



ELBA – Integrated Eco-friendly Mobility
Services for People and Goods in Small Islands
Contr. No. LIFE09 ENV/IT/000111

**ELBA ICT systems and supporting
infrastructure: implemented solutions**

Deliverable D8

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Deliverable D8 – ELBA ICT systems and supporting infrastructure: implemented solutions Vers. 1.0



Document information

Abstract

The Elba project addresses innovations in two main aspects of mobility: collective people transport and goods transport/distribution.

Within the frame of *Action 8*, the ICT enabling infrastructure (including all technical services, tools and systems needed by Elba eco-mobility services) was implemented, based on design decisions taken in *Action 5*. Overall, the infrastructure integrated a wide range of technologies and components (most of them taken as background know-how by project partners), in order to support all Elba project services.

This document describes the implemented ICT solutions and the way they've been adapted to specific project requirements.

Keywords

Small islands, freight distribution, environmental compatibility, clean vehicles, EU Projects.

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1 Introduction

1.1 Background and aim of LIFE+ ELBA Project

Elba is a pilot project part-funded by the European Commission under the <http://ec.europa.eu/environment/life/funding/lifeplus.htm>, the EC financial instrument for the Environment.

Launched in October 2010 and running until September 2013, ELBA has the main objective of planning, implementation and demonstration of a number of advanced eco-sustainable, integrated mobility schemes and services for people and goods targeting, specifically, the "small islands" environment and application context.

Particularly, the territorial context of ELBA project includes the Elba Island, the main island of Tuscan Archipelago (Tuscany Region, Italy) and the connected mainland area, including the town of Piombino (Livorno province) and the surrounding regional transport environment.

Action 8-related activities have been carried out starting from the identified stakeholders and user needs (*Action 2*), making reference to Elba service schemes resulting from *Action 4*, and taking into account the enabling technologies reviewed in *Action 3* and selected in *Action 5*.

1.2 Scope of Deliverable D8

Deliverable D8 is the expected result for *Action 8 (Implementation and customization of ICT platform and systems)*, which successfully concluded on time in May 2012.

This deliverable reports the implemented ICT platforms and software solutions to be adopted for achieving the main objectives of the Elba project. The implementation work was mainly conducted at *Softeco Sismat* premises.

The overall technological architecture/infrastructure is modular and open, in order to ensure flexibility and expansion of the system and to integrate support and management of future Elba services and mobility schemes.

Basically, the system (resulting from actions 3 and 5) includes three major functional groups of ICT services:

- *Optimization and Planning Services*, which primary goal is to improve the efficiency, the reliability and the traceability of the freight distribution process in identified Elba areas. These services include the two ICT platforms *ElbaFreight* and *ElbaLaundry*.
- *Monitoring Services*, which primary goal is to provide an effective means to monitor the actual vehicle routes, to collect travel data and to support the assessment of the measures under test. These services primarily include the ICT platform *ElbaShuttle*, which application domain has been extended to freight vehicle monitoring.
- *Infomobility Services*, which primary goal is to provide citizens with up-to-date information about implemented measures (namely public transport services). These services primarily include the *ElbaMobile* app.

All these groups are supported by a cross-functional set of communication services and web infrastructures, enabling the inter-networking and collaboration among the aforementioned platforms (*ElbaFreight*, *ElbaLaundry*, *ElbaShuttle* and *ElbaMobile*) and the different actors of the transport system (public transport operators, good delivery operators, mobile service providers, logistics service providers, citizens, etc.).

The following chapters describe the three functional groups and the underlying IT platforms.

2 Optimization and Planning Services

Within the frame of the *Action 8*, two ICT platforms (namely *ElbaFreight* and *ElbaLaundry*) were developed, tested and validated, in order to implement a set of *Optimization and Planning Services*,



which primary goal is to improve the efficiency, the reliability and the traceability of the freight distribution process in identified Elba areas.

Such services have been implemented starting from available ICT components/systems and enhancing them by taking into account the identified stakeholders' and users' needs. As from project deliverable D4 (*Design of sustainable mobility services for people and goods*), the two reference stakeholders for freight management are:

- *Corriere Fulceri* – a local carrier providing a regular service between the mainland and the island (see Figure 1 and Figure 2).
- *Lavanderia Industriale Ilva* – an industrial laundry servicing most of the hotels and restaurants in the Elba Island (see Figure 3 and Figure 4).



Figure 1. Logistics base of Corriere Fulceri in Portoferraio (outside view)



Figure 2. Logistics base of Corriere Fulceri in Portoferraio (inside view)



Figure 3. Premises of Lavanderia Industriale Ilva in Rio Marina (outside view)



Figure 4. Fleet of Lavanderia Industriale Ilva

Although running two (obviously) different service models, both actors can benefit from the adoption of the Elba project ICT platforms, in terms of better control over the process (track & trace, vehicle monitoring), overall optimization of the trips and simplification of operational procedures. All these benefits, together with the adoption of the eco-friendly fleet deployed within the project, will result in concrete and measurable environmental improvements, which will be evaluated within *Action 15 (Pilot evaluation and environmental impacts assessment)*.

In order to support such assessment, the relevant vehicles will be continuously monitored, so as to collect travel data, distances and timings. Data collection, management and presentation will be accomplished by the same on-board devices and by the same IT platform as for the public transport vehicles. More precisely, monitoring data will be made available by means of a dedicated section of the *ElbaShuttle* platform (only accessible by project management team and freight operators *Corriere Fulceri* and *Lavanderia Industriale Ilva*). For more details about the freight vehicles monitoring function for freight operators, please refer to chapter 3.1.

The *ElbaFreight* application is based upon *eMile*, a well-established IT platform entirely developed and marketed by *Softeco*. *eMile* is an integrated platform for the overall management of the freight distribution cycle in urban environments (city logistics), featuring all base services for last-mile delivery management (trip planning and optimization, track-and-tracing, vehicle localization and monitoring, accounting and invoicing) and a series of value-added services (park-and-buy, 3rd-party warehousing, unloading area control, fixed-visits planning).

In order to meet the needs of reference stakeholders selected for system trials and demonstration, *eMile* has been heavily customized by adding new features and by applying a general restyling to the user interfaces (Elba project look & feel).

The *ElbaLaundry* application is also based upon *eMile*. More specifically, it extends the native fixed-visits planning function, originally designed to optimize trips of generic mobile workforce (e.g. salesmen, energy & gas agents, etc.), taking into account some specific requirements of the laundry service.

Following chapters briefly describe the *ElbaFreight* and *ElbaLaundry* platforms, and summarize the major customizations made to the underlying *eMile* application in order to satisfy Elba-specific requirements.

2.1 The *ElbaFreight* Platform

The *ElbaFreight* platform will be installed at *Corriere Fulceri* logistics base in Portoferraio. Field trials will mainly focus on freight distribution across the whole island.

Beside specifically implemented functionalities, the *ElbaFreight* platform keeps the basic layout of the underlying *eMile* system. It features a classic *Windows*-style graphical user interface, based on a main application window surrounded by a menu bar, a toolbar and a status bar (see Figure 5).

