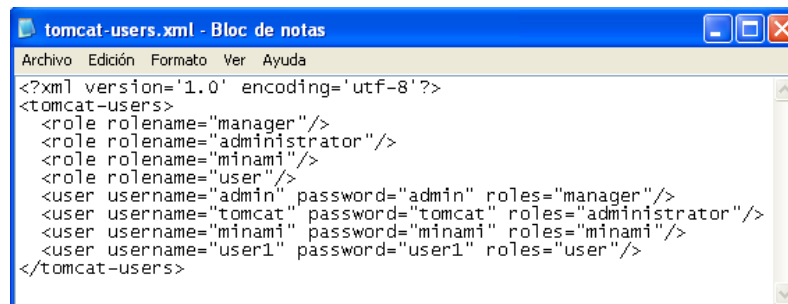


Figure 11 - Tomcat users

The T7.2 Health monitoring & Homecare demonstrator Web Server application is configure to authenticate and authorize the role *minami*, so *minami* it's the only user to have access to the T7.2 Web application.

3.3.3 Server availability

It must be performed the following test to ensure the server is working.

- Type in any PC's Web browser connected to Internet the following URL: <https://minami2:8443/Demonstrator2/data>
- It's a test server; a certificate error is expected so pass around if possible.
- Then a pop-up window will ask for a login/password. If it's typed a wrong login/password the pop-up window will open again until it's typed the correct one: minami/minami.
- If the Web server is started up and the login/password is correct, the server must respond with a blank page (See Figure 12).

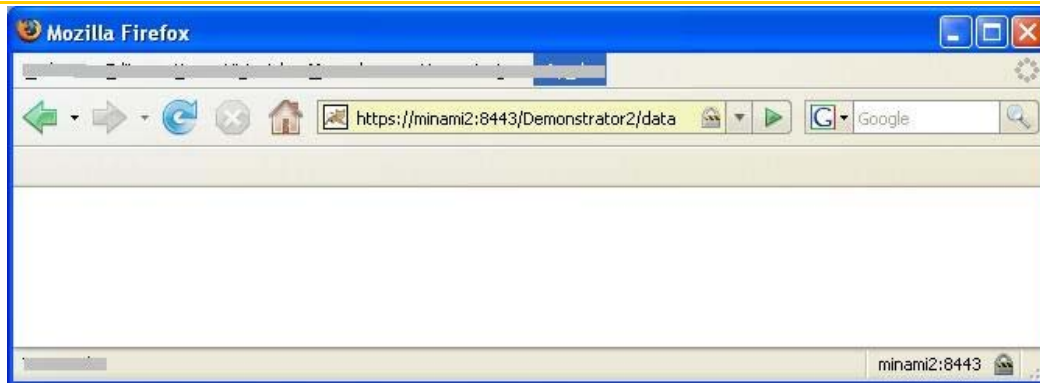


Figure 12 - Server response

Section 4 - User manual

This section explains how the user should make use of the demonstrator: Sleep logger and Reader & Charger prototype and mobile application. Therefore, it describes the Sleep logger and Reader & Charger prototype user interface and the mobile application user interface with the different options available to the user.

4.1 Sleep logger and Reader & Charger prototype

This chapter describes the steps needed for:

1. Collecting EEG and acceleration data.
2. Transferring the data to Logger Base.
3. Transferring the data to PC, converting it into EDF file format and visualizing the data.

In addition to the system components described in Chapter 3.1.1, the following tools are needed:

1. Regulated power supply providing 7 VDC / 200 mA.
2. PC with Windows XP, USB connector and SD card reader.

4.1.1 Recording

The following describes the required steps to record data with the Logger Patch.

- Power up the Logger Patch by closing the Battery Jumper (See Figure 2).
- Plug the disposable GE Entropy Sensor M1038681 into the Electrode Connector (See Figure 2 'Electrodes').
- Attach electrodes on the forehead of the subject according to Figure 13.
- The logger starts recording automatically when the electrodes are attached to the skin.
- The recording stops when the memory is full, or when the logger is placed on the base (simulated by the connection of the 'Presence –signal' to external 7V supply, see Figure 2), or when the logger is powered down.
- After recording, disconnect the GE Entropy Sensor from the Electrode Connector.
- Open the Battery Jumper (Keep always open when the logger is not in use).

