MaGeX

Map With GPS Extension

USER MANUAL

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1. Introduction

1. The MaGeX Suite

The aim of the *MaGeX - Maps with GPS Extension* project is to develop a set of applications for displaying maps and transferring GPS data on a mobile phone. It allows you to convert maps from common formats and transfer them to your mobile device, to show your GPS position and record tracks and waypoints from it, to send your position to a server and track or be tracked over the Internet.

2. The applications

There are four applications within the MaGeX project that serve the following purposes:

–Mobile - the mobile phone application for displaying maps and communicating with GPS devices. It is capable of displaying current GPS location, saving tracks and waypoints and transferring data to desktop (via Bluetooth) or the MaGeX Server (over the internet).

–Preparation - a desktop application, used to convert the maps from a commonly used Polish format to a format suitable for the mobile application.

–Transfer - a desktop application, used to communicate with the mobile application and transfer maps, tracks and waypoints from and to the mobile device.

–Server - the MaGeX Server provides the user with advanced functionality, such as tracing objects over the internet.

3. Technologies used

In order to achieve wide compatibility among the mobile devices, the Mobile application uses the Java for mobile devices technology. Thanks to this, at least the basic version of the application (without GPS extensions) works with most of the today's commonly used mobile phones.

The used input data format for maps is the Polish format. It is possible to convert maps from most commonly used formats into Polish format using the free GPSMapEdit application, which may be obtained via this link.

The both desktop applications use the Java SE platform to achieve portability among different operating systems. They also include a graphical user interface for easy usage.

The MaGeX server works under Unix systems and provides an easy-to-use web-based control interface.

4. Requirements, used libraries and installation

The end-user parts of the suite, Mobile, Transfer and Preparation, come together in one ZIP package. The basic installation is very simple. Just unpack the ZIP package into any directory of your choice. You may then run the desktop applications directly (provided your computer meets the requirements described below) and install the mobile application into your mobile device (for details, see below).

As mentioned above, the Preparation and Transfer applications use the Java SE platform. Therefore, they require the Java Runtime Environment 1.6 or higher to work. They will then work on any operating system supported by Java and any hardware capable of running Java programs. If you don't have the Java Runtime Environment installed, you may download it for free using this link. Both the desktop applications use the Swing layout library, which is provided within the MaGeX end-user bundle. The Transfer application further uses the BlueCove free Java Bluetooth implementation (JSR-82), which works with most operating systems and is also provided within the bundle. Since the Transfer application uses Bluetooth to transfer data from computer to mobile devices, you will need Bluetooth on your computer and in the destination mobile devices for the transfers to work.

The Server part comes in a separate bundle, which includes the source code for the application and the installation of the database and web interface. To build the sources, you need the GCC compiler (minimum version 4.2) and Unix Socket API libraries, which is a common part of all Unix-like operating systems. To obtain a free Unix-like operating system, try e.g. Debian Linux by following this link. The Server application needs to connect to a MySQL database (minimum version 5.0), which may be obtained for free using this link. For the web interface, you will need a web server capable of running PHP 5.0 scripts and a corresponding PHP 5 module. The very common Apache PHP Server may be downloaded under this link and the PHP 5 scripting engine using this link.

The Mobile application makes use of Java for mobile devices. The only requirement for some basic functionality is that the device must support MIDP2.0. In order to communicate over Bluetooth, the device must support Java API for Blueooth (JSR-82). The device must also be connected to a GPS module or have embedded GPS functionality and both the GPS device and mobile phone must support Java Location API (JSR-179) or be able to communicate over serial link in order to be able to display GPS position and make all related functionality available. The Mobile application uses the free jMicroPolygon library for drawing vector graphics. It is provided within the Mobile application JAR package.

2. Preparation

1. Program description

In the MaGeX suite, the Preparation application serves for map data conversion, in order to use a map within the mobile device. The map input format is ".mp" – the so-called Polish format; maps with other data formats may be converted into it e. g. using the freeware GPSMapEdit application.