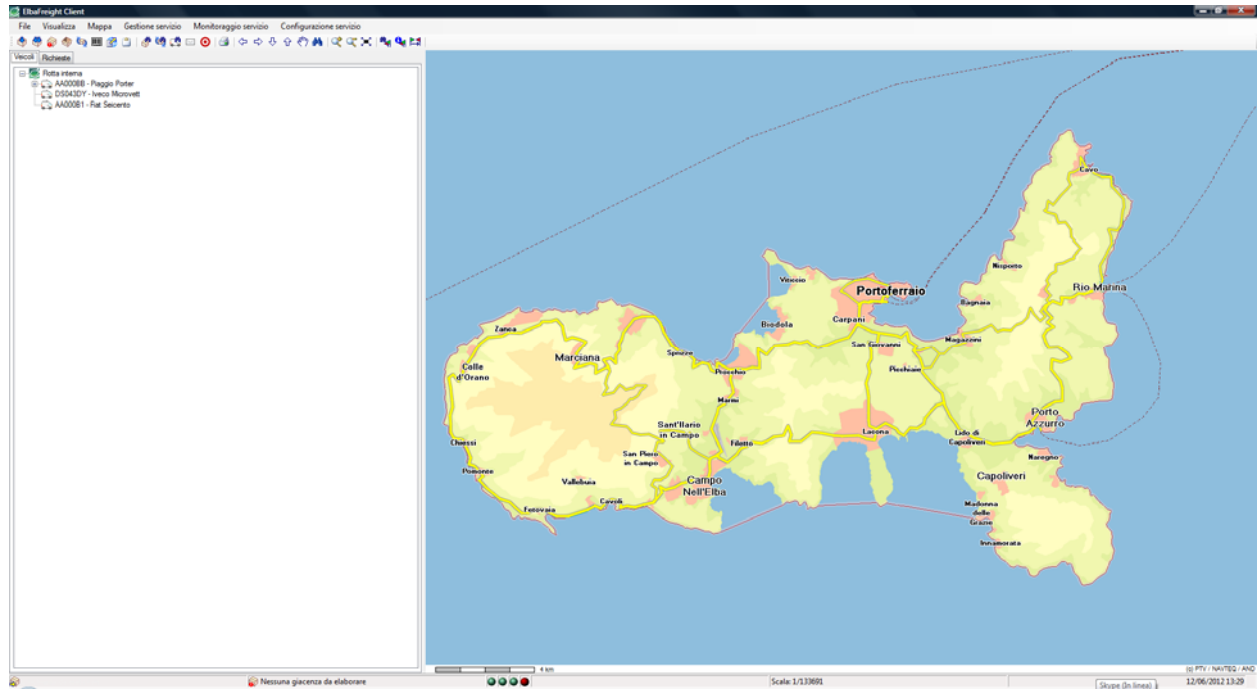


Figure 5. The *ElbaFreight* platform user interface

The main application window is split in 3 areas:

- A graphic representation (map) of the serviced territory (namely the Elba island). The map displays the road network, application POIs (points of interest) and other useful landmarks (rivers, mountains, shores, urban areas etc.). Since map elements are stored in vector format, the map can be zoomed and/or moved at user's choice without any quality loss. Furthermore, it can graphically represent the route of planned trips.
- The "fleet" panel (a tree view containing all configured vehicles and relevant currently planned delivery trips).
- The "shipment order" panel (a tree view containing all active shipment orders grouped by carrier).

The interactive status bar reports utility information about pending deliveries, failed deliveries, diagnostics summary, current date and time, etc. It provides direct access to trip planning window and failed delivery window by double-clicking the relevant area.

The menu bar and the toolbar provide access to all system functions. Menus and buttons are grouped per functional area, and their layout is affected by licensed features and role of currently logged operator.

According to the discussions held with reference stakeholder, the main functions of interest are:

- Shipment order management (single point data entry, massive import, labeling, tracking of different status along the delivery chain, failed delivery management).
- Delivery trip planning and optimization.
- Carrier invoicing.

The menu bar and the toolbar have been customized accordingly, in order to provide access to the relevant functions and to hide all unused features.

Basically, the operational model implemented by the *ElbaFreight* platform consists in freight delivery cycle management: from the check-in (after transshipment from the mainland), to trip management (including trip routes optimization) up to final delivery to destination. Supported logistics services are:

- Forward logistics (also known as *last mile*).
- Reverse logistics (also known as *first mile*).

In both cases, the shipment request is originated by the long/mid range carrier, who gets the order by the customer (the consignor) and delegates to city logistics operator (namely *Fulceri*) the interface with local servicing area.

The whole process of collecting, storing and delivering parcels is under the control of the *ElbaFreight* platform, following a sequence of logically-related steps, which have been extensively illustrated in previous deliverable D5 (*Elba ICT platform services and system design*).

Shipment orders can be entered into the system manually (single point data entry), in batch mode (massive import) or remotely (via a web interface). In the scope of the project, only first two methods are relevant.

The following pictures (Figure 6 and Figure 7) illustrate the forms used to submit a shipment order (basic information and accounting information respectively). It's rather important to notice that, despite the apparently large number of information present, the overall data entry procedure is simple and quick. In fact, most of the fields support an auto-complete option, helping the user to retrieve information already present in the system (e.g. complete addresses of pre-defined shops and destinations). Furthermore, all optional fields are preset with reasonable default values. Finally, the usage of the barcode reader greatly improves the data entry experience. All this considered, a basic shipment order data entry usually takes just a few clicks/taps and no more than 20 seconds.

The single point data entry is normally used when there is no automated procedure to communicate with the carrier, and the user must manually enter information printed on the accompanying documents. Alternatively, shipment orders may be massively imported from electronic documents (e.g. csv or excel files): this approach is based on the cooperation with major carriers, who are called to send by mail the list of the forthcoming shipment orders (e.g. on a daily basis).



Proprietà richiesta di consegna

Parametri generali Lista colli Fatturazione

Codice cliente: []

ID richiesta: -1 Stato: In attesa

Etichetta lettera di vettura: Etichetta autogenerata Tipo servizio: []

Numero bolla: [] Data bolla: 08-nov-12

Tipo merce: Colettame Poto: Franco destino

Numero colli: 0 Peso totale (kg): 0.00 Volume totale (m³): 0.00

Peso equivalente (kg): 0.00 Peso tassato (kg): 0.00

Mittente

Ragione sociale: []

Riferimento: [] Telefono: []

Indirizzo: []

C.A.P.: [] Città: [] Usa coordinate mittente (se disponibili)

Vincoli: Nessuno 00:00 Riposizione

Destinatario

Ragione sociale: []

Riferimento: [] Telefono: []

Consegna c/o box del destinatario

Indirizzo: []

C.A.P.: [] Città: [] Usa coordinate destinatario (se disponibili)

Vincoli: Nessuno 00:00 Riposizione

Note: []

Prepagata: Nessuna

Elimina Salva Annulla

Figure 6. Shipment order submission, basic information

Proprietà richiesta di consegna

Parametri generali | Lista colli | **Fatturazione**

Parametri richiesta

Valore assicurato (€)

Pagamento con contrassegno

Contrassegno (€) Pagamento

Tariffe applicate

Descrizione	Tariffa cliente (€)

Maggiorazione applicata a cliente (€) Maggiorazione percepita da autista (€)

Diritti assicurativi (€)

Importi fatturati

Voce	Valore
Tariffa base (€)	5.80
Totale consegna (€)	5.80

Riferimento prepagata

Elimina Salva Annulla

Figure 7. Shipment order submission, accounting information

Once a shipment order is submitted, every status change is tracked and recorded by the system. Such status changes may be recorded by the system console or by means of mobile devices (rugged palmtops/handheld PCs)¹. Also in this case the system provides different means to help the user to speed up the operation (multiple selections, barcode point-and-shoot).