GE Entropy Sensor, Disposable

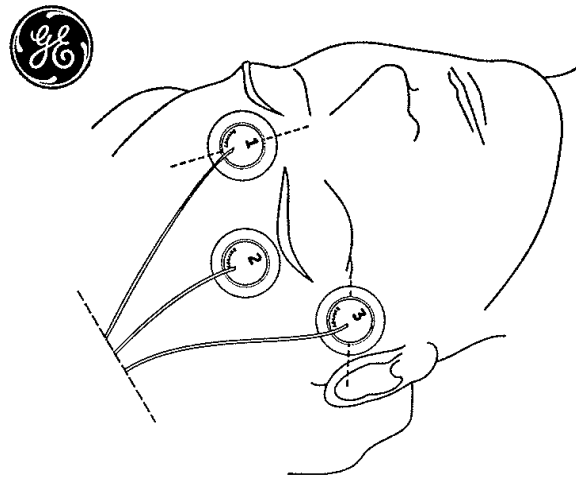
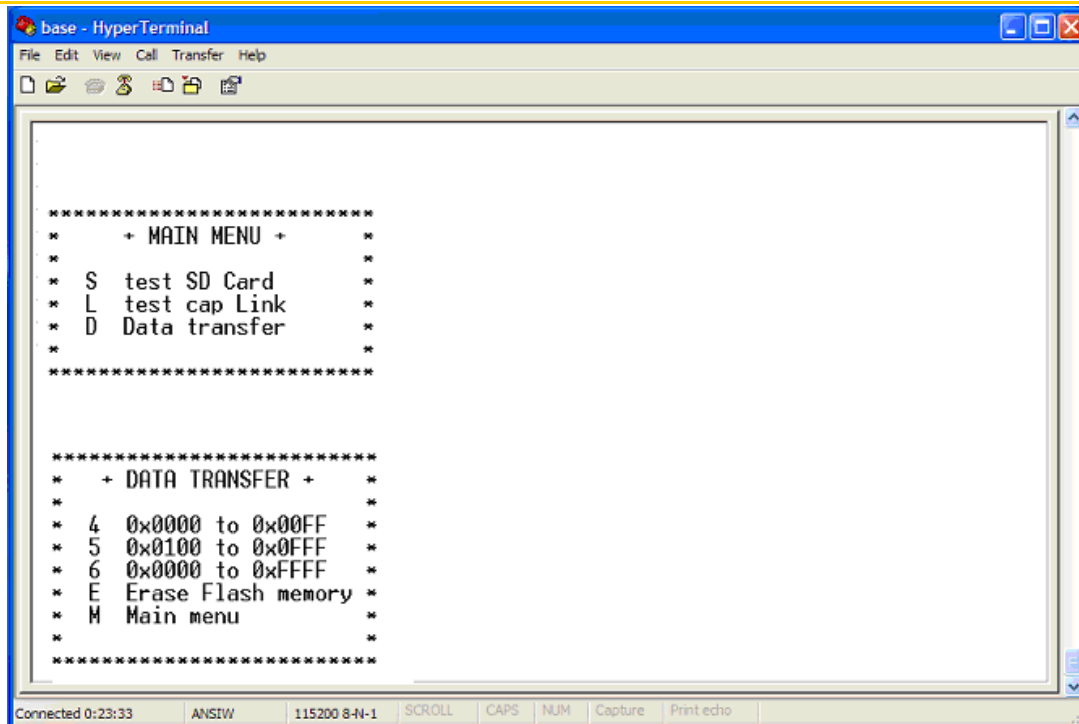


Figure 13 - Electrode positions

4.1.2 Data transfer from Logger Patch to Logger Base

The following describes the required steps to download the acquired data from Logger Patch. The procedure also included Logger Patch battery recharging.