It offers some simple map manipulation features, such as map area or zoom levels limitation and map renaming. In the usual case, the resulting map may be uploaded to the mobile device using the Transfer application. Within the Preparation application, you also have the possibility to embed the resulting map into a Mobile application JAR file and use it directly on his mobile device.

2. Requirements, installation and launching

The Preparation application comes in the bundle with the rest of the end-user applications, for unpacking and requirements see above. As mentioned, the only requirement is the Java Runtime Environment. However, the conversion process may be very resource-consuming, so a 1GHz CPU or faster and 1 GB or more RAM is recommended.

Launching is very simple. Go to the directory where you have unpacked the MaGeX end-user bundle (see details above) and launch the `MaGeX-preparation.jar` file within the Java platform. For your convenience, quick-launch files for the most common operating systems are included:
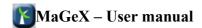
–`MaGeX-preparation.bat` for Windows systems

–`MaGeX-preparation.sh` for Unix-like systems (capable of running Bash scripts)

You may just run these files (by typing their name in a console or double-clicking them, if your operating system graphical interface settings are correct.

3. The GUI

The Preparation application offers a simple GUI, which allows you to select the input file, place any restrictions regarding the conversion and start the whole conversion process. It also allows to set-up the application options (see below).

Start with selecting the input file by clicking the appropriate button in the top of the window and finding the path to it, or typing the path directly into the upper box. All map limitation features are grayed-out until
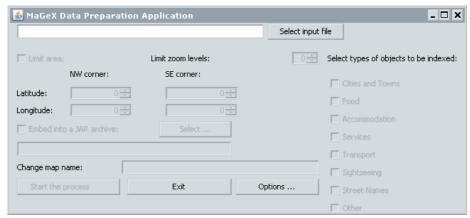

Fig. 1: Preparation main window

the file is selected. After you select a valid file in Polish format, you may toggle the manipulation features.

You may of course exit the Preparation application any time by clicking the "Exit" button or the "X" in the upper-right corner of the window.

4. Map restriction
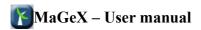
a) Area limitation

By checking the "Limit area" check-box in to the upper left in the window, you enable the area limitation feature. It allows you to limit the whole input map just to a given square area. Just insert the coordinates of the north-western and south-eastern corner of the desired square (in whole degrees with decimal point) into the appropriate input-boxes.

b) Zoom level limitation

You may limit map zoom levels and leave out the most detailed ones in order to reduce map's size, by editing the "Limit zoom levels" input-box. The maximal value that may be filled in is always the number of zoom levels within the input map. If you do not wish to filter out any zoom levels, leave the number as it is.

c) JAR and indexing

It is also possible to embed the resulting map into the Mobile application JAR file (see below) and to index some of the map's objects, in order to enable searching (see below).

d) Map name change

The map's name is automatically loaded from the input file upon opening. If you wish to change it, type the new map's name into the "Change map name" input box. The name will then display in the Transfer or Mobile application in the list of available maps.

5. Embedding a map into a JAR file

It is possible to embed the resulting map into a Mobile application JAR file, so that after the installation of the JAR into a mobile device, there's no need to transfer the map via Bluetooth. This is useful for devices without Bluetooth support or to save space with large maps.

If you wish to embed the result into a JAR file, just check the "Embed into a JAR archive" check-box. The default Mobile application JAR file (as set-up in the options, see details below) will then be used. In case you need to use another JAR file, select it by clicking the "Select..." button and finding the path to it or by typing its path directly into the input-box nearby. This is useful e. g. if you wish to embed multiple maps into one Mobile application JAR file.

The application descriptor file (JAD) is always created along with the JAR file and saved into the same directory.
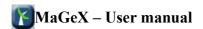
6. Indexing

In order to be able to search within objects of the map by their names, select some or all of the check-boxes on the right of the main window. Each of them represents a group of object types that are to be selected for indexing; e. g. if you wish to search for street names within the resulting map, check the "Street names" check-box etc.

Map indexing increases the size of the resulting map, but without it, the search within map's objects by name is not possible.