All status changes can be reviewed at any time, even after the parcel has been delivered and the relevant transaction has been closed. Figure 8 illustrates the Track & Trace form, containing the whole history of a given shipment.

¹ In Elba project implementation, Corriere Fulceri decided not to use any mobile device, due to the characteristics and volume of the service.

Data e ora evento	Nome agente/autista	Descrizione evento	Stato
12/03/12 10:35:04	Tommaso Tambellini	Inserimento richiesta cliente TOSCOSPED srl, Destinatario: La Boutique dei Golosi snc, Mittente: Ambrogio...	In attesa
12/03/12 17:14:35	Tommaso Tambellini	Stato richiesta: In magazzino (era In attesa)	In magazzino
15/03/12 17:13:09	Tommaso Tambellini	Modifica Stato: era In magazzino, è In consegna	In consegna
15/03/12 17:13:19	Tommaso Tambellini	Modifica Stato: era In consegna, è Consegnato	Consegnato

Figure 8. Track & Trace form

The other main pillar of the *ElbaFreight* platform is the *trip planning and optimization service*. Such service aims at maximizing the load of delivery vehicles and minimizing the routes, always complying with possible constraints, such as delivery priority, opening hours, etc.

The system supports three planning modes: fully automated, manual or mixed (see Figure 9).

- In fully automated mode, the system takes all pending shipment orders (i.e. last-mile orders currently checked-in for temporary storage at the logistics base) and automatically creates all delivery trips needed to serve them all. Within such trips, the sequence of deliveries (and/or collections) is automatically decided by the system, in order to optimize the route, unless specific constraints exist. Trips are created taking into account the nominal load of each vehicle and its availability. In this phase, the user may also define an overload/underload factor, in order to alter the basic behavior (e.g. more trips with less load, so as to distribute the workload among more drivers). Shipment orders may be grouped by servicing area (e.g. Portoferraio, Rio Marina, rest of the island) or processed all together.
- In manual mode, the user must manually create trips and associate them with vehicles. Then, he/she must drag each single shipment order (on the left pane) and drop it to the desired trip (on the right pane). A given shipment order may be moved back and forth in the trip, as well as moved to another trip, or even taken back to the left pane. Similarly, a whole trip can be moved from one vehicle to another. In manual mode, the user is the only responsible of the trip pattern: he/she can decide to overload/underload a vehicle, or even to create a non-optimized trip. Anyway, the system provides an helper function that optimizes the sequence of operations of a manually-created trip.
- The mixed mode is basically a combination of the two modes above. The basic idea is to perform a first pass in automatic mode, and then to refine the proposed trip pattern by moving single deliveries or whole trips.

It is important to notice that the *trip planning and optimization service* will be used to organize trips of the whole fleet, and not only for the electric van provided by the Elba project.

Figure 9 illustrates the trip planning and optimization form.

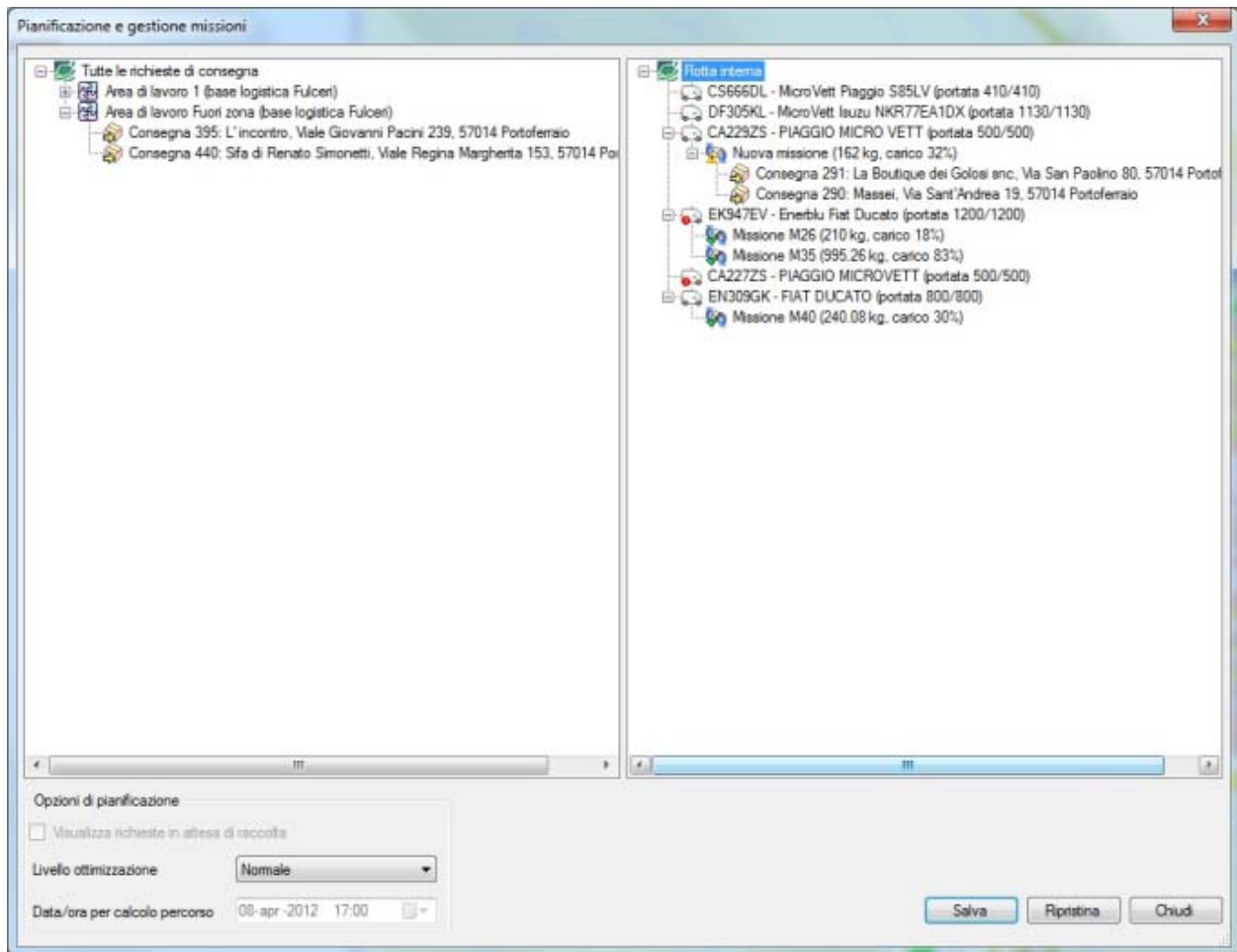


Figure 9. Trip planning and optimization form

The last function of interest is the *carrier invoicing service*. Such service aggregates all shipment orders and automatically calculates the amount due by the relevant carriers, applying different invoicing policies (per trip, per parcel, per weight).

