DWC14 Smart PDA maintenance user interface

Contents

Component Description

Basic Services

The basic services of the application are:

- Storing technical information of a segment, asset or measurement location. Also, it is possible to create technical chapters that are not directly connected to a segment or an asset.
- The information can be plain text, html text, photos, videos, sounds and links to web pages or intranet pages.
- Creating PDA users profiles by declare different PDA users categories.
- Recording all the actions during an inspection.
- Presenting the information according to PDA user profile.
- Easily change the information or adding new.
- Easily and reliable recognition of a segment, an asset or a measurement location.
- Special care for persons with special needs.
- Statistical analysis of the inspections.
- Navigation Map.
- Dictionary of technical terms.
- Comparison of assets.
- Reporting Forms.
- Supporting of training courses.

Basic Architecture

The main element of the system architecture is a server with a data base for the technical information and the data that support the system operation.

There are two types of users:

1. The PDA users that make the maintenance inspections
2. The system users that operate the system, manipulate the information and get the statistical results.

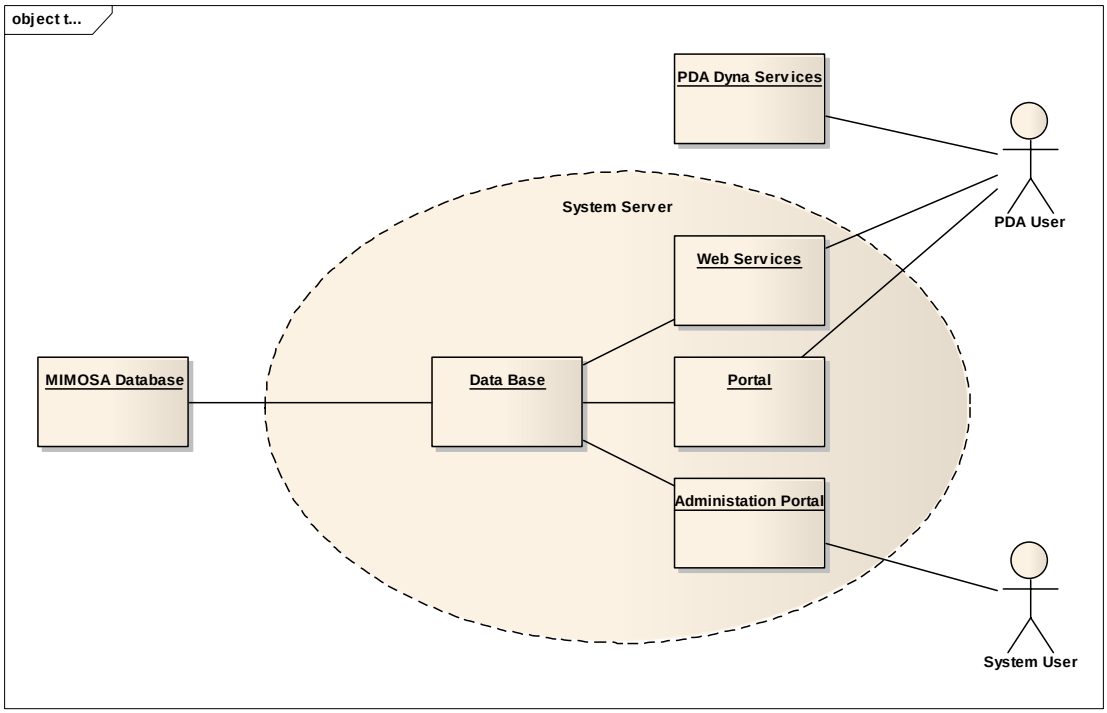


Figure1. Basic Architecture

System Server

In the system server two data bases are included. In the first data base are stored all the technical information. That db is called “dbInfo”. In the second one are stored all the data and the parameters for the operation. That db is called “dbSupport”.

The users cannot have directly access to these data bases. The connection is established through web services and a portal.

Also, there is connection between some fields in the system DBs and the MIMOSA db.

System Users

The roles of the system users are to support the system operation, parameterize it, retrieve statistical results and manipulate all the technical information. Actually, there are four system users’ roles:

1. System Administrators. The person that is responsible for the installation, the parameterization and the operating of the system.
2. PDA Administrators. The person that gives the PDA to the maintenance staff, creates their profiles and selects predefined inspections procedures.
3. Information Content Managers. The person that inserts the technical information and handles the connections of the data to MIMOSA data base.
4. Staff Supervisors. The person that handle the statistical analysis of the inspections.

PDA users

On the PDAs, there is installed an application with friendly interface. That application is connected through web services to the server and all the information are displayed in html pages connecting to the portal in the server.

Recognition of Segments, Assets and Measurement Locations

The recognition of a segment, an asset or a measurement location is based on RFID technology. In this way, it is not necessary to type any number or select any item from a list. There are rfid tags connected to any asset, segment or measurement location. On the PDAs there is an rfid reader device that reads the unique code of the rfid tag and sends it to the server in order to retrieve all the information considering the selected segment, asset or measurement location (objects).

The selected RFID type is MIFARE 1K in 15,56MHz. The reading distance is about 10 centimeters. So it is quite difficult the reading to be fault.

PDA Services

Services are calling all the applications that included in the system and are available to the PDA user. The main services are:

Technical Information

All the information about a segment, an asset or a measurement location is represented in html pages which are created dynamically by the server. The information is modified according to user profile. The format of the html pages is standard for all pages. The information for every object is separated into fields. In every information field there is a field title, pictures, text and links to videos and other html pages. There is the ability to create as many fields are necessary for each object category. Also, because the screen of a PDA has small resolution, you can create a number of connected pages and split the information fields in these pages.

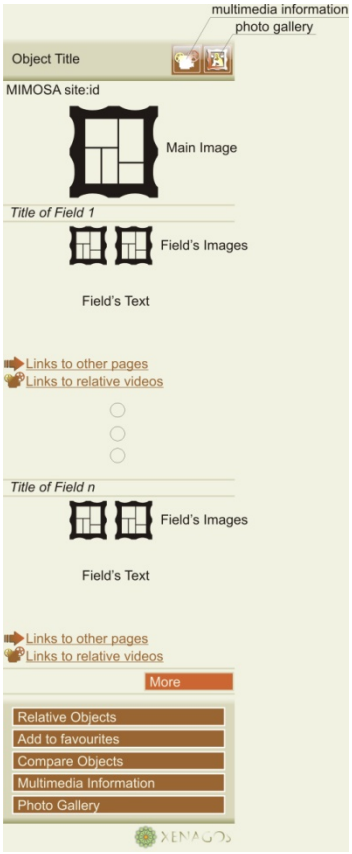


Figure2. Information Format

On the top of the page, the title of the object is displayed and next to it there are two buttons if there is multimedia information or a photo gallery.

Under the title, the site and the id of MIMOSA database are displayed. After, MIMOSA information an image of the object is displayed in order the user to confirm that he has selected the right object. Under the main image the information fields are displayed. At the bottom of the page there is a link to the next page and some buttons linked to other services.

More Information

If the user needs more information by clicking the button More in the main page the next information fields are displayed in a page in the second screen of the application. In that way, if the user needs to go to the main page of the object again just selects the first screen.

Dictionary of terms

In the system there is implemented a dictionary of technical terms. If a term is presented in a text then by clicking it the user can see the explanation.

Predefined Maintenance Inspections

There is the ability to declare the steps of a maintenance inspection. Actually, a route of segments, assets and measurement locations can be declared. The PDA user can select a route and the system will give him instructions which objects and in which sequence he should check them. Additional, special reports forms can be created in order to be filled after the inspection of a segment, asset or measurement location.

Predefined Maintenance Inspections Cases

On the PDA the user can select a predefined inspection. On the map is displayed the next segment or asset that the user must check. After the check the next point is displayed on the map.

Map

The map is a very useful tool. There is diagram of all the facilities where the objects are displayed with special marks. The mark for the objects that have been checked is different than the others. Also, by clicking on a mark the user can retrieve all the information for this object.

On the map, critical points like fire exits, doors and stairs, are displayed. By clicking them there is available a short description of it.

