

## **EXPERIMENTAL SOFTWARE FOR A LOGISTICS NETWORK - THE ORADEA – CLUJ NAPOCA SECTION**

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**Abstract:** The developed software offers the SMEs the possibility to interact effectively and to cooperate in order to obtain maximum profit from the communications and transport infrastructure, by using the available and predictable ICT resources. It ensures acces and it coordinates the use of the logistics infrastructure of the SMEs, in terms of using the new technological infrastructure. The use of the software can be extended so that it is possible to use it for any other national road routes.

### **1. INTRODUCTION**

The development of this software offers to the SMEs the possibility to interact effectively and to cooperate in order to obtain maximum profit from the communications and transport infrastructures, by using the available and predictable ICT resources.

The developed software is able to provide acces and coordinate the use of the logistics infrastructures of the SMEs that are divided into appropriate groups (clusters), considering applying the new logistics concepts and the use of the new technological infrastructures (GPS, GIS) [2]. Its use can be extended for any other national road routes.

The developed experimental software [1] has been implemented on a server at the University of Oradea, in order to be tested for a period of three months. For this purpose there has been a coloboration with several SMEs from the Oradea- Cluj Napoca section of E60 route.

The software was tested under actual operating conditions, in a closed system, with partners who knew each other from previous collaborations. The fact that the system was closed means that no one other than the test participants has had acces to the collaborative logistic system.

### **2. THE PRESENTATION OF THE DEVELOPED SOFTWARE**

Structurally, the software has two parts:

- One part for the management activity
- One part for the users.

In order to acces the management section, the user has to log in with a password and a user name.

There are two user groups:

- Administrators, with software and/or database management/modification rights.
- Registered users, who enjoy the facilities offered by the software.

The users registered on the public page have acces to both truck registration and cargos registration. After the login, the table with registered users is displayed.

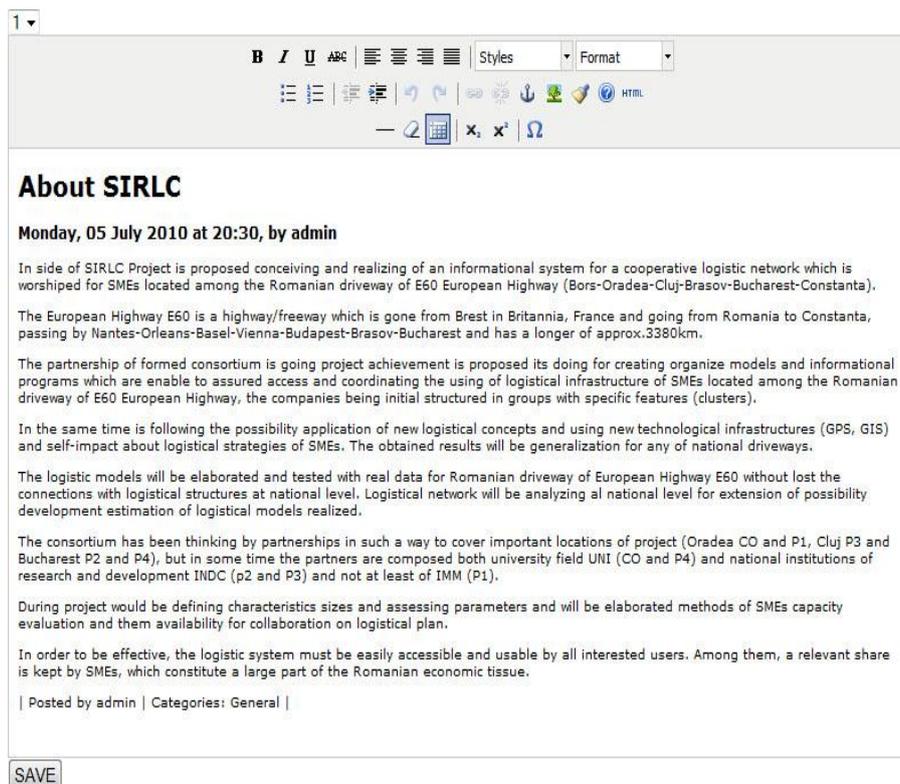
ID	Registration Date	Login Date	User Name	Email Address	Access level
1	2009-10-21	2010-07-01	one	one@one.com	1
2	2009-02-20	2010-07-01	admin	admin@admin.com	9

The **Registration Date**, **Login Date**, **User Name** and **Email Address** table columns can be sorted ascending or descending, in order to easily identify the users. The User Name is a link to a window that enables the user to modify their data (for instance the email address, the level (the rights) of access, the password and the information regarding the user's company). The „delete user” operation is also available in the data modification window.

The main menu is in the administration section of the software. The application menu has an arborescent form, to which there can be added (theoretically) an infinite number of submenus. For each submenu there is the possibility of adding a link towards an external (or local) static page, or of using the built-in page editor in order to create/modify the content of the aforementioned submenu.

