

Visitors Queue Management Optimization using Web System for Activity Support of the Administrative Services Center

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Abstract: In this paper the improving of quality and minimizing the waiting time at managing the queue of visitors during providing services in the Administrative Services Center of Ternopil city is described.

Keywords: City Council, Administrative Services Center, Queue Optimization, Web System.

I. INTRODUCTION

The Ternopil City Council (TCC) provides a large number of services in various spheres of its activities (land relations, housing, passport, communal, etc.). TCC department, which coordinates these services, defined as Administrative Services Center (ASC) [1]. Taking into account the number of Ternopil population and a significant number of legal entities, a large number of people visit the ASC every day. It leads to queue forming that require be managing and optimizing.

The tasks of queue managing and optimization is well investigated for structured queues [2, 3].

The queue in ASC now is formed using an electronic display and terminal, which allows viewing information about available services and getting a ticket with the number in queue. That is kiosk-based queue. Advising and inquiries processing are handled by the administrators which are qualified employees assigned to a specific group of services. Servicing in the center is in three halls:

Hall 1 - Sector for providing administrative services;

Hall 2 - Sector for providing permitting procedures;

Hall 3 - Sector for providing nonadministrative services.

For registering in queue, it is necessary to know in what hall the selected service is providing. Further client need to register himself and receive a ticket for servicing.

In existing system when registering in a queue, using the terminal, a new number is immediately assigned to one of the administrators.

The administrator is chosen randomly, so several employees can get a different number of clients. This approach does not take into account the duration of servicing, so customers have to wait for assigned administrator, even when the other is free and could provide the service. Therefore, the situations are possible when the customer is registered the first one, but waits longer.

On the other hand, in ASC the web-based support system is functioning which allows online registration for ASC servicing [4, 5]. Whereby, it became necessary to combine and provide service for two queues of customers – people, who were registered online and those ones, who were registered in terminals in ASC. Nowadays, the division of the

queue is made when an one administrator services only online registered clients. However, in this case, an administrator should wait for a client, who did not come in time but he could provide services for those who registered in queue using terminals.

There are registration and information terminals providing the list of services in ASC. However, these terminals do not show full important information, which is on ASC web site. To make changes or add some information require separate changing for a site and for a terminal that is inconvenient and ineffective for administrators.

Therefore, web-based support system for ASC queue management should be upgraded.

II. MODELING SYSTEM REQUIREMENTS

Nowadays, existing ASC web-based support system allows online registration. However, the existing functional should be extended by module that combining and processing online queue and terminal-based queue. The queue list should be formed for a present day for an administrator and the list should be shown only for his hall. Registration numbers or time in case of online registration should be shown in this list. For each position in this list it should be shown the current status, for example “Waiting for” or “Is now servicing by an administrator №”. For starting and stopping servicing, an administrator should have the possibility to press the keys “Start servicing” and “Stop servicing”. If a customer does not come in time, there should be functions to move records down or to take off from queue.

Software for terminals and display panels should be updated. It allows showing selected web pages accessible only in ASC network. Queue list will be shown on display panel for each hall. Number of ticket, which are servicing just now will be displayed by green color, and which waiting for services by yellow color, and all other by grey color. Creeping line with useful information will be placed at the bottom of screen.

Information terminal will contain information about services, working hours in the center, contacts and registration on the next days etc. A registration terminal will be used for a registration where it is necessary to select a hall and receive a ticket with an indicated number in the queue. At the same time, for online registration it is necessary to choose a service or hall, day and time. For a registration it is necessary to indicate personal surname, name and patronymic, phone number, number of tasks to solve and confirm personal agreement for processing of personal data.

Having successfully registered, a customer has a possibility to print a ticket for receiving a service. A registered date and time are considered as reserved and blocked for other customers.

At software modeling considering above mentioned requirements and using MVC approach, the database has been developed. Its general structure and relations are presented in class diagram (Fig. 1).

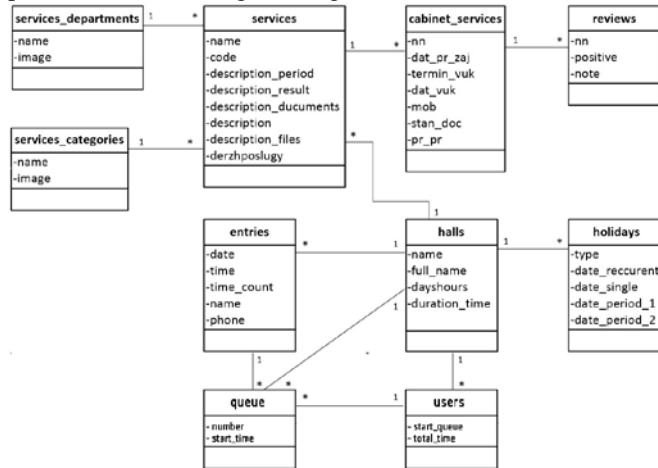


Fig.1. Class diagram of proposed system

The proposed structure provide the possibility to take into consideration functional and non-functional system requirements.