7. The conversion process

Start the map data conversion process by clicking the "Start the process" button. The output file selection dialog window will display. Select the output path and type the name of the output file (without extension; the file extension will be automatically appended to the name). If you select an already existing file, the application will ask for permission to rewrite it.

You may cancel the file selection by clicking "Cancel". After you confirm the output file name (and file rewrite, if it already exists), the conversion process will start immediately. It

consists of three phases: map parsing and object selection for the output, the actual conversion (cutting into parts, sorting and indexing) and finally the writing of the output. If an error occurs, an information message box will appear.

Please wait for the conversion process to finish. It will be signalized by a message box. You may also cancel the process and exit the program (but the output will not be saved). After the process is finished, the initial screen displays and you may select another map for conversion.

8. Application options

By clicking the "Settings" button in the main application window, you open the settings dialog for the application.

It's possible to select the language of the GUI, path to the default JAR file and a type change rules file here.

All the options are by default saved to the `.magex` subdirectory of your `Application data` (Windows) or `home` folder (other OS).
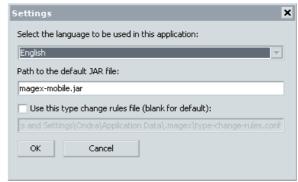
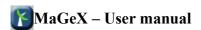*Fig. 2: The settings window*

a) Default JAR file

The default JAR file is used always if you select JAR embedding and do not specify a particular JAR file. The given path must specify a valid Mobile application JAR file. After the installation of the suite, it points to the Mobile application, so you probably do not want to change it.

b) Type change rules file

The type change rules file is a plain text file with a special syntax, which serves for changing some of the objects in the map automatically.

If you leave the "Use this type change rules..." check-box in the options window unchecked, no such file is used. If you check it, but do not specify any file name, the default (sample) file located in the application installation directory (see above) is used.

Using the type change rules file, you may order the Preparation application to find objects within the map of a given data type (POLYGON, POLYLINE, POI) and/or object type (a spe-
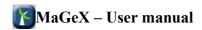
cial number, for details see The Polish Format Specification within the cGPSMapper application manual) and/or label and change their object type and/or label.

```
CHARSET cp1250
# charset must be the first line
#
# change three comma-separated types of polylines with given label into a new type with another label
# double quote = single quote and continuation
POLYLINE 0x2f,0x3f,0x1f "Li"* 0x2f "A new "" line"
# change a given type of polyline with any label to another, don't change the label
POLYLINE 0x1f * 0x3f *
```

Fig. 3: Example type change rules file

The syntax of the type change rules file is shown on the picture. The very first line always MUST contain the name of the character set which the file is using. Then, one rule goes on one line. A rule consists of the input data type (strings POLYGON, POLYLINE or POI), list of input object types (comma-separated hexadecimal numbers), the input label (double-quoted string), the output object type (hexadecimal number) and the output label (double-quoted string).

If a line starts with a hash ("#"), it is ignored/considered an user comment. You may use an asterisk "*" instead of the input object label to target objects with any label, or a double-quoted string followed by an asterisk to target object with any label beginning with the given string. If you wish to have double quotes within the output name, type them twice.

3. Transfer

1. Program Description

In the MaGeX suite, the MaGeX Data Transfer Application (referred to from now on as the "desktop application") enables the user to send maps, tracks and waypoints via Bluetooth to the MaGeX Mobile Application (referred to from now on as the "mobile application"). The desktop application enables the user to receive maps, tracks and waypoints from the mobile application as well. The user can convert a route XML file taken from the website mapy.cz, transform it into the MapEdit GPX format and consequently send it to the mobile application.

2. Installation

Same as the Preparation application, the Transfer application also requires Java Runtime Environment 1.6 or higher to work. It also comes in the MaGeX end-user bundle. For details on unpacking and obtaining the Java Runtime Environment, see above. You will also need Bluetooth on your computer and in the destination mobile device in order to actually transfer data.