The language selector is positioned on the upper part of the editor. The application is designed in a manner that allows the use of the software in three languages: Romanian (by default), German and English, respectively.

After the language selection, the content is loaded in the editor, and it may be modified. The **Save** button allows the user to save any changes he made in the database. The Javascript programming language has been used in the development of the content editor, due to its usability and to the fact that new modules can be added, for example a module for loading and image view, or a module for managing the files. For the administrators who have advanced programming skills, there is the possibility of writing HTML and CSS code [3, 4, 5].



**Figure 1. The Editor of the application**

The menus and submenus can be enabled and disabled with one button click, to avoid reloading the connected pages.

The application has a modular design. This allows adding functions and new pages without the need to change already existing modules.

The public section of the page is presented as follows (fig. 2).



**Figure 2. The public section of the application**

The menu is displayed on the left side, in the language selected with the help of the icons. In the lower part of the menu are positioned the text boxes for user authentication. The authentication is necessary because it allows the interaction between users and application, and also between the users of the application. The authentication is made with a username and a password, the latter being the same as the one requested to the user when he registered in the system. The passwords are encrypted with the help of the MD5 algorithm and they are stored in the database.

In order to receive an authentication account, the users of the page must complete a registration form displayed on the page **user.register.php** (fig.3).

Username	<input type="text"/>
Password	<input type="password"/>
Password Again	<input type="password"/>
Email Address	<input type="text"/>
Contact Name	<input type="text"/>
Company	<input type="text"/>
Registration NR.	<input type="text"/>
IBAN	<input type="text"/>
Country	Romania (RO) <input type="button" value="v"/>
Region	All Regions(0) <input type="button" value="v"/>
City	<input type="text"/>
Zip Code	<input type="text"/>
Address	<input type="text"/>
Phone Number	<input type="text"/>
Fax Number	<input type="text"/>
Type	<input type="text" value="Trans"/> <input type="button" value="v"/> <input type="text" value="Exped"/> <input type="text" value="Both"/> <input type="text" value="Other"/>
<input type="button" value="Register"/>	

**Figure 3. The registration form**

After clicking the **Register** button, a Javascript function checks if the user name is available (if it is not a duplicate), if the password has at least four characters and if the email address is valid (if it has the @ character and at least one dot character). Next, the data in the form are saved in the database. After registering, the user has the possibility to instantly use the account, or, if the account administrator wishes so, he can allow access to the account only after receiving confirmation of the email address, through a code sent

to the email address of the user. If the registration succeeded, each user receives an exclusive identification number, after which the connections between the user data and the trucks and cargos they registered is made.

On the **user.edit.php** page, the users have the possibility to change all the data introduced in the registration form, except the user name. This page also has Javascript functions attached, which check the validity of the modified data. The previous data are overwritten by the modified ones, but the identification number is kept. This number is unique and it cannot be changed. The user can access the page that allows him to change the data only after he logged in (fig.4).

Username: one  
Email Address: one@one.com  
Save Email Address  
Password:  
Password Again:  
Save Password  
Contact Name: a  
Company: b  
Registration NR.: c  
IBAN: d  
Country: Romania (RO)  
Region: Bihor(41)  
City: e  
Zip Code: f  
Address: g  
Phone Number: 1  
Fax Number: 2  
Type: Trans  
Save Detail

**Figure 4. The modification form for the user data**

The registration of the trucks is possible on the **transport.register.php** page (fig.5).

Transport Identifier:  
Start Date:  
Country: Romania (RO)  
Region: Bihor(41)  
City: Oradea  
Zip Code:  
Transport Type: general  
Weight (t):  
Description:  
Save

**Figure 5. The registration form for the trucks**

In order to facilitate date selection, an applet is used for displaying a calendar that allows the selection of any date.

After the registration of the truck, the **transport.list.php** page is displayed, where all the registered trucks are listed (fig.6). This page allows the user to change or delete these trucks.

1	t1	2010-07-01	Romania (RO)	Bihor	Oradea	general	20.00	<input type="button" value="Edit"/>	<input type="button" value="Delete"/>
2	t2	2010-07-01	Romania (RO)	Bihor	Oradea	general	10.00	<input type="button" value="Edit"/>	<input type="button" value="Delete"/>

**Figure 6. The means of transportation list**

The **cargo.register.php** page (fig.7) allows the registration of the available cargos. This page also uses Javascript functions to check the data written in the form.

Cargo Identifier

**Start**

Start Date

Country

Region

City

Zip Code

**Stop**

Stop Date

Country

Region

City

Zip Code

Cargo Type

Weight (t)

Description

**Figure 7. The cargos registration page for the commodities for which the transport is requested**

After the registration, the **cargo.list.php** page appears, where there is the possibility of selecting a truck for the registered cargo (fig.8).