For each carrier, the user must define some basic information (invoicing period, VAT, etc.) and must select one of the possible invoicing policies and all the relevant parameters (e.g. for per-weight invoicing, a series of weight thresholds and the relevant fares). In addition, it is also possible to define a list of additional price rises (e.g. delivery to a specified floor, cash on delivery, etc.) and/or discounts.

After that, all shipment orders for this carrier will be subjected to invoicing management (calculation of the base fee). At data entry time, the user can also specify if any of predefined price rises is active.

Depending on the invoicing period (usually one month), the user can display the summary of closed shipment orders (i.e. delivered or returned), calculate the amount due and print the relevant invoice.

The Figure 10 illustrates the carrier invoicing summary form.

Data	ID richie...	Nro Bolla	Data bolle	N. b...	Pest. kg	Plass. kg	Etichetta	Tipo servizio	Tariffa base €	Dir. fissi €	Dir. assic. €	Dir. contras. €	Dir. giac...	Maggioraz. €	Tot. cons. €	Prepagata	Tot. fatt. (€)
12/03/12	193	57287	11/03/12	6	48.00	100.00	eMile193	Ultraso riglio	4.20	0.00	0.00	0.00	0.00	0.00	4.20		4.20
15/03/12	208	57578	12/03/12	7	58.00	58.00	eMile208	Ultraso riglio	4.20	0.00	0.00	4.22	0.00	0.00	8.42		8.42
15/03/12	209	2122/999	12/03/12	1	80.00	172.00	eMile209	Ultraso riglio	8.40	0.00	0.00	0.00	0.00	0.00	8.40		8.40

Options di ricerca: Da: [dom 01-apr-2012] A: [lan 30-apr-2012] Default

Dettaglio fattura: Sconto %: 0.00

Voce	Valore
Sconto applicato (€)	0.00
Importabile (€)	33.62
IIVA (€)	7.06
Totale fattura (€)	41.68

Figure 10. Carrier invoicing summary form

With reference to the basic *eMile* implementation, *ElbaFreight* platform required following major customizations:

- Shipping note scan attachment. In order to certify the transfer of liability of the parcel upon final delivery, *Fulceri* used to make a copy of the shipping note (including the signature of the consignee) prior of returning it to the carrier. Beside the adoption of the *ElbaFreight* platform, *Fulceri* asked that such copy is attached to the shipment order and accompanies it for its whole lifecycle. This requirement has been implemented in a more generic form: at any time of the shipping order management, it is possible to attach a generic file, which is persisted in database as a BLOB (*binary large object*). The attachment is then made accessible for reading by the Track & Trace form, and the registered application for that file extension (if any) is automatically invoked (e.g. Adobe Reader© for a pdf file).
- Vehicle-to-area assignment. Due to the limited range of the electric van used for field trials, it is important to avoid that such vehicle is assigned to a long range trip. In order to do so, the *ElbaFreight* platform supports the association of vehicles with one specific servicing area: if such association exists, the *trip planning and optimization service* ensures that only deliveries for that specific area are loaded aboard the vehicle. Hence, servicing areas can be used to define the boundaries of safe range for electric vehicles.

2.2 The *ElbaLaundry* Platform

The *ElbaLaundry* platform will be installed at *Lavanderia Industriale Ilva* headquarters in Rio Marina. Field trials will mainly focus on the planning of linen delivery/collection trips, to feed hotels and restaurants with clean towels, sheets, napkins (and to collect the used ones).

As for *ElbaFreight*, the *ElbaLaundry* platform keeps the basic layout of the underlying *eMile* system (see chapter 2.1, Figure 5).

According to the discussions held with reference stakeholder, the main functions of interest are:

- Definition of periodic visit calendar.
- Linen delivery/collection trip planning and optimization.

The menu bar and the toolbar have been customized accordingly, in order to provide access to the relevant functions and to hide all unused features.

Basically, the operational model implemented by the *ElbaLaundry* platform consists in organizing the calendar of visits (according to specific conditions, such as season and feed frequency) and optimizing the trips accordingly.

The platform supports the definition of a directory of customers (hotels, restaurants). For each customer, the user must define some basic information (name, address, quantity-per-item, etc.) and must select one of possible visit policies and all the relevant parameters (e.g. daily, weekly, monthly, fixed days of the week, fixed days of the month, etc.).

After a visit policy has been defined, the system automatically generates “visit orders” for a given period (typically a couple of months). Visit orders are basically a special type of shipment orders, since they are characterized by the same main attributes, such as address/location, weight, constraints, etc. (see chapter 2.1, Figure 6).

At any time, the user can display the visit calendar for a given customer, displaying completed (green), failed (red) and planned (blue) visit orders. From this form, the user may also insert additional visits orders or delete unnecessary ones.

The following picture (Figure 11) illustrates the visit calendar definition form.

Calendario visite negozi/clienti privati

ID: Periodicità:

Informazioni anagrafiche

Ragione sociale:

Nome: Telefono fisso:

Indirizzo:

Giorni periodicità settimanale

Lunedì Martedì Mercoledì Giovedì Venerdì Sabato Domenica

2012	Giugno	Agosto	Ottobre	Dicembre	Febbraio	Aprile	2013
lun	4 11 18 25	6 13 20 27	1 8 15 22 29	3 10 17 24 31	4 11 18 25	1 8 15 22 29	lun
mar	5 12 19 26	7 14 21 28	2 9 16 23 30	4 11 18 25	5 12 19 26	2 9 16 23 30	mar
mer	6 13 20 27	1 8 15 22 29	3 10 17 24 31	5 12 19 26	6 13 20 27	3 10 17 24	mer
gio	7 14 21 28	2 9 16 23 30	4 11 18 25	6 13 20 27	7 14 21 28	4 11 18 25	gio
ven	1 8 15 22 29	3 10 17 24 31	5 12 19 26	7 14 21 28	1 8 15 22	5 12 19 26	ven
sab	2 9 16 23 30	4 11 18 25	6 13 20 27	1 8 15 22 29	2 9 16 23	6 13 20 27	sab
dom	3 10 17 24	5 12 19 26	7 14 21 28	2 9 16 23 30	3 10 17 24	7 14 21 28	dom
lun	2 9 16 23 30	3 10 17 24	5 12 19 26	7 14 21 28	4 11 18 25	6 13 20 27	lun
mar	3 10 17 24 31	4 11 18 25	6 13 20 27	1 8 15 22 29	5 12 19 26	7 14 21 28	mar
mer	4 11 18 25	5 12 19 26	7 14 21 28	2 9 16 23 30	6 13 20 27	1 8 15 22 29	mer
gio	5 12 19 26	6 13 20 27	1 8 15 22 29	3 10 17 24 31	7 14 21 28	2 9 16 23 30	gio
ven	6 13 20 27	7 14 21 28	2 9 16 23 30	4 11 18 25	1 8 15 22 29	3 10 17 24 31	ven
sab	7 14 21 28	1 8 15 22 29	3 10 17 24	5 12 19 26	2 9 16 23 30	4 11 18 25	sab
dom	1 8 15 22 29	2 9 16 23 30	4 11 18 25	6 13 20 27	3 10 17 24 31	5 12 19 26	dom

Legenda

Escludi richieste assegnate a missioni Visualizza archivio a lungo termine

Figure 11. Visit calendar definition form

Being the visit order a special type of shipment order, the planning of linen delivery/collection trip works exactly the same way as for *ElbaFreight* platform (see chapter 2.1, Figure 9).