Launching is similar to that of Preparation application. Just launch the `MaGeXDataTransfer.jar` file from the directory where you have unpacked the MaGeX end-user bundle within the Java platform. For your convenience, quick-launch files for the most common operating systems are included:

– `MaGeXDataTransfer.bat` for Windows systems

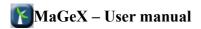– `MaGeXDataTransfer.sh` for Unix-like systems (capable of running Bash scripts)

You may just run these files (by typing their name in a console or double-clicking them, if your operating system graphical interface settings are correct.

3. The Layout

The GUI has a file-manager look to it. On the left side there are the lists of maps, tracks and waypoints that are stored in the mobile application. On the right side there are the lists of maps, tracks and waypoints that are loaded in the desktop application. A progress bar is situated at the bottom of the window.

The middle three buttons are described here (top – down description):

● Refresh

      ○ Reloads the mobile application data lists.

- Transfer

      ○ Transfers data either from PC to mobile or vice versa, depending on what items are selected in the list.

- Delete

      ○ Deletes data either from the mobile application (permanent delete) or from the desktop application (deletes only from list, not from the physical location on the disk).
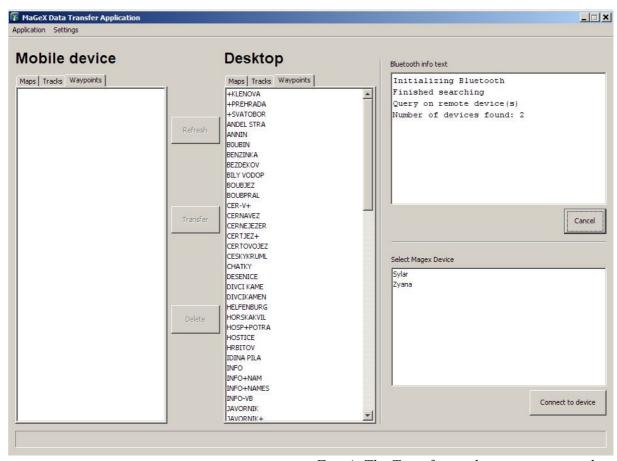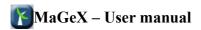

Fig. 4: The Transfer application main window

On the right you can see two text-boxes, one labeled "Bluetooth info text" and the other one labeled "Select device".

As you may have already guessed, the "Bluetooth info text" textbox displays various information regarding the desktop application's Bluetooth communication.

The "Select device" text-box let's you choose the mobile phone you want to connect to via Bluetooth.

In the top menu there are two sections: "Application" and "Settings"

The "Application" menu part contains:

- Open MaGeX Data File
  - The user can load a .gpx file or a .zip file containing a map to the desktop application
  - The .zip file must have been created using the MaGeX Preparation Application
- Export as MapEdit format
  - Converts and saves loaded tracks and waypoints as a .gpx file
- Exit
  - Ends the desktop application

The "Settings" menu part contains:

- Language
  - The user can change the language of the desktop application.
  - Currently there are only a few languages supported: English, German, Czech, Slovak, Spanish and Portuguese.
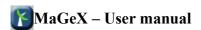
4. Connecting to a mobile device running MaGeX

To connect the desktop application to the mobile application, follow these simple steps:

1. Choose the "Receive data" menu item from the menu in the mobile application.
2. Click on the "Search for device" button in the desktop application.
3. Wait while the desktop application finds the mobile phones that have Bluetooth turned on.
4. Select your mobile phone's Bluetooth name from the list and press the "Connect to device" button.

5. FAQ

The Frequently Asked Questions section is an important part of a manual. Here you will also find answers to possible error messages that you may encounter during use of the desktop application.

Q: The .gpx file will not load.

A: The GPX format in the .gpx file may be corrupt, try validating it using the GPX schema.

Q: The .zip map file will not load.

A: The .zip map file has to be created via the MaGeX Preparation Application, any other method of creation may result in the desktop application's inability to load it correctly.

Q: When trying to search for a device, an error message comes up "java.lang.RuntimeException: <vendor_name> BluetoothStack not found".

A: Make sure you have Bluetooth turned on or that you have a Bluetooth dongle inserted into your PC.

Q: When trying to connect to a device, you get a "Could not connect" error message.