- Insert the SD Card into the SD Card Slot in Logger Base (See Figure 2).
- Connect USB cable between the Logger Base (See Figure 2) and the PC.
- Connect the Logger Base supply (+7V).
- Open the HyperTerminal.
- Press (space) to refresh the terminal display. The main menu (See Figure 3) is displayed.
- Power up the Logger Patch by closing the Battery Jumper (See Figure 2).
- Connect the "communication line", green wires in Figure 2 (simulate RF communication).
- Connect the 'Presence –signal' (pink wire) to +7V (simulate proximity sensor).
- Wait for 10 seconds.
- Choose 'D' in HyperTerminal to access the Data transfer –menu (See Figure 3).
- Transfer the whole content of the memory by pressing (6). Partial transfer is possible with (4) and (5). (See Figure 14).
- Erase the memory of the Logger Patch by choosing 'E'.
- Leave the system on for 8 hours to recharge the batteries.
- Open the Battery Jumper.
- Switch of the Logger Base supply.



```
base - HyperTerminal
File Edit View Call Transfer Help

*****
*      + MAIN MENU +      *
*                          *
* S test SD Card          *
* L test cap Link         *
* D Data transfer         *
*                          *
*****

*****
*      + DATA TRANSFER +  *
*                          *
* 4 0x0000 to 0x00FF      *
* 5 0x0100 to 0x0FFF      *
* 6 0x0000 to 0xFFFF      *
* E Erase Flash memory    *
* M Main menu             *
*                          *
*****

Connected 0:23:33  ANSIW  115200 8-N-1  SCROLL  CAPS  NUM  Capture  Print echo
```

Figure 14 - Data transfer menu

4.1.3 Data transfer to PC and data conversion

In order to move the acquired data to PC, remove the SD card from Logger Base and insert it into the PC's card reader. File listing as in Figure 15 should appear. Each of these files includes 2000 s of EEG and acceleration data. In total, the 16 files include 8.8 h of consecutive data.

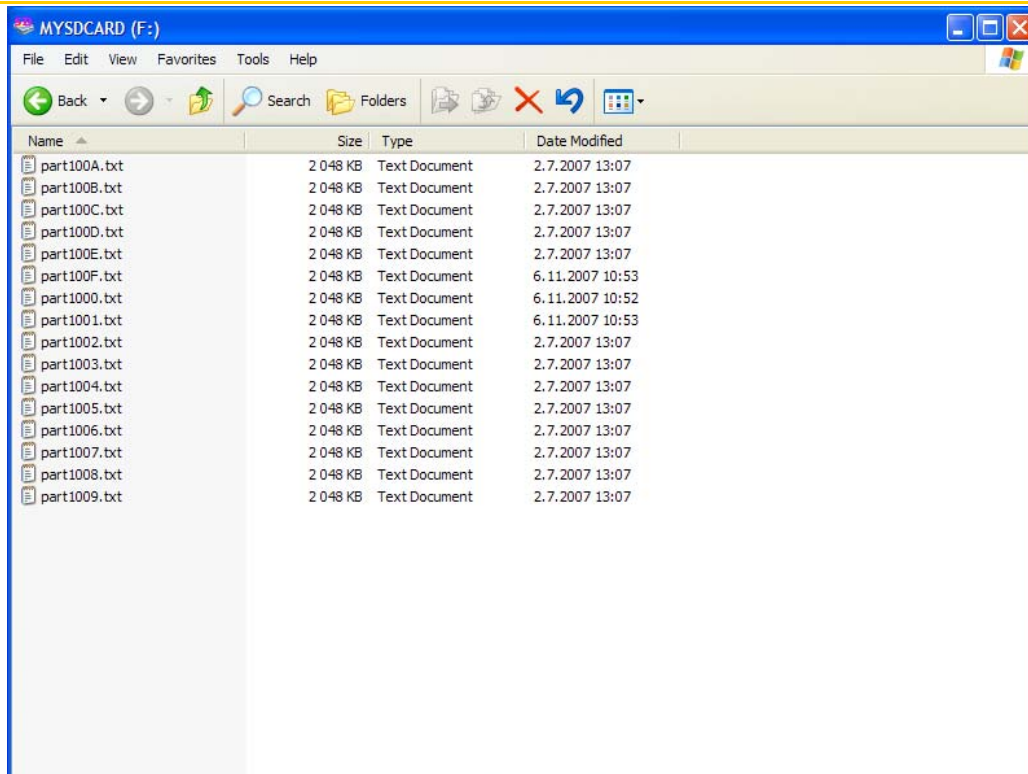
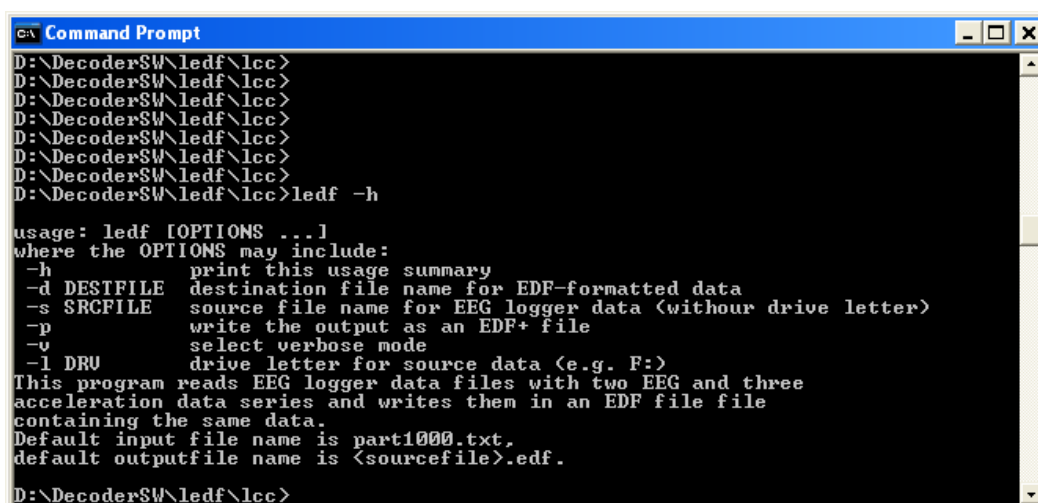