Network

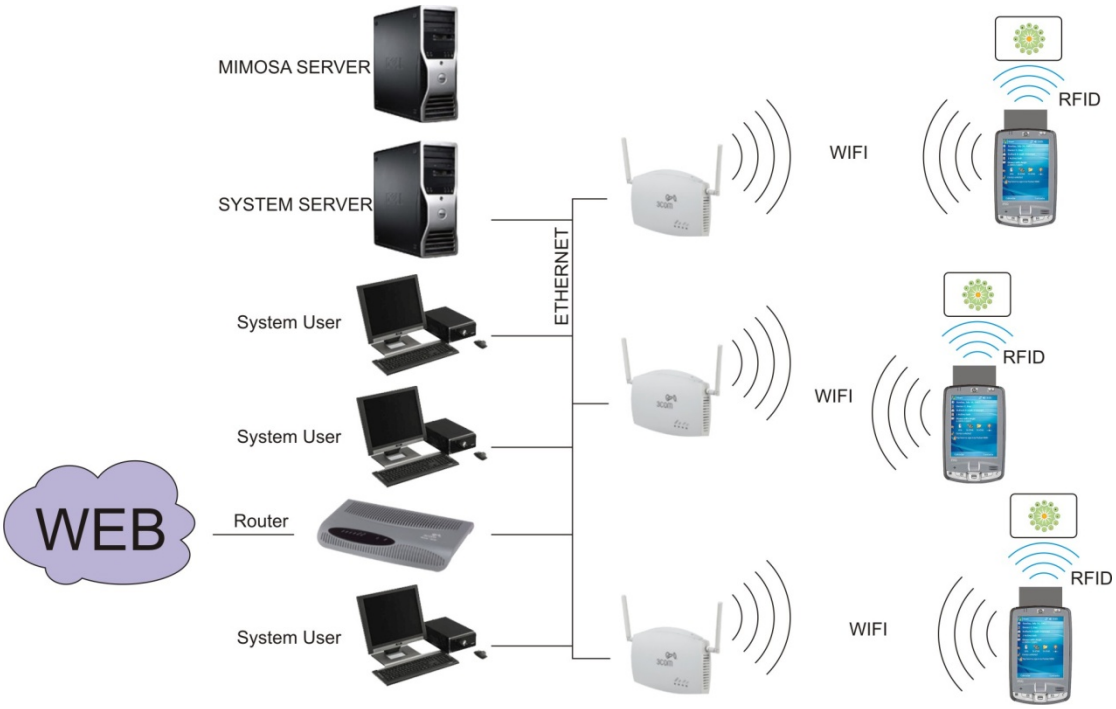


Figure3 Network diagram

System User Interface

The system interface is a portal where the user can access all the tables of the database according to his rights. The actions that can be done with that portal are:

- Declare the basic parameters of the system
- Declare the PDAs and the rfid reads.
- Create new language.
- Create the territories on the map and connect them to each other.
- Create critical points on the map.
- Create new PDA users categories.
- Create new PDA users and System users.
- Start or terminate an inspection.
- Check the status of running inspections.
- Send messages to PDAs.
- Create training groups.
- Parameterize the data base for the technical information by creating object categories, groups of categories, information fields, types of presentations, adding or removing information fields on a category.
- Insert or modify the technical information (text, images, videos, sounds, links)
- Insert new terms in dictionary.
- Create correlations between the objects.
- Display all the history of inspections. Also, the history can be displayed with charts.

MTI PDA Application

Starting the Application

The application when initializing tries to communicate with the system's server in order to exchange critical information. After that procedure is finished a message will appear on the screen that will inform you about the device's state, that message will be one of the following:

1. **Device ready for new tour.** The device will show a message informing that is ready to be assigned with a new tour. By pressing "Start" you can start the tour. However, if the device is not assigned with a valid tour you will be informed with the appropriate message and the device will not be able to start until is assigned with a new tour[1].

Image 1: Successful initialization of the device.

2. **Device with low charging level.** If the device is not charged enough, then the corresponding message will appear. In that case connect the device with its power supply and press "Check State", this action will show the current charging level. When the device charges it will automatically move to state 1.

3. **Invalid device.** In case that a "Invalid Device" message appears, then the device is not in the collection of devices that are associated with the MTI system. Importing a new device to the system can only be performed by the systems administrator.

4. **Failure of communication.** This message appears in case that communication between the PDA device and the main server cannot be achieved. More information about this error can be found on the manual of MTI helping applications.

[1] Information about assigning a new tour to a device can be found on the "Reception User Manual".

In order to move to the main functionalities of the application, the device must be on the first state and will have to be assigned with a valid tour. In that case and by pressing the "Start" button the main application starts.

Starting a digital tour

The application directs you to the starting web page, which contains some brief information about the inspection area; by pressing "Start" you will be directed to the main menu of the application[2].

Image 5: Starting page.

When the main application loads, press the button that depicts an arrow on the lower right side of the screen, by doing that the device will suggest an object by presenting its location on the window of the map. Once you walk near to the RFID tag of the object, place the upper end of the device on the tag. That procedure will present to you the relative information of the object. By repeating the same procedure (press the arrow on the lower right side and scanning the RFID tag of the object) you will be able to follow the suggested tour that you were assigned to in the beginning. However, you can get information for any item by placing the upper end of the device to the corresponding RFID tag.

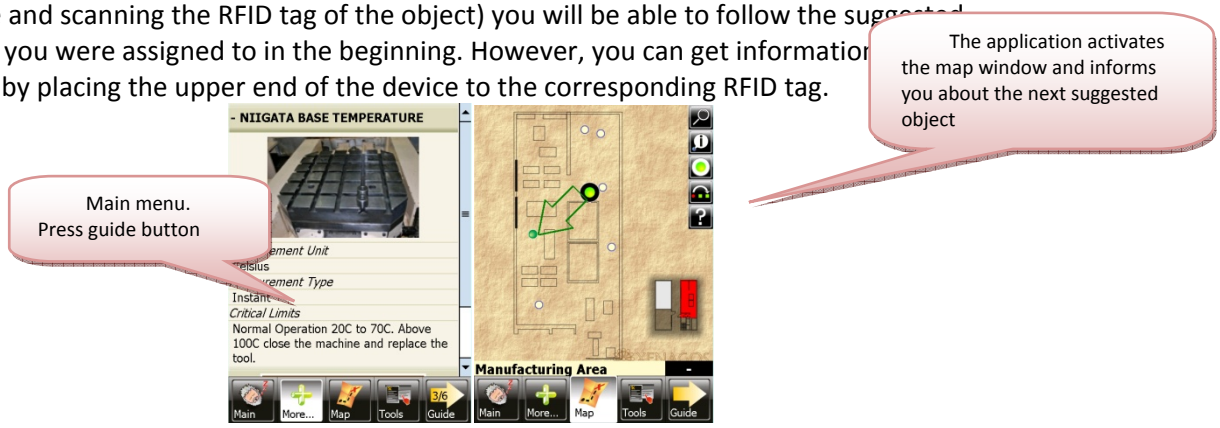


Image 6: Starting main application

Main Menu

MTI, parts of two main areas:

1. **Functionality Area.** The functionality area consists of five in total buttons. Each one defines the active window on the information area.

[2] The main page can be absent; in that case you will be moved directly to the main menu.

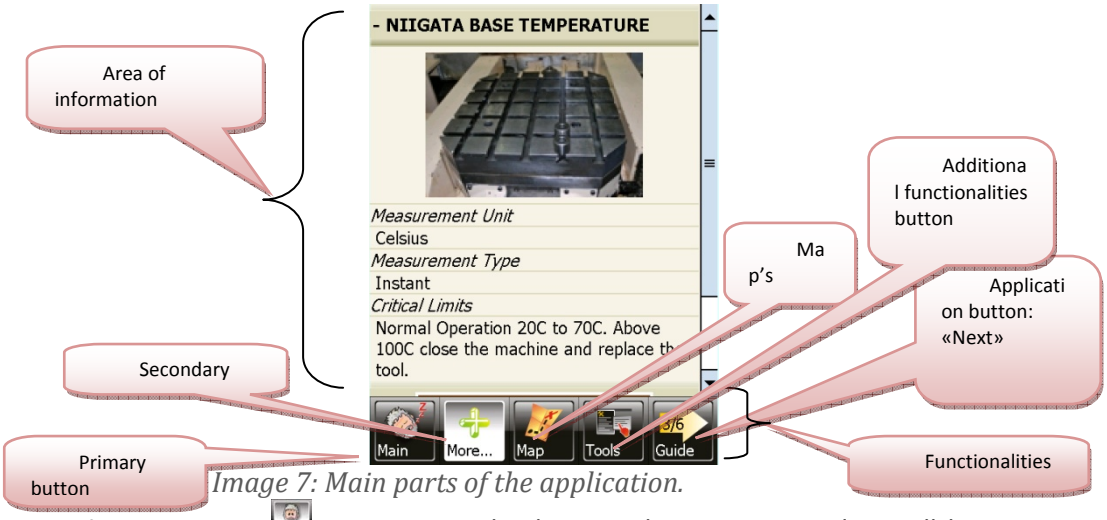


Image 7: Main parts of the application.

a. **Primary Button,**  **.** By pressing this button, the primary window will be activated on the information area.

b. **Secondary button,**  **.** By pressing this button, the secondary window will be activated on the information area.

c. **Map's button,**  **.** By pressing the third button on the functionality area, the map window will be activated on the information area.

d. **Additional functionalities button,**  **.** By pressing the forth button, the window of additional functionalities will be activated on the information area.

e. **Next Step Button,**  **.** This button's functionality is to present the next, suggested, action. This choice may lead to two possible results:

   i. **The next action is a web page:** In this case, on the information area, the Primary window will be activated, by presenting the page under discussion.

   ii. **The next action is an object.** In this case, on the information area, the Map's window will be activated, by presenting the route that you should follow in order to reach the next suggested object.