A: Either the phone you are trying to connect to has not selected the "Receive data" item from the mobile application menu or there is a problem with the Bluetooth connection and either the desktop application has to be restarted or both applications have to be restarted and Bluetooth on the phone has to be turned off and on again.

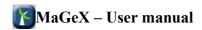*Q: Why does it take so long to send a map to the phone via Bluetooth?*

A: If the map file size is large, then the data transfer can take quite long. Also if there are any obstacles in the path between the phone and the PC, it can increase the length of time needed to transfer data.

Q: How can I select multiple maps/tracks/waypoints to send to the other phone?

A: While selecting the desired maps/tracks/ or waypoints, press and hold the Ctrl key.

Q: Can I send map, tracks and waypoints at the same time?

A: No, you can only send multiple maps or tracks or waypoints at the time, not two different types.

4. Server

1. Program description

In the MaGeX suite, the Server application offers communication between different mobile applications. Information received from mobile applications is stored in the database and is accessible to other mobile applications (having granted the access) or to users of the Web application.

2. Requirements and installation

The Server does not come as the part of the end-user bundle, as mentioned above. You need GCC 4.0 or above to compile the Server sources and PHP 5 and MySQL 4.1 to run them (including the web interface; for details, see above).

To compile the Server sources, unpack them and run ./configure; `make`. The `magex` executable will then be created. Execute it to run the server, but first set-up the database and install the web interface.
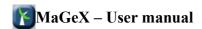
In order to set up the database and install the web interface, create the database user with the name "magex", log in as this user and run all the provided SQL scripts (in `db/mysql` directory) in your MySQL database in order to create the necessary tables. Then set-up your database password in the `dbpass.inc.php` file and place the `php` subdirectory of the Server bundle onto your web server, capable of running PHP.

3. Usage

The Server application is a command-line application running on Linux/Unix-like systems. It listens on TCP port and waits for an incoming connection from a mobile application. Application executable called `magex` can be started with following options:

-h   Show command-line options

-v   Be verbose, display debug output

-p port   Listen on defined port (default: 7232)

5. Web

1. Program description

In the MaGeX suite, the Web application is used with conjunction with the Server application to access data retrieved from the mobile applications. Web application offers functions such as current position information or user and access rights maintenance. For installation see above.

2. Application layout

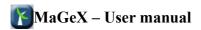The Web application offers following pages:

- welcome and login

- new user registration and e-mail address verification

- overview of the current status

- user data maintenance

- manage access to the position data by other users

- show position of other users

Fig. 5: MaGeX server web interface welcome screen

The welcome page, including all headers looks as shown on the picture nearby.

You can reach this page at any time by either clicking on Home link or logging out of the application. Information about the MaGeX project is reachable via Project home page link.

Language of the application can be changed at any time by clicking on one of the language links on the right-hand side of the application pages.

Fig. 6: web application main menu

To register a new user, click on Register link. Application require to choose a user name, user description, e-mail address and password. E-mail address is verified by sending a message with a confirmation code. User is not allowed to log in prior to verifying his/her e-mail address by entering this confirmation code on Verify e-mail address page.

Password used in web application is the same as for the mobile application connecting the server application. In fact, to be able to use this functionality in the mobile application, user has to register in the web application.

a) Overview

Once logged in, user is presented the Overview page. It contains:
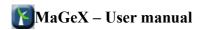
- information about the user

- last login date/time on the web and in the server (from a mobile device)

- last known position

- list of users that are currently tracking him/her

Using the menu (see the previous figure) it is possible to enter other pages of the application.

Fig. 7: User overview

5. Web

Fig. 8: Password change

b) User maintenance

The user can review his/her details and change the password.

c) Manage access

This page displays a list of users that are granted the access to the logged-in user's position. Users may be removed from the list by clicking Remove link or added to the list by entering the desired user name to the input box.

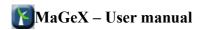*Fig. 9: Managing other users' access to my position*

d) Show others

This page contains a list of users that have granted the logged-in user th access to their positions, including the last known position with date and time indication.