Figure 15 - EEG and acceleration data files on SD card

To convert the Logger data into commonly used EDF-format for visualization and post processing, use the ledf.exe –program.

The easiest way is to use the preconfigured icon (see Installation chapter) on PC's Desktop. Clicking the icon reads the data from the SD card and writes down the converted data into previously specified folder.

For more options, use the Command Prompt window as shown in Figure 16.



```
C:\> Command Prompt
D:\DecoderSW\ledf\lcc>
D:\DecoderSW\ledf\lcc>
D:\DecoderSW\ledf\lcc>
D:\DecoderSW\ledf\lcc>
D:\DecoderSW\ledf\lcc>
D:\DecoderSW\ledf\lcc>
D:\DecoderSW\ledf\lcc>
D:\DecoderSW\ledf\lcc>
D:\DecoderSW\ledf\lcc>
D:\DecoderSW\ledf\lcc>
D:\DecoderSW\ledf\lcc>ledf -h

usage: ledf [OPTIONS ...]
where the OPTIONS may include:
-h          print this usage summary
-d DESTFILE destination file name for EDF-formatted data
-s SRCFILE  source file name for EEG logger data (without drive letter)
-p          write the output as an EDF+ file
-v          select verbose mode
-l DRU      drive letter for source data (e.g. F:)
This program reads EEG logger data files with two EEG and three
acceleration data series and writes them in an EDF file file
containing the same data.
Default input file name is part1000.txt,
default outputfile name is <sourcefile>.edf.
D:\DecoderSW\ledf\lcc>
```

Figure 16 - Use of ledf –program from Command Prompt window

4.1.4 Data visualization

Use your favourite EDF viewer to visualize the data.

The two examples in Figure 17 and Figure 18 have been generated using proprietary SigView³ program.