III. SYSTEM IMPLEMENTATION

Taking into account that the existing web-based support system was developed in PHP software language, MySQL was used as DBMS, dynamic and standardized interfaces were built using jQuery and Bootstrap and page output on devices with different resolution is made using CSS Media Queries, it is the same tools are proposed to use for modules compatibility and support of the corresponding processing speed [3].

The set of technical tools, which is used for formation and management of the queue in ASC, was presented in Fig. 2.



Fig. 2. Set of used technical tools in ASC

Therefore, the possibility to view and manage the queue was added into an administrative interface to meet specified requirements. Interfaces for terminals and display panels have been developed on the base of web site in combination with special software for pages viewing and surfing.

A page for the queue processing was added into an administrative interface. In Fig. 3, the list of customers, who registered for the hall 1 for current day at the given moment, was shown. All records from the last day are automatically

archived. An administrator can see only his customers. The number and time of registration, and the status of processing were indicated in the list.

| Visitor | Information | Status |
|-------------|-------------|-------------------------------|
| Ticket # 8 | from 11:30 | Served by the administrator 6 |
| Ticket # 9 | from 11:31 | Served by the administrator 8 |
| Ticket # 10 | from 11:32 | Waiting |

Fig. 3. Queue display in an administrator's profile

To start servicing, an administrator should visit the administrative profile of the site and press the button "Start servicing". After this, an administrator will see the number of a customer, who should come to him (Fig. 4). After providing the service, an administrator should press the button "The service provided, close the ticket", after this the next customer from the queue will be directed to an administrator.

| Visitor | Information | Status |
|-------------|-------------|-------------------------------|
| Ticket # 10 | from 11:32 | Served by the administrator 2 |
| Ticket # 8 | from 11:30 | Served by the administrator 6 |
| Ticket # 9 | from 11:31 | Served by the administrator 8 |
| Ticket # 13 | from 11:33 | Waiting |

Fig. 4. Processing of a customers queue

If an administrator needs to have a break, he can press the button "Stop servicing". Then customers will be directed to another administrator and if the present customer has not been serviced, he will return to the queue and will be directed to the next free administrator. There are some additional menu selection which are opened while pressing the button "In addition" (Fig. 5).

| Information | Status |
|-------------|-------------------------------|
| from 11:32 | |
| from 11:30 | |
| from 11:31 | Served by the administrator 8 |
| from 11:33 | Waiting |

Fig. 5. Menu items of the queue

In case, an administrator serviced a customer's request and wants to stop servicing, the menu item "Close the ticket and

stop servicing” can be selected. As well, an administrator can use the button “The service provided, close the ticket” and after this “Stop servicing”. However, in this case, the next customer will be directed to an administrator.

In case, if a customer did not come in time he can be moved in some positions down in the queue or if he did not come he can be taken off from the queue. In Figure 6 a customer with the number 10 was moved in one position and the next customer was directed to an administrator. The status of the moved customer is changed into “Waiting, changed position”.

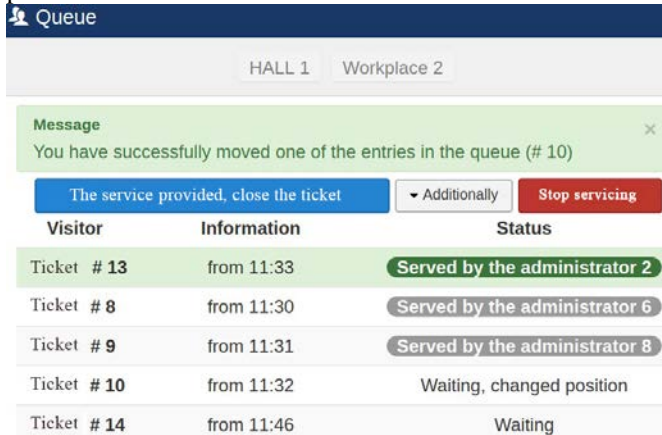


Fig. 6. Moving a customer in the queue

In addition to customers, who were registered using the terminals, also in the queue list are included customers, who online registered using ASC web site (Fig. 7). Unlike terminal registrations, those, who were online registered, have not number but time of servicing and their registered surnames, names, patronymic and phone number. They do not differ and the processing of such customers is made the same way. The list of online registration can be seen at the tab “Registration for servicing”. Such records appear in the list of the queue before the time of servicing.

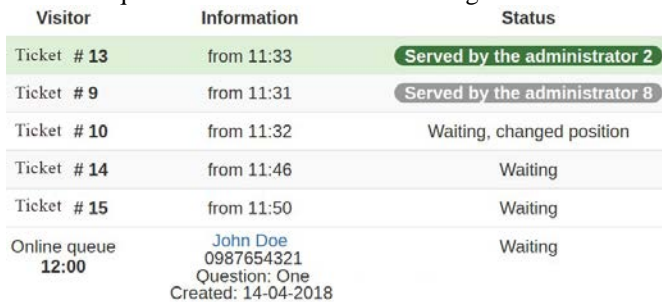


Fig. 7. Online registered customers on display

In Figure 8, the form of administrator editing is presented, where can be found his hall and working place for servicing. If only hall was indicated, it can be seen only the list of the queue. The path to edit the site users: Admin section – Users – Manager – Select the user – Tab “ASC”.