Fig. 10: List of users that have granted access to you

6. Mobile

1. Program description

The Mobile part of the MaGeX suite is the core part. It covers map viewing, GPS navigation services and communication with a MaGeX server and desktop part as well. The following part of this user manual will follow an imaginary use flow and explain the particular features of the Mobile application.

2. Installation

The Mobile application comes as a part of the end-user MaGeX bundle. It runs on all MIDP-2.0 capable devices, but some features are available only if certain conditions are met (for details, see above).

After unpacking of the bundle (see details above), you may install it to your device. Transfer the MaGeX-mobile.jar (and MaGeX-mobile.jad, on some configurations) onto your mobile device using data cable and the software given from the vendor or via Bluetooth (if enabled). You may wish to embed some map(s) first using the Preparation application (see details above). If you choose to do this, transfer the results of its work, not the original JAR file, which does not contain any maps. The application should install immediately after the successful transfer (this may depend on your phone's software – please refer to the phone manual or ask the vendor of the device how to do this).

3. The program layout

When the program is loaded for the first time, a menu screen with nations' flags appears. At this menu you can choose your preferred language and then confirm your choice by pressing "Save" button (see the example picture to the right).

When the program's successfully started, you'll see the menu of the mobile application as shown in the picture.

The neat menu is divided into tabs. Each tab has its own icon and logically groups certain program features and functions.

Fig. 11: Initial language preferences setting

Navigating through the menu is pretty easy. Depending on your phone's hardware you may use arrow buttons or joystick to navigate through. To switch to another tab, press the left or the right button. By pressing the up and down buttons you can choose the desired program feature listed in a selected tab (represented by a menu item). Each tab is also accompanied with shortcut calls to Exit and keyboard-lock functions (press the right option key of the phone).

4. Program features

a) Map viewing

Map viewing is the essential part of the application which can be triggered on the first tab. To have the

Fig. 12: Application main menu

feature fully working, you have to download map data from the desktop application or have data embedded in the mobile application from the beginning. Then you must activate the particular maps in the application menu (see below).

When you launch the map viewing feature, you'll see a screen filled with graphical objects representing map objects. Geographic coordinates and a red arrow centered on a cross hair are displayed, too. The cross hair represents your actual position

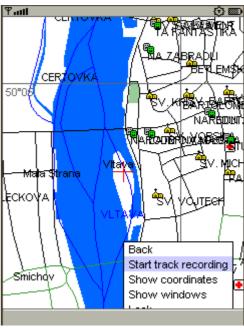*Fig. 14: GPS position indicator, map view menu*

Fig. 13: Map view

and the arrow shows course of your movement (in case that a GPS device or the Simulator is activated).

When viewing maps, you can launch certain functions as well. The menu for these functions is pops up if you press the right option key of your phone (this depends on your hardware).

The menu contains these items and related functions:

- Back – gets you back to the main menu screen

- Start track recording – triggers the recording of the track of your trip

    o Recording stops only by pressing "Stop track recording", not by shutting down application. After restart of the application, recording of the track continues.

- Show coordinates – displays latitude and longitude of your actual position

- Lock – locks your device's keyboard

- Show windows – displays additional information window about your position

    o By pressing the button "1" or "3" you can control content of the left window or the right window, respectively.

    o After selecting a desired window, you can press the "down" button to expand an appropriate context menu offering you additional information to display (see the picture to the right).
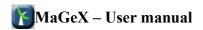

Fig. 15: Position information windows

Other useful functions can be activated by pressing the left option key, which pops up another context menu. This context menu lets you set detail drawing level. The lower level the value is, the more detailed map is drawn. For more convenience, you can let the application set the detail level automatically by selecting the "auto" option. This function is present only if at least one map is active.

When viewing a map, certain functions are assigned to some keyboard buttons:

- By pressing the OK button or the "5" button, you can save your actual position (waypoint) to the Storage system of the application by assigning it a name and a label.