As for *ElbaFreight*, the *trip planning and optimization service* aims at maximizing the load of linen delivery/collection vehicles and minimizing the routes.

Again, the system supports three planning modes: fully automated, manual or mixed.

- In fully automated mode, the system takes all pending visit orders and automatically creates the trips needed to serve them. Within such trips, the sequence of visits is automatically decided by the system, in order to optimize the route. Visit orders may be grouped by servicing area (e.g. Portoferraio, Rio Marina, rest of the island) or processed all together.
- In manual mode, the user must manually create trips and associate them with vehicles. Then, he/she must drag each single visit order (on the left pane) and drop it to the desired trip (on the right pane). A given visit order may be moved back and forth in the trip, as well as moved to another trip, or even taken back to the left pane. Similarly, a whole trip can be moved from one vehicle to another. In manual mode, the user is the only responsible of the trip pattern. Anyway, the system provides a helper function that optimizes the sequence of visits of a manually-created trip.
- The mixed mode is basically a combination of the two modes above. The basic idea is to perform a first pass in automatic mode, and then to refine the proposed trip pattern by moving single visits or whole trips.

It is important to notice that the *trip planning and optimization service* will be used to organize trips of the whole fleet, and not only for the electric van provided by the Elba project.

With reference to the basic *eMile* implementation, *ElbaLaundry* platform required following major customizations:

- Delivery/collection sequence. In order to guarantee the hygiene of the goods, *ElbaLaundry* trips must first deliver all the clean linen, and then collect all the used one. This requirement has been implemented by doubling the visits orders (one for delivery and one for collection), and by creating a new constraint that puts all collections after deliveries.

3 Monitoring Services

Within the frame of the *Action 8*, a new ICT platform (*ElbaShuttle*) was developed, tested and validated, in order to implement a set of *Monitoring Services*, which primary goal is to collect travel data and to support the assessment of the two experimental public transport lines named *LIFE+ Elba Spiagge* (“*Linea S*”) and *LIFE+ Elba Est* (“*Linea R*”).

Such service has been implemented starting from available ICT components/systems and enhancing them by taking into account the identified stakeholders’ needs. As from project deliverable D4 (*Design of sustainable mobility services for people and goods*), the reference stakeholder for public transport is *ATL*, a transport company serving Livorno and other cities in Tuscany (see Figure 12).



Figure 12. ATL bus terminal in Portoferraio

The *ElbaShuttle* application is based upon *eLise*, a well-established IT platform entirely developed and marketed by *Softeco*. *eLise* is a web-based application for the monitoring of generic vehicle fleets, and thus applicable to public transport, logistics and other purposes. Due to this flexibility, the application domain of *ElbaShuttle* has been extended, in order to monitor also freight vehicles operating for *ElbaFreight* and *ElbaLaundry*.

In order to meet the needs of reference stakeholders, *eLise* has been customized by applying a general restyling to the user interfaces (Elba project look & feel).

3.1 The *ElbaShuttle* Platform

The *ElbaShuttle* web application has been developed using *Microsoft Silverlight Framework*.

From the *ElbaShuttle* web site main page, a user login is requested to proceed and to access main monitoring functionalities (Figure 13):

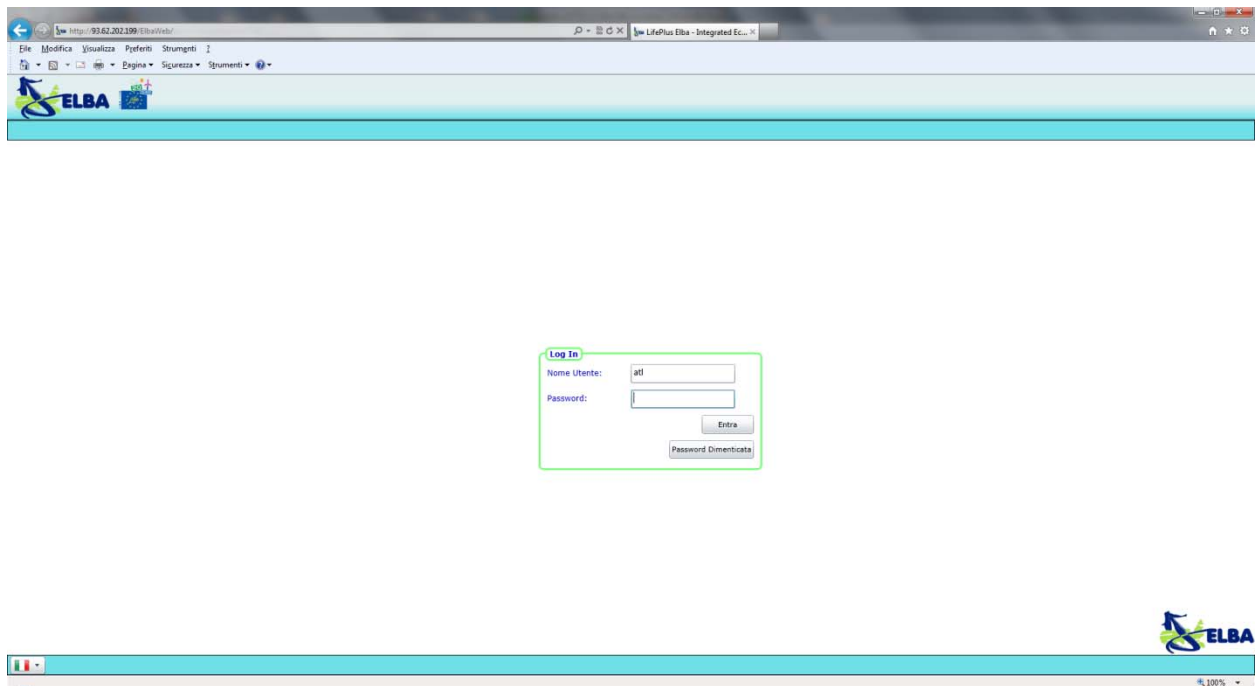


Figure 13. *ElbaShuttle* web site, login page

In order to prevent users from accessing other parties' data, three separate accounts were created: one for *ATL*, one for *Corriere Fulceri* and one for *Lavanderia Ilva*. Each account has been associated with the relevant fleet, so that a given user can only access data he/she is authorized to.