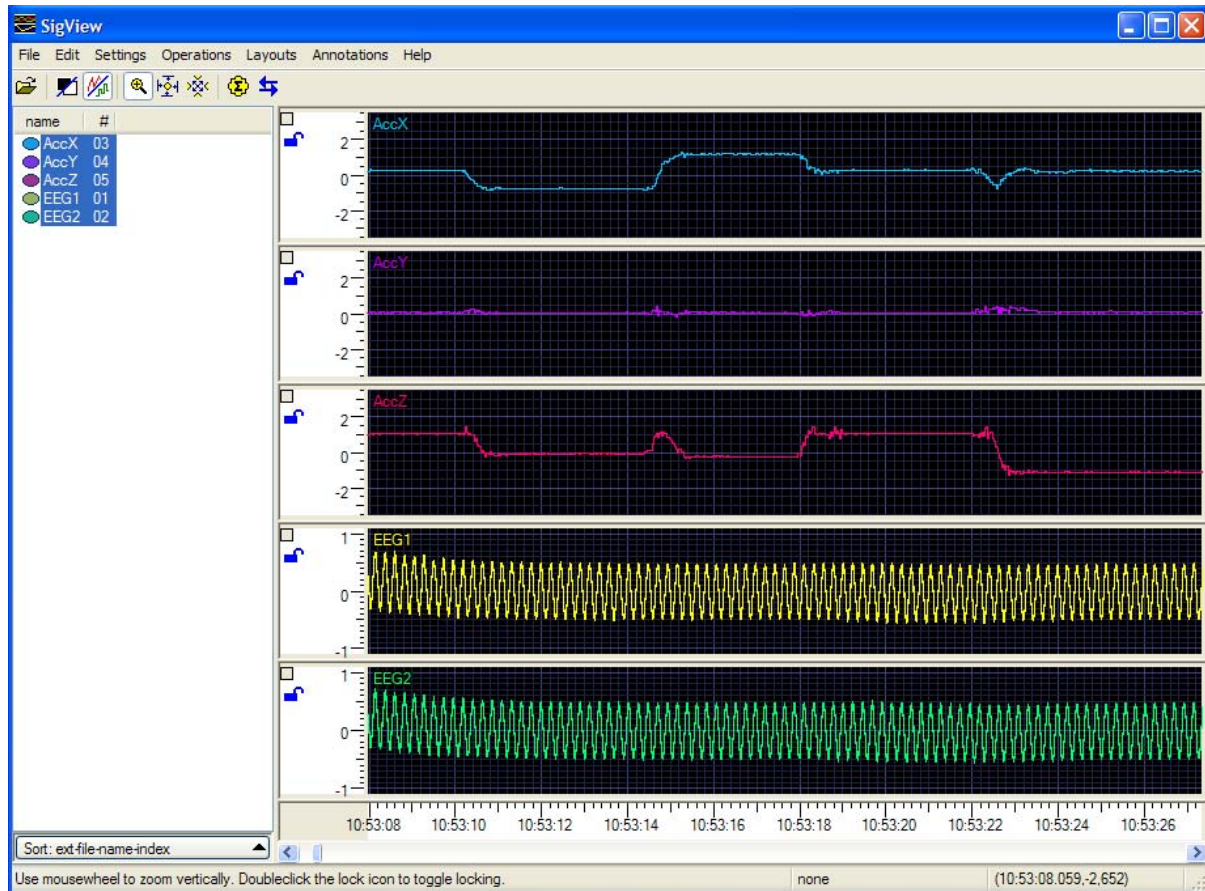


Figure 17 - Example signals: Moving the Logger Patch into different orientation generates square-wave like acceleration signals of $\pm 1g$. In the example, 1 mVp-p / 4 Hz sine wave is fed into both EEG channels

³ SigView is a real-time signal analysis software package with wide range of powerful FFT spectral analysis tools, statistics functions and a comprehensive visualization system. For more information go to <http://www.sigview.com/>