To sum up, by pressing the next button, you will be either, directed to the Primary window, where the relative information will appear, or to the Map's window, where you will be informed about the route to the next suggested object.

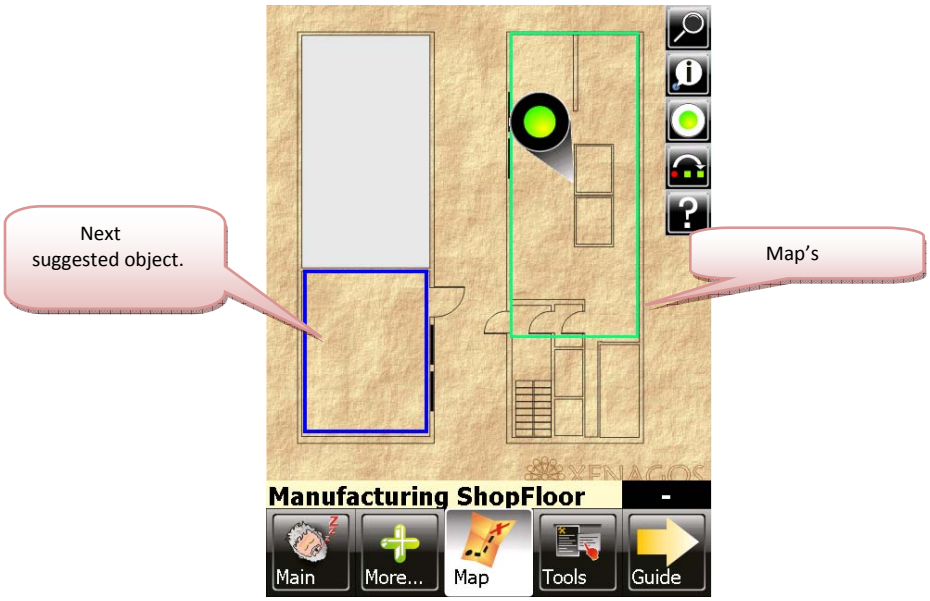


Image 8: The green arrow shows the next suggested object.

2. Information Area.

This area parts of four windows in total, from which only one is visible. The identity of the active window is determined by the selected button of the functionality area, which will be highlighted.

a. Primary Window. Presents the information that corresponds to the object that you choose to collect information, by reading its RFID tag[3]. Reading an RFID tag, activates automatically the Primary window, and presents the information of the requested object. The same procedure can be accomplished in case you press the "Next" Button and the next action is a web page. The difference with the first case is that instead of the information regarding an object the content of the corresponding web page will appear.

[3] For more information refer to paragraph Presentation of Information(Primary, Secondary Window).

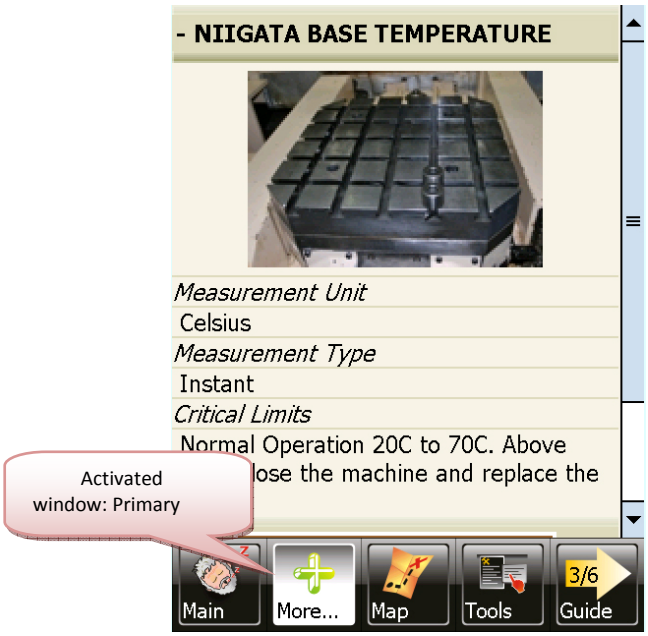


Image 9: Primary window activated.

b. Secondary Window. The purpose of the primary window is to present, always, information about the last object for which its RFID tag was scanned. For this reason the secondary window serves a helping role and it basically presents web pages that come from hyperlinks selected on the primary window. When reading an RFID tag, on the secondary window, the additional information about the object will be presented, however, the window will remain inactive until you press its activation button. In general the secondary window can be activated on the following cases:

i. By navigating to a hyperlink from the Primary Window.

ii. By selecting to view objects information from the Map's window.

iii. By selecting to view objects information from the relative functionalities found on the Additional Functionalities window[4].

[4] For more information refer to paragraph Functionalities of the Additional Functionalities window.

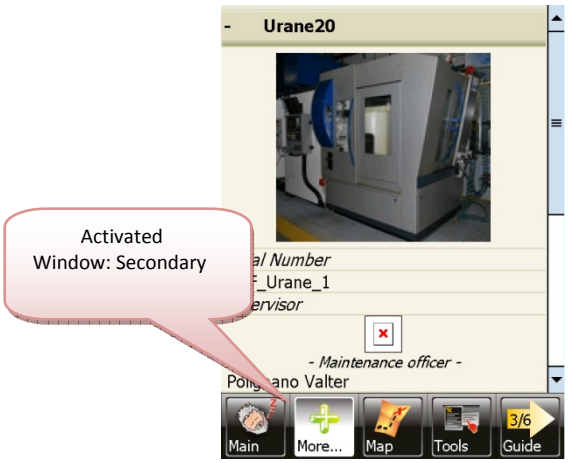


Image 10: Secondary window activated.

c. **Map.** The Map's window represents information relative to the installation area of MTI and is activated either by pressing the map's button or by the "Next Step" button. Its functionality is to guide you to the inspection area as well as to show you the route to the next suggested object.

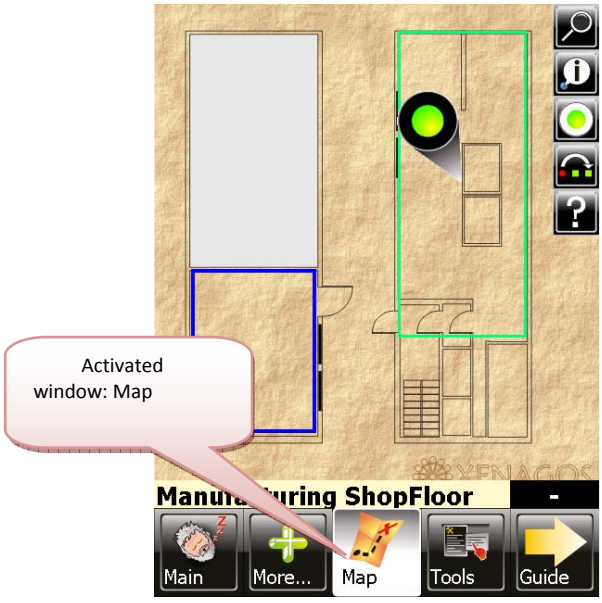


Image 11: Map's window activated.

i. **Symbols.**

1. **Relative to objects.** By the symbol your current location is depicted. The symbols , state the objects that are in the area (you haven't inspect yet, inspected object), while when an object is flashing it states that is the next suggested one.