Upon successful login, the user gains access to the main page, which is divided in four panels: fleet directory, event summary, alarm summary and main map (Figure 14).

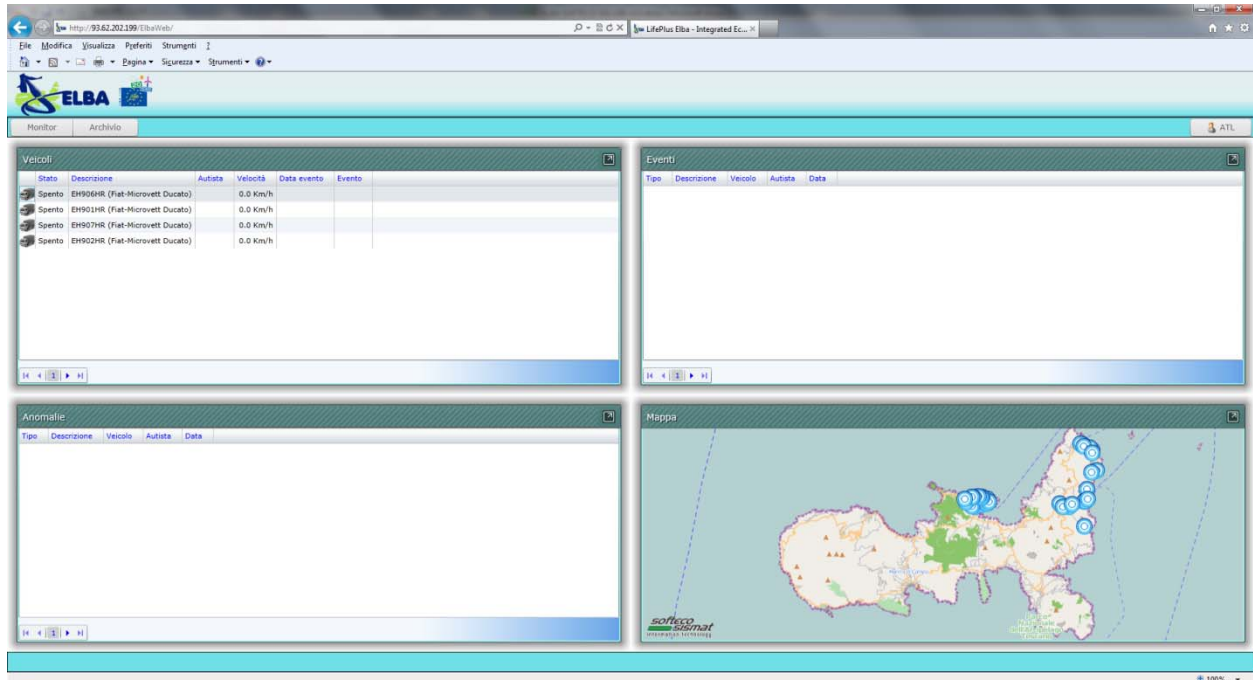


Figure 14. Elba Shuttle web site, main page

By clicking of the title bar of a given tile, it becomes the main window and takes all available space on the client area, while all the other tiles are iconized on the bottom line.

The main functionalities provided by the four panels are described below:

- **Fleet directory:** this panel displays the list of all vehicles associated with the currently logged user. By clicking one vehicle, its current position is displayed on the main map.
- **Event summary:** this panel displays all events received from all the vehicles associated with the currently logged user. An event is basically a message that describes a normal operating condition (e.g. power on, power off, bus stop reached, etc.). The panel is automatically refreshed and scrolled, in order to present most recent events at the top of the list.
- **Alarm summary:** this panel displays all alarms received from all the vehicles associated with the currently logged user. An alarm is basically a message that describes a non-normal condition (e.g. missing stop at bus stop, unexpected power on, etc.). The panel is automatically refreshed and scrolled, in order to present most recent alarms at the top of the list.
- **Main map:** this panel displays the serviced territory (namely the whole Elba Island), the service targets (bus stops) and the current position of all the vehicles associated with the currently logged user. The map can be zoomed and/or moved at user's choice, and is automatically refreshed on a periodic basis.

On the top-left corner of main window, two buttons provide access to real-time and long-term monitoring. The two functions are basically the same, except for a different time horizon (only today's data for real-time monitoring, a range of data in the past for long-term monitoring).

Monitoring data are basically used for statistics and reporting. They can be filtered by vehicle and by time, and provide the following types of report:

- **Event history:** list of occurred events during a selected time interval for all vehicles or for a given vehicle (see Figure 15):
 - Power-up/Power-down
 - Reached target (bus stop)
 - Begin/end of target stop (bus stop)
- **Alarm history:** list of occurred alarm events during a selected time interval for all vehicles or for a given vehicle (see Figure 16):
 - Unexpected Power-up
 - Unexpected stop begin/end
 - Speed alarm
- **Daily report:** for a given day and vehicle, the system aggregates travelling data on a per-trip basis (assuming that a trip starts when receiving a power-up event and stops when receiving the subsequent power-down). Aggregated data mainly consist of (see Figure 17):
 - Vehicle stops date and time
 - Total travelled distance (km)
 - Average speed (km/h)
 - List of occurred events and alarms
- **Drive style report:** speed chart for a given vehicle for a given time period or for a given day (see Figure 18).

Following figures illustrate the page layout for some of the features above.