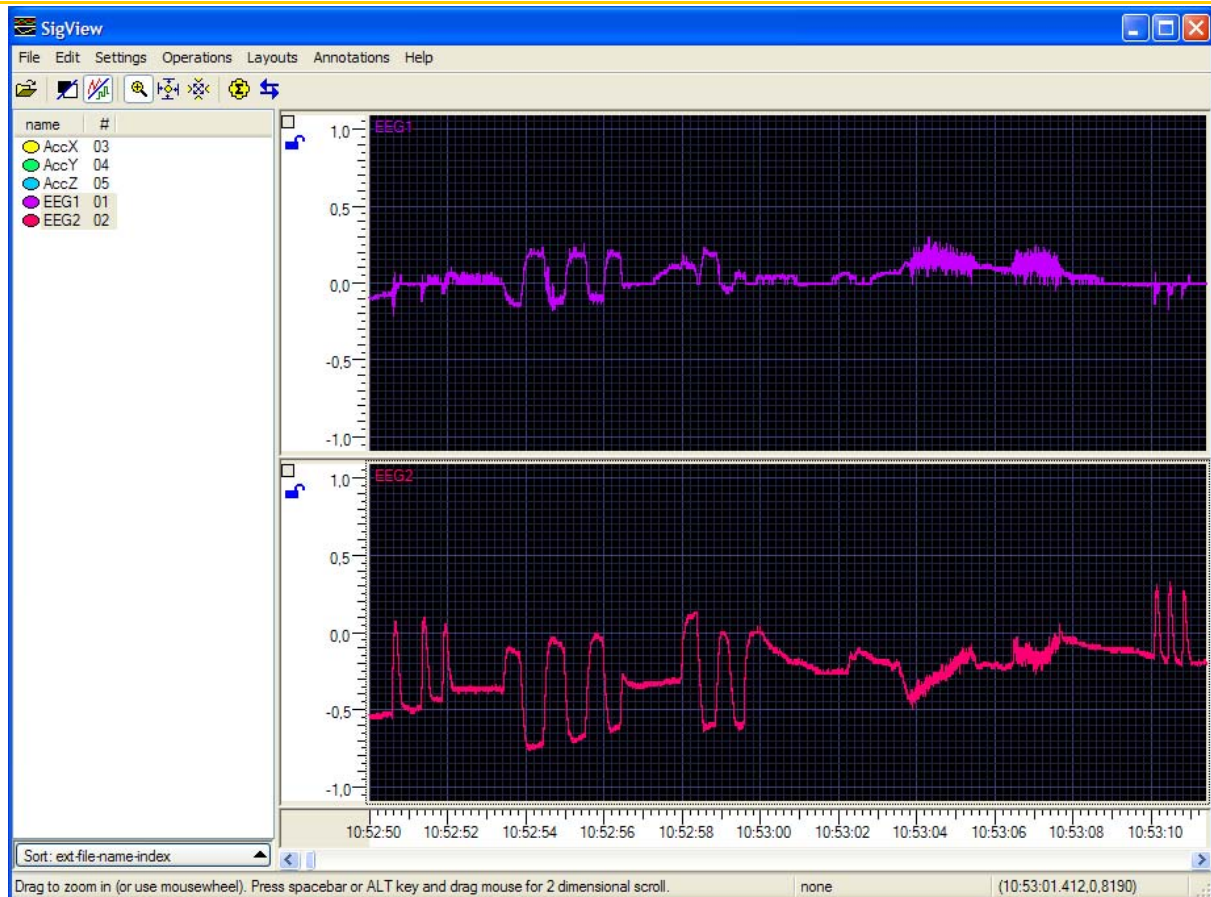


Figure 18 - Example signals: Two EEG signals from forehead indicating blinks, horizontal eye movements, frowning and again blinks

4.2 Mobile device application

Environmental needs:

- Sleep logger and Reader & Charger prototype to test functionalities.
- Bluetooth for communications.
- A running HTTP web server for communications.
- Internet connection (through GRPS or Wi-Fi access point).
- Mobile device with signed MINAmI T7.2 application installed.

4.2.1 Open T7.2 application

T7.2 MINAmI application is available in the Applications folder on the mobile device's menu (See Figure 19).



Figure 19 - Application T7.2

4.2.2 Start the application

When the user runs the MINAmI_T7_2 application the main view is shown (See Figure 20).



Figure 20 - MINAmI T7.2 main window

4.2.3 Exit

In the bottom right part of the main view there is a soft key labelled “Exit”. Clicking this key the application is closed asking for a confirmation (See Figure 21) and showing the Applications menu again of the mobile device.

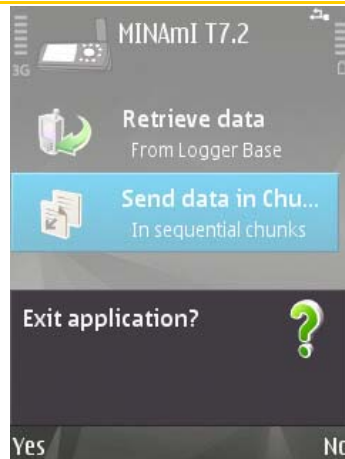


Figure 21 - Exit confirmation

4.2.4 Options

In the bottom left part of the main view there is a soft key labelled “Options”. Clicking this key a menu is presented with the following actions (See Figure 22): *Configure*, *Help* and *Exit*.