- By pressing the "9" button, you trigger the Waypoints grouping functions. This function allows you to assign selected positions (waypoints) to a group, and this group of waypoints then defines a track of your trip. To assign a position to a group press the "9" button and repeat this step until you're satisfied with your defined track. To store a track defined in such way, press the "5" or OK button to give this track a name and description and then select "Save"; or choose "Cancel" to terminate the Waypoints grouping function.

- You can scroll the map using arrows buttons, and then after pressing the "0" button you can go back to your actual GPS position (only is simulator or GPS is active).

- By pressing "*" or "#" you can zoom in or zoom out respectively.

b) Tracing

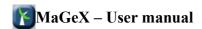Tracing allows the user to trace a certain object or a person.

Note:

- To have the feature fully working you have to be connected to a MaGeX server, which allows you to send and to receive data of user positions (MaGeX tries to use as little data bandwidth as it's possible to minimize the cost of a connection. We still recommend you to have a data profile with your cell phone network carrier).

- And also, permission from a traced person is needed to be able to trace the person.

If you want to trace a person (i.e. their device), just select the "Trace" item in the first tab of the main menu, type the name of the desired user in the form provided and the application will show you the object on the map as a blue named cross hair.

You can stop the tracing of a person anytime by selecting it from the list which shows under the "Stop Tracing" item in the menu in the first tab.

To determine whether you want to (dis)allow users to trace you, select "Permission to trace me". After selecting the feature you're asked to enter a login of the MaGeX user whom you want to (dis)allow to trace you. Also, you can choose certain actions related to tracing by pressing context menu button:

- Permit – allows a user with the login to trace you. "Permit all" applies the same functionality to all users of your server.

- Revoke – revokes the permission for the selected user to trace you. "Revoke all" applies the same functionality to all users of your server.

c) Viewing a position

The feature positions the map viewer to some desired coordinates. The feature can be found in the first tab. After selecting the feature, you can see a menu where you can define coordinates of the desired position.

d) Data managing features

On the second tab you have certain features with w
maps, tracks and waypoints data.

–Tracks – after selecting the menu, a context menu with following functions appears:

  o Details – displays details of a track such as: its label, legend, length, start and end time of the track, time length of the track and finally, data size of the track in the storage system

  o Track profile – shows you "altitude progress" of a selected track. This feature shows you a graph of altitudes of waypoints of a track. There are two modes of track profile viewing:

Fig. 16: Track profile: green mode

    ▪ The green mode - when the graph is displayed in green, you can use arrows buttons to scroll around the progress screen.

    ▪ The red mode - after pressing "OK" you can use arrows buttons again to change details of the progress screen.

  o Edit – allows you to edit track's legend and label
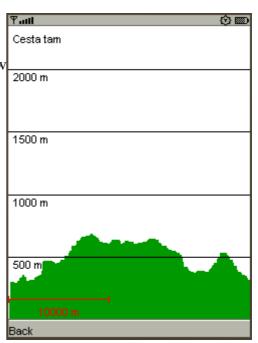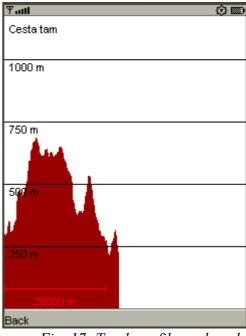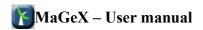

Fig. 17: Track profile: red mode

o Navigate – allows you to navigate to a track in the map viewer

o Delete – deletes a selected track

o Send – activates the Bluetooth module to allow you to send selected tracks to another users using MaGeX

o Mark – marks a selected track for batch deleting or sending (These functions are named "Delete marked" and "Send marked")

o If you press "OK" (or "Select") on the track, the whole track is shown on the map

–Maps – allows you to select which map you want to use and view. These maps can be transferred to the application by the Desktop application of the MaGeX suite or those maps can be embedded into the application from the beginning. For convenience, maps loaded in the application are listed with icons representing their states, which are:

o Activated - used for map viewing (displayed as a green dot icon)

vs. Not activated - not used for map viewing

o Embedded in the applications jar (displayed as a lock icon)
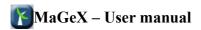
vs. stored in the RMS.