2. **Relative to critical points.** All the rest symbols state various critical points of the area; like entrances, elevators etc (, ,).

ii. **Territories and zoom levels.** The map is consisted of various zoom levels, where each level is a sub territory of the installation area. A zoom level might be an entire floor, a separated room or even a display case. The existence of a territory is stated with the help of a colored rectangle, by clicking within the area that is defined by the rectangle you will zoom in to that area. To zoom up you will have to press the  button, on the map's tool case. The area that is painted with green color and has in its middle the symbol  states that this territory or one of its sub territories contains the last object that you scanned. The area that is painted with red color and has in its middle the symbol  , states that this territory or one of its sub territories contains the next suggested object. The rest of the territories are painted with blue color.

iii. **Finding Next Object.** In order to find the next suggested object you will have to follow the course that is pointed by the green arrow, the base of which shows the territory that you are located. In case that you are on the same area with the next suggested object, then the base of the arrow will show your position and its point the location of the next object. If you are on a different territory, then the arrow will point to the area that contains the next object.

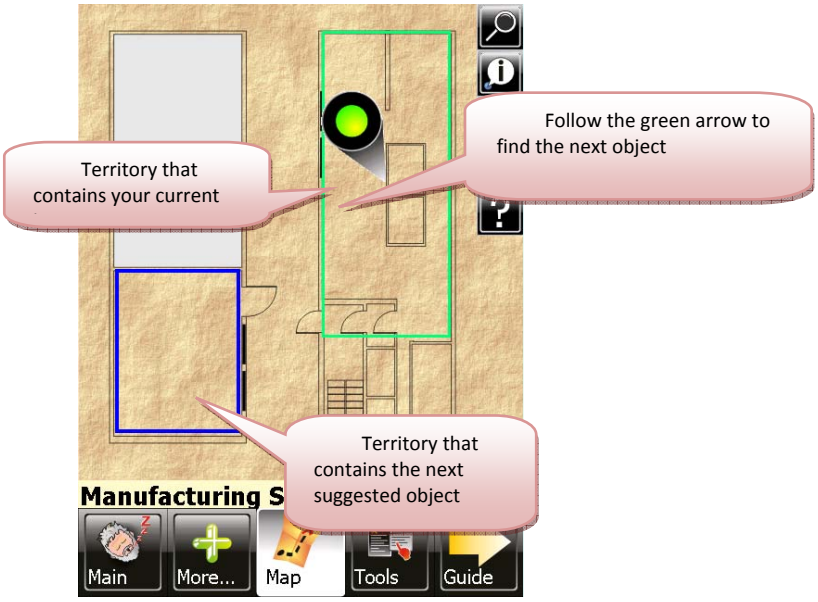


Image 12: Instructions to the next suggested object.

iv. **Tool Case.** The map has a number of additional functionalities for easier navigation within its limits.

1.  : Zoom up.

2.  : Gives you the route to the next suggested object, by listing the sequence of territories that you will have to go through.

3.  : Zooms to the territory that you are located.

4.  : Skip next suggested object.

5.  : Activates the secondary window by showing a brief tutorial about the map.

v. **Interactivity.** The map is quite interactive. By pressing an icon that depicts an object then, by selecting the proper action, the secondary window will be activated, where the information of the object will be presented. By pressing on a critical point, then on the map's window you will receive the point's information. Finally you can zoom down by clicking on any colored rectangle.

Image 13: Clicking on an object and on a critical point.

d. **Additional Functionalities window.** This window is activated either by its corresponding button or by a relative hyperlink, which can be found on Primary or the Secondary window. Its functionality is to present all the available, additional, functionalities of MTI. For further details refer to the paragraph Additional Functionalities.

Presenting and Handling Information

Navigation within the Active Window

The Primary, the Secondary and the window of Additional Functionalities are controls that can render web pages. In case that the dimensions of a web page are greater than that of the screens, then in order to navigate through the web page you will have to use the counter scrollbar. That is, for vertical navigation use either the scrollbar on the right side of the screen, or the pad on the lower end of the device. For viewing the previous or the next

web page that you visited, on the active window, use, correspondingly, the first on the left and the last on the right device's buttons.

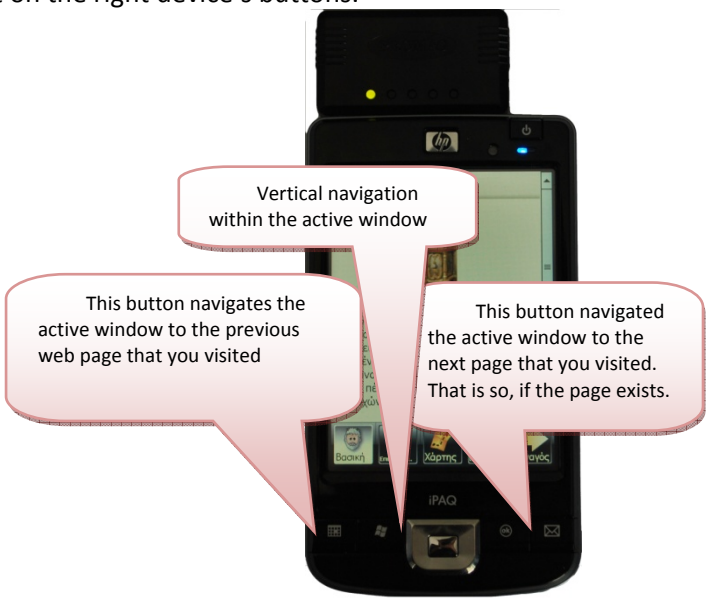


Image 14: Navigation within the active window.

Presenting the Information (Primary, Secondary Window)

Scanning an RFID tag activates the primary window, where you will be automatically navigated to the information web page of the object.

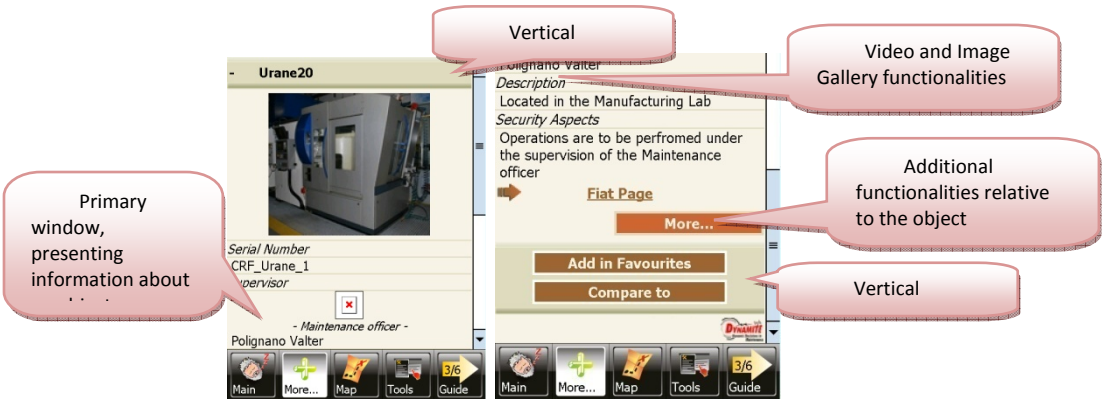
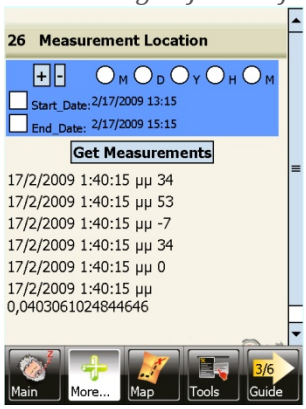


Image 15: Presenting object's information.



The information that is presented consists of the objects main picture along with its main information. Moreover, depending on the object, additional functionalities can be available:

1.  : The object has multimedia content (video and audio files). By clicking on the icon, the secondary window will be activated, where these files will become available as active hyperlinks. Follow each hyperlink to access the corresponding file. In case that the object is associated with only one multimedia file, then the file will start playing immediately. Using the multimedia control, you can *pause* or even view the video file in full screen mode.

2.  : The object has a collection of relative images. By pressing the icon the secondary window will be activated, where the first image of the collection will be presented, in order to see the next one click the “>>” button.

3. **More:** By clicking the option “More” the secondary window will be activated, which will present to you additional information relative to the object.

4. **Favorites:** By clicking on the option “Add to favorites” the *Additional Functionalities* window will be activated, which will navigate to the relative web page. This web page contains a list with all the objects that you have added to your favorites. After your tour is over, at the reception, you will be asked if you would like to get a printed version of your favorites objects or if you would like to get an email with this information.