Tipo	Descrizione	Veicolo	Autista	Data
	Accensione terminale fuori orario operativo	EH906HR (Fiat-Microvett Ducato)		05/05/2012 07:40
	Spegimento terminale	EH906HR (Fiat-Microvett Ducato)		05/05/2012 07:41
	Accensione terminale	EH906HR (Fiat-Microvett Ducato)		05/05/2012 09:14
	Raggiunto target Portoferraio V.le Elba	EH906HR (Fiat-Microvett Ducato)		05/05/2012 09:20
	Sosta presso target Portoferraio V.le Elba	EH906HR (Fiat-Microvett Ducato)		05/05/2012 09:20
	Spegimento terminale	EH906HR (Fiat-Microvett Ducato)		05/05/2012 09:21
	Accensione terminale	EH906HR (Fiat-Microvett Ducato)		05/05/2012 09:29
	Fine sosta presso target Portoferraio V.le Elba, durata 00:09:20	EH906HR (Fiat-Microvett Ducato)		05/05/2012 09:29
	Raggiunto target Via Carducci Zambelli	EH906HR (Fiat-Microvett Ducato)		05/05/2012 09:31
	Riscontro target Via Carducci 2	EH906HR (Fiat-Microvett Ducato)		05/05/2012 09:32
	Raggiunto target Capo Bianco 2	EH906HR (Fiat-Microvett Ducato)		05/05/2012 09:37
	Raggiunto target Via Einaudi	EH906HR (Fiat-Microvett Ducato)		05/05/2012 09:37
	Raggiunto target Ponte del Brogi	EH906HR (Fiat-Microvett Ducato)		05/05/2012 09:43
	Raggiunto target Via Mangano PT	EH906HR (Fiat-Microvett Ducato)		05/05/2012 09:44
	Raggiunto target Via Mangano P.Pietri	EH906HR (Fiat-Microvett Ducato)		05/05/2012 09:45
	Raggiunto target Via Carducci Zambelli	EH906HR (Fiat-Microvett Ducato)		05/05/2012 09:46
	Raggiunto target Via Zambelli	EH906HR (Fiat-Microvett Ducato)		05/05/2012 09:46
	Sosta presso target Via Zambelli	EH906HR (Fiat-Microvett Ducato)		05/05/2012 09:46
	Raggiunto target Portoferraio V.le Elba	EH906HR (Fiat-Microvett Ducato)		05/05/2012 09:48
	Fine sosta presso target Via Zambelli, durata 00:01:16	EH906HR (Fiat-Microvett Ducato)		05/05/2012 09:48
	Sosta presso target Portoferraio V.le Elba	EH906HR (Fiat-Microvett Ducato)		05/05/2012 09:56
	Fine sosta presso target Portoferraio V.le Elba, durata 00:03:28	EH906HR (Fiat-Microvett Ducato)		05/05/2012 09:59
	Raggiunto target Via Carducci Zambelli	EH906HR (Fiat-Microvett Ducato)		05/05/2012 10:01
	Raggiunto target Via Carducci 2	EH906HR (Fiat-Microvett Ducato)		05/05/2012 10:02
	Raggiunto target Padulella Acquamarina	EH906HR (Fiat-Microvett Ducato)		05/05/2012 10:05
	Raggiunto target Bivio Albereto	EH906HR (Fiat-Microvett Ducato)		05/05/2012 10:08
	Raggiunto target Spumetta	EH906HR (Fiat-Microvett Ducato)		05/05/2012 10:10