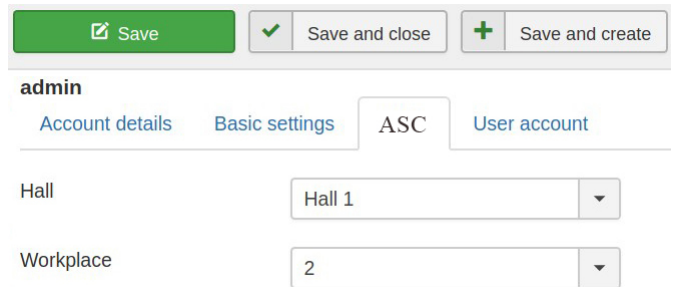


Fig. 8. Hall and working place of an administrator

Information and registration terminals with updated functional are located in the center. In Figure 9, the homepage of the information terminal, which is formed on the base of the web site functional, is shown. Here, users can see all necessary information and register online for the next day.



Fig. 9. Homepage of the information terminal

In Figure 10, the web page of the information terminal with working hours of the center was shown.



Fig. 10. Working hours of the center

In Figure 11, the example of web page of the information terminal with the service list was shown.

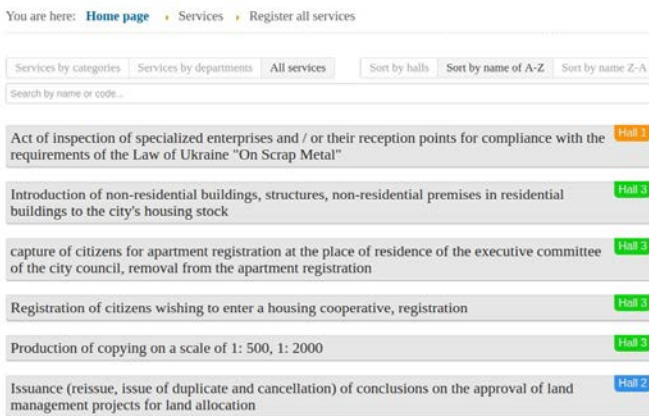


Fig. 11. Screen of information terminal with the service list

In Figure 12, the homepage of the registration terminal was presented. Now, while registration there is no need to select a concrete service, it is enough to select the hall where it is provided.

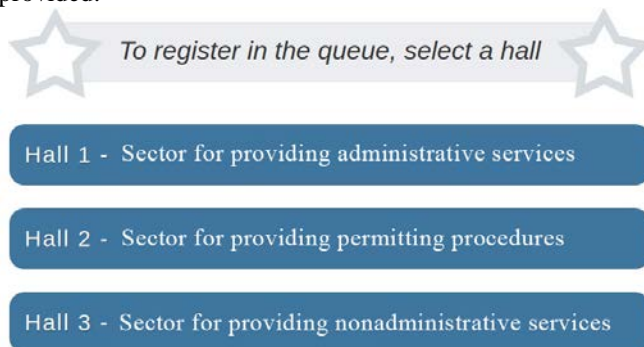


Fig. 12. Screen of registration terminal

Having selected the hall, a customer is proposed to confirm his selection pressing the button "Print a ticket" (Fig. 12). It was developed to protect wrong registration.

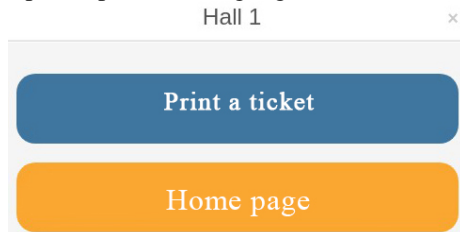


Fig. 13. Confirmation of registration

In Figure 14, the sample of the ticket printed by the registration terminal is shown.



Fig. 14. Registration ticket

In Figure 15, the interface of a display panel of the first hall was shown. Registrations, which are being processed at the moment by an administrator is displayed by green light. Those registrations, which are in the queue and will be processed in a while, are displayed by yellow light. The number of such registrations depends on the number of administrators, who are providing services for customers at the given moment.

| HALL 1 | | |
|--------|----|----|
| 8 | 9 | 13 |
| 10 | 14 | 15 |
| 16 | 17 | 18 |
| 09:30 | 20 | 21 |

Fig. 15. Display panel with registration list

Having finished the servicing, a number of an administrator disappears from the display panel, and the number of the next one will change its color from yellow one into green and it is blinking for some time changing the text and informing about the number of the servicing table. In case of online registrations not registration number is shown but the time of the registration and for some time the text will be changed from the time into "Online queue".

IV. CONCLUSIONS

Research results anticipate their use to support servicing of individuals and legal entities registered in Ternopil in ASC at TCC. As result the software was developed which supports enhance customer service and improve efficiency by optimizing the queue management.

The software for queue management in ASC has been modeled and the functional of web site, terminals and display panels are combined to provide optimization.

The interfaces of software, registration and information terminals, display panels have been developed; their role and peculiarities have been described in the article.

Proposed applied results may be used for solving similar queue optimization tasks.

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