A context menu related to the maps management offer the user to activate, delete, view details of a map with correspondingly named buttons.

- Receive data – the function activates the Bluetooth module. After selecting and connecting to another user in the available users list, the application stores sent data from a selected user.

Fig. 18: Map management

- Waypoints – very similar to tracks managing feature, the feature allows you to manipulate with stored waypoints like deleting, viewing details, editing its label, navigate to a waypoint etc.

- Format all data – after confirmation the function deletes all data (Maps in RMS, tracks, waypoints) from the data storage of the application. Configuration of the application will not be deleted.

e) Searching feature

The application offers quite powerful searching abilities which covers:
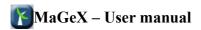
- Search by name – searches for objects with a given label or name. Objects which may be searched for include cities, restaurants, accommodation, services…etc. To filter certain object types you may check the "Only some types" check-box.

- Search by distance – allows you to search for all objects matching to a given name in a defined perimeter. The square perimeter is defined by its center coordinates and distance from a corner to the center. You can filter objects of your search interest in lower check-boxes. Please note that for large perimeters this type of search may be very time-consuming, so keep the distance reasonable (several kilometers at most are recommended).

   After a successful search, the application notices you about the number of matched objects a then it offers you a list of them. To view a matched object, press "OK" and the application will move you to the position of the object. If the number of results is too large (over 100; the input was too general), only the first 100 results are shown. You will be informed about this. If this happens, please use more specific input.

f) Program settings

The application offers plentiful settings options. Most settings can be found on the fourth tab.

- Display settings – this option has a shortcut from the first tab as well. Here you can set-up various displaying and map drawing options such as:

   o font size

   o polygon drawing style – you can choose between drawing only polygon's borders or including its inner fill. Drawing only polygon's borders is much faster.

   o lines drawing style

   o day or night color scheme. The feature tries to select colors that are convenient to your eyes at night or light enough at daytime.

    o data caching, which can accelerate map viewing.

- Viewpoints – with this setting you can select which map objects you want to be drawn on the map.

- View groups – allows you to filter which types of objects you want to be displayed on the map.

- Languages – allows you to choose your preferred language.

- Units – allows you to select your preferred units of distance, speed, elevation and position

- Server – a MaGeX server is needed to send your position in case you want to allow someone to trace your positions and trip. For a successful connection certain server details are required, such as:

    o User login and password – these facilities can be created and modified on the server's website

    o Connection interval – how often the application should send data to the server

    o Server address and port

    o Ability to allow parking tracking

- GPS – the setting allows you to select desired GPS device type

    o None – deactivates GPS module

    o LAPI – activates internal GPS module of your device if it's available

    o Serial – connects to an external GPS device via serial port

    o Bluetooth – connects to an external GPS device via Bluetooth

    o Simulator – activates a GPS simulator, which simulates a movement around a point, whose settings can be also set

- Simulator settings – settings related to the GPS simulator are coordinates of the center of a simulated circle, speed of movement, radius of the circle

g) Additional features

The last but not the least are additional geographic functions which can be found in the fifth tab.

- GPS information – detailed information of your actual position.

- Sun – information about Sun like its position, sunrise, sunset, twilights

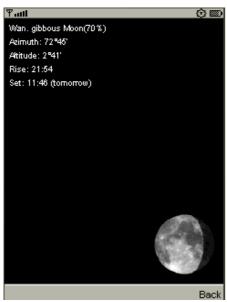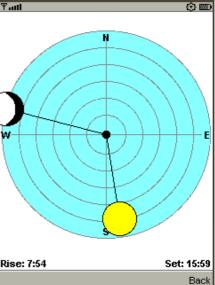- Moon – interesting information about Moon such as its phase, set/rise time, position. See below.

Fig. 19: Sun information and compass

- Compass - the feature can help you to determine cardinal directions using Sun's or Moon's position. Just coordinate the Sun or the Moon picture on the display to correspond to an actual position of the real Sun and the Moon, and you'll be able to figure out cardinal directions easily by the arrows of the compass (see the picture).

Fig. 20: Moon information