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 access 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 access 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 collaboration 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 access 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 access 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 access to both truck registration and cargos registration. After the login, the table with registered users is displayed.

<table>
<thead>
<tr>
<th>ID</th>
<th>Registration Date</th>
<th>Login Date</th>
<th>User Name</th>
<th>Email Address</th>
<th>Access level</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>2009-10-21</td>
<td>2010-07-01</td>
<td>one</td>
<td><a href="mailto:one@one.com">one@one.com</a></td>
<td>1</td>
</tr>
<tr>
<td>2</td>
<td>2009-02-20</td>
<td>2010-07-01</td>
<td>admin</td>
<td><a href="mailto:admin@admin.com">admin@admin.com</a></td>
<td>9</td>
</tr>
</tbody>
</table>
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].

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).
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).

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).

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

![Figure 6. The means of transportation list](image)

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.

![Figure 7. The cargos registration page for the commodities for which the transport is requested](image)

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

![Figure 8. The page for selecting the means of transport](image)
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).

<table>
<thead>
<tr>
<th>c1</th>
<th>2010-07-01</th>
<th>45</th>
<th>3.00</th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>name</td>
<td>start_date</td>
<td>transdist</td>
<td>fulldist</td>
<td>weight</td>
<td>loaded</td>
<td>type</td>
</tr>
<tr>
<td>t1</td>
<td>2010-07-01</td>
<td>-</td>
<td>-</td>
<td>20.00</td>
<td>0.00</td>
<td>general</td>
</tr>
<tr>
<td>t2</td>
<td>2010-07-01</td>
<td>-</td>
<td>-</td>
<td>10.00</td>
<td>0.00</td>
<td>general</td>
</tr>
</tbody>
</table>

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.

<table>
<thead>
<tr>
<th>map_structure_id</th>
<th>map_structure_city_id</th>
<th>map_structure_city</th>
<th>map_structure_distance</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>1</td>
<td>2</td>
<td>38.86</td>
</tr>
<tr>
<td>2</td>
<td>1</td>
<td>4</td>
<td>53.61</td>
</tr>
<tr>
<td>3</td>
<td>1</td>
<td>5</td>
<td>40.32</td>
</tr>
<tr>
<td>4</td>
<td>1</td>
<td>7</td>
<td>41.65</td>
</tr>
<tr>
<td>5</td>
<td>1</td>
<td>8</td>
<td>64.87</td>
</tr>
<tr>
<td>6</td>
<td>2</td>
<td>3</td>
<td>24.73</td>
</tr>
<tr>
<td>7</td>
<td>2</td>
<td>4</td>
<td>20.51</td>
</tr>
<tr>
<td>8</td>
<td>2</td>
<td>8</td>
<td>64.42</td>
</tr>
<tr>
<td>9</td>
<td>4</td>
<td>6</td>
<td>19.65</td>
</tr>
<tr>
<td>10</td>
<td>6</td>
<td>9</td>
<td>27.07</td>
</tr>
<tr>
<td>11</td>
<td>9</td>
<td>11</td>
<td>25.69</td>
</tr>
<tr>
<td>12</td>
<td>11</td>
<td>13</td>
<td>84.61</td>
</tr>
</tbody>
</table>

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