<input checked="" type="radio"/>	1	c1	2010-07-01	Romania (RO)	Bihor	Valea lui Mihai	Marghita	electronic	3.00	<input type="button" value="Edit"/>	<input type="button" value="Delete"/>
<input type="radio"/>	2	c2	2010-07-01	Romania (RO)	Bihor	Sacueni	Alesd	electronic	3.00	<input type="button" value="Edit"/>	<input type="button" value="Delete"/>

**Figure 8. The page for selecting the means of transport**

This page offers the possibility to modify/delete the registered cargo. After selecting the cargo, the application searches for available trucks; with free capacity and with the appropriate type for goods (fig.9).

c1	2010-07-01	45	3.00	electronic			
name	start_date	transdist	fulldist	weight	loaded	type	
t1	2010-07-01	-	-	20.00	0.00	general	<b>Accept</b>
63(1-3), 45(3-4), 108							
t2	2010-07-01	-	-	10.00	0.00	general	<b>Accept</b>
63(1-3), 45(3-4), 108							

**Figure 9. The list with the appropriate means of transportation for the required commodity**

After applying these filters, the shortest route is computed, with the help of a php class that uses the Dijkstra algorithm.

If there are more cargos to be transported with the same truck (compatible cargos), the application uses the permutations of the places where the truck has to reach. Each place (city) is identified through an unique number. The first stage is to generate possible alternatives of combinations such as location-shift, followed by the removal of all the impossible or logically incorrect alternatives from the list. For example leaving the first location is not possible if there hasn't been an unloading activity at the location no. 1.

The tables structure, which generates the locations of the route (the localities) and the distances between them, is presented in figure 10. In figures 11 and 12 are presented the tables defining the localities and their identification codes, respectively.

	map_structure_id	map_structure_city_id_1	map_structure_city_id_2	map_structure_distance
<input type="checkbox"/>  	1	1	2	38.86
<input type="checkbox"/>  	2	1	4	53.61
<input type="checkbox"/>  	3	1	5	40.32
<input type="checkbox"/>  	4	1	7	41.65
<input type="checkbox"/>  	5	1	8	64.87
<input type="checkbox"/>  	6	2	3	24.73
<input type="checkbox"/>  	7	2	4	20.51
<input type="checkbox"/>  	8	5	8	64.42
<input type="checkbox"/>  	9	4	6	19.65
<input type="checkbox"/>  	10	6	9	27.07
<input type="checkbox"/>  	11	9	11	25.69
<input type="checkbox"/>  	12	11	13	84.61

**Figure 10. The structure of the table for defining the route locations**

			map_city_id	map_city_name	map_city_country_id	map_city_region_nr
<input type="checkbox"/>			1	Oradea	ro	904
<input type="checkbox"/>			2	Sacueni	ro	904
<input type="checkbox"/>			3	Valea lui Mihai	ro	904
<input type="checkbox"/>			4	Marghita	ro	904
<input type="checkbox"/>			5	Salonta	ro	904
<input type="checkbox"/>			6	Suplacu de barcau	ro	904
<input type="checkbox"/>			7	Alesd	ro	904

*Figure 11. The encoding of the localities*

			region_nr	region_country_id	region_country_name	region_id	region_name
<input type="checkbox"/>			901	ro	Romania (RO)	31	Arad
<input type="checkbox"/>			902	ro	Romania (RO)	11	Arges
<input type="checkbox"/>			903	ro	Romania (RO)	60	Bacau
<input type="checkbox"/>			904	ro	Romania (RO)	41	Bihor
<input type="checkbox"/>			905	ro	Romania (RO)	42	Bistrita
<input type="checkbox"/>			906	ro	Romania (RO)	71	Botosani
<input type="checkbox"/>			907	ro	Romania (RO)	81	Braila

*Figure 12. The encoding of the regions*

### 3. CONCLUSIONS

The users have expressed a high interest for the software. Some of the elements that were considered positive are:

- Usability
- The automatic assignment of a truck, taking into consideration the characteristics of the cargo, which largely eliminates the subjective factor.
- The automatic route generation and the optimal delivery sequence generation, respectively, and the selection of goods according to the cluster "route" of the system.

Because the product was in the testing period, there have been comments about the improvements that can be made to the system. Among them, the most important suggested the addition of an applet in order to facilitate the „live" tracking of the cargo location, through the GPS systems, directly on the site of the cooperative system. Also, the expansion of the service offering options toward hotel and service companies, car wash companies, gas stations, parking lots has been suggested. During the testing period, the negative aspects that have been noticed were related to the access issues, both on system and the Internet.

In the future the research will be oriented toward the system development, the improvements that were mentioned in the testing period and to other similar facilities that can appear during the operating period of the designed system.

## **Bibliography**

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