Figure 15. ElbaShuttle web site, event history

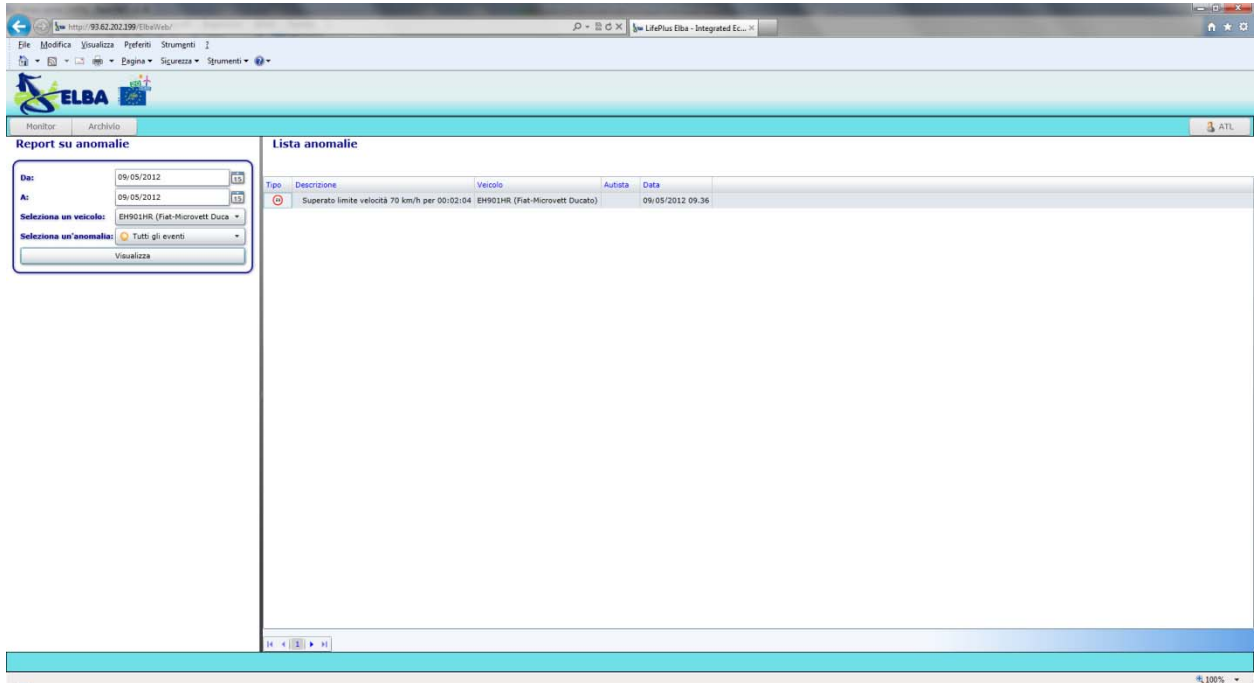


Figure 16. ElbaShuttle web site, alarm history

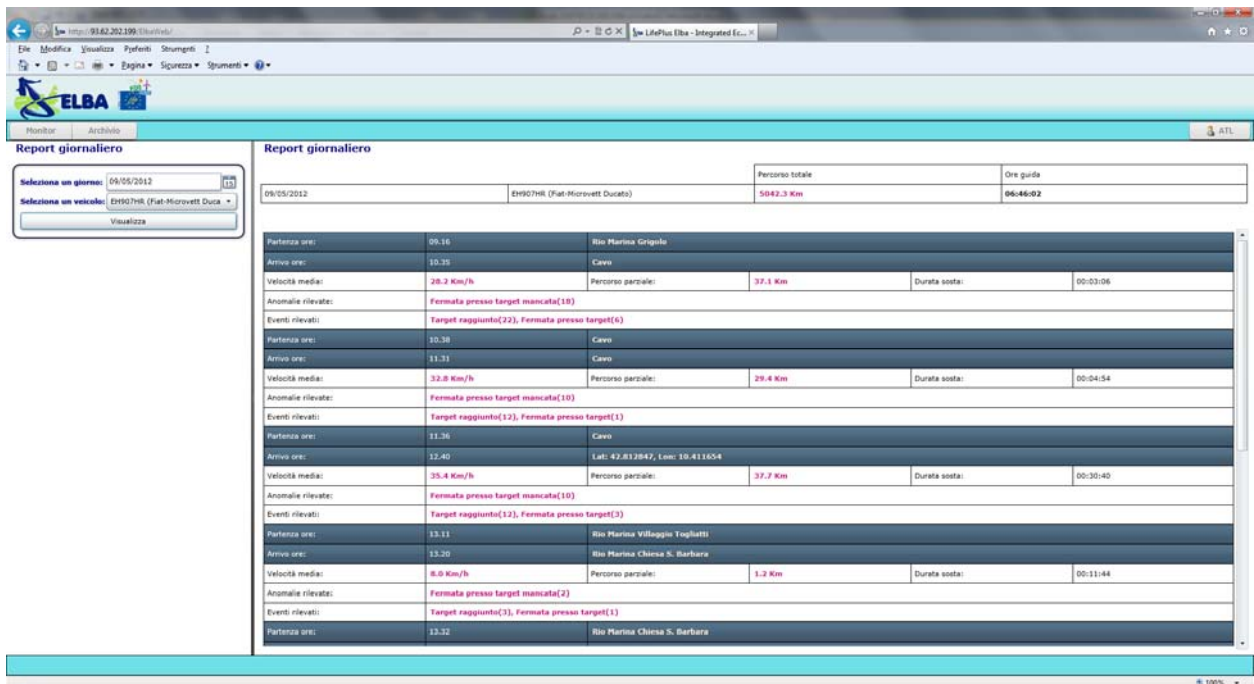


Figure 17. ElbaShuttle web site, daily report

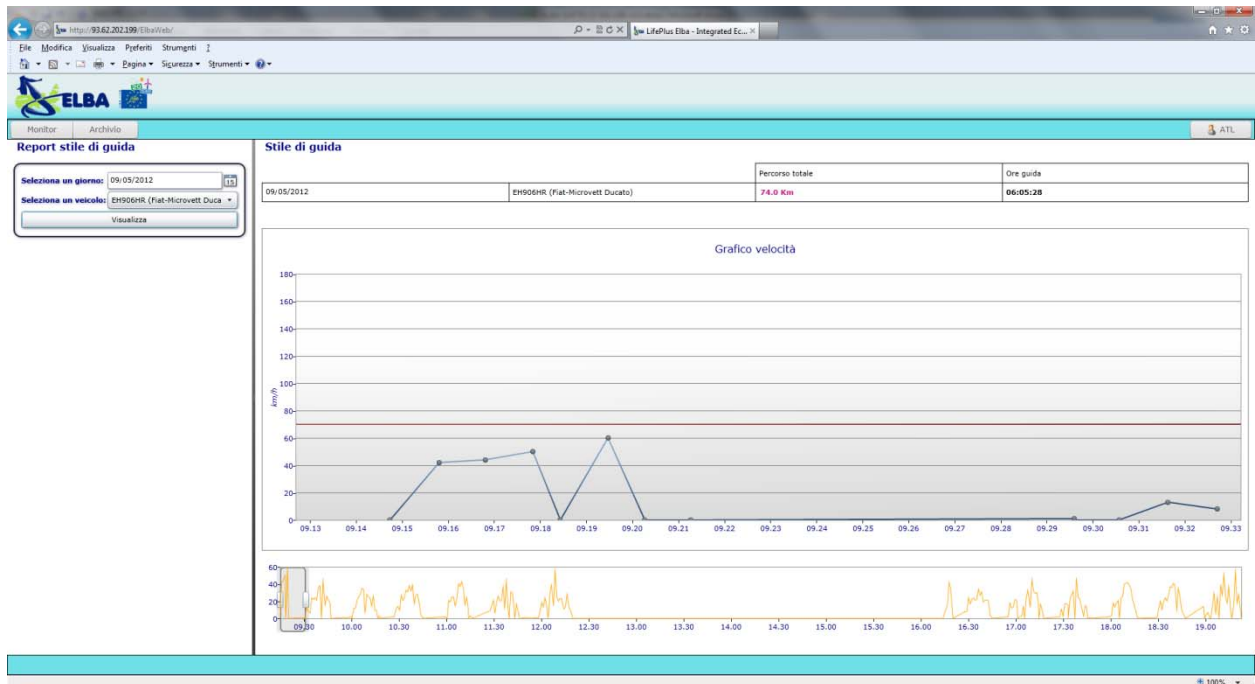


Figure 18. ElbaShuttle web site, drive style report

Travelling data are collected by a combined GPS/GPRS module (black-box) that will be installed aboard the field trials fleet (four vehicles for *ATL*, one for *Fulceri* and one for *Ilva*).

The Figure 19 illustrates the above-mentioned module.



Figure 19. The on-board module (black-box) Choral© XTraker XT02J

4 Infomobility Services

Within the frame of the *Action 8*, a new mobile application (*ElbaMobile*) was developed, tested and validated, in order to implement a set of *Infomobility Services*, which primary goal is to provide citizens (tourists and inhabitants) with up-to-date information about the two experimental public transport lines named *LIFE+ Elba Spiagge* ("*Linea S*") and *LIFE+ Elba Est* ("*Linea R*"). Such information is made available to users by means of an *Android* app that can be downloaded for free from the *Google Playstore* marketplace.

The *ElbaMobile* application is based upon *eMixer*, a well-established IT platform entirely developed and marketed by *Softeco*. *eMixer* is a web-based application that integrates mobility data from multiple sources (public transport companies, local authorities, traffic information centers, etc.) and delivers them to citizens over multiple channels (SMSs, mobile apps, web pages, variable-message displays, etc.). In the scope of the Elba project, the selected information delivery channel was a mobile app running upon the *Android* platform.

In order to meet the needs of reference stakeholders, *eMixer* has been customized by applying a general restyling to the user interfaces (Elba project look & feel).

4.1 The *ElbaMobile* App

ElbaMobile is a free *Android* app that can be downloaded from the *Google Playstore* marketplace. Figure 20 illustrates the download page.



Figure 20. *ElbaMobile* download page

ElbaMobile is mainly dedicated to travelers using free transport services provided by *ATL* (“*Linea S*”, servicing beaches on the coast northward Portoferraio, and “*Linea R*”, servicing villages of Rio Marina, Rio Elba, Cavo and Ortano beach). The figure below illustrates the welcome page of *ElbaMobile* app.



Figure 21. ElbaMobile app, welcome page

The application provides information about timing and transits of buses over the stop points around the current position of the user or around a specified location. The figure below illustrates bus stop selection page.

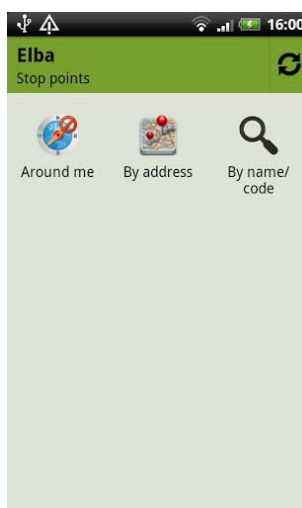


Figure 22. ElbaMobile app, selection of desired stop points

Once a bus stop is chosen, the application retrieves all scheduled transits (starting from current time) from the up-to-date service database (provided by ATL), and displays them to the user, as in the figure below:



The screenshot shows the ElbaMobile app interface. At the top, the status bar displays the time as 16:01. Below the status bar, the app title 'Elba' is shown in a green header, followed by 'Next departures'. A yellow bus icon is visible next to the title. The main content area is titled 'Via Manganaro PT' and contains a table of bus departures. The table has three columns: 'Departure', 'Line', and 'Towards'. The data rows show departure times from 4:25 PM to 7:10 PM, all on line 'S', and all towards 'Padulella'.

Departure	Line	Towards
4:25 PM	S	Padulella
4:40 PM	S	Padulella
4:55 PM	S	Padulella
5:10 PM	S	Padulella
5:25 PM	S	Padulella
5:40 PM	S	Padulella
5:55 PM	S	Padulella
6:10 PM	S	Padulella
6:25 PM	S	Padulella
6:40 PM	S	Padulella
6:55 PM	S	Padulella
7:10 PM	S	Padulella

Figure 23. ElbaMobile app, bus transit list