Image 19: Favorites web page.

5. **Comparison:** By clicking on the option “Compare to” the *Additional Functionalities* window will be activated, which will navigate to a web page that contains a list of all available objects. Click on one object and press “Compare”, this will lead to the comparison web page of the two objects.

6. **Multimedia Files:** This option has the exact same action as the icon  .

7. **Image Collection:** This option has the exact same action as the icon  .

Functionalities of the Additional Functionalities window

The additional functionalities that are available on this window are the following:

1. **Services.**

   a. **Dictionary.** Navigates the *Additional Functionalities* window to the dictionary web page, where all the available, special terms appear. By selecting one of them and clicking "View" you can see the exact meaning of the term. While, by using the buttons "A" – "Z", you can see the terms that start with the selected letter. Moreover, you can perform a search request by writing on the available text box.

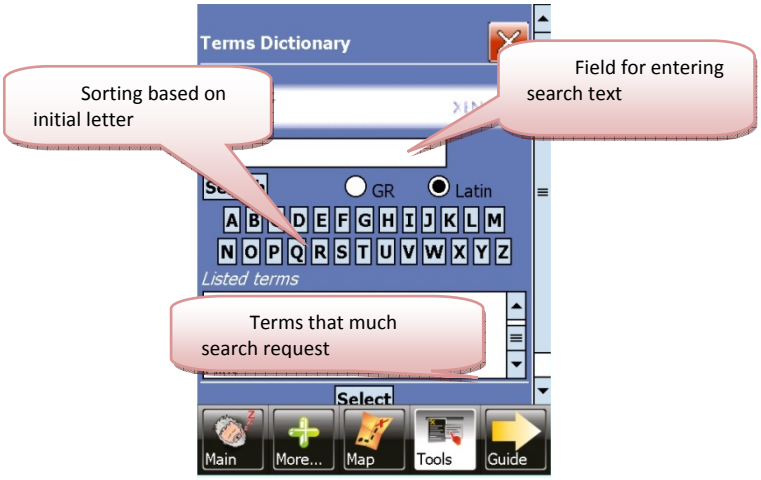


Image 23: Dictonary.

   b. **Object search.** Navigates the *Additional Functionalities* window to the web page of object search. At start, you will get all the available objects, which are sorted in groups of ten items. For each one of the listed objects you can see their location on the map or view their information. The option "Show" activates the secondary window, where the information of the object is presented. Moreover, the option "position" activates the map's window and shows the location of the requested object by marking it with the green arrow.

   c. **Favorites Objects.** Navigates the *Additional Functionalities* window to the favorite web page, where you can see the list of your favorite objects. In this web page you can delete a listed object or see its information. In the last case the secondary window will be activated by navigating to the objects information web page.

Image 24: Favorites web page.

2. Tour formatting.

a. Language selection. By this option you can chose the device's language. To *Additional Functionalities* window will be navigated to a web page that contains all the system's available languages, with the current language selected. To change the device's language select the new one and click "OK".

Image 25: Language Selection.

MTI PDA Supporting Applications

Beyond the basic application of MTI (Maintenance Technical Information) system, there is a set of auxiliary applications supporting the PDA operation. These applications focus on PDA management and parameterization and they are not addressed to the maintenance area staff but to the PDA system administrator. These applications are:

1. PDA Starting Up Application – Starting Application.
2. PDA Management General Application – Launch Application.
3. RFID Tag Management Application – RFID Manager.
4. Graphics and Multimedia content management application – Multimedia Administration

PDA Starting Up Application – Starting Application

This specific application starts up automatically after restarting the PDA. It carries out the following procedures:

1. Establish wireless connection of the Device with the system Access Point.
2. Establish communication between Device and the Server.
3. Start up the basic application MTI.

These functions will be performed automatically, in case the PDA has already started up at least once. During its first start up, some functions has to be performed manually.

Starting Up the Application

Starting up the application, a file containing all MTI adjustments is being read and Access Point (AP) information as well as the Server address retrieved. In case that the application starts up for first time the file will be empty, which means that all these adjustments should

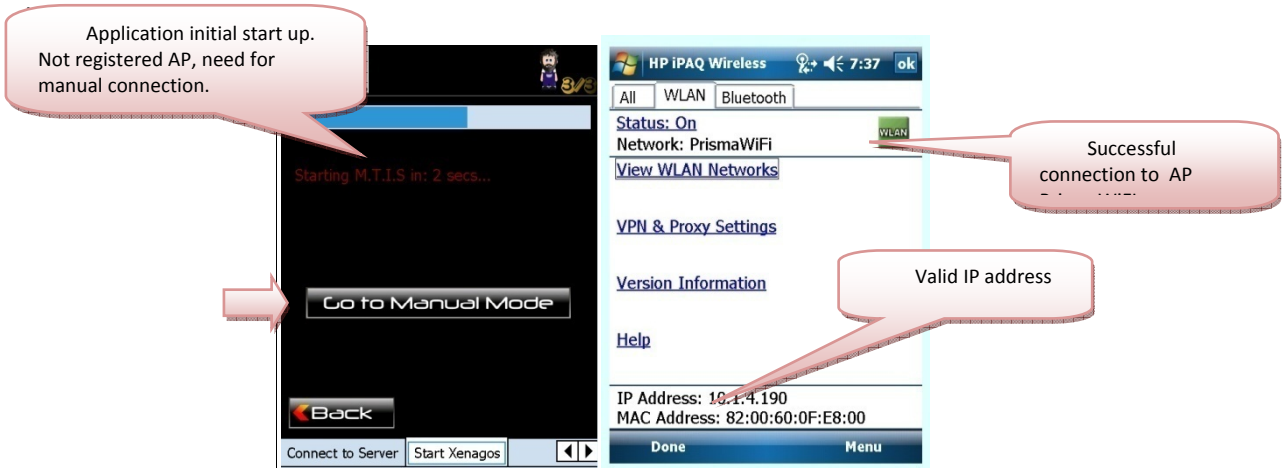


Figure 1: Starting the Application.

To do it, initially press "Connect Manually", this selection will lead you to the device wireless network menu, in order to make the connection with the wireless network of the system[5]. The connection is considered successful when the AP appears on the screen and a

[5] For more information contact the system Administrator.

valid IP address has been assigned to the device. Closing the window you go back to the application, then press “Next” to go to the next step. If you know the Server IP, then type it in the relevant field and press “Enter IP”. In case you do not know the Server IP then press “Scan for Server”. This procedure will initiate the Server locating function. The successful connection will bring you to the next step, if you don’t select “Go to Manual Mode” then MTI application will start immediately, else the PDA General Administration will start up.