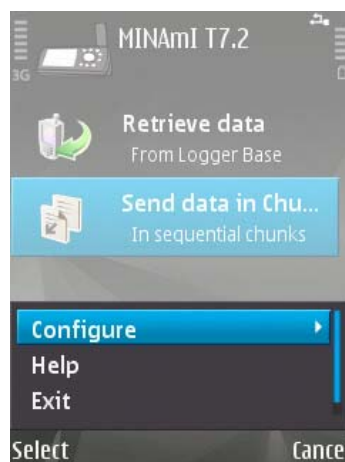


Figure 22 - Options

The user can interact with the application through this menu. The user can select one action or cancel the menu showing the main view again. Following each action is described in detail.

4.2.4.1 Configure

If the user selects this option a sub-menu is displayed (See Figure 23). The option here corresponds to: *Server*

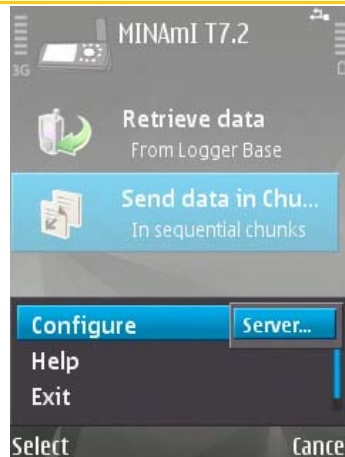


Figure 23 - Configure options

- **Server**
When selecting this option some setups regarding the web server are introduced here: URL, login, password (See Figure 24).



Figure 24 - Server settings

The URL that must be typed to configure the server is: <https://minami2:8443/Demonstrator2/data>. The login / password are (case sensitive): minami / minami

This configuration must be tested in order to authenticate and authorize the user clicking the bottom right soft key labelled “Test”. If the testing is passed the configuration is stored.

4.2.4.2 Help

This option is not implemented yet.

4.2.4.3 Exit

If the user selects this option, it has the same behaviour as the right soft key in the main view of the application; the application is closed showing the Applications menu again of the mobile device.

4.2.5 Retrieve data

In the main view, if the user selects this option, a message is display because this feature is not implemented for phase I.

4.2.6 Send data in Chunks

In the main view, if the user selects this option, data (stored in the application structure in phase I) will be transferred from the mobile device to the server (See Figure 25).



Figure 25 - Sending data to server

When all the chunks are received in the server, the file will be stored in a MINAmI's structure.

4.3 Server

The Web server is hosted in a TID's test server and stores the MINAmI T7.2 Web application. The Web application receives in chunks the file stored in the mobile phone memory and stores it in the structure of the server. It's been used a 35Mb PDF file for testing.

4.3.1 Data transferred to server

Once the user has configured the server in his MINAmI mobile phone application, he can send the file to the Web Server. The file will be stored in the following structure (See Figure 26): \MINAMI\t7.2.health_monitoring\<login>\<login><date_in_format_YYYYMMDDHHmmss>.pdf

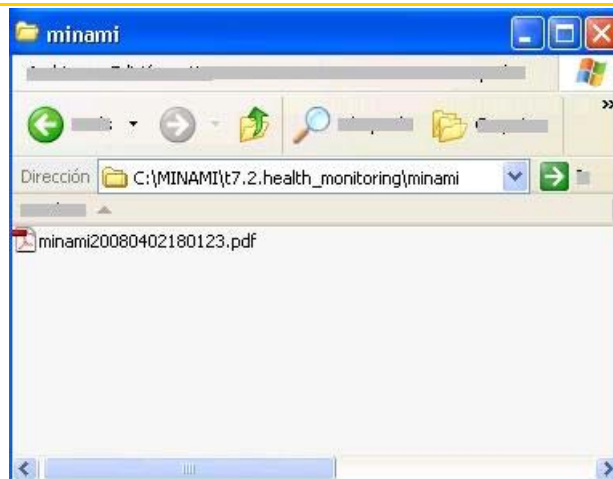


Figure 26 - Data file path