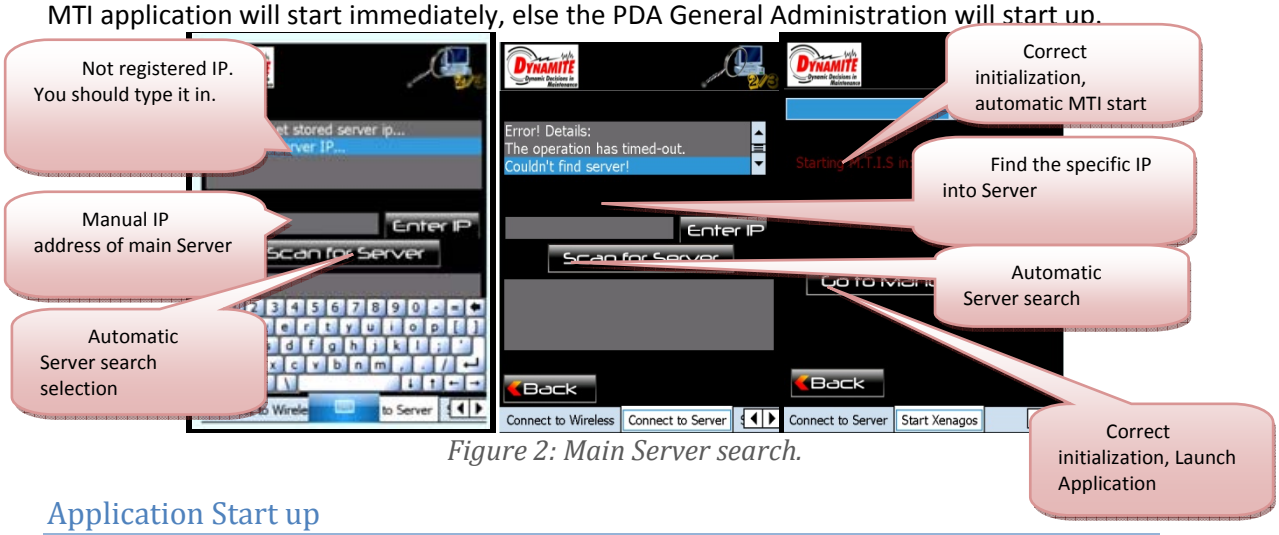
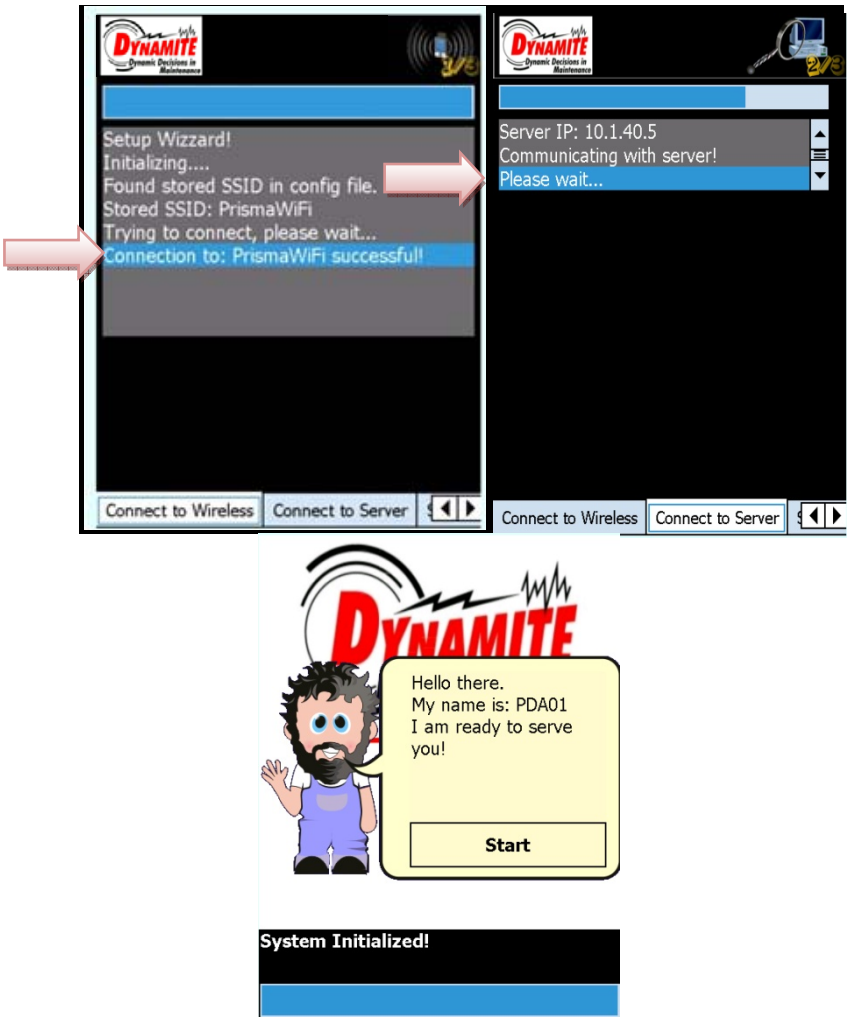


Figure 2: Main Server search.

Application Start up

Since the application has already started up, at least once, then the steps mentioned above will be executed automatically, so that in order to start MTI you do not have to make any other action. However, if you like to start up the PDA general administration application, you have to select “Go to Manual Mode”, in the last step.



Picture 3:Automatic Start up of MTI system.

Deal with Problems

The specific application can deal with two kinds of problems[6]:

1. **Fail to connect to wireless network.** In the first step of the application, you will get a message on 'Failing to Connect'. To resolve it execute manual connection, pressing "Connect Manually" key. Be sure that the system AP looks to be available, which means that you can connect to it. After having connected, please check that you have received a valid IP address.

2. **Fail to connect to main Server.** Be sure that you are connected to system AP and that MTI Services operate under the main Server.

PDA General Administration application – Launch Application

As soon as the application starts up, it goes through the same initialization procedure as in PDA Start Up application. Its status indicated by the "Ready" message.

[6] In case of non satisfactory result, contact the system administrator.

Picture 4: Launch Application.

Icons Annotation:

1. **Title.** Presents the current device status. Possible cases:
    a. **"Ready".** The PDA is connected to system's AP and communicates with the main server. In this case, all available actions/options are active (7-10).
    b. **"Not Ready".** The PDA is not connected to system's AP and it doesn't communicate with the main server. In this case, the "Connect"(6) key is visible while all other options are inactive (7-10).
2. **Wireless interface status.** Possible cases:
    a.  : Wireless interface activated active connection.
    b.  : Wireless interface activated non-active connection.
    c.  : Wireless interface non-activated, inactive connection.
3. **Battery Status .** Possible case:
    a.  : Full loaded.
    b.  : Partially Loaded.
    c.  : Low level Loaded.
4. **Charge indication**  **.** In case this icon is visible then the PDA is connected to the power supply.
5. **Wireless network status.** In case that the PDA is connected to system AP, then you can see its name else you get the corresponding message.

a. **Not Connected:** Wireless interface activated, non active connection with system AP.

b. **Not Enabled:** Non active wireless interface.

6. **Connection Key.** The specific key appears only in case that there is no connection to the system main server. By pressing it, the connection to system AP procedure starts up

7. **MTI.** Start up MTI application.

8. **RFID Manager.** Start up RFID Manager application.

9. **Wireless.** Starts up the PDA wireless network interface application.

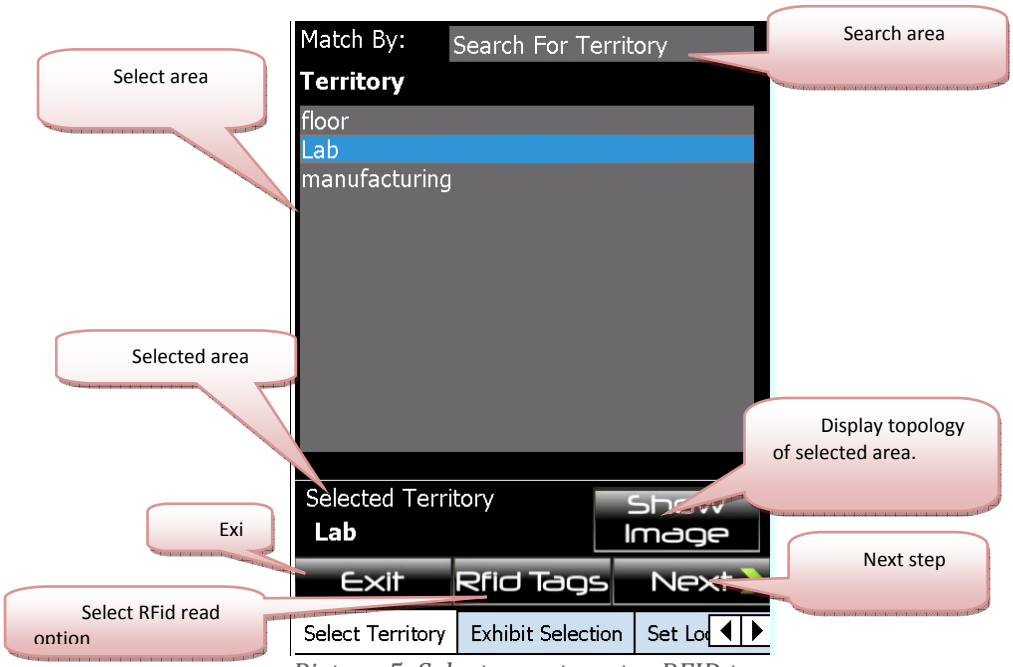
10. **Update.** It starts up the Multimedia Administration application.

RFID Tags Management Application – RFID Manager.

The specific application provides you with the capability to correspond RFiD tags to the registered objects (assets, segments, measurement locations) of the inspection area.

Steps for the correlation between object and RFID tag

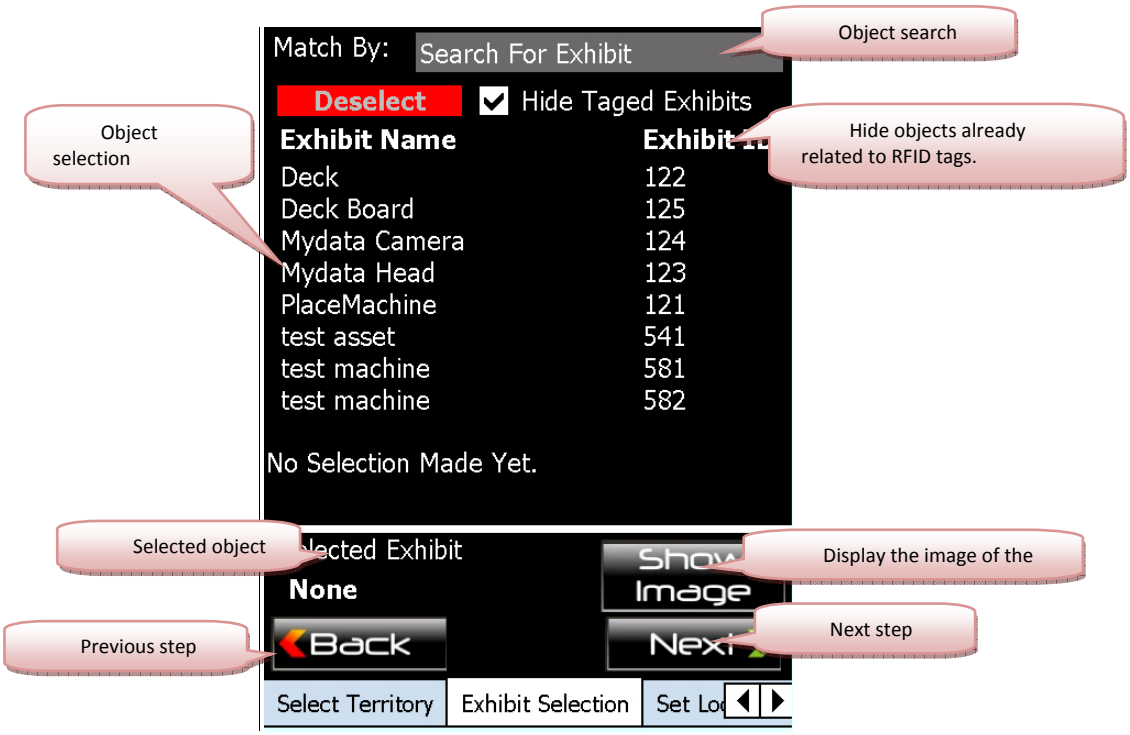
1. Initially, select the area into which you like to enter the RFiD tag. Selecting "Show Image" you can see the topology of the area selected.



Picture 5: Select area to enter RFID tag.

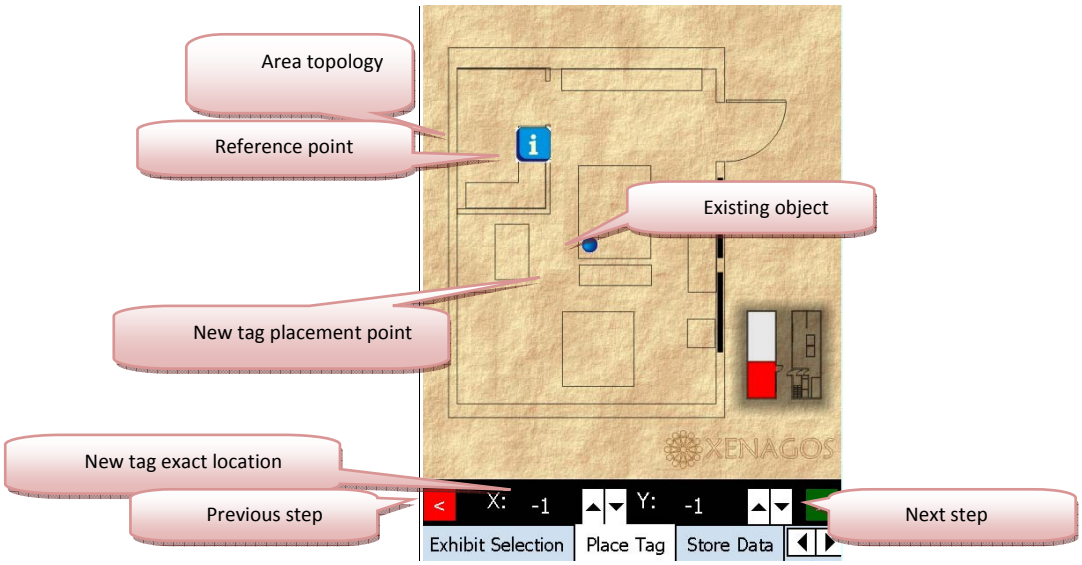
2. Press "Next" to move onto the next screen and then select the object to correlate with the RFiD tag. The objects already related to tags do not appear. To do so you should deselect through the option "Hide tagged objects". Should you select any object which is already related to a tag then you are going to be asked whether you

wish to delete the existing tags, otherwise you will relate one of the above tags with the selected object[7].



Picture 6: Select object to relate it with RFID tag.

3. Pressing "Next" you are being moved to the next screen onto which you will see the area topology you have selected in the previous screen. Press with the pencil at the specific point on the screen, where you wish to place the object.

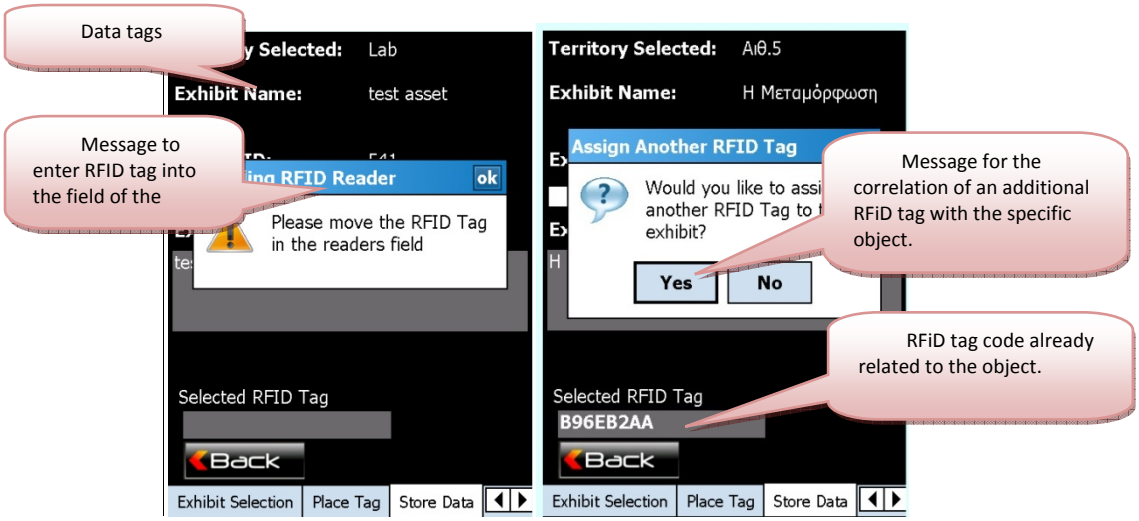


Picture 7: RFID tag placement in the topology.

4. Press the symbol ">" to move to the next screen. You will be prompted to enter an RFiD tag, in the field of reading/writing of the RFid reader. Then press "OK" to close

[7] If you do not select any object then you are going to simply enter a tag to redefine the position. This means that when the inspector reads the tag, his position in the map will be refreshed.

the message. In the current screen information related to the object are being displayed (selected area, title, code and object description). In case you like to write this information in the tag select the option "Write Info To RFID Tag". By moving the tag onto the RFiD reader all the related data will be registered to the main server.



Picture 8: Correlating tag to the object, writing data in the tag.

5. Next, you are going to be asked if you wish to enter a new tag for the specific object. In case you respond positively then it will be needed to repeat the procedure from step 3. In case you wish to enter a new tag into a different area (not recommended) you should go manually at step 1.

6. By completing the definition of all tags to a specific object, you will go back to step 1, in order to be able to repeat the procedure for another object.

Other Functions

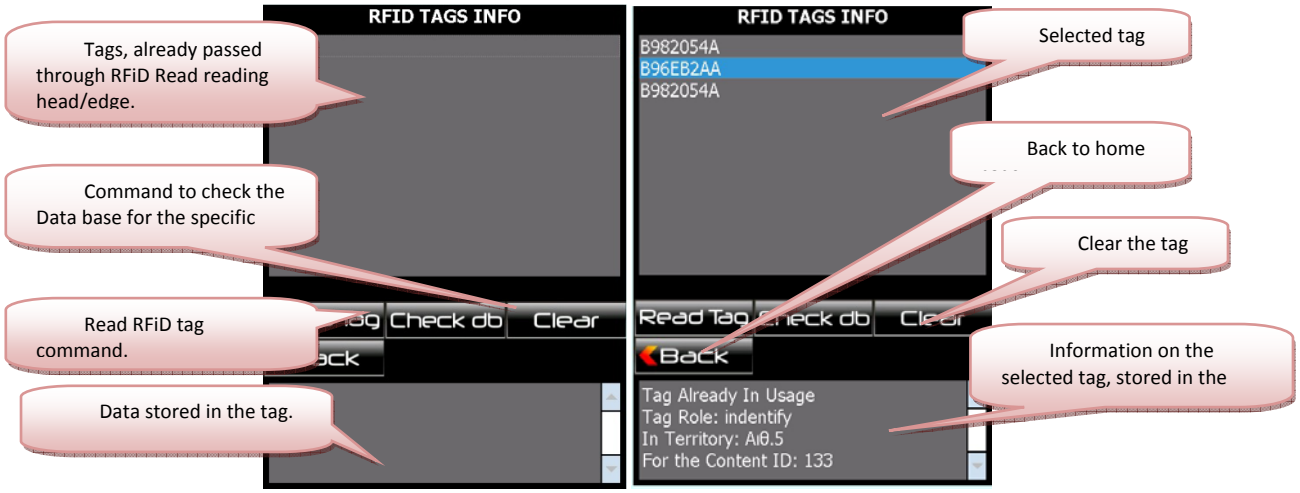
1. ***RFID Tags.*** *Upon this selection you have the following options/capabilities:*

    a. *Read information stored in RFiD tags, through "Read" key. Place the tag onto the RFiD reader and press this key.*

    b. *Retrieve data (area, object code), which are stored in the system main data base. To execute this operation, bring the tag close to the reader. As soon as the tag code appears on the list press "Check db". On the bottom of the display you will see all these details.*

    c. *By selecting "Clear", you can delete the list, displayed on the top of the screen.*

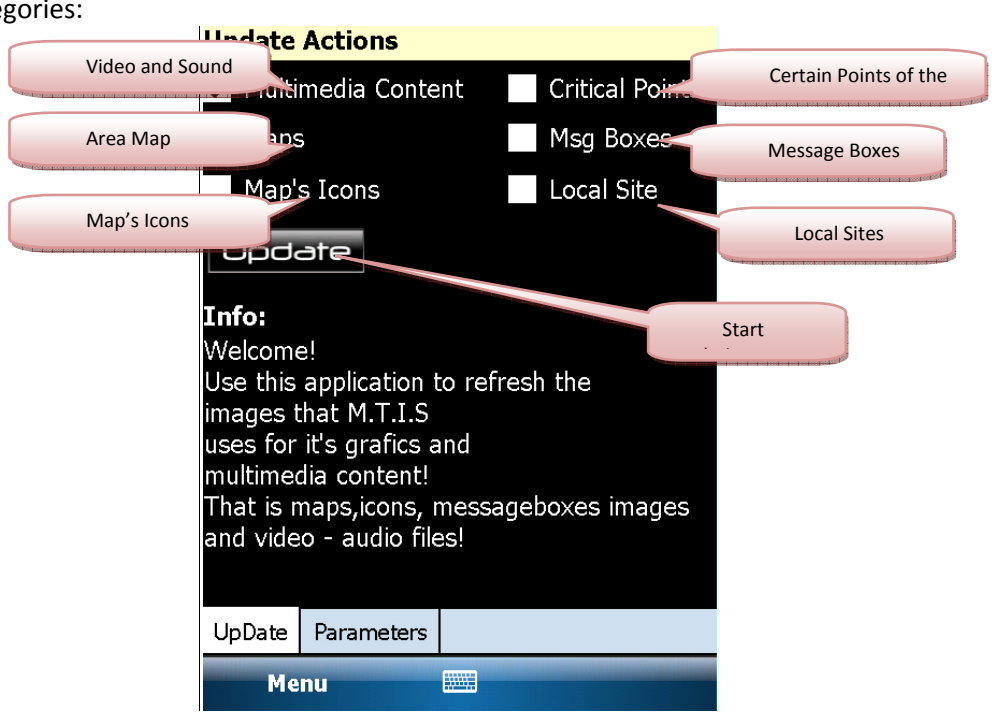
    d. *By selecting "Back", you go back to the home page of the application.*



Picture 9: Functions to retrieve details of RFiD tags.

Graphics and Multimedia Content Management Application – Multimedia Management

Using the specific application you can update graphics and multimedia files of MTI system. Various operations performed through the corresponding options, divided into three categories:



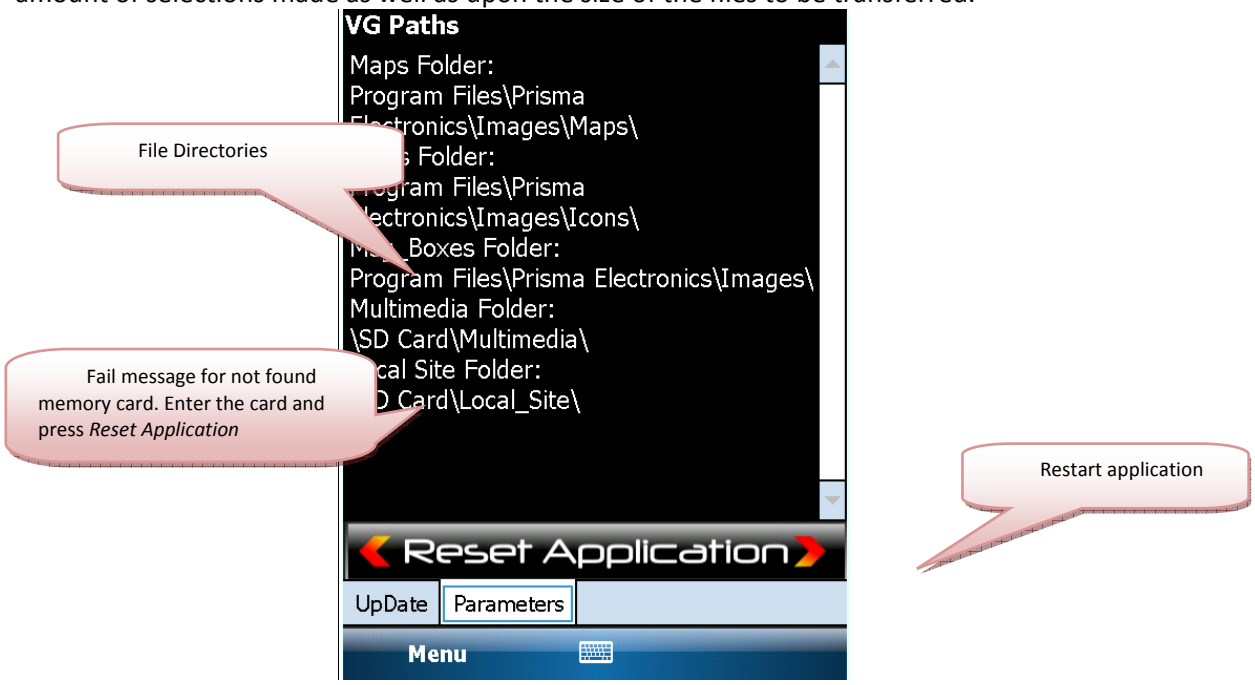
Picture 10: Multimedia Management

1. **Graphics.** You have the following options:
   a. **Critical Points.** Updates the icons of the critical points of the Map.
   b. **Maps.** Updates the areas of the Map.
   c. **Msg Boxes.** Updates the graphic messages.
   d. **Map's Icons.** Updates the Map icons related to the objects.

2. **Multimedia Content.** This option is applicable when the PDA has an SD card, since the specific data can only be written on this card. In case that the PDA does not have such a memory card, this option will remain inactive.

3. **Local Sites.** The PDA has the capability to operate without the presence of a central server. To do it, the PDA should have in local level a clone of MTI dynamic web page. By selecting "**Local Site"** you can copy **the specific files into the PDA**[8], provided that the PDA has an SD memory card.

As soon as you select the files that you wish to update, press "**Update" to start the data transfer procedure.** The time necessary to complete the procedure depends upon the amount of selections made as well as upon the size of the files to be transferred.



Picture 11: Multimedia Administration Parameters

[8] Should the number of the files to be transferred is large then the procedure will be delayed seriously.